

Pleasant Valley Groundwater Sustainability Plan

February 22, 2022

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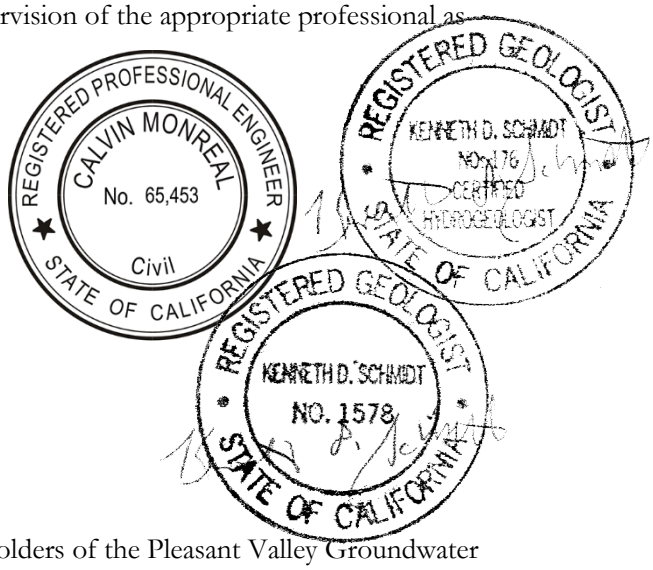
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LIMITATIONS

In preparation of this Groundwater Sustainability Plan (Plan), the professional services of Provost & Pritchard Consulting Group and Kenneth D. Schmidt and Associates were consistent with generally accepted engineering and hydrogeologic principles and practices in California at the time the services were performed.

Section 3 of this Plan, Basin Setting, was prepared in general conformance with Title 23 California Code of Regulations, section 354.12 either by and /or under the direct supervision of the appropriate professional as indicated herein.

> Per Regulation Requirements
> §354.12 Introduction to Basin Setting
> This Subarticle describes the information about the physical setting and characteristics of the basin and current conditions of the basin that shall be part of each Plan, including the identification of data gaps and levels of uncertainty, which comprise the basin setting that serves as the basis for defining and assessing reasonable sustainable management criteria and projects and management actions. Information provided pursuant to this Subarticle shall be prepared by or under the direction of a professional geologist or professional engineer.
>
> Note: Authority cited: Section 10733.2, Water Code.
> Reference: Section 10733.2, Water Code.



This GSP is a work product of the members and associated stakeholders of the Pleasant Valley Groundwater Sustainability Agency (PVGSA) members and associated stakeholders. Judgments leading to conclusions and recommendations were made based on the best available information but were made without a complete knowledge of subsurface geologic and hydrogeologic conditions. This Plan is intended to provide information from readily available published or public sources and additional data gathered since the first submittal. We understand that the interpretations and recommendations are for use by the PVGSA in assisting the GSA in making decisions related to potential Groundwater Management Act (SGMA) regulations.

Variations in subsurface conditions cannot be exactly known, or entirely accounted for, in spite of significant study and evaluation. Future surface water and groundwater quantity, quality, and availability cannot be precisely known. Trends have been estimated and projected based upon past historical data and events and are used for planning purposes. It should be noted that historic trends may not be indicative of future outcomes. Historic hydrology has been used to identify averages and potential extremes that may be experienced in future years; however, it will be important for the GSA to evaluate the parameters that make up the agency water budget. Additionally, the rapidly changing regulatory environment surrounding the SGMA and State regulatory agencies may render any or all recommendations invalid in the future if not implemented and necessary approvals, permits, or rights obtained in a timely manner. Information contained in this GSP should not be regarded as a guarantee that only the conditions reported and discussed are present within the PVGSA or that other conditions may exist which could have a significant effect on groundwater availability.

In developing methods, conclusions, and recommendations this GSP has relied on information that was prepared or provided by others. It is assumed that this information is accurate and correct, unless noted. Changes in existing conditions due to natural and man-made causes including climate change, operations in adjoining GSAs or subbasins, or future management actions taken by a GSAs may deem the conclusions and recommendations inappropriate. No guarantee or warranty, expressed or implied, is made by Provost & Pritchard Consulting Group or by Kenneth Schmidt & Associates by placing a Registered Professional Engineering, Registered Geologist, or Certified Hydrogeologist Stamp upon this document.

Prepared by:

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Abbreviations and Acronyms

AF	Acre-Foot
AF/YR	Acre-Foot Per Year
APE	Area of Potential Effect
CASGEM	California Statewide Groundwater Elevation Monitoring
CCGSA	City of Coalinga GSA
CDFW	California Department of Fish and Wildlife
CEQA	California Environmental Quality Act
CFGSA-GSA	County of Fresno GSA – Pleasant Valley Area
CFS	Cubic Feet Per Second
CGPS	Continuous Global Positioning System
CSH	Coalinga State Hospital
CITY	City of Coalinga
CVP	Central Valley Project
CWC	California Water Code
DBCP	1, 2-Dibromo-3-chloropropane
DDW	Division of Drinking Water
DHS	Department of Health Services
DMS	Data Management System
DQO	Data Quality Objectives
DTSC	Department of Toxic Substance Control
DWR	Department of Water Resources
E	Eocene Marine
EC	Electrical Conductivity
EDB	Ethylene-Dibromide
EPA	Environmental Protection Agency
ESA	European Space Agency
ET	Evapotranspiration
FCPVSGA	Fresno County Pleasant Valley GSA
FMFCD	Fresno Metropolitan Flood Control District
ft/yr	Feet per Year
GAMA	Groundwater Ambient Monitoring and Assessment
GDE	Groundwater Dependent Ecosystem
GPS	Global Positioning System

GPD/FT ..... Gallons Per Day Per Foot
GPM ..... Gallons per Minute
GSA ..... Groundwater Sustainability Agency
GSP ..... Groundwater Sustainability Plan
HCM ..... Hydrogeological Conceptual Model
ILRP ..... Irrigated Lands Regulatory Program
InSAR ..... Interferometric Synthetic Aperture Radar
IRWMP ..... Integrated Regional Water Management Plan
JPL ..... Jet Propulsion Laboratory
KDSA ..... Kenneth D. Schmidt and Associates
LAFCo ..... Local Agency Formation Commission
LU ..... Land Use
M.D.B.&M ..... Mount Diablo Base and Meridian
MCL ..... Maximum Contaminant Level
MG/L ..... Milligrams per Liter
MO ..... Measurable Objectives
MOU ..... Memorandum of Understanding
MSL ..... Mean Sea Level
MT ..... Minimum Thresholds
MTBE ..... Methyl tert-Butyl Ether
NASA ..... National Aeronautics and Space Administration
NC ..... The Nature Conservancy
NCDC ..... National Climatic Data Center
NGS ..... National Geodetic Survey
NRCS ..... Natural Resource Conservation Service
P ..... Pilocene Marine
PAC ..... Policy Advisory Committee
PCE ..... Perchloroethylene
PG&E ..... Pacific Gas & Electric Company
Plan ..... Groundwater Sustainability Plan
PVSP ..... Pleasant Valley State Prison
PV Subbasin ..... Pleasant Valley Subbasin
PVWD ..... Pleasant Valley Water District
Qoa ..... Quaternary Older Alluvium
QPc ..... Pilo-Pleistocene nonmarine, Pilocene nonmarine.

Q ..... Quaternary Alluvium
R&R ..... Recharge and Restoration
RC ..... Resource Conservation
RMS ..... Representative Monitoring Site
RWQCB ..... Regional Water Quality Control Board
SAGBI ..... Soil Agricultural Groundwater Banking Index
SAR ..... Sodium Adsorption Ratio
SGMA ..... Sustainable Groundwater Management Act
SMC ..... Sustainable Management Criteria
SWP ..... State Water Project
SWRCB ..... State of California Water Resources Control Board
TAC ..... Technical Advisory Committee
TCE ..... Tricholoroethylene
TCP ..... 1, 2, 3 -Trichloropropane
TDS ..... Total Dissolved Solids
UNAVCO ..... University NAVSTAR Consotrium
USACE ..... US Army Corps of Engineers
USGS ..... United States Geological Survey
VOC ..... Volatile Organic Compound
WHPA ..... Wellhead Protection Area
WSIP ..... Water Storage Investment Program

Executive Summary

Chapter 1-Introduction

The Pleasant Valley Subbasin (PV Subbasin or Subbasin) (DWR Basin 5-022.10) is located in Fresno County in the San Joaquin Valley Groundwater Basin. The Subbasin is adjacent to the Westside Subbasin of the San Joaquin Valley Basin to the east and north of the Kettleman Plain Subbasin. The Subbasin is bounded on the north by the Joaquin Ridge, on the west by the Tertiary and older marine sediments of the Coast Ranges, on the south by the Kettleman Hills and Plains and Kings County line, and on the east by the Guijarral Hills and Westside Subbasin. Figure ES- 1 depicts the regional location of the Subbasin. The subbasin is considered a separated basin. Although the PV Subbasin is hydraulically connected to the Westside Subbasin, the influence of the management plan in this GSP has little or no effect on the Westside Subbasin. Water flows from the PV Subbasin to the Westside Subbasin through the anticline but these flows are minimal.

In the late 19th century, the Pleasant Valley area and the city of Coalinga experienced significant development over a short period of time as a result of oil production. The Coalinga Oil Field was the largest oil field in the western US at that time. Agriculture developed in the valley as a result of both oil development and the establishment of the city of Coalinga. The city of Coalinga sprung up and became one of the largest cities west of the Mississippi.

The Pleasant Valley Subbasin is in the Southern Coast Range in California. The coastal ranges are predominantly dominated by a marine environment and the rocks are of marine origin and were uplifted. When rain events occur within the watershed above the valley, excess run off may generate stream runoff that traverses across the Subbasin. Therefore, significant amounts of streamflow percolates into the Subbasin from both the upper watersheds and the streams. The Subbasin contains marginal groundwater quality predominantly dominated by sulfate chloride, boron, and a number of other constituents. Because of the high salinity, the city of Coalinga realized early on that the water quality was poor for human consumption. Drinking water was imported by rail from Armona, this began as early as the 1930s. Subsequently, the city operated one of the only desalination plants in the country.

Historical cropping patterns were adapted to be not susceptible to the high salinity of the groundwater. The high electrical conductivity of groundwater limited the types of crops historically grown in the Subbasin. Over time, around the early 2000s, individuals started experimenting with pistachio crops. There was a recognition that pistachios had a tolerance for higher concentrations of salts. Over time the production of pistachios throughout the Subbasin accelerated.. This expansion of pistachio crops surpassed the groundwater supply's ability to remain sustainable. Groundwater levels have been declining and continue to do so due to agricultural demand. In the last two years a greater understanding of the groundwater pumpage volume is known through actual flowmeter data from each well that is being gathered.

This Pleasant Valley Subbasin was ranked as a low priority by DWR in 2014, and in November 2018, DWR re-ranked the subbasin as a medium priority basin. The landowners prior to the implementation of SGMA have been proactively engaged in management activities and projects that support importation of surface water and implementation of data collection of groundwater levels, pumpage, groundwater quality, and land subsidence.

Chapter 2-Plan Area

The Pleasant Valley Plan Area includes the Pleasant Valley Groundwater Sustainability Agency (**PVGSA**), County of Fresno GSA – Pleasant Valley Area (**CFFSA-GSA**), and City of Coalinga GSA (**CCGSA**). **Figure ES-2** identifies the GSA boundaries and the additional jurisdictional boundaries adjacent to the Plan Area.

No Federal owned lands exist within the Plan Area; however, the State owned and operated California Department of Corrections and Rehabilitation's Pleasant Valley State Prison (**PVSP**) and the Coalinga State Hospital (**CSH**), operated by the Department of State Hospitals, reside within the Plan Area. The PVSP and CSH combined span approximately 640-acres and receive water from the City of Coalinga. In addition, a portion of the Pleasant Valley Ecological Preserve, operated by the California Department of Fish and Wildlife, is located within the Subbasin. **Figure ES-3** clarifies the locations the State lands within the Subbasin.

No adjudicated areas exist within the Subbasin; therefore, the entirety of the estimated 48,159 acres of the Subbasin is subjected to GSP regulations. An outline of the GSA acreages is available in **Table 2-1.**

Pleasant Valley Subbasin **(PVSB)** is connected hydraulically to an adjacent subbasin, to the east is the Westside Subbasin. The water levels in the PVSB have little effect on the Westside Subbasin. According to the USGS Paper 1360-G, Page 164, a description of the PVSB, "it is a structural depression west of the San Joaquin Valley proper from which it is separated by Anticline Ridge, Guijarral Hills, and Kettleman Hills."

The main users of groundwater are:

- Irrigation: Crop Production-Irrigation Wells
- Domestic Wells: Homesteads-Local wells, where water is used to irrigate lawns and wash clothing, and for toilets. There are no identified homes treating the groundwater for drinking water. The plan sets Minimum Thresholds for current domestic well water levels and potential future water treatment needs, without causing undesirable results.

Chapter 3-Basin Setting

Subbasin lies along the west side of the San Joaquin Valley, north of the Fresno-Kings County Line. The major geologic features surrounding the Subbasin are anticlinal structures and an intervening syncline within Pleasant Valley. These anticlinal features include Anticline Ridge on the north-northeast, the Jacalitos and Kreyenhagen Hills on the west, and the Guijarral and Kettleman Hills to the east (KDSA, 2016). These anticlines are major barriers to groundwater flow from the Pleasant Valley Subbasin to the San Joaquin Valley except through the Pasajero and Polvadero Gaps. The Pasajero and Polvadero Gaps are north and south of Guijarral Hills and the Pleasant Valley Subbasin abuts the Westside Subbasin on the eastside of these two gaps. South of the Fresno-Kings County line Pleasant Valley Subbasin shares a border with the Kettleman Plains Subbasin. The Subbasin is surrounded throughout most of its perimeter by folded Tertiary continental and marine sedimentary rocks of the Coast Ranges and the west flank of the Kettleman Hills. The Subbasin includes the older and younger alluvium (DWR, 2006). The Subbasin boundaries have been derived from both hydrologic and institutional criteria. Several intermittent streams enter the basin from the mountains to the west; these streams include Los Gatos, Warthan, Jacalitos, and Zapato Chino Creeks (DWR, 2006).

The bottom of the usable aquifer is approximately 3,000 feet below ground (KDSA, 2016).

Transmissivity values range from 15,000 gpd/ft to 73,000 gpd/ft.

Specific Yield values estimated by Williamson and others (1989) by weighted averages ranged from 0.08 in the southern portion of the GSA to 0.13 in the northern portion of the GSA. Recent data from newly installed monitor wells and infiltration data suggest that much of the aquifer is confined.

Current cropping and irrigation practices throughout the Subbasin are the driving force in determining the parameters of this Groundwater Sustainability Plan (Plan). There is a need to balance the groundwater levels and a significant need for the importation of new surface water supplies to maintain successful crop production of pistachios in the valley and to prolong the life of the aquifer. One significant project outlined in this Plan is to build new and to expand current conveyance facilities to bring additional surface water supplies

into the Subbasin, promoting and prolonging agricultural production. In the past the groundwater overdraft was estimated based on average ET values, the overdraft pumping was overestimated for permanent crops as much as 0.6 to 0.8 acre-feet per acre, and row crops as much as 0.2 to 0.4 acre-feet per acre. The GSA is now gathering actual flowmeter readings to evaluate overdraft and the water budget tables have been re-evaluated and can be seen in Section 3. Recharge that occurs from the watershed is not known but monitoring a well on the western edge of the subbasin has seen the rate of decline in this area slow due to the two above-normal precipitation years. From 2020 to 2023 there was rate of decline of about 8 ft/yr., but for 2023-2024 there was a rate of decline of 1.5 feet. this indicates the recharge water from the watershed is flowing towards the subbasin floor but takes 1 to 2 years to be seen. Additional monitoring and management actions are being discussed with the current landowner.

Groundwater quality in the Subbasin tends to be predominately marginal to brackish, ranging from 1,500-3000 mg/L of TDS. Available research suggests that pistachios in particular are capable of thriving in salinity conditions up to 5000 mg/L TDS. The conversion factor for electroconductivity is dS/m times two-thirds equals total dissolved solids concentration in mg/L. Pistachios are salt-tolerant, but depending on the salt composition, irrigation water exceeding 4.5 to 7 dS/m EC is probably not sustainable for the long term The subbasin values range from 2.8 ds/m in 2014, to 3.0 ds/m in 2020, and 2.7 ds/m in 2024. The values have remained constant while the groundwater levels have declined about 30 feet. This water has also been used for domestic use, although no known domestic well water is treated for drinking water.

The City of Coalinga (City) maintains a contract with the Bureau of Reclamation (USBR) and has been importing surface water since the Central Valley Project was expanded to serve the San Luis Unit. The first surface water deliveries to the city occurred in 1971. Landowners within the PVSB have participated in the purchase of excess surface water from the City of Coalinga. This water was used within the Subbasin Boundary, for irrigation and recharge of groundwater.

The city treats diverted surface water at its treatment facility at the Coalinga Canal and delivers it to their facilities as well as to a nearby prison and a hospital. A 100-acre area called the Lost Hills community in the southern portion of the district relies on individual domestic wells on 2- to 5-acre lots. As previously noted, the groundwater quality is poor to marginal for residential use and consumption. The groundwater is used for indoor plumbing and to water the outside landscaping. There are no known treatment systems that exist within the Community of Lost Hills. It is assumed that drinking water comes in the form of bottled water. An outreach program has begun with the Lost Hills Community. Flyers with a questionnaire have been sent out, as well as face to face outreach with one resident has begun. PVGSA will continue to gather information to better understand the needs of the domestic well users and the water level situation in that area, including water quality and from what depth this water is pumped. Recent information shows the domestic wells are drilled to a depth in the range of 500 feet to 600 feet, the production of these wells' ranges from 15 to 25 gallons a minute, with one that pumps 60 gpm used for stock water. There are no known wells that have gone dry in the Lost Hills Community area. There is little farming in the area of the Lost Hills Community and a minimal amount of irrigation wells nearby the community.

Regarding Climate Change and the Pleasant Valley Subbasin-"The Central Valley is expected to experience quite a few: hotter temperatures, droughts, wildfires, and extreme precipitation events. " (Union of Concerned Scientist-The Equation, 12/2021). According to The Equation it is anticipated that there will be more frequent rain events and potential for run-off due to climate change as well as increased evapotranspiration of plants. The MOs and the MTs have been set with Climate Change in mind and climate projections of increased heat projections of days above 104 degrees Fahrenheit. The effects are expected to happen gradually within the next 30 years. The pumping increases will be noticed in the pumping data and will be evaluated at each five-year interval, and changes to the GSP will be addressed as needed. The PVSB does not rely on snowpack for essential water, it relies on run-off from rain fall on the watershed. The projects and management actions will be designed to take advantage of these events and store additional water in the Subbasin, if runoff increases due to climate change.

Groundwater elevations fluctuate in the subbasin due to pumpage variations and stream recharge and aquifer recharge which are variable from year to year. The depth to groundwater in spring of 1998 was 300 feet near Los Gatos Creek and increased to more than 500 feet by 2017. Current (April 2024) monitor data from the newly installed MW-3 well identifies a static water level of 413 feet below ground surface. The subbasin has historically seen fluctuations in water levels.

Chapter 4-Sustainable Management Criteria

Measurable Objectives

Measurable objectives will be identified in each category. The governing MO will be the lowering of water levels as they pertain to the groundwater wells. These MOs are lower than the 2015 water levels in the west area and the mid area of the subbasin but have dropped slightly or are near the 2015 water levels in the southern area of the subbasin near the Lost Hills Community. Data from 2015 and within two miles of the Lost Hills Community shows water elevations at 387 feet above mean sea level. Due to the large amount of groundwater stored in the subbasin and the aquifers' ability to recover, these MOs are reasonable. The analysis was run using the lowest MOs in each area. The North-west part of the subbasin is approximate at an elevation of 156 feet above mean sea level, and in the mid area of the Subbasin, the average MO is set at an elevation of 114 feet, and at the southern end the average MO is set at an elevation of approximately 390 feet above mean sea level. The southern end of the subbasin is where the domestic users are located, and these values coincide with the domestic well construction information. The MOs can be confidently set due to the minimal crops and wells in the area used for irrigation, without causing an undesirable result.

Groundwater levels:

Irrigation wells: The MO for the groundwater levels has been set at a water elevation where more than 70% of the perforations of the existing wells are submerged. Figure ES- 1 shows the results of the available data comparison. Monitoring of groundwater levels will continue and outreach to local landowners for feedback through the milestones will be part of the continued outreach activities. Historic groundwater level changes, draft pumping reductions (curtailment policy), estimated importation of surface water during normal and wet years, no importation of surface water during dry years, including climate change and domestic well users in the urban areas were all used to set the MOs within the Subbasin. Each RMS will be monitored for its RMS under these criteria. For examples of the spreadsheet models used to calculate MOs see Appendix Q.

Domestic Well Users generally extract water from a depth above the Ag irrigation wells perforations. The domestic wells are at a depth range of 500 to 600 feet below ground surface (bgs), with encountered water at approximately 300 to 400 feet bgs and most wells have a production rate of 15 to 25 gallons a minute. A Domestic well monitoring plan and outreach is part of this revised plan. Included coordination with the landowners to inform them of water levels and construction suggestions for future wells, due to the management of the subbasin.

The aquifer conditions are conducive to recovering water levels back from the MTs to the MOs. For additional information on subsurface geologic conditions see Chapter 3. The MOs provide usable stored water to implement the projects and the management actions by the milestones. The average overdraft is approximately 20,000 AF per year, the overdraft was calculated using historic data as well as water level declines, see Section 3.3.8 for the Historical Groundwater Budget for 1998-2010, Section 3.3.9 for the Average Annual Groundwater Budget and the Groundwater Budget for 2023, and Section 3.3.10 for the 2042 Groundwater Budget. The draft pumping curtailment policy is summarized in the following table and is based on the natural average recharge in the subbasin. The pumping curtailment policy is part of the sustainability plan. The actual landowner extraction amounts may be increased by importation of surface water, upon evaluation of the MTs in the area. These overdraft numbers are a worst-case scenario and do not take into

account the imported surface water used for irrigation and does not account for the recharge water from the upper watershed.

Year	2022-2025	2026-2030	2031-2035	2036-2040	2041-2042	2043-Forward
Overdraft (AF)	20,000	16,000	12,000	8,000	4,000	0

The GSA is aware that additional mandatory pumping restrictions may occur as the milestone dates approach. The water levels will be monitored, and corrective actions will take place at each five-year interval, upon review of the water levels in the area in question.

An analysis was run comparing the MOs to the perforations in the wells we were able search out using a "Script Program" from the DWR well database. The criteria were to use the lowest MO for the area shown on the map as the blue dashed line-watershed delineation. These areas are being tracked because of their different characteristics, such as different rate of decline in these areas, different cropping and pumpage amounts, delayed influence from the upper watershed recharge. They are still in evaluation but are used and separated by different MOs and different MTs as you can see in the MT map as well. The goal was to compare MOs and MTs with the amount of submergence for each of these wells as a percentage, being that a trigger would be, if MOs or MTs were set at a level that created a well to have less than 70% submergence of the perforations. Below 70% submergence may cause a reduction in flowrate production of the well, to where the crops cannot be irrigated in time without causing stress to the crop and increase cost to pump the water.

The green color represents the perforations are submerges above 70%.

Not all wells are built the same and some were built in the 1990s, and it is understood that the well completion reports are not always 100% accurate as in the case of one of the domestic wells, that shows up as "red" in the MT map, due a value of beginning of perforations starting at 160 feet bgs, and water level was at 350 feet bgs in 2018, where other wells drilled by this same driller used about 200 of screen from bottom up. This analysis was used as an evaluation tool to help derive the MOs and MTs and identify any fatal flaws. Each RMS will be evaluated according to this criterion as well as other wells in the area. Communication with the Lost Hills Community started in late June 2024, and monitoring throughout the subbasin will continue and be evaluated at each annual report submittal and adjusted at each 5-year period as needed.

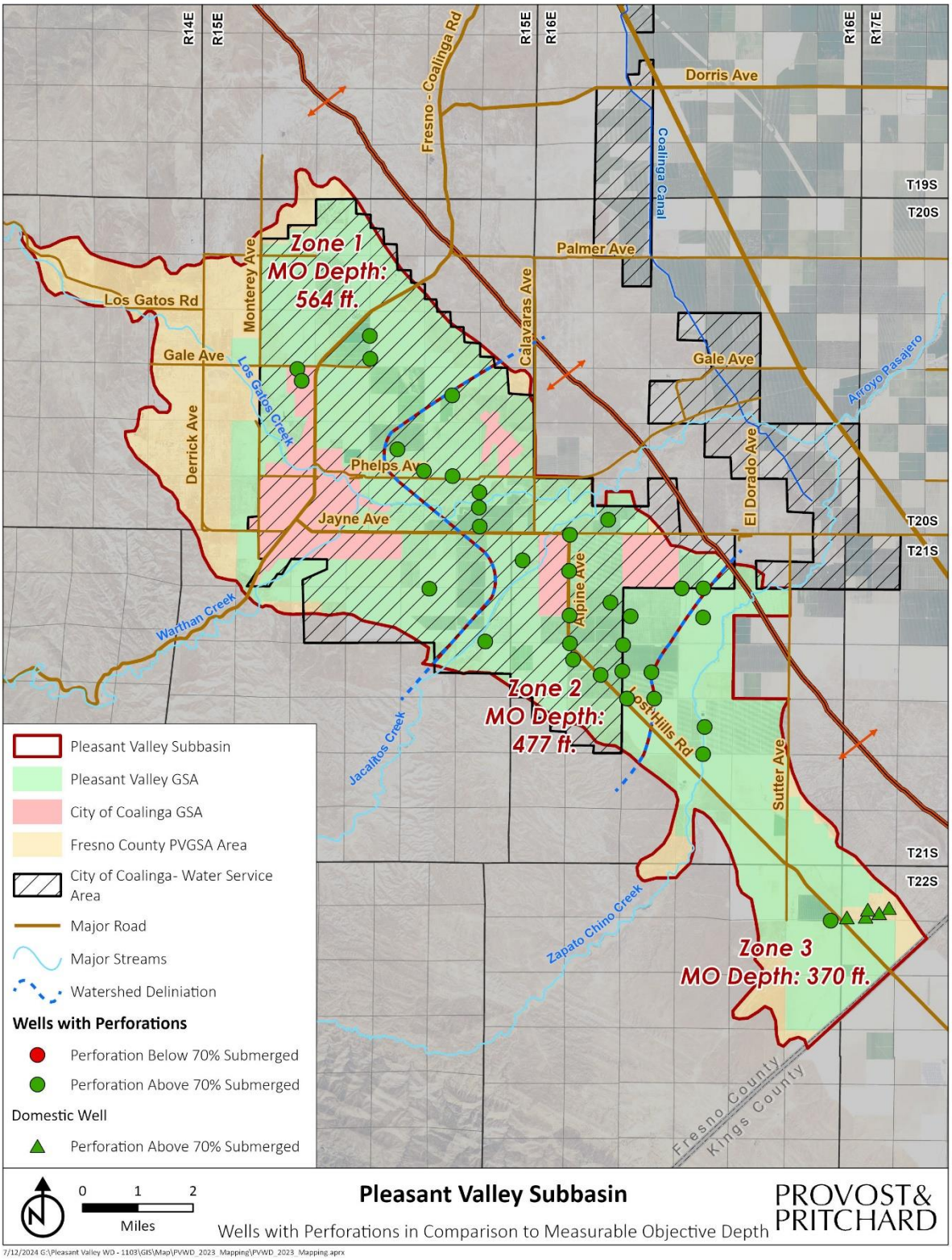


Figure ES- 1 Map of Lowest MO in the Area

Groundwater Storage Volume:

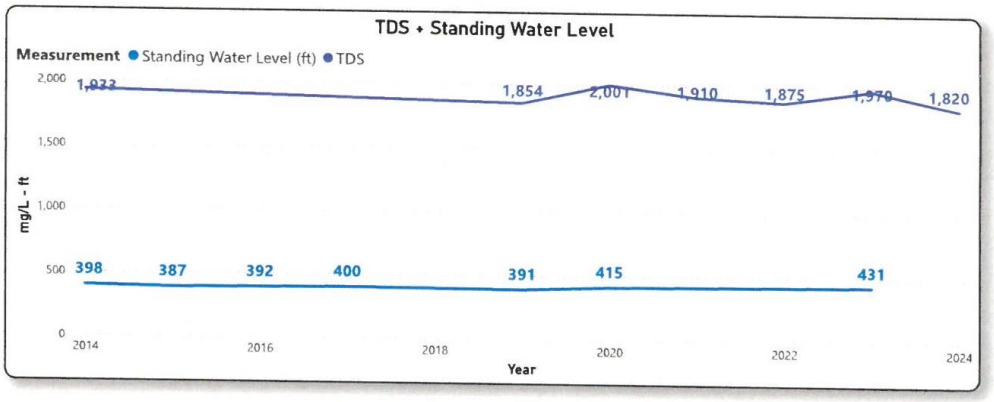
The MOs have been set to achieve sustainability by the year 2042. The aquifer conditions are conducive of recovering groundwater levels. The alluvium in the subbasin does not significantly compact and reduce the potential storage volume capabilities of the subbasin. For additional information on subsurface geologic conditions see Chapter 3. The MOs provide usable stored water to implement the projects and the management actions by the milestones, thus becoming sustainable. The draft curtailment amounts are summarized in this section and are based on the natural average recharge in the subbasin. This pumping curtailment is part of the plan to become sustainable. The actual landowner extraction amounts can be increased by importation of surface water.

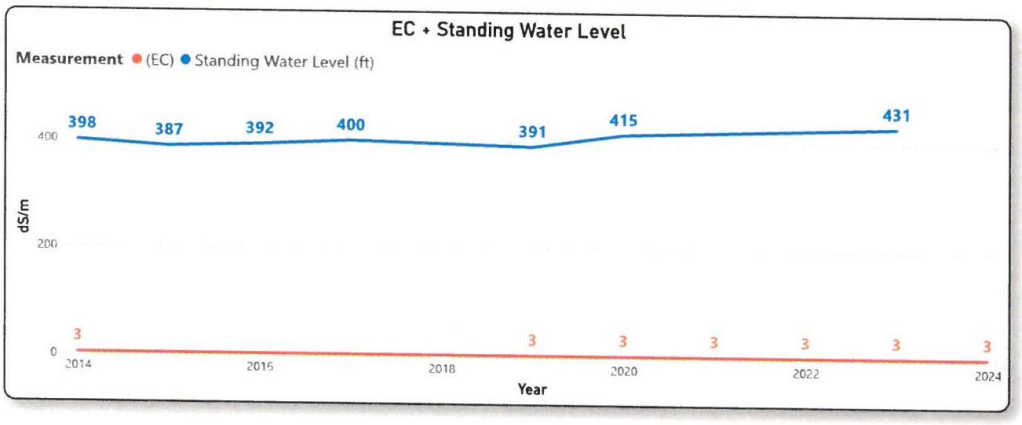
Seawater Intrusion:
Is not applicable in the PV Subbasin:

Interconnected Surface Water:
Is not applicable in the PV Subbasin, the streams within the PV Subbasin are considered ephemeral. Recent information from the three new monitoring wells that were constructed, saturated conditions were not encountered above 380 feet below ground surface. For additional information see Appendix N.

Water Quality:

Irrigation wells: The major crop grown in the PV Subbasin are pistachios. Pistachios are salt tolerant and can survive using water with TDS levels of up 5,000 mg/L. The historic water level declines have little to no effect on the groundwater quality as seen in the historic hydrographs for selected constituents. Three new monitor wells have been constructed and allow monitoring of the shallow water levels and groundwater quality. The MO for water quality is set at 2,500 mg/L. This value gives the subbasin flexibility to operate as described in the SGMA guidelines and follows the existing water quality data. It is expected if there is a change in water quality it will be due to recharge projects pushing historic over irrigation water down, but the quality is expected to remain within the MOs and MTs. Close observation will be conducted with the new monitoring plan. The water quality hydrographs shown in this section are an example of the historic lowering of GW levels compared to the stable water quality values over time. Water quality monitoring has been implemented since the first submittal. This information was used to evaluate the water quality MO. Attached is an example of one well that has been monitored over time, showing groundwater TDS and EC levels versus declining water levels, for more information see Appendix K.





Measurement	2/25/14	7/24/19	11/7/19	5/29/20	7/8/20	8/12/20	5/14/21	5/5/22	8/17/22	9/1/23	4/5/24
(pH)	7.8	7.9	7.7	7.3	7.4	7.6	7.7	7.5	7.4	7.6	7.8
(EC)	2.8	2.5	2.9	3.0	2.9	2.8	2.8	2.7	2.8	2.9	2.7
(B)	2.1	1.7	2.4	2.5	2.4	2.1	2.3	2.0	2.2	2.3	2.2
(Ca)	403.0	236.0	382.0	406.0	370.0	401.0	400.0	384.0	397.0	404.0	379.0
(Mg)	261.0	224.0	251.0	278.0	257.0	278.0	277.0	231.0	262.0	286.0	268.0
(Na)	908.0	832.0	902.0	922.0	898.0	937.0	944.0	826.0	888.0	981.0	770.0
(K)	18.3	13.6	14.1	16.4	16.1	14.9	13.5	14.4	16.2	17.1	22.2
(HCO_3)	557.0	452.0	359.0	518.0	504.0	338.0	557.0	473.0	479.0	418.0	445.0
(Cl)	601.0	508.0	469.0	472.0	471.0	458.0	485.0	467.0	472.0	472.0	488.0
(NO_3-N)	11.7	4.9	18.0	15.6	16.1	14.6	14.5	13.9	15.4	13.0	14.3
(SO_4-S)	1,431.0	1,423.0	1,837.0	1,952.0	1,806.0	1,941.0	1,870.0	1,690.0	1,850.0	2,120.0	1,700.0
(TDS)	1,933.0	1,737.0	1,970.0	2,043.0	2,011.0	1,949.0	1,910.0	1,840.0	1,910.0	1,970.0	1,820.0
(SAR)	5.2	5.6	5.3	5.2	5.3	5.3	5.4	5.0	5.2	5.5	4.5
(SEC)	1.9	2.2	1.9	1.8	1.8	1.9	1.9	1.9	1.9	1.9	1.7
(pHc)	7.0	7.3	7.3	7.1	7.2	7.2	7.0	7.2	7.2	7.1	7.2

Domestic well users: There are minimal domestic well users in the PV Subbasin due to known water quality issues and the large coverage area of the City of Coalinga's surface water area which can provide city drinking water. There is no known wells being used for drinking water. It is used for toilets and for landscape irrigation. PV Subbasin will be implementing a domestic well monitoring plan to monitor water quality and water levels for future potential drinking water needs. A correspondence letter has been sent to the domestic landowners to begin this process. And a site outreach meeting is being planned for the end of September 2024 at the Los Hills Community. Management of the subbasin will utilize groundwater levels as the indicator when setting the water level MOs, and MTs, as they govern.

Land Subsidence:

The goal of the GSP is to have zero subsidence by 2024. Subsidence is minimal to nonexistent in the subbasin and will be monitored using InSAR data and the well pads from the RMS wells. The northern area of the PV Subbasin is approximately at an elevation (feet above sea level) of 850 feet, the middle area of the PV Subbasin is approximately at an elevation of 590 feet, and the south end is approximately at an elevation of 775 feet. The gradient across the subbasin allows the Subsidence MOs to be set at 1 foot by 2042 without any undesirable results. For additional information regarding subsidence see Appendix P, and Chapter 4.

Minimum Thresholds

Minimum thresholds will be identified in each category as well as the governing MTs will be identified. The Subbasin will manage to the governing MTs, which is the water level decline as it pertains to the groundwater wells within the subbasin and in the southern end near the domestic well owners.
See MO Section for description of analysis and reasoning of the evaluation of the MTs, as shown in Figure ES-2

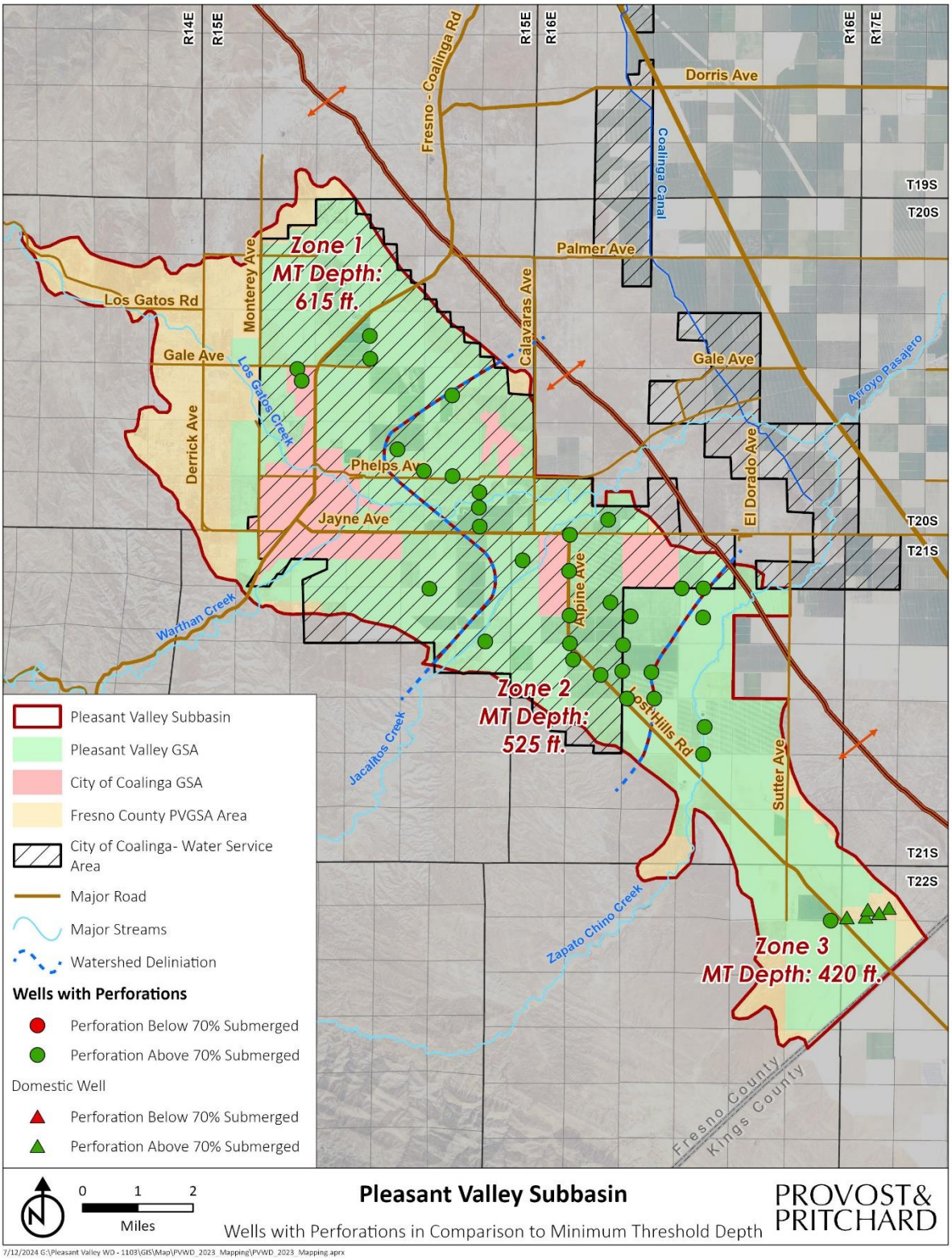


Figure ES-2 MT Analysis

Groundwater levels:

Irrigation wells: The MTs for the groundwater levels has been set at a water elevation where there is no undesirable effects to groundwater users. Figure ES-2 shows the results of the available data comparison of water level to well perforations using the DWR data base. Monitoring of groundwater levels will continue and outreach to local landowners for feedback through the milestones will be discussed. Pumpage and groundwater level decline is the governing management strategy as it pertains to impacts on groundwater wells and overdraft. As seen in Figure ES-2, the wells show that the perforations are submerged, and the wells are expected to be operable at the set MT.

These milestones are achievable with the projects and management actions identified in this report.

Domestic Well Users generally extract water from a depth above the irrigation wells perforations. The extracted water is not treated for drinking water. The domestic wells are at a depth range of 500 to 600 feet deep, with encountered water from 300 to 400 feet bgs and a production rate of 15 to 25 gallons a minute. A domestic well monitoring plan and outreach is part of the plan to identify any changes that may occur due to implementing this GSP. Contact with a local landowner was made and discussion of placing a data logger in their domestic well is in negotiation with the landowner. The MTs in this area were set to not adversely affect their wells. Current water levels are in the range of 300 to 400 feet bgs and the wells are constructed to 600 feet bgs. The MTs were set to a level where the perforations will be 90 to 100% submerged. Monitoring in this area is part of the future coordination with the landowners in the Lost Hills Community.

Undesirable Results:
Irrigation Wells: Undesirable Results Below MTs when 3 wells within a 3-mile radius of the RMS experiences the following:

- Static water level submergence is below 70% of the total perforations, for one event, either spring or fall measurement. The following may be experienced due to the water level decline below the MT.
    - Approximate 30% loss in production of well capacity, based on 2024 pumping data rates,
    - Increase in estimated power cost, See Appendix Q, for examples of the power cost analysis.
        - West area - 14% increase
        - Mid area - 23% increase
        - South area- 20% increase

Domestic Wells: Undesirable Results Below MTs when 1 domestic well experiences the following:

- Static water level submergence is below 70% of the total perforations, for one event, either spring or fall measurement. The following may be experienced due to the water level decline below the MT.
    - Approximate 30% loss in production of well capacity, based on 2024 pumping data,
    - Increase in estimated power cost of 20%, See Appendix Q, for examples of the power cost analysis.

For domestic well evaluation process flow chart, should an undesirable result exist, see Appendix O.

Groundwater Storage Volume:

The MTs have been set to achieve sustainability by the year 2042. The soil conditions are conducive to restoring the water levels back to the MO levels with recharge. The soil in the subbasin will not compact and reduce the potential storage volume capabilities of the subbasin. For additional information on soils see Chapter 3 and Appendix P. The MTs provide usable stored water to implement the projects and the management actions by the milestones, thus becoming sustainable. The governing MT are described in the Groundwater Level section of this report and Executive Summary.

Undesirable Results:
The base of the freshwater aquifer is approximately 3,000 feet below ground surface. The MTs are set to provide flexibility through a five-year drought and when no surface water is available. The water level change between the MOs and the MTs is approximately 50 feet, this change provides approximately 190,000 AF of supply over a five-year period at a specific yield of 0.08 over 48,000 Acres. The alluvium in the subbasin is elastic and will rebound with recharge. The MTs are set at a level where in wet years water can be recharged as well as the curtailment schedule can be implemented to reduce overdraft. Storage decline in the subbasin below the MT will be difficult to rebound from as the recharged water takes time to reach the aquifer. The undesirable result below the MT is the irrecoverable storage volume to raise the water levels.

Seawater Intrusion:
Is not applicable in the PV Subbasin:

Interconnected Surface Water:
Is not applicable in the PV Subbasin, the streams within the PV Subbasin are considered ephemeral. Recent information from the three new monitoring wells that were constructed, saturated conditions were not encountered above 380 feet below ground surface. For additional information see Appendix N.

Water Quality:

Irrigation wells: The major crop grown in the PV Subbasin are pistachios. Pistachios are salt tolerant and can survive using water with TDS levels of up 5,000 mg/L. The water level declines have little to no effect on the groundwater quality. Three new monitor wells have been constructed and allow monitoring of the shallow ground water. The MOs for water quality is set at 2,500 mg/L. The MTs have been set at 3,000 to accommodate the fluctuations in the quality of water. This value gives the subbasin flexibility to operate as described in the SGMA guidelines and follows the existing water quality data. The water quality hydrographs shown in this section demonstrate the historic lowering of GW levels compared to the stable water quality values over time even though water levels decline significantly the quality remains stable. Water quality monitoring has been implemented since the first submittal and this information was used to set the water quality MTs.

Domestic wells: There are minimal amount of domestic water well users in the PV Subbasin and this water is not used for drinking water. It is used for toilets and for landscape irrigation. GSA will be implementing a domestic water monitoring plan to monitor water quality and water levels. A correspondence letter has been sent to the landowners in the Lost Hills Community, to begin this process. Also, GSA staff are reviewing Self-Help guidelines for Domestic well mitigation. See Appendix O for the Self-Help Mitigation Guidelines Report.

Undesirable Results:
Historical data and recent data have shown that lowering of the groundwater has little effect on the quality of the groundwater: The lowering of the groundwater to where an undesirable effect would occur would be at a level of more than 500 feet below the minimum threshold. If this occurs, a high percentage of wells would have gone dry. The MT is set and at a TDS of 3000 uS/dm, allowing for future water treatment facilities within the Los Hills Community and allows the farmers to continue to farm Pistachios and row crops. The undesirable result should the levels exceed the MT, would be a high cost to treat the water and loss of production of the crops within the subbasin.

Land Subsidence:
The goal of the GSP is to have zero subsidence by 2024. Subsidence is minimal in the subbasin and will be monitored using InSAR data and the well pads from the RMS wells. The northern area of the PV Subbasin is approximately at an elevation (feet above sea level) of 850 feet, the middle area of the PV Subbasin is

approximately at an elevation of 590 feet, and the south end is approximately at an elevation of 814 feet. Due to the steep gradient across the subbasin, the MTs were set at 1-foot gradient change within a three-mile radius. Communication with Caltrans, City of Coalinga and Fresno County is part of the project to coincide ground surface movement due to tectonic plate movement in this area. This area is known to have many fault lines.

There is no major infrastructure that will be disrupted or see an undesirable result by the subsidence of 1 foot by the year 2042, as set in this report. Continued monitoring and communication with the City of Coalinga, Fresno County and Caltrans is key to the subsidence monitoring.

Undesirable Results:
The goal of this GSP is to have zero subsidence by 2042. Subsidence after 2042 is considered an undesirable result. Historical data and recent data have shown that lowering of the groundwater has not caused undesirable results due to subsidence: The lowering of the groundwater to where an undesirable effect would occur would be at an estimated level of more than 500 feet below the minimum threshold. If this occurs, the expected range of subsidence (compaction) would be in the range of 2-3 feet. The alluvium in the subbasin is elastic and will rebound with recharge. Currently, the subsidence is measured in millimeters and could be within a tolerance of the InSAR Data for zero subsidence. The MT is set at 1 foot by 2042. Communication with Caltrans, City of Coalinga and Fresno County is part of the project to coincide ground surface movement due to tectonic plate movement in this area. This area is known to have many fault lines. See Appendix P for additional information on subsidence and analysis of forecasted subsidence.

Chapter 5-Monitoring Network

Following are discussions of several active and proposed monitoring and water management programs within the Subbasin. More details on monitoring can be found in **Chapter 5**.

Groundwater Level Monitoring

Pleasant Valley Water District performs periodic (typically spring and fall) groundwater level monitoring at select locations as part of the California Statewide Groundwater Elevation Monitoring (**CASGEM**) Program. Historically, DWR has done these measurements, but it is expected that they will discontinue these and the District will need to maintain the monitoring effort. To comply with SGMA, these efforts may be expanded to include groundwater levels from additional areas and continuous water level measurements utilizing transducers with continued preparation for GSP implementation and associated reporting. **Chapter 5** details the monitoring efforts associated with GSP implementation. Three new monitor wells have been drilled since the first submittal of this plan. The wells will allow monitoring of water levels, water quality and be used for stable Isotope analysis. A domestic well monitoring plan is being developed and will include the monitoring of the wells used for domestic use in the Lost Hills Community, near the Fresno and Kings County line.

Groundwater Pumpage Monitoring

The GSAs in the Subbasin do not own any operating wells, all wells are owned by landowners. Approximately 98 percent of the irrigation wells have flow meters, and the pumping volume is recorded by the GSA, twice a year. For some wells the pumpage is estimated by other means, such as typical per crop water demands per acre. . More details on proposed monitoring can be found in **Chapter 5 and Chapter 6**.

Groundwater Quality Monitoring

Groundwater quality monitoring activities performed within PVGSA and the FCPVGSA and the associated primary aquifer are not related to community water system drinking water production and, therefore, are not publicly reported to the state. The City of Coalinga does not have any drinking water wells in operation. Therefore, any groundwater monitoring regarding drinking water quality standards is performed privately and is not generally publicly available. Since the first submittal of the GSP, the PVGSA has implemented a water

quality monitoring plan. Historic data is available and will be used as well to set the MOs and MTs for water quality. For irrigation wells, electrical conductivity is measured annually in the summer, and irrigation suitability analyses are obtained on one-third of the irrigation wells each year. Coordination between the PVGSA and the domestic well users in the Lost Hills Community and others has begun and a monitoring program is being developed. The domestic well owners in the Lost Hills Community do not treat and use the groundwater for drinking water. The monitoring plan will be used to gather data for future groundwater use and to inform the well owners of fluctuating water levels. The GSA will provide technical assistance with new well construction. For water quality versus water level decline hydrographs see Appendix K.

Section 3.1 includes more information regarding the groundwater quality in the Subbasin.

Land Surface Subsidence Monitoring

While some local agencies in the San Joaquin Valley monitor for land subsidence, the majority rely on monitoring performed by regional water agencies or the State and Federal government. Lands within the Plan Area have been monitored for land subsidence for many years. United States Geological Survey (USGS), National Aeronautics and Space Administration (NASA) Jet Propulsion Laboratory (JPL), and University NAVSTAR Consortium (**UNAVCO**) measure subsidence in the Central Valley. There are several UNAVCO land surface elevation monitoring locations near the Subbasin. USGS and JPL have maps on their websites that show the subsidence for a defined time period, but there is limited information shown for the Subbasin. The Nevada Geodetic Laboratory GPS Network includes data since 2017 from a single GPS monitoring station (CACO – IGS14) at West Hills Community College in the City of Coalinga. More data would be helpful to assess land subsidence in the valley.

For more information on subsidence in the Subbasin, see **Section 3.2**. For more information on land subsidence monitoring, see **Chapter 5**. Chapter 5 includes information from 2007 to 2011 for vertical ground surface displacement rates, which are derived from Interferometric Synthetic Aperture Radar (InSAR) data that are collected by the European Space Agency (ESA) Sentinel-1A satellite and processed by the NASA JPL under contract with to the California Department of Water Resources (DWR).

The well pads of the wells that are being monitored for groundwater levels will be surveyed every two years to true up the well datum. This information will be used to compare to the InSAR data.

Surface Water Monitoring

Historical data is available for stream flows from the USGS or DWR, but is not consistent. In recent years, PVWD has started to measure flows in the creeks and natural waterway flows coming into the Subbasin and exiting the subbasin. For more information on stream flow in the Subbasin, see **Section 3.1** and **Section 3.3**. Surface water imports in the area are monitored by the USBR, City of Coalinga and irrigation entities. Visual inspection and monitoring of the flow in the streams from the watershed after high precipitation events are recorded. Flows that reach the streams, as in 2023 were noted until mid-June.

Chapter 6-Projects & Management Actions

As a part of this Plan, several projects and management actions have been proposed and some have been constructed since the first submittal of this plan and can be reviewed in greater detail in **Chapter 6**. Some of the projects & management actions discussed therein include but are not limited to the following:

Proposed Projects

- North Canal Pipeline-Design is approximately 95% complete
- South Canal Pipeline Expansion-Current delivery is approximately 20 cfs and can be expanded to 40 cfs total. 4,250 AF was imported in 2023, Recharged-1,919 AF in Firestone, and 2,331 AF was recharged via on-farm recharge.
- Los Gatos Creek Gravel Pits-Preliminary Design stage,

- Zapato Creek Instream-Conceptual Stage
- Import Surface Water Supplies-Continued efforts, individual landowners have imported water through private purchases.
- Firestone Recharge Facility-In operation and has recharged over 1,919 AF in 2023.
- Installation of three new monitor wells to fill data gaps-Wells are operational and will provide water level data, sample water for water quality and stable isotope identification to better understand the downward movement of water through the soil.
- Also, the PVWD is a member of the San Luis Delta Mendota Water Authority and may participate in the Dry Year Program.
- The City of Coalinga has a contract agreement to sell excess surface water to local landowners.

Proposed Management Actions

- Install Flowmeters to measure pumpage on the last remaining wells, (approximately 8 wells).
- Rules and Regulations
- Water Recharge and Banking Policy
- Transfer Policy
- Pumping Limits Policy (Curtailment Policy)
- Fill Data Gaps
- Outreach to Domestic groundwater users

The following management actions have been developed or are being developed since the first submittal of this report.

Farmland: The following policies are implemented or under development:

- Metering policy - in place since January 2023
- Semi Annual static water level measurements - in place since January 2023
- Well registration policy - in place since January 2023
- Per acre foot extraction fee policy - in place since January 2023
- Annual water quality sampling policy - in place since July 2023
- Construction of (3) 500' foot deep monitor wells
- Groundwater recharge policy - in development
- Groundwater pumping curtailment policy – in development.
- Surface water in lieu groundwater pumping policy-in development
- Demand reduction when surface water is not available - in development.
- Restriction of further permanent crop planting - in development.
- The following projects are in development or in place to deliver surface water to the subbasin:
- South Pipeline – in operation
- North Pipeline – 90% completion of permitting and design. Construction schedule for the 3rd quarter of 2024
- Outreach to educate landowners on the DWR Dry well reporting System, and/or Contacts at the Subbasin where they can voice their concerns or provide feedback of effects on their well due to groundwater management in the Subbasin.

Domestic Users: The following policies are under development:

- Domestic Well Monitoring Policy: Outreach with the property owners every six months by flyers or direct communication.
- Set up a monitoring program in the Lost Hills Community for data collection of water levels and water quality to assist with technical services for the development of new wells and continued operation. At the time of this resubmittal there were no known wells used for drinking water.
- Outreach to educate landowners on the DWR Dry well reporting System, and/or Contacts at the Subbasin where they can voice their concerns or provide feedback of effects on their well due to groundwater management in the Subbasin.

Consideration of Beneficial Uses and Users and Comments during the review period.

A number of comments were received that specially questioned the thoroughness and identification of disadvantaged communities, domestic water users, interconnected surface waters, groundwater dependent ecosystems, native vegetation and managed wetlands. To this end additional information can be found within this update or revision of the plan. It was also felt that a summary of this information was warranted and included in this summary so that the updated data and information can be found in one place.

Beneficial users
As noted in the document beneficial users include the City of Coalinga. The outskirts of the city is designated as a disadvantaged area. The City constructed a surface water treatment plant and constructed a surface water system to serve not only the cities needs as well as the Prison and State hospital, and houses and businesses along the conveyance routes. The routes are shown on Figure 3-15 and is reproduced here as Figure ES-4. Also shown on Figure ES-4 is the updated map showing the city's water service area and the location by section of the eight domestic wells identified in the State well construction database as well as the Lost Hills community. Shown on Figure ES-5, are the interconnected surface water locations (see Figure 3-36) that may be identified as ISW sites per the plan, but are within the streams that may only run when rain events occur. These streams are considered ephemeral. Three new monitor wells have been constructed since the first submittal of this plan and show there are no ISW in those areas. Recognizing that the City system supplies surface water and not groundwater and the location of the ISW sites from irrigation wells (groundwater extraction site), both Figures ES-4 and ES -5 were developed to identify the possible locations that may have the potential to experience undesirable results due to management of the groundwater basin. From review of the Management Objectives found in chapter 4, it doesn't appear at this time that these sites would have undesirable affects based upon the Management Objectives proposed. Care will be taken to continue to monitor these locations to see if these conclusions continue to be valid.

Chapter 7-Plan Implementation

Plan implementation has been ongoing since before SGMA we enacted. The landowners within the subbasin have been designing projects, collecting data and pursuing activities that would benefit the subbasin to become sustainable, all funded by the landowners. The following is updated cost information on projects and management actions activities since the last submittal of the GSP.

Table ES-1 Administrative Expenses

Item	2022	2023	2024	2025	2026
Administration	$5,000	$10,000	$10,000	$10,000	$10,000
Groundwater Monitoring and Measurement	$10,000	$25,000	$25,000	$25,000	$25,000
Legal	$2,000	$10,000	$10,000	$10,000	$10,000
Annual Reporting	$75,000	$75,000	$75,000	$75,000	$75,000
Coordination with adjacent Basins	$2,000	$4,000	$4,000	$3,000	$3,000
Plan Update				$150,000	$150,000
Totals	$94,000	$124,000	$124,000	$273,000	$273,000

Project Costs. At this time, project costs are not the responsibility of PVGSA and will be borne solely by a project proponent. Management of the GSA and the PVWD is currently funded by two seperate 218 Propositions. Each project will be required to develop and secure funding needed to ensure their sustainability by 2042. Member agencies will re-evaluate their respective SGMA efforts periodically to determine whether an adjustment is necessary in their project implementation plan.

Table ES-2 Project Costs

Item	2022	2023	2024	2025	2026
North Canal Pipeline		$1,000,000	$10,000,000	$10,000,000	
South Canal Pipeline Exp					$2,500,000
Los Gatos Gravel Pits					$2,100,000
Meter Policy	$50,000				
Rules and Regulations	$20,000				
Transfer Policy	$20,000				
Pumping limits Policy	$50,000				
Monitor Well Installation			$300,000		
[1]Surface water Purchase			$1,500,000	$1,500,000	$3,000,000
[2]Firestone Recharge Facility		470,000			
Totals	$140,000	$1,470,000	$11,800,000	$11,500,000	$7,600,000

[1]Assumes a rate of $250-500/AF. [2]In Operation

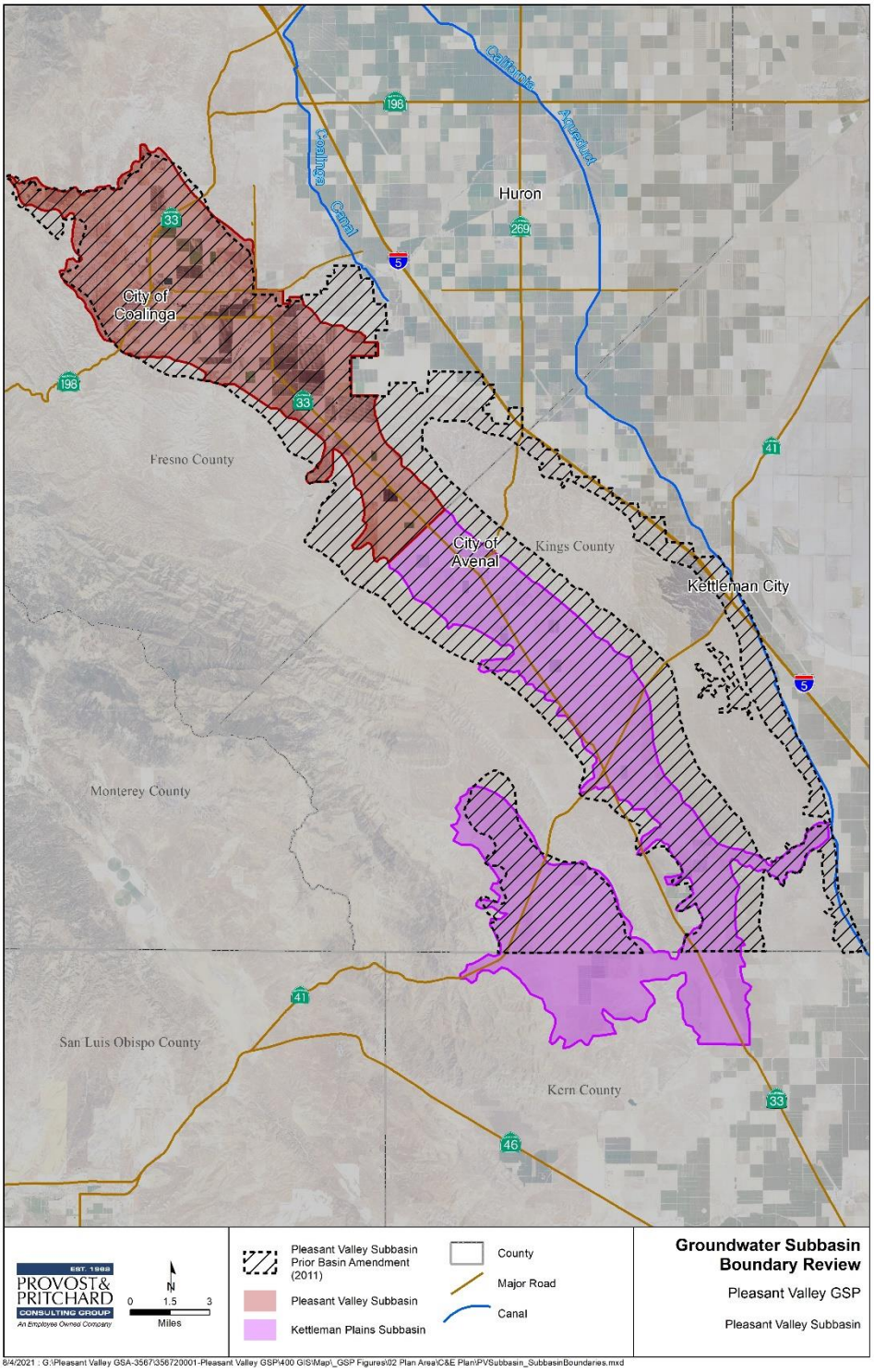


Figure ES-3 Regional Location of Pleasant Valley Subbasin

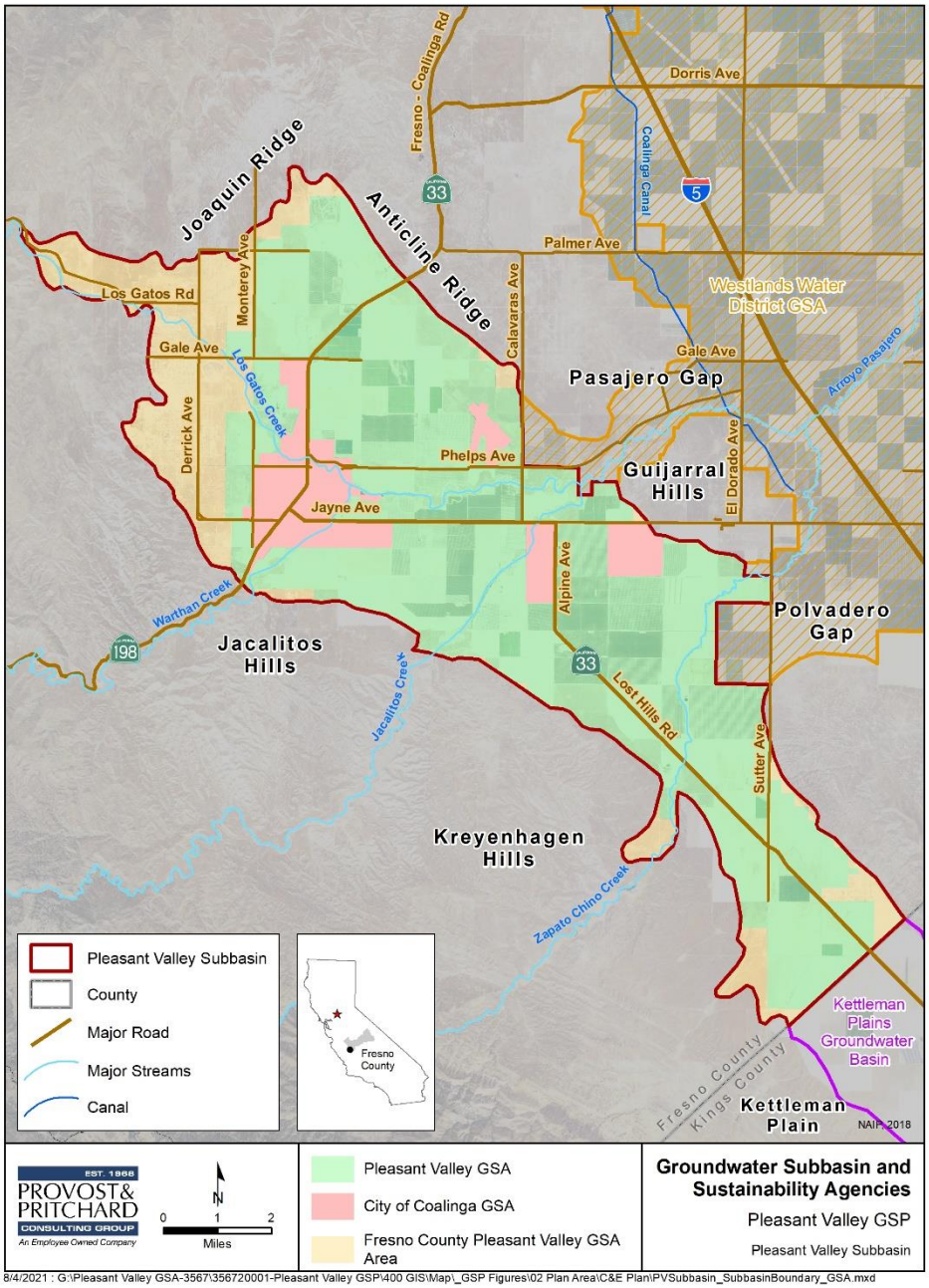


Figure ES-4 GSAs within the Pleasant Valley Subbasin

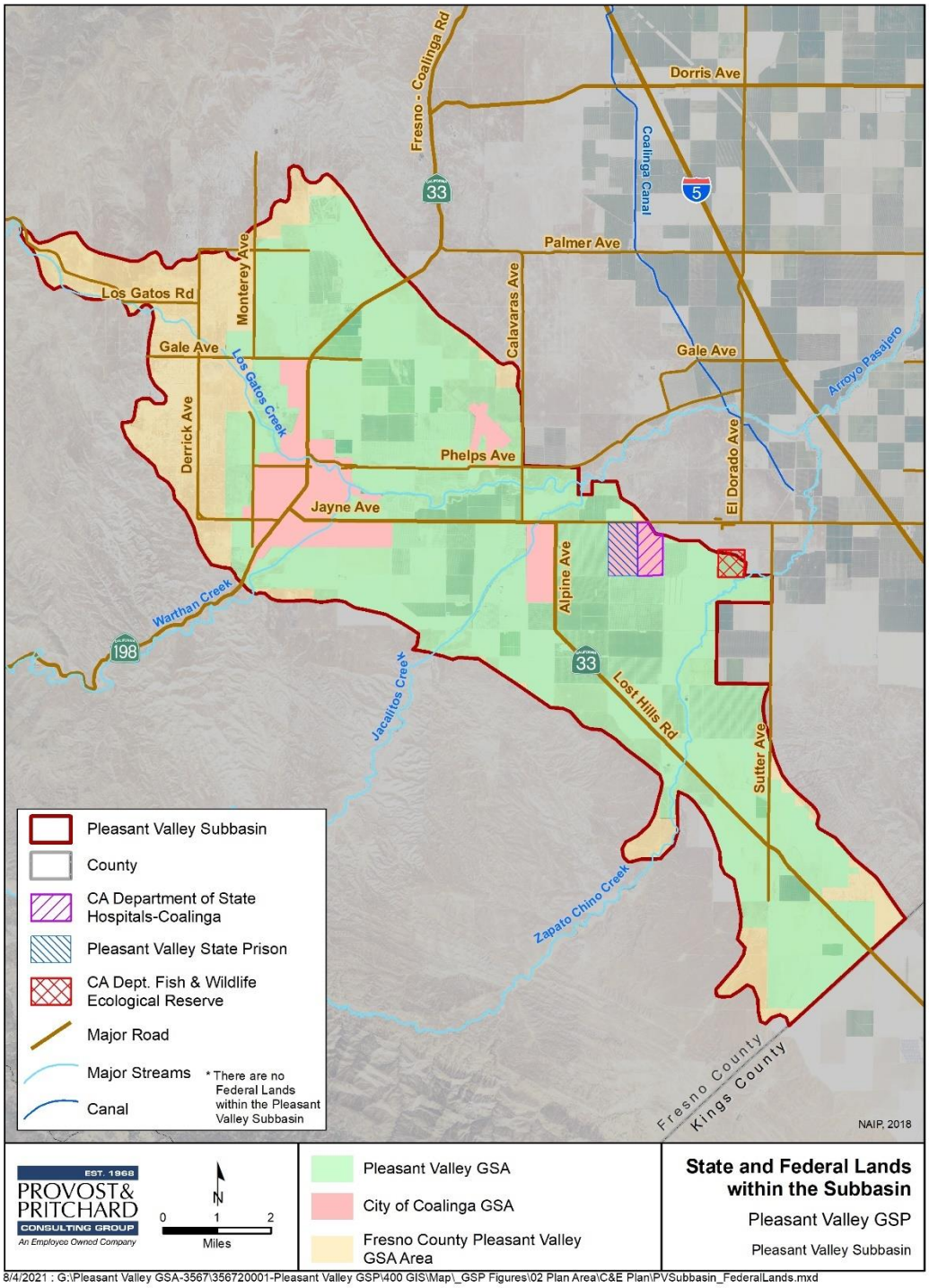


Figure ES-5 State and Federal Lands within the Subbasin

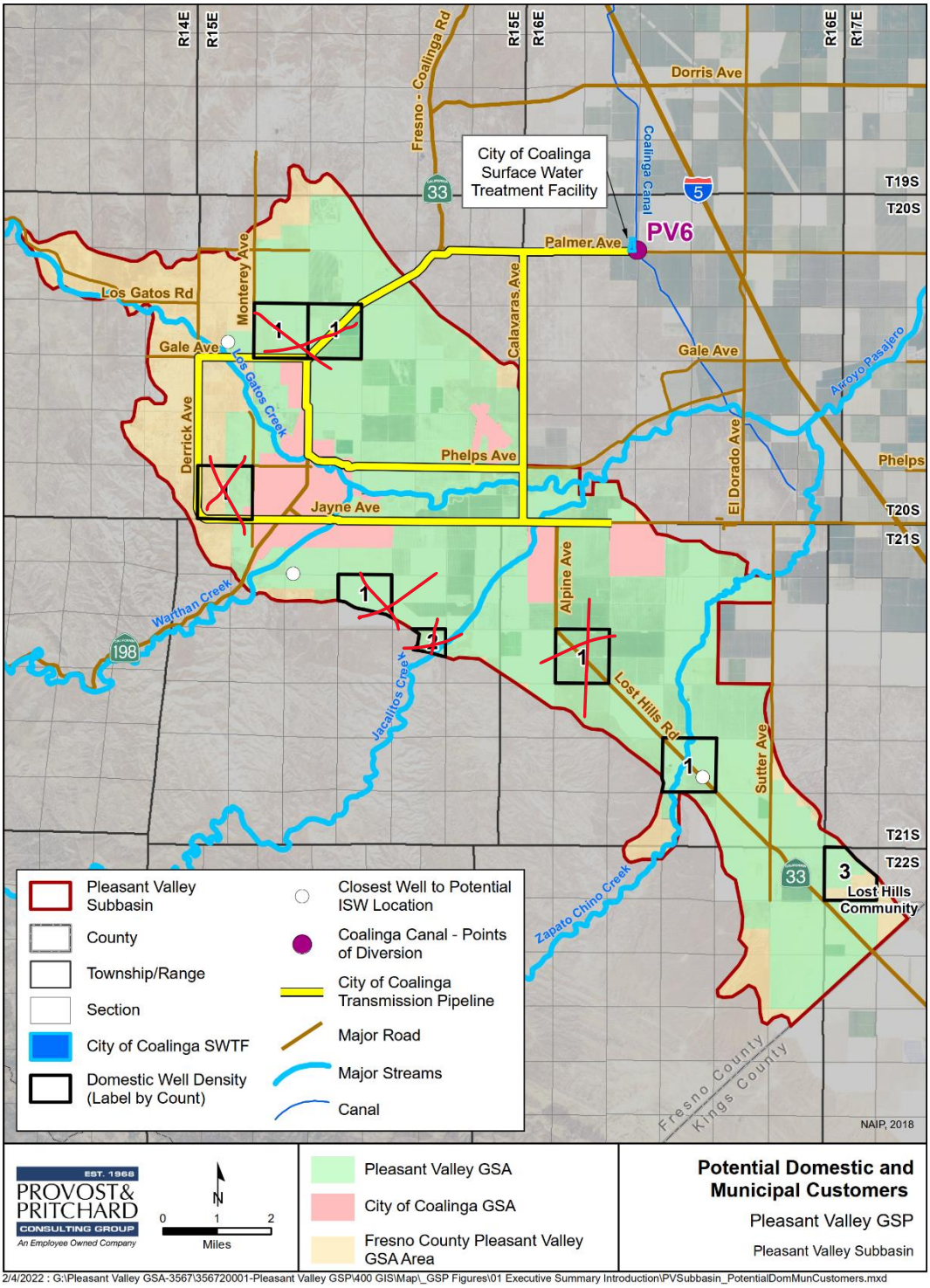


Figure ES-6 Potential Domestic and Municipal Customers

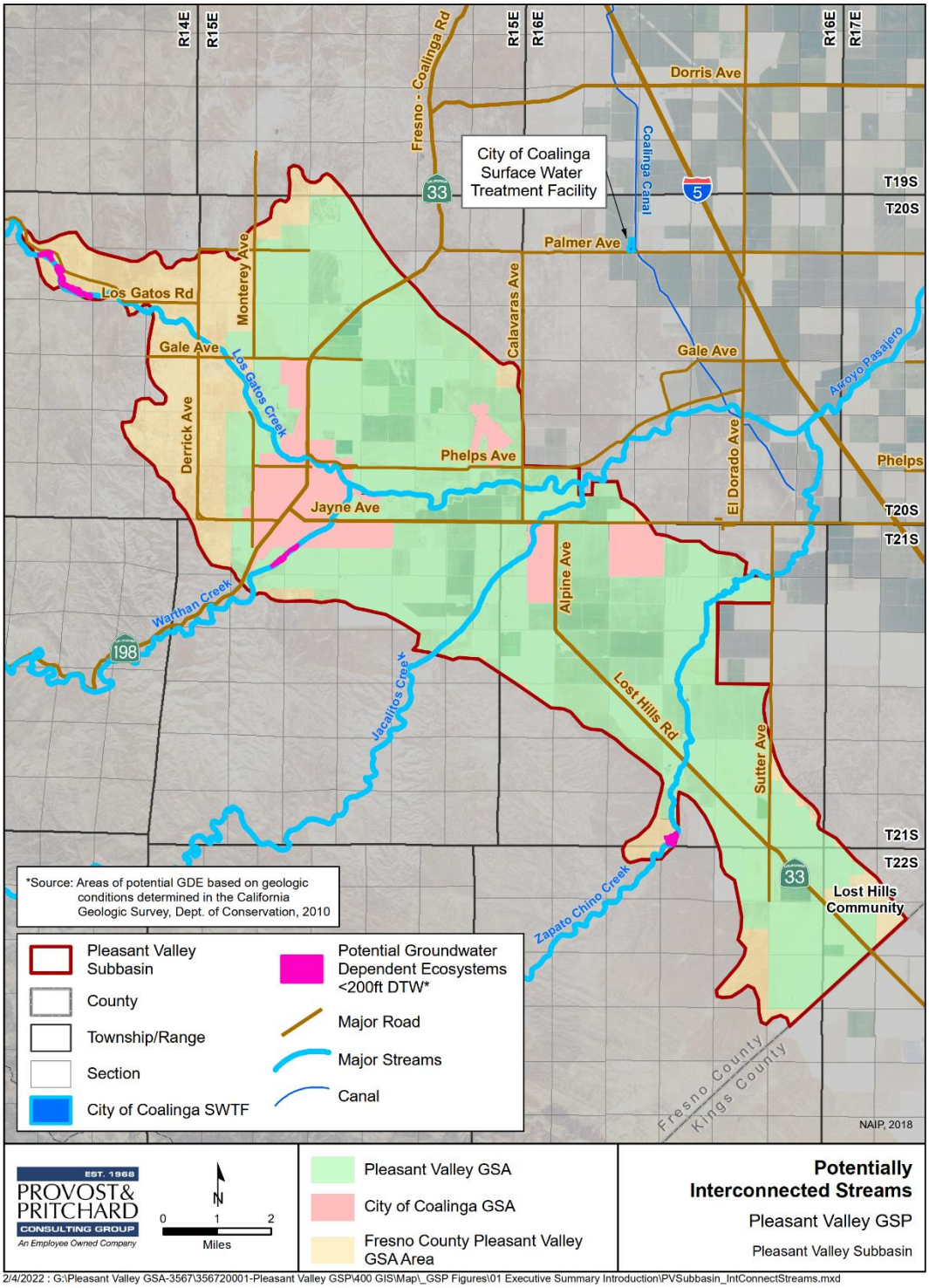


Figure ES-7 Potentially Interconnected Streams

1 Introduction

1.1 Subbasin Overview

The Pleasant Valley Subbasin (California Department of Water Resources (**DWR**) Basin 5-022.10) is located in Fresno County in the San Joaquin Valley Groundwater Basin and is estimated to total 48,159 acres. In November 2018, DWR reclassified the basin's groundwater overdraft conditions from a low-priority basin to a medium-priority basin. The Pleasant Valley Subbasin (**PV Subbasin or Subbasin**) is adjacent to the Westside Subbasin (Basin 5-022.09) of the San Joaquin Valley Basin to the east and north of the Kettleman Plain Subbasin (Basin 5-022.17). The PV Subbasin is bounded on the north by the Joaquin Ridge, on the west by the Tertiary and older marine sediments of the Coast Ranges, on the south by the Kettleman Hills and Plains and Kings County line, and on the east by the Guijarral Hills and Westside Subbasin. The subbasin is considered a separated basin. Although the PV Subbasin is hydraulically connected to the Westside Subbasin, meaning a small amount of water flows from the PV Subbasin to the Westside Subbasin through the anticline. The influence of the management plan in this GSP has little or no effect on the Westside Subbasin. The boundaries touch in two spots totaling about five linear miles and at differential elevation of more that 100 to 300 feet in elevation drop from the PV Subbasin to the Westside Subbasin through the Polvadero Gap (Westside Subbasin GSP, Figure 2-18, Map of Ground Surface Elevation). Also on the westerns side of Figure 2-32 Base of Fresh Water of the Westside Subbasin GSP shows a base of freshwater at elevation -800 feet below mean sea level. The base of fresh water in the PV Subbasin is approximately at elevation -2,400 below mean sea level. This information shows a separation of aquifers. Communication with the Westside Subbasin and their management actions has occurred as some PV Landowners also own land in the Westside Subbasin.

This Pleasant Valley Subbasin was ranked as a low priority by DWR in 2014, and in November 2018, DWR re-ranked the subbasin as a medium priority basin. The landowners prior to the implementation of SGMA have been proactively engaged in management activities and projects that support importation of surface water and implementation of data collection of groundwater levels, pumpage, groundwater quality, and land subsidence.

1.2 Purpose of Groundwater Sustainability Plan (GSP)

On September 16, 2014, Governor Jerry Brown signed into law a three-bill legislative package, composed of AB 1739 (Dickinson), SB 1168 (Pavley), and SB 1319 (Pavley), collectively known as the Sustainable Groundwater Management Act (SGMA) which was passed in 2014 and is codified in Section 10720 et seq. of the California Water Code. This legislation created a statutory framework for developing local groundwater management that can be sustained during planning and implementation without causing undesirable results.

SGMA requires governments and water agencies of high- and medium-priority basins to halt overdraft and bring groundwater basins into balanced levels of pumping and recharge. Under SGMA, these basins should reach sustainability within 20 years of implementing their sustainability plans. For medium priority basins, the deadline for achieving sustainability is 2040. With the reclassification of the basin from low to medium by DWR in 2018, the Pleasant Valley GSP is due to the state by 2023 and sustainability is required by 2043. The grant from DWR contractually requires the GSP and the grant to be concluded by February 28, 2022.

In his signing statement, Governor Brown emphasized that "groundwater management in California is best accomplished locally." With ongoing financial and technical assistance from DWR, the three Groundwater Sustainability Agencies (GSAs) in the Subbasin (Pleasant Valley GSA [PVGSA], Fresno County Pleasant Valley GSA—Pleasant Valley [County], and City of Coalinga GSA [City]) have coordinated to develop this one GSP and are working together to achieve groundwater sustainability.

Table1-1 GSP Requirements

GSP Requirements
Groundwater conditions must be adequately defined and monitored to demonstrate the GSAs are achieving the sustainability goals for the basin.
GSAs must be sufficiently defined and compatible to evaluate the effect of GSPs on adjacent basins.
GSPs must meet substantial compliance standards.
A GSA shall provide a description of basin setting and establish criteria that will maintain or achieve sustainable groundwater management.
DWR will consider state policy to the human right to water when implementing these regulations.
The GSP sustainable groundwater management criteria, projects, and management actions should be based on the level of understanding of uncertainty and data gaps.
A GSP must achieve the sustainability goals for the basin in 20 years.

1.3 Sustainability Goal

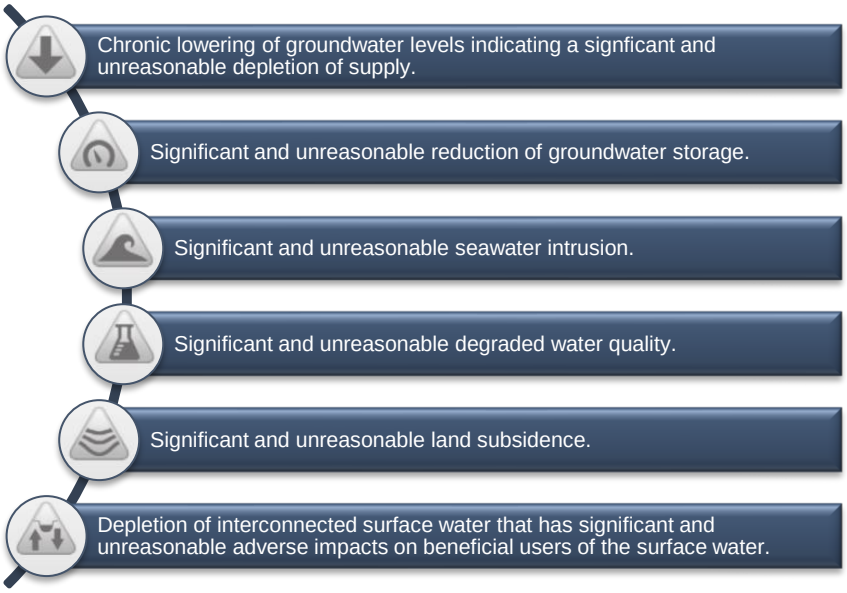


Figure 1-1 Six Categories of Undesirable Results

The sustainability goal of the Pleasant Valley Subbasin and this GSA is to ensure that by 2042 the basin is being managed in a sustainable manner to maintain a reliable water supply for current and future beneficial uses without experiencing undesirable results. A more detailed description of the Sustainability Goal for the Subbasin and Sustainable Management Criteria for the Subbasin and this GSA is included in **Chapter 4.**

The San Joaquin Valley Basin, including the Pleasant Valley Subbasin, has been determined to be in a state of overdraft consistently since the first edition of the DWR Bulletin 118 in 1978. Since that time, the Pleasant Valley Subbasin has experienced subsurface storage reduction through a combination of groundwater pumping and several years of below-normal recharge driven by drought conditions and low surface water flows. **Chapter 3** of this Groundwater Sustainability Plan (GSP) discusses this chronic water imbalance in more depth.

While the Pleasant Valley Subbasin has experienced a reduction in stored groundwater, the aquifers beneath the Subbasin still contain extensive supplies and the alluvium is conducive of replenishment of groundwater storage. That extensive storage volume has long obscured the effects of overdraft from year to year, providing a buffer against what would otherwise be extreme fluctuations in recharge depending on the climatic conditions. Water agencies in the Subbasin must work together to maintain the viability of the aquifer.

This GSP proposes measures to reduce and eventually eliminate overdraft within the PV Subbasin area. Eliminating overdraft is defined as balancing average groundwater withdrawals with average groundwater recharge over a hydrologic base period. The variability in recharge, in contrast to the steady nature of water demands, makes it infeasible to achieve stable groundwater levels every year. There will be years where water levels within the Subbasin fluctuate.

To accomplish this goal of sustainability, this Plan identifies undesirable results, which are outcomes that will be realized should the MT's be exceeded. Undesirable results occur when water levels fall below the MT water level. Positive outcomes defined in this GSP will take time to achieve; none of the goals can be realized in a year. Many will not be fully achieved until well into the 20-year attainment period defined in the SGMA legislation. Measurable objectives have been defined to gauge progress during the intervening years and to help assure not only that the Subbasin is moving toward its sustainability goals, but also that the rate of progress is as planned and sufficient to meet the overall implementation schedule.

Sustainability goals, undesirable results, minimum thresholds, and measurable objectives are all defined and discussed in detail in **Chapter 4** of this GSP.

Table 1-2 Sustainability Indicators

Sustainability Indicators
Groundwater Levels
Groundwater Storage Volume
Seawater Intrusion
Water Quality
Land Subsidence
Interconnected Surface Water

1.3.1 Goal Description

The goal of the GSP is to provide a tool for managing groundwater that will assist in maintaining basin-wide sustainability for the long-term for existing beneficial uses and users while avoiding undesirable results. Throughout the SGMA phases, the PV Subbasin GSA's Boards of Directors and technical teams will be responsible for collecting and organizing data, engaging and retaining experts and consultants, and soliciting feedback from beneficial users of groundwater and interested parties within the Subbasin boundary. The Pleasant Valley GSP participants intend to work collaboratively to continue to better understand the basin characteristics by establishing a coordinated network of monitoring points and reporting requirements. This will help to recognize existing hydrogeological patterns and to better refine Sustainable Management Criteria (SMC) in future Plan updates. The Pleasant Valley GSP participants also plan to establish criteria and implement programs and projects to monitor and manage groundwater levels and storage, protect

groundwater quality, and reduce the effects of subsidence in a manner that is open to the public and stakeholders and considers the needs of all beneficial users.

1.3.2 Discussion of Measures

The establishment of criteria and implementation of programs, projects, and management actions will help to achieve the goals of the GSP. Infrastructure projects and additional surface water supply will be crucial components. Existing and planned projects and management actions to aid in GSP implementation are identified in detail in **Chapter 6**.

1.3.3 Explanation of How the Goal will be Achieved in 20 years

The Sustainable Management Criteria will be evaluated in conjunction with the data obtained via monitoring efforts identified in **Chapter 5**. Every five years, the PV GSP participants can revise the GSP with the intention of refining the course to sustainability, if necessary, based on additional information.

The measurable objective quantitatively reflects the sustainability goal for 2042 and the interim goals quantitatively represent the sustainability goal at five-year increments, corresponding with Plan update periods. Monitoring results will be compared to the interim goals, measurable objectives, and minimum thresholds during Annual Report and GSP update development. The analysis will assess the ability to prevent undesirable results in the PV Subbasin as they relate to the other SMCs.

The sustainability goal for the Pleasant Valley GSP is to increase the importation of surface water to the region for direct irrigation use as well as for intentional recharge to the groundwater and to instate a curtailment policy to reduce groundwater extractions. If additional mitigation is needed, then the GSP would consider reductions in crop acreage to further reduce the amount of groundwater pumping in the basin.

1.4 Groundwater Sustainability Agency Information

Regulation Requirements:
§**354.6(a)** The name and mailing address of the Agency

Pleasant Valley Groundwater Sustainability Agency
P.O. Box 468
Coalinga, CA 93210

Contact: Brad Gleason
Phone: (559) 216-1411
Email: info@pleasantvalleywaterdistrict.com

County of Fresno Groundwater Sustainability Agency
2220 Tulare St. 6th Floor
Fresno, CA 93721

Contact: Roy Jimenez, Jr
Phone: (559) 600-4292
Email: RJJimenez@fresnocountyca.gov

Glenn Allen
Phone: (559) 600-9672
Email: GLAllen@fresnocountyca.gov

City of Coalinga GSA
155 W. Durian
Coalinga, CA 93210

Contact: Sean Brewer
Phone: (559)935-1533 Ext. 143
Email: sbrewer@coalinga.com

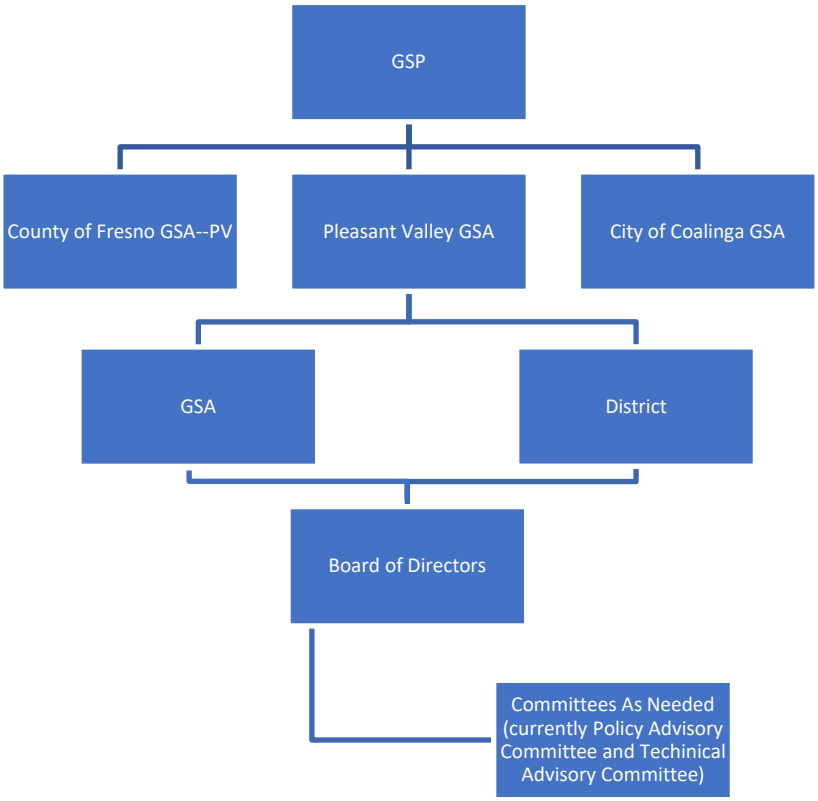
1.4.1 Organization and Management Structure of the GSA(s)

Regulation Requirements:
§**354.6(b)** The organization and management structure of the Agency, identifying persons with management authority for implementation of the Plan.
§**354.6(c)** The name and contact information, including the phone number, mailing address and electronic mail address, of the plan manager.

The Subbasin is covered by the three Groundwater Sustainability Agencies: County, City, and PVGSA.

The PVGSA Board of Directors has met every two months while developing this plan. It is expected that in 2022 the Board will revert to regularly meeting on the 2nd Tuesday of January, April, July, and October after the District Board meeting. The Agency is governed by a board of directors made up of seven directors who also serve on the Pleasant Valley Water District Board of Directors.

The following graphic illustrates the organizational structure.



The GSA may form committees on an as-needed basis. The Technical Advisory Committee (TAC) reviews and provides technical input on the preparation of the GSP. The TAC is comprised of a liaison with the GSAs, Kenneth Schmidt (hydrogeologist), Brian Ehlers (engineer), and a local agronomist. The Policy Advisory Committee, which reviews the recommendations of the TAC and recommends to the stakeholders policy issues, consists of five members (one representative from both the city and county GSAs and three representatives from the PVGSA).

At the time of writing this Plan, the following is the current contact information for the Plan Manager:

GSA Plan Manager:
Name: Brad Gleason
Phone: (559) 216-1411
Mailing Address: Pleasant Valley GSA
P.O. Box 468
Coalinga, CA 93210
Email: info@pleasantvalleywaterdistrict.com

The basin is preparing a single GSP.

Table1-3 Participating GSAs Contact Information

Pleasant Valley Subbasin Participating GSAs				
GSA	**Plan Manager**	**Mailing Address**	**Phone**	**Email**
Pleasant Valley GSA	Brad Gleason	P. O. Box 468 Coalinga, CA 93210	(559) 216-1411	info@pleasantvalleywaterdistrict.com
County of Fresno GSA-Pleasant Valley	Glenn Allen Roy Jimenez	2220 Tulare St., 6th floor Fresno, CA 93721	(559) 600-9672 (559) 600-4292 (559) 600-4251	glallen@fresnocountyca.gov rjimenez@fresnocountyca.gov
City of Coalinga GSA	Sean Brewer	155 West Durian Coalinga, CA 93210	(559) 935-1533	sbrewer@coalinga.com

1.4.2 Legal Authority of the GSA(s)

The Pleasant Valley Groundwater Sustainability Agency (PVGSA or Agency) was formed in 2016 as part of its compliance effort to meet California's SGMA legislation enacted in 2014. The Agency's boundaries overlay the boundaries of Pleasant Valley Water District (District) excluding the City of Coalinga.

The Pleasant Valley Subbasin was amended in 2016 following an application made by the District to the State Department of Water Resources (DWR). The revised Subbasin boundary encompasses approximately 48,159 acres entirely in Fresno County of which about 21,000 acres is currently cultivated.

The DWR reclassified the Subbasin from a low- to medium-priority designation in November 2018. In cooperation with the City and County, the PVGSA has until February 2022 due to grant contract

requirements to submit its GSP for the Subbasin and has undertaken a series of steps to develop and meet the GSP submission deadline.

The three GSAs have established Memorandums of Understanding (MOUs) to ensure coordination in developing and implementing the GSP. See **Section 1.5** for more about the MOUs.

Pleasant Valley Water District was formed in 1963 to provide agricultural water to landowners. The District was formed under California Water Code section 34000-38500 which enables the formation of Water Districts to acquire, plan, construct, maintain, improve, operate, and keep in repair the necessary works for the production, storage, transmission, and distribution of water for irrigation, domestic, industrial, and municipal purposes.

The Fresno County Local Agency Formation Commission (LAFCo) recognizes the District as a qualified public agency that provides its landowners with representation, information services regarding statewide water policy, water rights, new state legislation, water agency coordination, and other issues affecting local water resources.

The District is an independent special district which has a seven-member board of directors not governed by another legislative body (either a city council or county board of supervisors). Candidates eligible to serve on the board of directors must be a holder of title to land within the District boundaries or the legal representative of the holder of title to land within the District boundaries. District board members are subject to election of four-year staggered terms; in the event that the number of candidates filing with County elections is equal to the number of open seats on the board, the Board of Supervisors may appoint members in-lieu of an election; in the event no candidates file election papers, members may be appointed by the Fresno County Board of Supervisors based on a recommendation provided by the District's board of directors.

The District has authority to manage the groundwater resources within its service area through CWC, Division 6, Part 2.75 (Sections 10750 et seq.) It is the primary agency responsible for its groundwater management plan, and it provides for management of the groundwater basin within its political boundary. The groundwater management plan complies with CWC, Sections 10750 et seq., as amended January 1, 2003.

The PVGSA, County of Fresno GSA, and City of Coalinga GSA have the responsibility to monitor for compliance of sustainable groundwater management within its service area. The powers given to GSAs are enumerated in CWC, Division 6, Part 2.74 and include but are not limited to the following: the ability to acquire personal property of any kind, such as land, rights-of-way, water rights, etc.; the authority to mandate the registration of groundwater extraction facilities; the authority to regulate groundwater extractions; and the ability to impose well operation requirements. Legal authority given to the GSAs by SGMA will not be used to its maximum extent unless deemed necessary.

Regulation Requirements:
§**354.6(d)** The legal authority of the Agency, with specific reference to citations setting forth the duties, powers, and responsibilities of the Agency, demonstrating that the Agency has the legal authority to implement the plan.

1.4.3 Estimated Cost of Implementing the GSP and the GSA's Approach to Meeting Costs

The costs associated with implementation of the GSP are discussed in detail in **Section 7.1**.

As will be described later in this document, the County of Fresno GSA and the City of Coalinga GSA do not pump significant groundwater and thus the majority of the management and costs will be borne by the PVGSA. The following describes the estimated costs for administration operations and capital expenses in the future.

PVGSA and the Pleasant Valley Water District will experience two types of implementation costs – ongoing administrative expenses and project costs. Ongoing administrative expenses are anticipated to initially include fiscal agent and legal counsel expenses, audits, annual data collection and reporting, outreach, and consultant expenses for preparing funding reports and updating the GSP. Although project implementation costs are likely to be excluded from PVGSA-related expenses to landowners and possibly negligible during the first interim GSP milestone period, a future scenario may require PVGSA to support capital costs for improvement of the monitoring network or another type of project with a collective benefit to local landowners. Total administrative costs for this initial interim five-year period are estimated to vary from $150,000 to $373,000 per annum and will be presented to PVGSA's Board of Directors for consideration and approval annually. Costs associated with implementing the GSP will require PVGSA to pursue funding mechanisms such as pumping fees and possible, Proposition 26 or Proposition 218, to provide a steady stream of revenue for a specific period. PVGSA has not determined which funding mechanism will be utilized to provide future revenue, at a minimum, for the first interim milestone period (five years).Landowners have funded all projects and currently being implemented.

Administrative Expenses. PVGSA must consider other funding mechanisms, such as through Propositions 26 or Proposition 218, to secure funds for the next five years leading up to the first interim milestone. Projected costs and expenses include such items as administrative support, GSP update and implementation, stakeholder outreach and engagement, consulting firms and legal counsel for SGMA compliance, etc. and estimated costs can be found in table 7.2 below. Given that project costs are not the current responsibility of PVGSA, the proposed budget included herein will be the basis for anticipated costs incurred during this first five-year interim milestone period. Annually, PVGSA Board of Directors will consider budget needs to ensure fiscal solvency with the understanding that adjustments may be required if budget assumptions do not hold true.

Table1-4 Administrative Expenses

Item	2022	2023	2024	2025	2026
Administration	$5,000	$10,000	$10,000	$10,000	$10,000
Groundwater Monitoring and Measurement	$10,000	$25,000	$25,000	$25,000	$25,000
Legal	$2,000	$10,000	$10,000	$10,000	$10,000
Annual Reporting	$75,000	$75,000	$75,000	$75,000	$75,000
Coordination with adjacent Basins	$2,000	$4,000	$4,000	$3,000	$3,000
Plan Update				$150,000	$150,000
Totals	$94,000	$124,000	$124,000	$273,000	$273,000

Project Costs. At this time, project costs are not the responsibility of PVGSA and will be borne solely by a project proponent. Such projects may be funded by existing capital improvement budgets, grant funding, propositions (26 or 218), low interest loans, or other methods. Each project will be required to develop and secure funding needed to ensure their sustainability by 2042. Member agencies will re-evaluate their respective SGMA efforts periodically to determine whether an adjustment is necessary in their project implementation plan.

Table1-5 Project Costs

Item	2022	2023	2024	2025	2026
North Canal Pipeline		$1,000,000	$10,000,000	$10,000,000	
South Canal Pipeline Exp					$2,500,000
Los Gatos Gravel Pits					$2,100,000
Meter Policy	$50,000				
Rules and Regulations	$20,000				
Transfer Policy	$20,000				
Pumping limits Policy	$50,000				
Monitor Well Installation			$300,000		
[1]Surface water Purchase			$1,500,000	$1,500,000	$3,000,000
[2]Firestone Recharge Facility		1,000,000			
Totals	$140,000	$2,000,000	$11,800,000	$11,500,000	$7,600,000

[1]Assumes a rate of $250-500/AF. [2]In Operation

-

Grant Funding. PVGSA recognizes that grants provide a key source of funding that can be utilized to offset fiscal burdens to stakeholders and beneficial users. While the foregoing is true, PVGSA also knows that such funds should not be factored into any budget projections because of the time lag between reimbursement and date expense is incurred.

Operational Costs: The most significant cost the landowners will face is the ongoing cost to purchase and deliver surface water. It is assumed that the basin will expand surface water imports an average of 6,000 acre per year (AF/YR) at a rate of $250/AF during the first implementation period. This results in an annual operating cost of over $1.5 million a year.

Regulation Requirements:
§**354.6(e)** An estimate of the cost of implementing the Plan and a general description of how the Agency plans to meet those costs.

1.5 Interim Operating Agreement

On February 25, 2020, the County of Fresno and the Pleasant Valley Water District (District) entered into a Memorandum of Understanding (MOU) for implementation of the SGMA and the development and implementation of a single GSP for the entire Pleasant Valley Subbasin.

On January 2, 2020, the City of Coalinga GSA and Pleasant Valley GSA entered into a MOU. On February 25, 2020, the County of Fresno and Pleasant Valley GSA entered into a revised MOU.

The MOUs have the following objectives: to achieve sustainable groundwater management, to work cooperatively with each other and with adjacent GSAs in the PV Subbasin to prepare a single GSP that covers the Pleasant Valley Subbasin, and to work cooperatively with each other and with adjacent GSAs in the PV Subbasin to achieve sustainable groundwater management in the PV Subbasin

The individual MOUs are included in **Appendix A**.

1.6 GSP Organization

This GSP is organized in accordance with the outline in the GSP Guidelines published by DWR.

Section 2 describes the Plan area, including geographic setting, existing water resources planning and programs, relationship of the GSP to other general plan documents within the Agency boundary, and additional GSP components.

Section 3 describes the basin setting. It includes a detailed discussion of the hydrogeologic conceptual model used to prepare the GSP, current and historical groundwater conditions, a discussion of the area groundwater budget, and a description of why there are no management areas.

Section 4 sets forth the Agency's adopted sustainability goals, addresses the mandated undesirable outcomes, defines minimum thresholds for each undesirable outcome, and sets measurable outcomes for both intermediate Plan years and for the Plan's complete implementation.

Section 5 describes the network of monitoring wells and other facilities adopted by the Agency to measure Plan outcomes and assesses the need for improvements to the network in order to provide fully representative data. Monitoring protocols and data analysis techniques are also addressed.

Section 6 lists and describes each project and management action adopted by the Agency in pursuit of sustainability. The section includes project details, required permits, anticipated benefits, project capital and operations/maintenance costs, project schedule, and required ongoing management operations.

Section 7 describes the Plan implementation process, including costs, sources of funding, an overall schedule through full implementation, description of the required data management system, methodology for annual reporting, and how progress evaluations will be made over time.

Section 8 summarizes the references and sources used to prepare and document this Plan.

2 Plan Area

Regulation Requirements:
§354.8 Each Plan shall include a description of the geographic areas covered, including the following information:
(a) One or more maps of the basin that depict the following, as applicable:
(1) The area covered by the Plan, delineating areas managed by the Agency as an exclusive Agency and any areas for which the Agency is not an exclusive Agency, and the name and location of any adjacent basins.
(2) Adjudicated areas, other Agencies within the basin, and areas covered by an Alternative.
(3) Jurisdictional boundaries of federal or state land (including the identity of the agency with jurisdiction over that land), tribal land, cities, counties, agencies with water management responsibilities, and areas covered by relevant general plans.
(4) Existing land use designations and the identification of water use sector and water source type.
(5) The density of wells per square mile, by dasymetric or similar mapping techniques, showing the general distribution of agricultural, industrial, and domestic water supply wells in the basin, including de minimis extractors, and the location and extent of communities dependent upon groundwater, utilizing data provided by the department, as specified in section 353.2, or best available information.

This chapter describes the Pleasant Valley GSA, Fresno County Pleasant Valley GSA Area, and City of Coalinga GSA that comprise the Pleasant Valley Subbasin (Subbasin or Plan Area). The GSP is prepared jointly by the three GSAs in the Subbasin and the GSP covers the entire Pleasant Valley Subbasin. Specifically, this chapter describes the geographic areas, governing entities, jurisdictional boundaries, existing water sources, land use and land use planning, and well density within the Subbasin covered by this GSP.

The Pleasant Valley Water District (**Figure 2-1**) is located in western Fresno County on the westside of the San Joaquin Valley. The District has an irrigable acreage of approximately 28,000 acres and is situated in its own valley on the easterly edge of the Coast Range mountains.

The District was organized on January 23, 1963, in accordance with the Water District Law of the State of California, for the purpose of contracting with the United States Bureau of Reclamation (URBR) for a water supply. This water supply was to be delivered through the Coalinga Canal also known as the Pleasant Valley Canal, a branch of the San Luis Canal. Although the canal and pumping plant were constructed with the capacity to deliver water to the Pleasant Valley Water District, a distribution system for the District is yet to be constructed.

The lands within the boundaries of the District have been irrigated since the early 1900s using groundwater. The existing groundwater basin is being overdrafted and the source is declining in level and deteriorating in supply and quality.

2.1 Summary of Jurisdictional Areas and Other Features

Regulation Requirements:
§354.8(b) A written description of the Plan area, including a summary of the jurisdictional areas and other features depicted on the map.

The Pleasant Valley Subbasin (DWR Basin 5-022.10) is located in Fresno County in the San Joaquin Valley Groundwater Basin. The Subbasin is adjacent to the Westside Subbasin of the San Joaquin Valley Basin to the east and north of the Kettleman Plain Subbasin. The Subbasin is bounded on the north by the Joaquin Ridge, on the west by the Tertiary and older marine sediments of the Coast Ranges, on the south by the Kettleman Hills and Plains and Kings County line, and on the east by the Guijarral Hills and Westside Subbasin. **Figure 2-2** depicts the regional location of the Subbasin.

2.1.1 Groundwater Sustainability Plan (GSP) Area

The Pleasant Valley Plan Area includes the Pleasant Valley Groundwater Sustainability Agency (**PVGSA**), Fresno County Pleasant Valley GSA Area (**FCPVGSA**), and City of Coalinga GSA (**CCGSA**). **Figure 2-3** identifies the GSA boundaries and the additional jurisdictional boundaries within the Plan Area as well as the Pleasant Valle WD boundary.

There are no Federal owned lands within the Plan Area; however, the State owned and operated California Department of Corrections and Rehabilitation's Pleasant Valley State Prison (**PVSP**) and the Coalinga State Hospital (**CSH**), operated by the Department of State Hospitals reside within the Plan Area. The PVSP and CSH combined span approximately 640-acres and receive water from the City of Coalinga. In addition, a portion of the Pleasant Valley Ecological Preserve, operated by the California Department of Fish and Wildlife, is located within the Subbasin. **Figure 2-4** clarifies the locations the State lands within the Subbasin.

No adjudicated areas exist within the Subbasin; therefore, the entirety of the estimated 48,159 acres of the Subbasin is subjected to GSP regulations. An outline of the GSA acreages is available in **Table 2-1**.

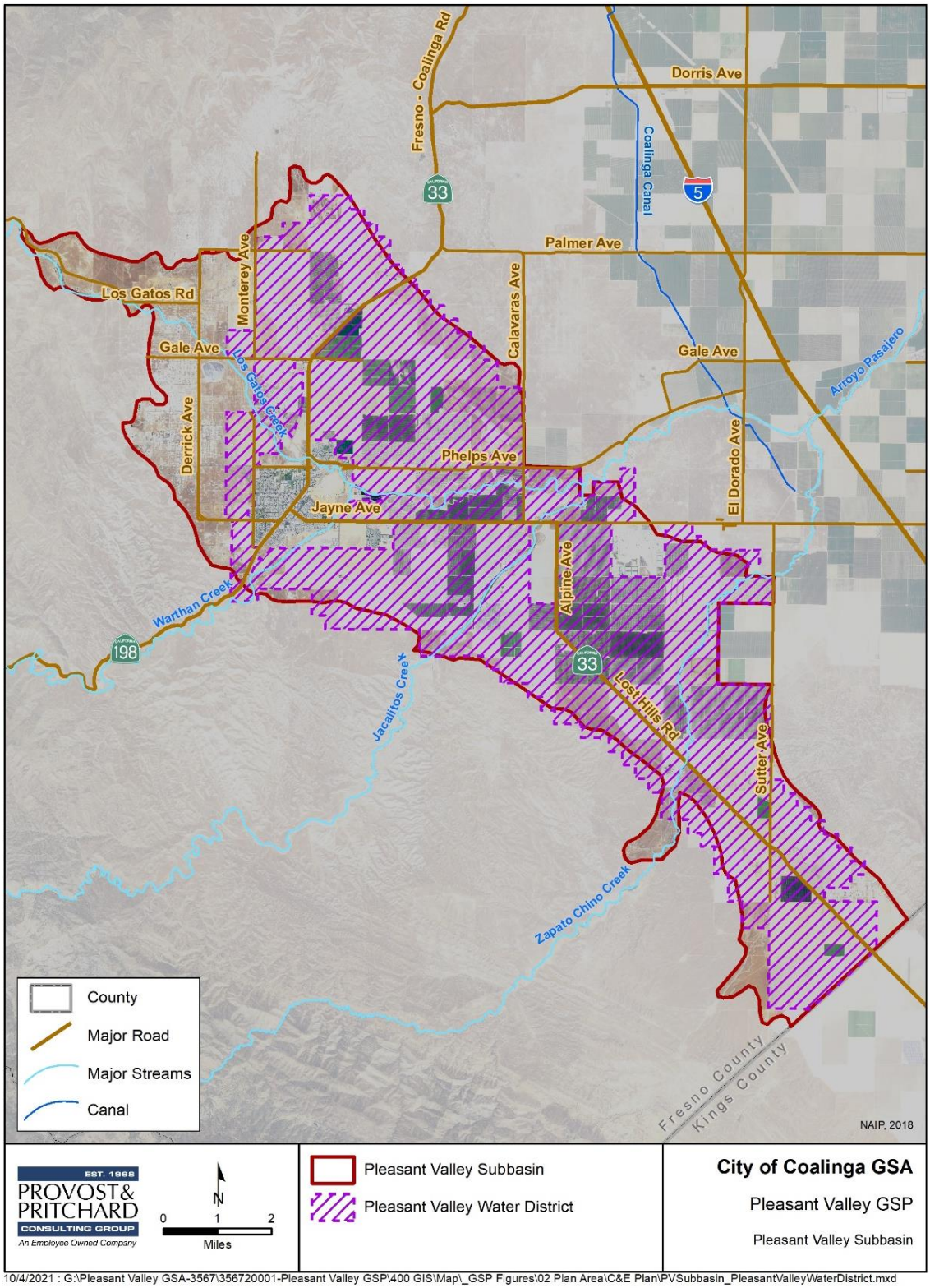


Figure 2-1 Pleasant Valley Water District

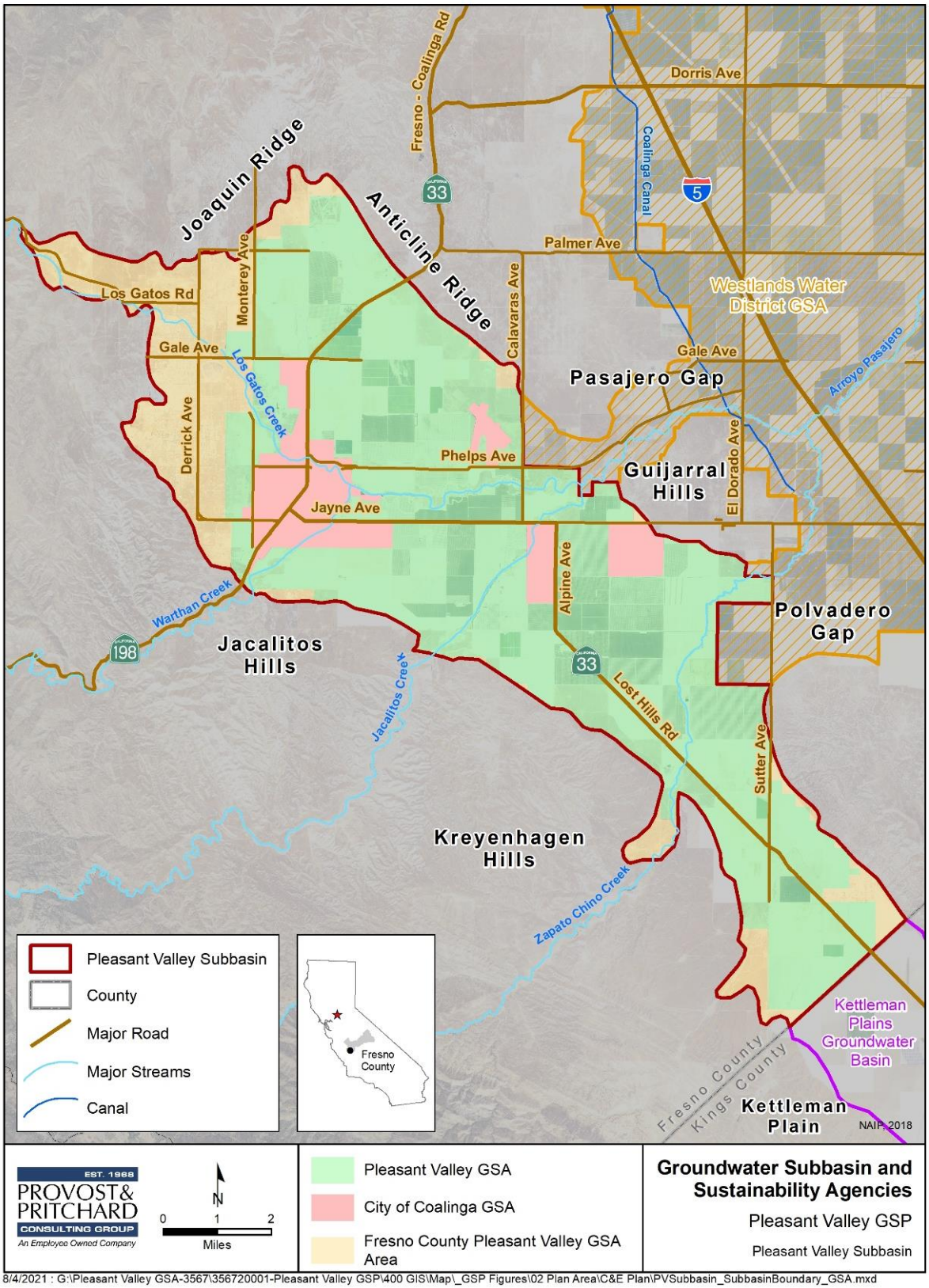


Figure 2-2 Pleasant Valley Subbasin

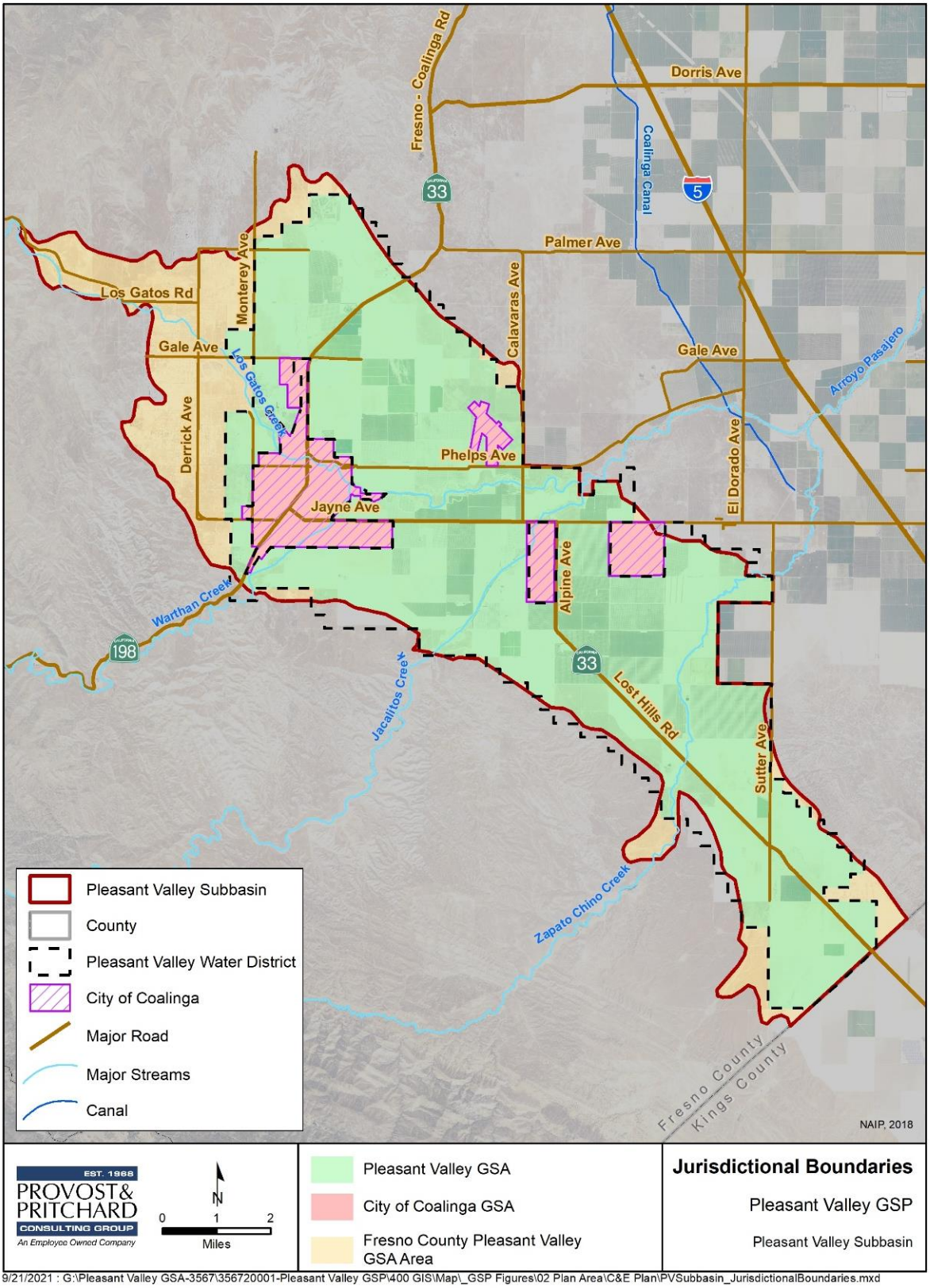


Figure 2-3 Jurisdictional Areas within the Pleasant Valley Subbasin

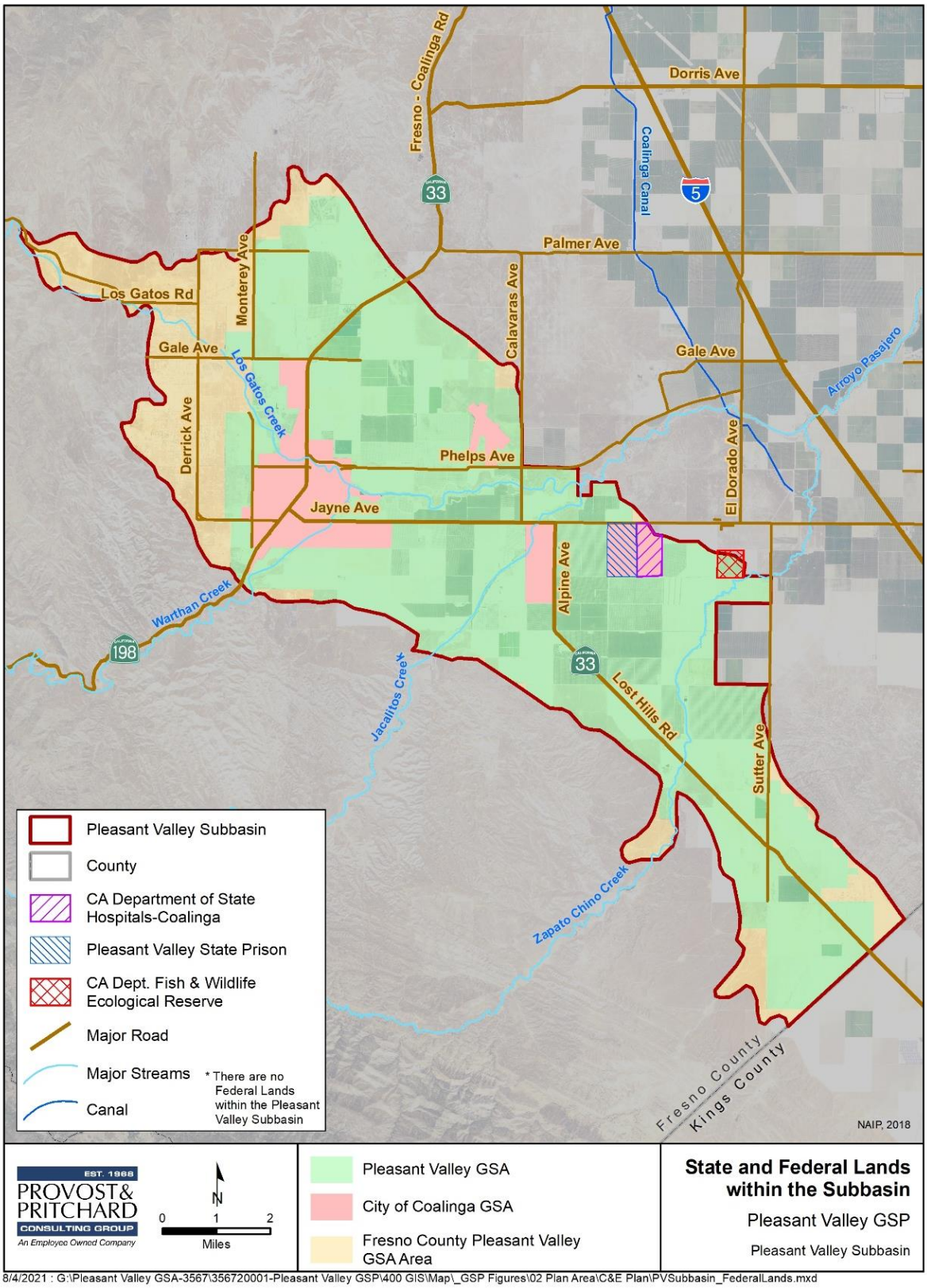


Figure 2-4 State and Federal Lands within the Pleasant Valley Subbasin

Table2-1 Approximate GSA Acreages

Jurisdiction	Approximate Acres	Approximate Percent of PV Subbasin
Pleasant Valley GSA	34,569	72
City of Coalinga GSA	4,251	9
Fresno County Pleasant Valley GSA Area	9,249	19
Pleasant Valley Plan Area	**48,159**	**100%**

The intent of the boundary determinations of the Groundwater Sustainability Agencies (**GSA**) within the Subbasin were outlined in the Resolutions produced for the Department of Water Resources (**DWR**) in accordance with the Notice of Intent of GSA Formation requirements, including Fresno County Resolution No. 19-192 and the City of Coalinga Resolution No. 3893.

Henceforward, the Subbasin's Groundwater Sustainability Plan (**GSP**) development will include GIS mapping and analyses in accordance with the intended GSA boundaries communicated in the GSA Formation Resolutions and not in accordance with other planning documentation. For further clarity, the GSA boundary extents are explained in **Table 2-2.**

Table2-2 GSA Boundaries Extent

Pleasant Valley Subbasin Intended GSA Boundaries		
City of Coalinga GSA	Pleasant Valley GSA	Fresno County Pleasant Valley GSA Area
City of Coalinga's jurisdictional boundary	Pleasant Valley Water District's jurisdictional boundary except those portions within the City of Coalinga and outside the Basin boundaries	All portions of the Subbasin outside of the City of Coalinga and Pleasant Valley Water District jurisdictional boundaries

2.1.2 Pleasant Valley GSA

The Pleasant Valley GSA was officially formed by the Pleasant Valley Water District (**PVWD**) on January 24, 2017, to meet the compliance requirements of California's SGMA legislation. The GSA's boundaries overlay the boundaries of the PVWD, except that portion of the PVWD that lies within the City of Coalinga as well as smaller portions of property that are within the Pleasant Valley Water District and outside the Subbasin boundary.

The primary industry within PVWD and the associated Pleasant Valley GSA is agriculture with nearly one/third of the producing acreage in pistachios.

PVWD was formed in 1963 to provide agricultural surface water from the Central Valley Project (**CVP**) to landowners. A contract for CVP supplies was not executed; however, the Coalinga Canal was constructed by the United States Bureau of Reclamation (**USBR**) as part of the federal CVP project and built with capacity to serve the valley. Some temporary water transfers have occurred resulting in surface supplies delivered for irrigation use in the valley. The PVWD includes approximately 38,000 total acres, of which around 28,000 are in agriculture production, and nearly 10,000 of those acres are pistachios. The district has identified 80 to 90 active irrigation wells. Prior studies conducted by the PVWD indicate a potential water storage space of 1

million acre-feet. Landowners within the southeastern area of the PVGSA have already begun importing surface water to help offset the overdraft of groundwater.

The Pleasant Valley GSA has a Memorandum of Understanding (**MOU**) with City of Coalinga GSA and Fresno County Pleasant Valley GSA Area to take the lead in preparing the Subbasin-wide GSP, while communicating and collaborating with management of the other two GSAs throughout the development, public review, and implementation phases.

2.1.3 City of Coalinga GSA

The City of Coalinga GSA boundary includes the city limits, which includes the city central, the New Coalinga Municipal Airport, Pleasant Valley State Prison (PVSP) and Coalinga State Hospital (CSH), and a parcel being considered for a potential future sewage treatment site. **Figure 2-3** visually clarifies the jurisdictional boundary of the City of Coalinga GSA.

Industry within the City of Coalinga is diverse. The economy is driven by the surrounding agricultural interests; small businesses; schools, including West Hills Community College; CSH; PVSP; and a library, museum, and other recreational facilities.

The City of Coalinga's water supply is imported from CVP. They have received water under a service contract with the USBR since 1971. The City generally does not rely on groundwater supplies. However, the Farm of the Future at the West Hills Community College and other agricultural lands within the City of Coalinga GSA pump groundwater to irrigate farmland. The City also manages the treatment and distribution of the water for municipal use and for the PVSP and CSH. Due to the brackish groundwater in the Subbasin, drinking water was initially brought into the area on rail cars prior to formation of the City of Coalinga in 1906. Sometime prior to 1959, the City installed a demineralization plant for the treatment of the saline groundwater for potable use. This was halted when aqueduct water became available. Currently the City of Coalinga supply's water to most Domestic Urban water users. The City of Coalinga water surface area map is attached. The Lost Hills Community has domestic wells but no know treatment facilities are in place. This plan accounts for future potential treatment facilities.

2.1.4 Fresno County Pleasant Valley GSA Area

The unincorporated lands in Fresno County that are not within Pleasant Valley Water District or City of Coalinga are included in the Fresno County Pleasant Valley GSA Area. In addition to the Pleasant Valley Subbasin, Fresno County is included in the critically overdrafted: Kings Subbasin, Westside Subbasin, and Delta-Mendota Subbasin. To accommodate the various approaches and unique challenges across the various regions, Fresno County areas in each of the noted subbasins are defined by distinct GSAs corresponding to the subbasin in which they reside. **Figure 2-3** further depicts the jurisdictional boundaries within the FCPVGSA.

The Fresno County Pleasant Valley GSA Area predominantly relies on groundwater. The primary industry within the Fresno County Pleasant Valley GSA Area is oil production. A small rural residential community toward the southern end (the "Lost Hills Community") of the GSA also relies on groundwater pumped from individual domestic wells.

2.1.5 Management Areas

The Subbasin has three GSAs, and each GSA will be responsible for implementing projects and management actions for the GSA. For purposes of the GSP, the three member GSAs collectively will report to cover the extent of the basin.

2.1.6 Land Use within the Pleasant Valley Subbasin

General 2018 land use maps depicting DWR's LandIQ survey of land use for the three GSAs in the Plan Area are provided in **Figure 2-5**, **Figure 2-6**, and **Figure 2-7**. The Plan Area is comprised primarily of agricultural designations with most residential, municipal, and commercial development in the City of Coalinga GSA. **Table 2-3** outlines DWR's 2018 land use determinations across GSAs and the Subbasin by general land use categories. It should be noted that those areas not mapped, generally include rangeland, oil fields, native ground, and a non-incorporated area.

Table2-3 Major Land Use in the Pleasant Valley Subbasin

Pleasant Valley Subbasin 2018 Land Use				
GSA	**Land Use**	**Approximate Acres**	**Approximate Percent of GSA**	**Approximate Percent of Subbasin**
City of Coalinga GSA	Grain and Hay Crops	81	2%	0%
	Pistachios	41	1%	0%
	Truck, Nursery, and Berry Crops	33	1%	0%
	Urban	2,396	56%	5%
	Young Perennials	12	0%	0%
	Unknown	1,694	40%	4%
	City of Coalinga GSA Total	**4,257**	**100%**	**9%**
Fresno County Pleasant Valley GSA Area	Grain and Hay Crops	211	2%	0%
	Truck, Nursery, and Berry Crops	98	1%	0%
	Urban	14	0%	0%
	Unknown	8,904	97%	19%
	FCPVGSA Area Total	**9,227**	**100%**	**19%**
Pleasant Valley GSA	Field Crops	242	1%	1%
	Grain and Hay Crops	6,137	18%	13%
	Pasture	125	0%	0%
	Pistachios	9,444	28%	20%
	Truck, Nursery, and Berry Crops	1,168	4%	3%
	Urban	1,441	4%	3%
	Young Perennials	240	1%	1%
	Unknown	14,708	44%	31%
	PVGSA Total	**33,505**	**100%**	**72%**
Total Subbasin		**46,988**		
Data Source: DWR 2018 LandIQ Land Use Survey				

Table2-4 Pleasant Valley Subbasin Land Use with Provost & Pritchard Field Review

Pleasant Valley Subbasin Land Use with Provost & Pritchard Field Review				
GSA	**Land Use**	**Approximate Acres**	**Approximate Percent of GSA**	**Approximate Percent of Subbasin**
City of Coalinga GSA	Grain and Hay Crops	99	2%	0%
	Pistachios	41	1%	0%
	Truck, Nursery, and Berry Crops	33	1%	0%
	Urban Developed	3,729	88%	8%
	Young Perennials	12	0%	0%
	Idle	294	7%	1%
	Unknown	49	1%	0%
	City of Coalinga GSA Total	**4,257**	**100%**	**9%**
Fresno County Pleasant Valley GSA Area	Grain and Hay Crops	211	2%	0%
	Truck, Nursery, and Berry Crops	98	1%	0%
	Urban Developed	390	4%	1%
	Oil Fields	4,600	50%	10%
	Pasture	3,829	42%	8%
	Unknown	99	1%	0%
	FCPVGSA Area Total	**9,227**	**100%**	**19%**
Pleasant Valley GSA	Field Crops	242	1%	0%
	Grain and Hay Crops	8,756	26%	19%
	Pasture	3,674	11%	8%
	Pistachios	9,444	28%	20%
	Truck, Nursery, and Berry Crops	1,973	6%	4%
	Urban Developed	1,835	5%	4%
	Young Perennials	240	1%	0%
	Cattle and Dairy	185	1%	0%
	Idle	1,772	5%	5%
	Oil Fields	84	0%	0%
	Seasonal Fallow	3,635	11%	8%
	Unknown	1,665	5%	4%
	PVGSA Total	**33,505**	**100%**	**72%**
Total Subbasin		**46,988**		
Data Source: DWR 2018 LandIQ Land Use Survey and P&P Field Review				

2.1.7 Water Use and Water Sources within the Pleasant Valley Subbasin

Water use and water sources for each GSA are shown in **Table 2-5**. The primary water use designation is related to agricultural production and the primary water source in the Subbasin is groundwater. The City of Coalinga, however, is supplied by imported CVP water, which they receive under a water service contract with the USBR. The City of Coalinga's water uses are predominantly municipal, residential, commercial, and industrial, as well as for landscaping and providing water services to the PVSP and CSH. The City of Coalinga also has a rural water service area, where they supply drinking water to rural residences within the PVGSA, primarily along Palmer and Jayne Avenues. Additionally, private landowners within the PVGSA have been importing surface water through pipelines into the Subbasin in recent years.

Although, groundwater is the primary water source in the Plan Area, those agencies and landowners with access to imported surface water utilize it whenever available. As described in the SGMA Act section 10720.5(b), water rights stay with the water rights holder. The United States Bureau of Reclamation has Water Rights for diversion of Central Valley Project South of Delta San Luis Unit. Water for the Pleasant Valley

through the Coalinga Canal is serviced off of the California Aqueduct/San Luis Canal and imported for use by the City of Coalinga. Surface water supplies are utilized for direct deliveries for crop irrigation and surface water treatment for urban and rural residential domestic purposes.

The State of California Department of Corrections operates a prison facilty located within the PVGSA: A private landowner has an agreement to use the prison's treated wastewater for agricultural irrigation.

Table2-5 Water Uses and Water Sources

Pleasant Valley Subbasin Water Sources and Water Use by GSA		
Entity	**Water Use**	**Water Source**
Pleasant Valley Water District	Agricultural, Residential	Groundwater, Imported Surface Water, Recycled Water
City of Coalinga - DAC	Municipal, Residential, Agricultural, Industrial	Imported Surface Water and Groundwater
Fresno County Unincorporated Lands[1]	Agriculture, Residential, Industrial	Groundwater

1 – Fresno County does not directly provide groundwater, but groundwater is pumped from wells owned by private landowners, private industries, and small communities.

Well Density

Figure 2-8 is a map of well density in the Plan Area. The Subbasin has an estimated 80 to 90 active wells. The map is based on best available data including known well locations for each water agency and private well locations as determined by well canvassing efforts in 2004, 2016, and 2020. The map excludes monitor wells and test wells. The map does not necessarily show where pumping is concentrated, since there is no differentiation between whether the wells are active or inactive.

Figure 2-9 is a well density map for domestic wells in the subbasin, since the last submittal this map has been updated with the City of Coalinga's service area. The only domestic well owners are within the Lost Hills Community at the very southern portion of the subbasin. Kenneth Schmidt and Associates accessed the Water Well Drillers logs and completion reports from the DWR website for the area covered by the Pleasant Valley GSA. Excluding the Lost Hills Community, (section 6, T22S/R17E), logs for 12 domestic wells were obtained. **Table2-6** shows the perforated intervals for these wells. Of the wells four were less than about 300 feet and would be expected to not be active. The remaining wells have tops of perforations ranging from 224 to 480 feet deep and the bottom ranging from 400 to 980 feet deep An analysis (program written) was ran using the MOs and the MT in each area and comparing them to the perforations of the wells in the DWR Data Library. Most of these wells are no longer in use.

Domestic wells that are in use are located in the area of the Lost Hills Community. The groundwater is used for indoor plumbing and to water the outside landscaping. There are no known treatment systems that exist within the Community of Lost Hills. It is assumed that drinking water comes in the form of bottled water. An outreach program has begun with the Lost Hills Community. Flyers with a questionnaire have been sent out, as well as face to face outreach with one resident has begun. PVGSA will continue to gather information to better understand the needs of the domestic well users and the water level situation in that area, including water quality and from depth this water is pumped. Recent information shows the domestic wells are drilled to a depth in the range of 500 feet to 600 feet, the production of these wells' ranges from 15 to 25 gallons a minute, with one that pumps 60 gpm used for stock water. There are no known wells that have gone dry in the Lost Hills Community area. There is little farming in the area of the Lost Hills Community and a minimal

amount of irrigation wells nearby the community. Outreach to one landowner occurred on July 2, 2024, for notes on the communication see Appendix O.

Table2-6 Domestic Wells with Drillers logs in Pleasant Valley GSA

Location	Date Constructed	Perforated Interval (Feet)
T20S/R15E-16M1	10/56	340-400
T20S/R15E-17	6/92	486-980
T20S/R15E-31 P or Q	11/66	224-464
T21S/R15E-10	6/93	480-630
T21S/R15E-14	7/90	380-480
T21S/R15E-14	3/90	360-440
T21S/R16E-17	6/03	420-460
T21S/R16E-27	2/78	407-516

Figure 2-10 shows a map that depicts the location of oil and gas fields within the GSP plan area. This GSP does not cover the drilling and development of oil wells or oil wells that produce water in association with oil development. The area shown on the map has been used and is associated with oil development.

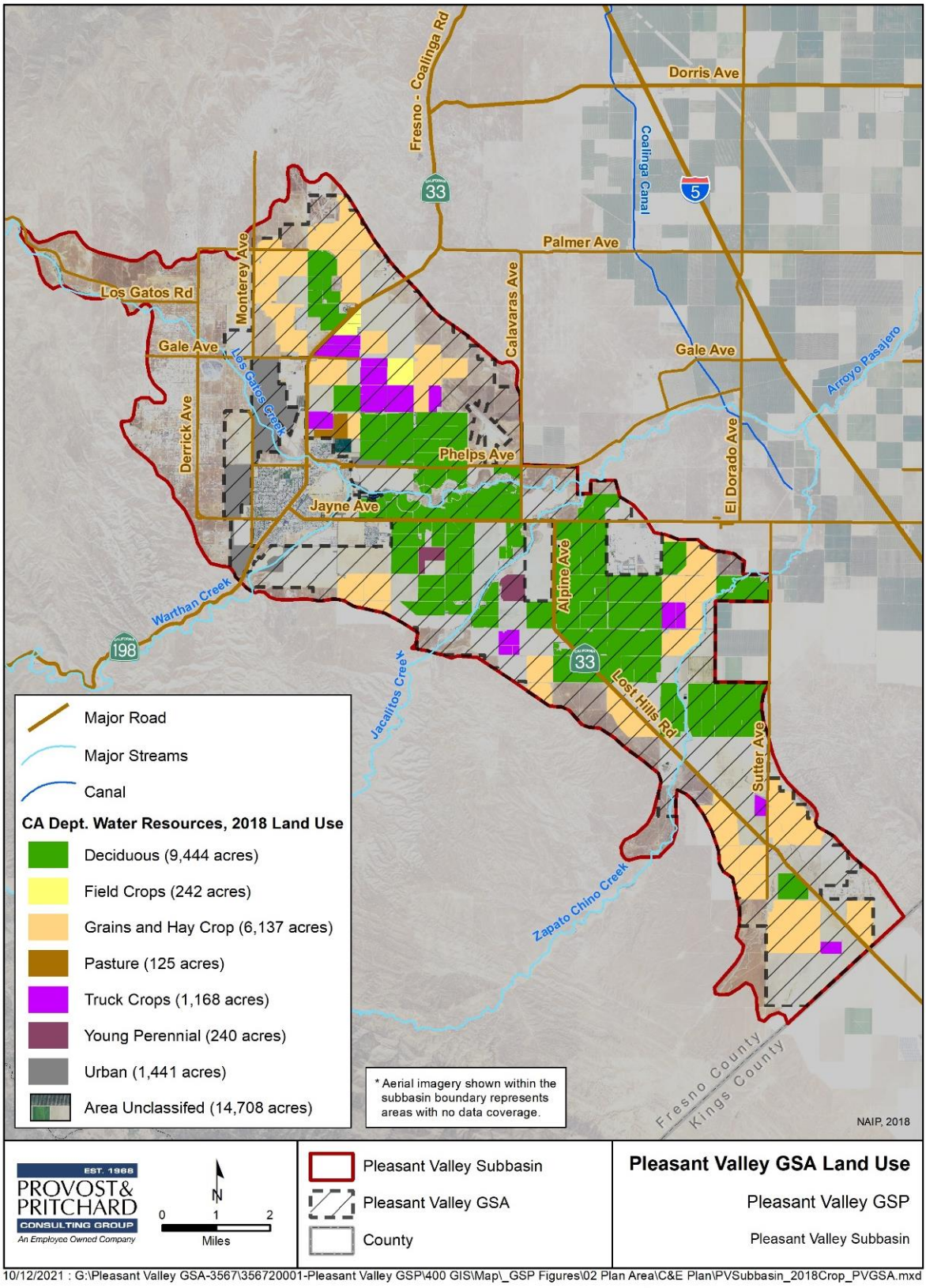


Figure 2-5 Pleasant Valley GSA Land Use Classifications

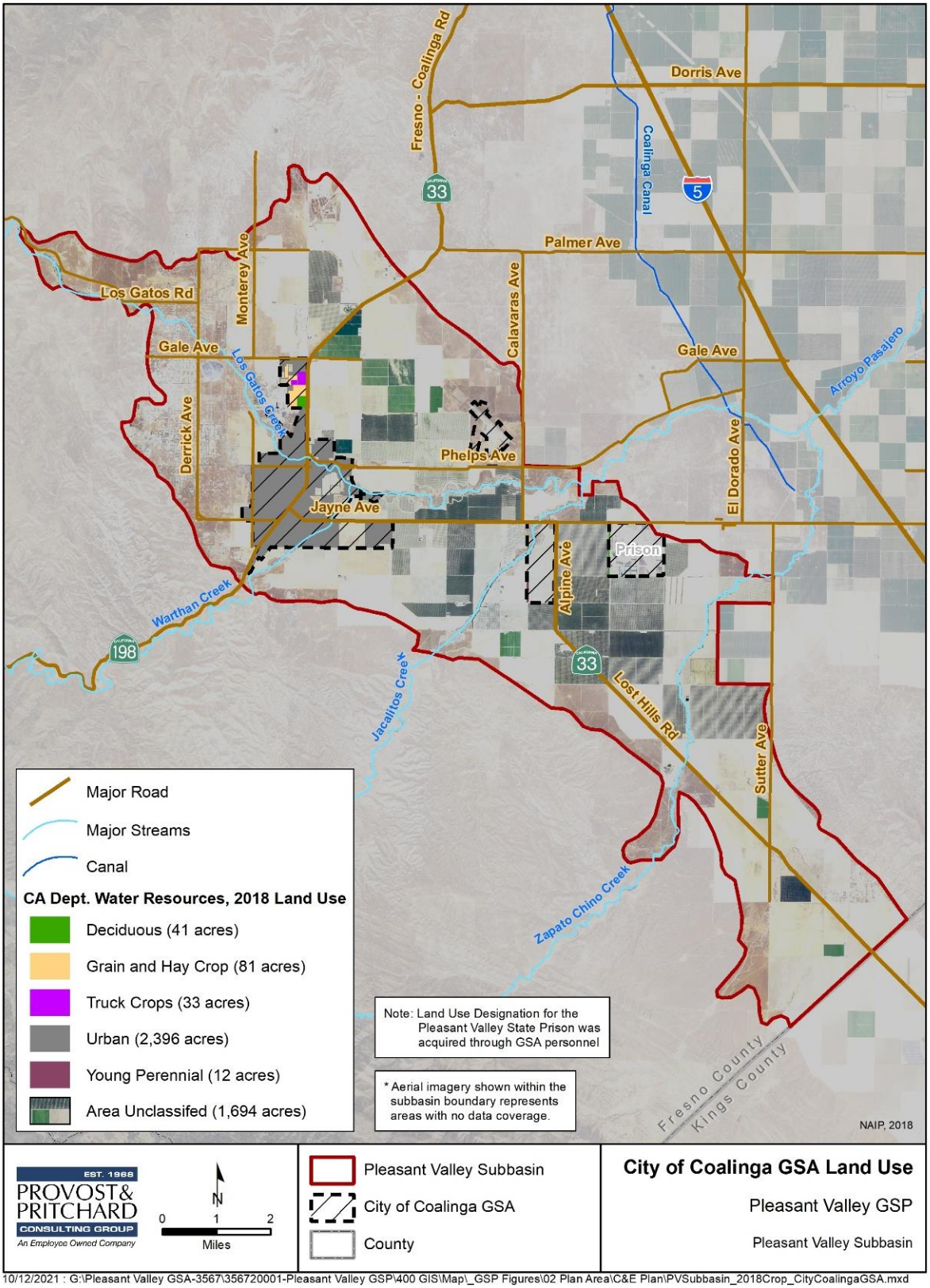


Figure 2-6 City of Coalinga GSA Land Use Classifications

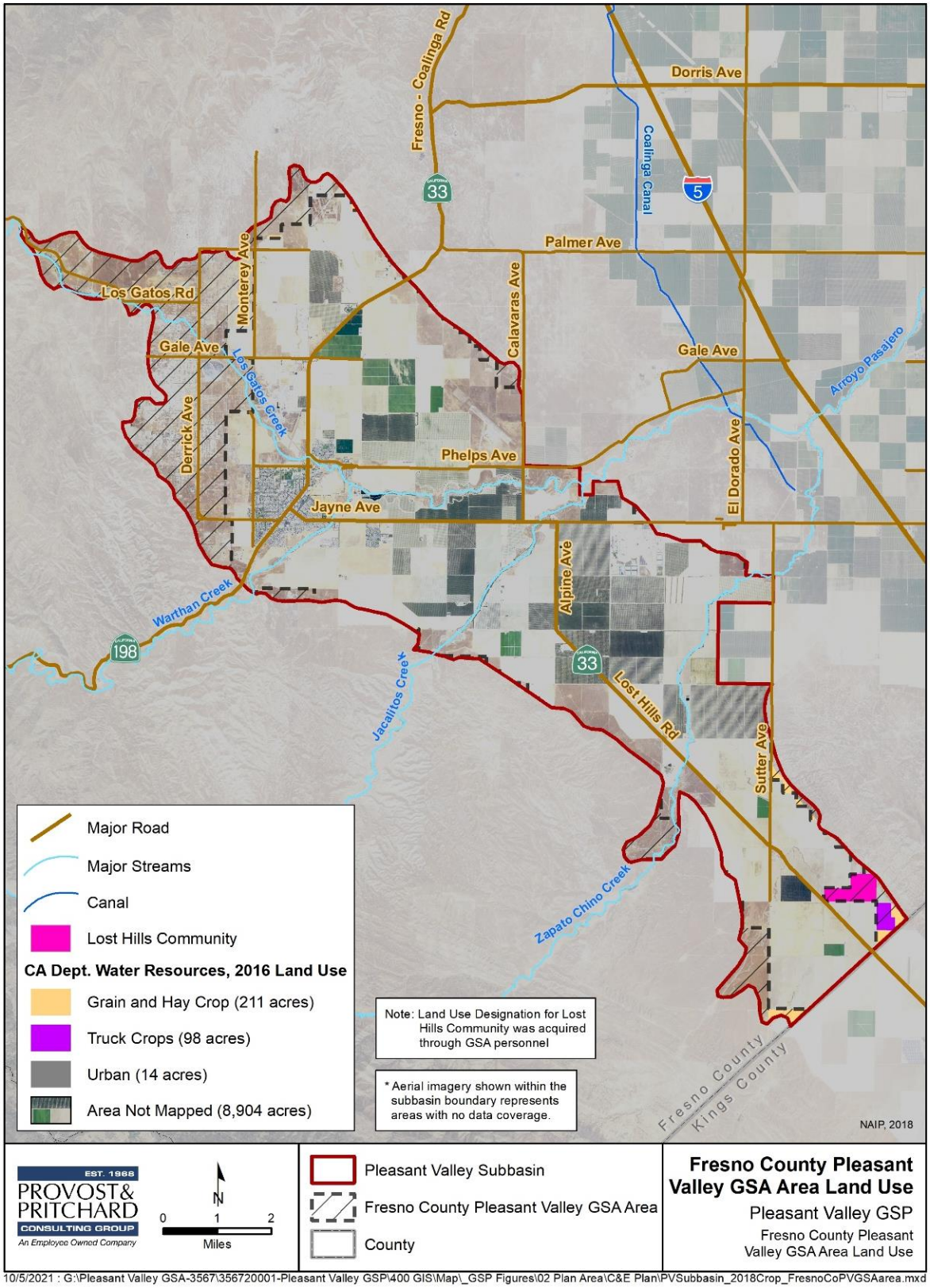


Figure 2-7 Fresno County Pleasant Valley GSA Area Land Use Classifications

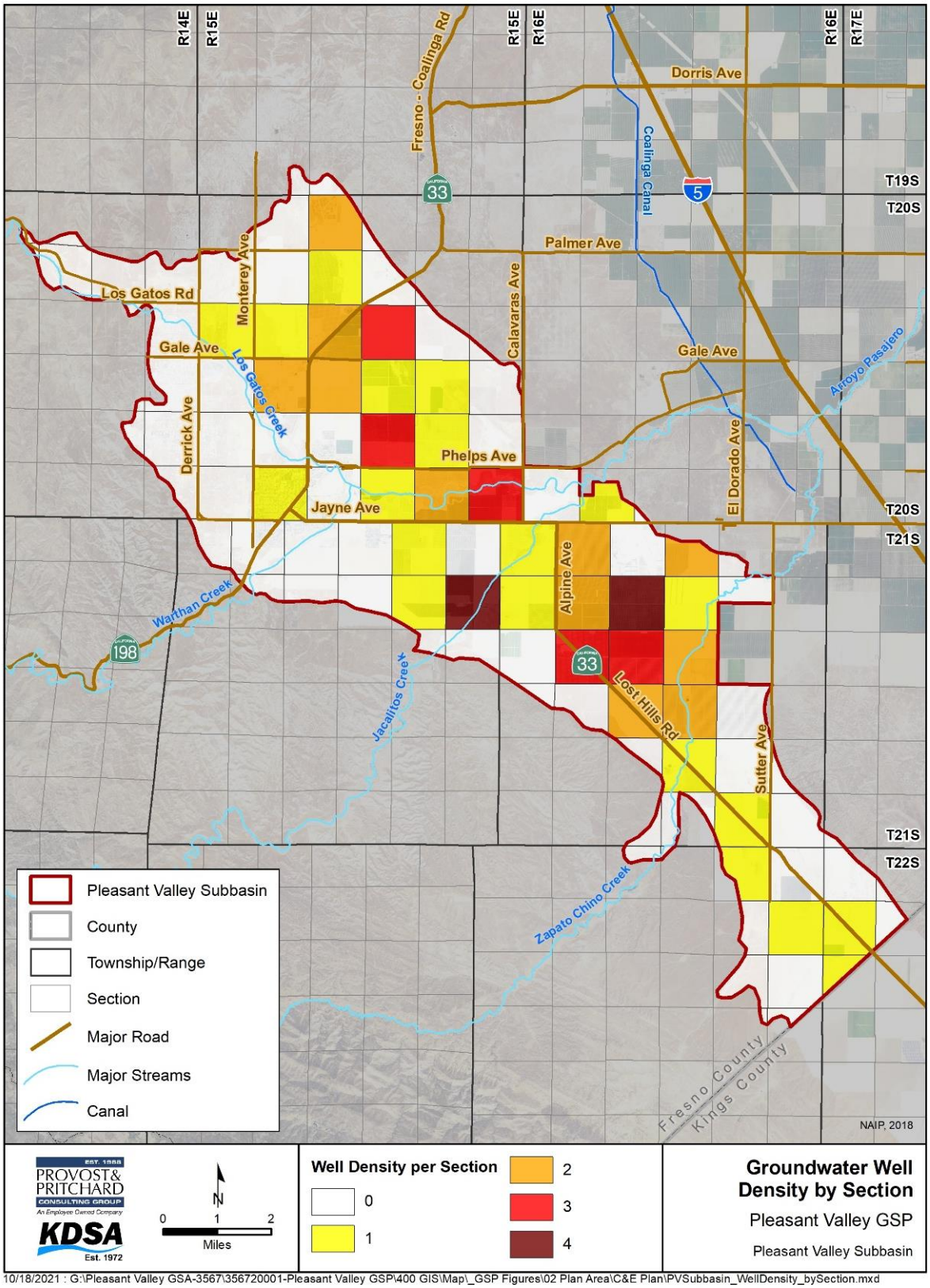


Figure 2-8 Groundwater Well Density by Section

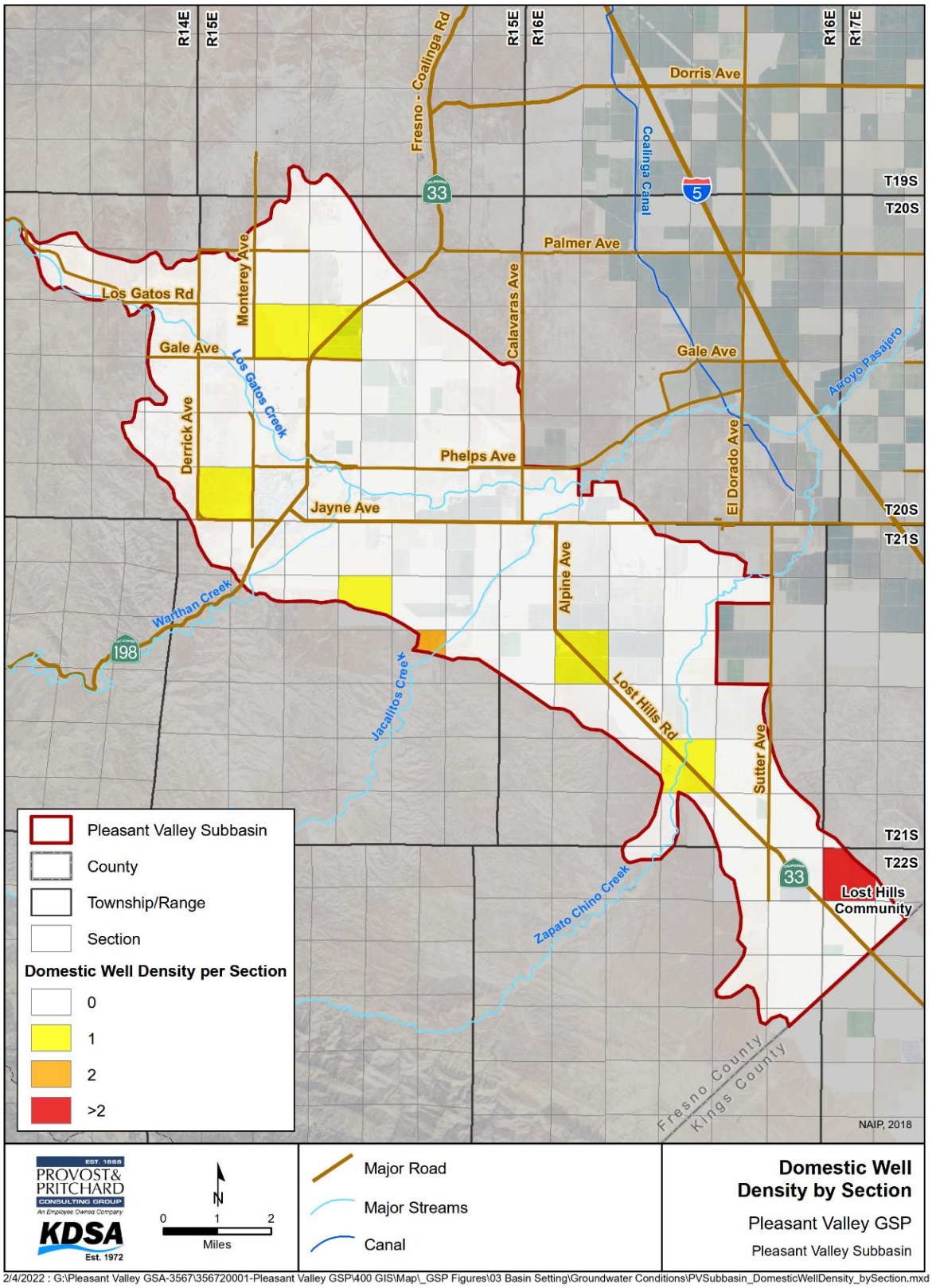


Figure 2-9 Domestic Well Density by Section

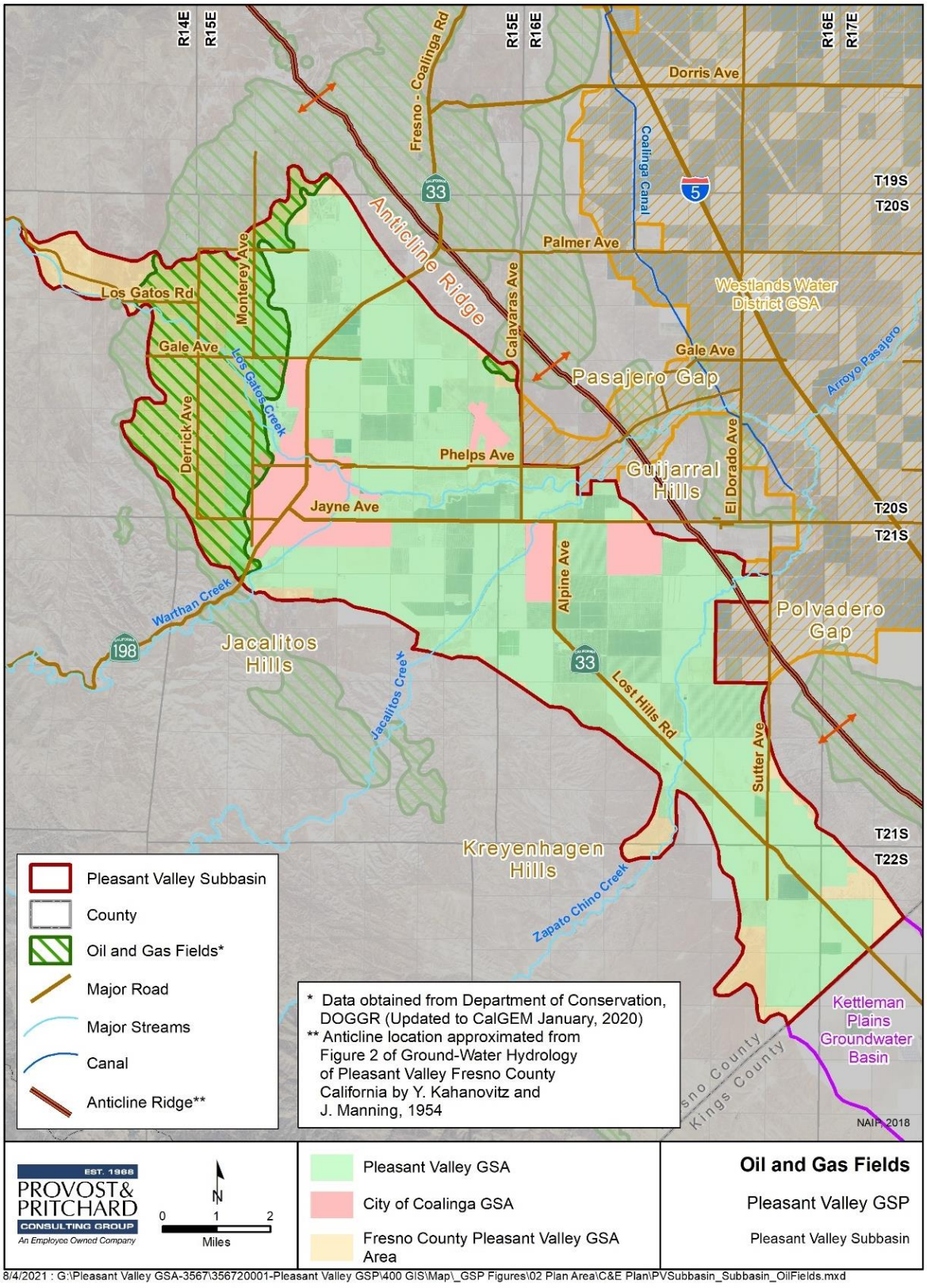


Figure 2-10 Oil and Gas Fields

2.2 Relation to General Plans

2.2.1 Summary of General Plans/Other Land Use Plans

Regulation Requirements:
§354.8(f) A plain language description of the land use elements or topic categories of applicable general plans that include the following:
(1) A summary of general plans and other land use plans governing the basin.

California Government Code (§65350-65362) requires that each county and city in the state develop and adopt a general plan. The General Plan consists of a statement of development policies and includes diagrams and text setting forth objectives, principles, standards, and plan proposals. It is a comprehensive long-term plan for the physical development of the county or city. In this sense, it is a blueprint for development.

The General Plan must contain eight (8) state-mandated elements. It may also contain any other elements that the legislative body of the county or city wishes to adopt. The eight (8) mandated elements are: Land Use, Open Space, Conservation, Housing, Circulation, Noise, Safety, and Environmental Justice. The General Plan may be adopted in any form deemed appropriate or convenient by the legislative body of the county or city, including the combining of elements. The following agencies within the Plan area have general plans:

- City of Coalinga - 2025 General Plan (Produced June 2009)
- Fresno County - 2000 General Plan (Produced October 2000)

2.2.2 Impact of GSP on Water Demands

Regulation Requirements:
§354.8(f) (2) A general description of how implementation of existing land use plans may change water demands within the basin or affect the ability of the Agency to achieve sustainable groundwater management over the planning and implementation horizon, and how the Plan addresses those potential effects.

Regulation Requirements:
§354.8(f) (3) A general description of how implementation of the Plan may affect the water supply assumptions of relevant land use plans over the planning and implementation horizon.

All of the General Plans in the Plan area were adopted prior to the development of the three GSAs in the Subbasin and prior to the inception of the PVGSP development. Therefore, the current General Plans did not consider the impacts of this Plan's implementation. The Fresno County and City of Coalinga land use plans make assumptions for urban development.

The assumed land use changes and growth rate are addressed in the Urban Water Management Plans for the City of Coalinga. This GSP used each agency's land use change assumptions and associated water demand in the water budget, described later in this GSP (**Section 3.3**). The growth projections were considered in determining the future water budget and targeted amount of mitigation required for each agency. Growth projections and projected water use change due to potential land development can be accommodated under the existing contract for surface water supplies with the USBR. The collective identification of potential projects and management actions in the Subbasin has been considered regarding groundwater impacts based on, among other factors, land use changes and associated water demands. A description of this process is included in **Section 3.3** and in **Chapter 6**.

2.2.3 Impact of GSP on Water Supply Assumptions within Land Use Plans

In general, all future land use changes will need to consider the net groundwater impact to the Subbasin, and updates to agency General Plans will need to consider this GSP and the responsibility of each member and participating agency. A discussion of some potential management actions, including potential policy changes, are described in **Chapter 6**.

As mentioned earlier (**Section 2.1.4**), there are two General Plans within the Plan Area. The General Plan sections that cover water supply are summarized below. As noted, both of these plans were developed prior to the development of the GSP.

City of Coalinga 2025 General Plan

The Land Use, Open Space and Conservation, Public Facilities and Services Elements of the City of Coalinga General Plan discuss various topics including water supply and sustainability. The primary water supply goal in this Plan is for reliable and cost-effective infrastructure systems that permit the city to sustainably manage its diverse water resources and needs. The City of Coalinga adopted an Urban Water Management Plan as well. Within the adopted plan is drought contingency plan which is intended to assist the City of Coalinga prepare and manage for drought. The relevant policies are listed below:

- Policy LU1-6 - The City shall encourage proposals that help to create a more sustainable community.
- Policy OSC1-1 - Secure a diverse network of open land encompassing valuable natural and agricultural resources within and around the Coalinga urban area. Valuable resources include creek corridors, wetlands, native grassland communities and woodlands, wildlife habitat and corridors, groundwater resources, hills and ridgelines, open-space settings for cultural resources and prime agricultural soils and economically viable farmland.
- Policy PFS8-3 - The City shall reduce per capita per day water consumption from 271 gpcd to 200 gcpd by the year 2015. The City relies on imported surface water from the CVP. The City currently uses a portion of its contract supply to meet its needs.

Fresno County General Plan

The Public Facilities and Services section of the Fresno County General Plan discusses general public facilities and services; funding; water supply and delivery; wastewater collection, treatment, and disposal; storm drainage and flood control; and numerous other services. The goal of the water supply and delivery section is to ensure the availability of an adequate and safe water supply for domestic and agricultural consumption. The relevant policies are listed below:

- Policy PF-C.12 - The County shall approve new development only if an adequate sustainable water supply to serve such development is demonstrated.
- Policy PF-C.13 - In those areas identified as having severe groundwater level declines or limited groundwater availability, the County shall limit development to uses that do not have high water usage or that can be served by a surface water supply.
- Policy PF-C.23 - The County shall regulate the transfer of groundwater for use outside of Fresno County. The regulation shall extend to the substitution of groundwater for transferred surface water.
- Policy PF-C.26 - The County shall encourage the use of reclaimed water where economically, environmentally, and technically feasible.

Implementation of the GSP will be consistent with the policies described above.

2.2.4 Permitting Process for New or Replacement Wells

Regulation Requirements:
§354.8(f) (4) A summary of the process for permitting new or replacement wells in the basin, including adopted standards in local well ordinances, zoning codes, and policies contained in adopted land use plans.

The following Fresno County General Plan (2000) policies pertain to the process of permitting new or replacement wells in Fresno County:

- Policy LU-E.6 - The County shall allow planned residential developments consisting of a minimum two (2) acre lot in areas designated for rural residential development subject to specified conditions.
- Policy PF-C.20 - The County shall not permit new private water wells within areas served by a public water system.
- Policy PF-C.21 - The County shall promote the use of surface water for agricultural use to reduce groundwater table reductions.

Fresno County coordinated with PVGSA to include GSAs in the well permitting process. Newly implemented GSA involvement includes:

- Permit applicants are required to identify the proposed well's GSA association in the application.
- Permit applicants are required to identify well depth and well perforated intervals in the application.
- The County of Fresno will provide notification and copies of the well permit applications to respective GSAs for review and comment.
- GSAs may request a delay in permit approval should significant concerns exist or should a well proposed for destruction be considered for potential future monitoring efforts. Land Use Plans Outside the Basin

2.2.5 Land Use Plans Outside the Basin

Regulation Requirements:
§354.8(f) (5) To the extent known, the Agency may include information regarding the implementation of land use plans outside the basin that could affect the ability of the Agency to achieve sustainable groundwater management.

Kings County 2035 General Plan

The Kings County General Plan discusses water supplies, water quality, and groundwater use. The goal for water supply and delivery is to ensure the availability of an adequate and safe water supply and the maintenance of high-quality water in water bodies and aquifers used as sources of domestic and agricultural water supply.

None of the Kings County 2035 General Plan policies are expected to impede the ability of the Pleasant Valley Subbasin participants to achieve sustainability. Several of the policies will support the goal of sustainability.

2.3 Water Resources Monitoring and Management Programs

2.3.1 Monitoring and Management Programs

Regulation Requirements:
§354.8(c) Identification of existing water resource monitoring and management programs, and description of any such programs the Agency plans to incorporate in its monitoring network or in development of its Plan. The Agency may coordinate with existing water resource monitoring and management programs to incorporate and adopt that program as part of the Plan.
§354.8(d) A description of how existing water resource monitoring or management programs may limit operational flexibility in the basin, and how the Plan has been developed to adapt to those limits.

Following are discussions of several monitoring and water management programs in the Plan Area. More details on monitoring can be found in **Chapter 5**.

Groundwater Level Monitoring

Pleasant Valley Water District performs periodic (typically spring and fall) groundwater level monitoring at select locations as part of the California Statewide Groundwater Elevation Monitoring (**CASGEM**) Program. To comply with SGMA, these efforts may be expanded to include groundwater levels from additional areas and continuous water level measurements with transducers with continued preparation for GSP implementation and associated reporting. **Chapter 5** details the monitoring efforts associated with GSP implementation.

Groundwater Pumpage Monitoring

The GSAs in the Subbasin do not own any operating wells. Most private wells have flow meters, and the pumping volume is recorded twice a year by the district. For other wells, crop consumption use and irrigation efficiency are used to estimate pumpage.

Groundwater Quality Monitoring

The requirements for groundwater quality testing and reporting are based on the water use and, if for drinking water, the size of the community system. Groundwater quality monitoring activities performed within PVGSA and the FCPVGSA are not related to community water system drinking water production and, therefore, are not publicly reported to the state. The City of Coalinga does not have any drinking water wells in operation. Therefore, any monitoring regarding drinking water quality standards is performed privately and is not publicly available. Electrical conductivity is measure annually for all irrigation wells in the valley, every three years, water samples are collected for irrigation suitability analysis.

Section 3.1 includes more information regarding the groundwater quality in the Subbasin.

Land Surface Subsidence Monitoring

While some local agencies in the San Joaquin Valley monitor for land subsidence, the majority rely on monitoring performed by regional water agencies or the State and Federal government. A Global Positioning System (**GPS**) control network has been established in the hills surrounding the Plan Area, and there is one within the Plan Area. With significant effort, the control network outside of the area could potentially be utilized to survey existing benchmarks in the Plan Area to see if change has occurred in their elevation. USGS, JPL, and University NAVSTAR Consortium (**UNAVCO**) also measure subsidence in the Central Valley. There are several UNAVCO land surface elevation monitoring locations near the Subbasin; however, a more robust public network may be helpful to provide regional context. USGS and JPL have maps on their websites that show the subsidence for a defined time period, but there is limited to no information shown for the Subbasin and immediate surrounding area. The Nevada Geodetic Laboratory GPS Network includes data since 2017 from a single GPS monitoring station (CACO – IGS14) at West Hills Community College in the City of Coalinga. More data would be helpful to assess land subsidence in the valley.

For more information on subsidence in the Subbasin, see **Section 3.2**. For more information on land subsidence monitoring, see **Chapter 5**. Chapter 5 includes information from 2007 to 2011 for vertical ground surface displacement rates, which are derived from Interferometric Synthetic Aperture Radar (InSAR) data that are collected by the European Space Agency (ESA) Sentinel-1A satellite and processed by the National Aeronautics and Space Administration (NASA) Jet Propulsion Laboratory (JPL) under contract with to the California Department of Water Resources (DWR). Also see Appendix P for additional information on subsidence.

Surface Water Monitoring

In recent years, PVWD has started to measure flows in the creeks or natural waterway flows coming into the Subbasin. Historical data are available on-stream flow from the USGS or DWR. For more information on stream flow in the Subbasin, see **Section 3.1** and **Section 3.3**. Surface water imports in the area are monitored by the USBR and City of Coalinga.

Irrigated Lands Regulatory Program

The Irrigated Lands Regulatory Program (**ILRP**) was initiated in 2003 to address pollutant discharges to surface water and groundwater from commercially irrigated lands. The primary purpose of the ILRP is to address key pollutants of concern including salinity, nitrates, and pesticides introduced through runoff or infiltration of irrigation water and stormwater. Surface water quality has been monitored for several years, and in the future groundwater quality will also be monitored. The program is administered by the Central Valley Regional Water Quality Control Board (**RWQCB**). On January 9, 2014, the RWQCB adopted new regulatory requirements (General Order) that affect irrigated lands within the California's Central Valley, including the Subbasin.

Under the ILRP rules, growers may form "third party" coalitions to assist with required monitoring, reporting, and education requirements for irrigated agriculture. The Westlands Water Quality Coalition was established to pool resources and combine regional efforts to comply with the regulatory requirements of the ILRP. The Westlands Water Quality Coalition (**Coalition**) has been approved by the RWQCB to serve as a third-party coalition for administering the terms and conditions of the LTILRP as described in General Order. All of the Subbasin properties fall within the boundary served by the Coalition. Additional information on the Coalition is located on their website at http://wwd.ca.gov/resource-management/irrigated-lands-management-program/. The Coalition area and supplemental areas cover the Plan Area. Regional information on surface and groundwater quality is available from the Coalition.

GSP Monitoring and Management Plans

The individual agencies located within the Plan Area will be responsible for collecting data for any monitoring or management plan for which they are already collecting data. As needed, the agencies will report the water quality, water level, and water supply data to their respective GSA for upload to the Subbasin's data management system (**DMS**). The monitoring program is described later in this GSP in **Chapter 5**.

2.3.2 Impacts to Operational Flexibility

Existing water management constraints impact operational flexibility and water operations. The primary concern is the availability and accessibility of surface water. Historically, the surface water allocations to the City of Coalinga have been less than the contracted supply, but as a municipal and industrial contractor the city has been able to receive sufficient supplies. In drought years, conservation measures have been employed to protect the limited supply. This may be attributed to climactic conditions and changes in environmental legislation. In addition, groundwater quality issues impact the usability for the beneficial users of groundwater in the Plan Area. The high level of Total Dissolved Solids (TDS) in the Subbasin groundwater has limited the

crops that are grown and the use of groundwater as a domestic supply. More discussion on the plans to monitor water quality and assign sustainable management criteria can be found in **Chapter 4** and **Chapter 5**.

2.3.3 Conjunctive Use Programs

Regulation Requirements:
§354.8(e) A description of conjunctive use programs in the basin.

Conjunctive use is the coordinated and planned management of both surface and groundwater resources to maximize their efficient use. Conjunctive use is utilized to improve water supply reliability and environmental conditions, reduce groundwater overdraft and land subsidence, and protect water quality.

The PVWD and City of Coalinga may consider conjunctive use areas that rely on groundwater extractions to supplement limited available surface water supplies in meeting water demands. However, to date, none are known.

Outflows to other GSAs, basins, or subbasins should not be included as inflow in GSPs for those GSAs. Beneficial users of water in the Pleasant Valley Subbasin do not intend to control, distribute, store, spread, sink, treat, purify, recapture, and salvage any such water. This includes but is not limited to groundwater, surface water, sewage and storm waters, imported or native return flows for the beneficial use or uses of the Plan Area's inhabitants or the owners of rights to water in the Pleasant Valley Subbasin.

2.4 Additional GSP Components

Regulation Requirements:
§354.8(g) A description of any of the additional Plan elements included in the Water Code Section 10727.4 that the Agency determines to be appropriate.

Following are discussions on several groundwater management topics relevant to protecting groundwater quality and preserving groundwater levels including:

- Wellhead protection
- Migration of contaminated groundwater
- Well abandonment/well destruction program
- Replenishment of groundwater extractions
- Well construction policies
- Groundwater projects
- Efficient water management practices
- Land use planning
- Impacts to groundwater dependent ecosystems

2.4.1 Saline Water Intrusion

Not applicable.

2.4.2 Wellhead Protection

A Wellhead Protection Area (**WHPA**) is defined by the Safe Drinking Water Act Amendment of 1986 as "*the surface and subsurface area surrounding a water well or wellfield supplying a public water system, through which contaminants are reasonably likely to move toward and reach such water well or wellfield.*" The WHPA may also be the recharge area that provides the water to a well or wellfield. Unlike surface watersheds that can be easily determined from topography, WHPAs can vary in size and shape depending on subsurface geologic conditions, the direction of groundwater flow, pumping rates, and aquifer characteristics.

The Federal Wellhead Protection Program was established by Section 1428 of the Safe Drinking Water Act Amendments of 1986. The purpose of the program is to protect groundwater sources of public drinking water supplies from contamination, thereby eliminating the need for costly treatment to meet drinking water standards. The program is based on the concept that the development and application of land use controls, usually applied at the local level, and other preventative measures can protect groundwater.

Under the Act, States are required to develop an EPA-approved Wellhead Protection Program. To date, California has no state-mandated program but instead relies on local agencies to plan and implement programs. Wellhead Protection Programs are not regulatory in nature, nor do they address specific sources. They are designed to focus on the management of the resource rather than control a limited set of activities or contaminant sources.

Contaminants from the surface can enter an improperly designed or constructed well along the outside edge of the well casing or directly through openings in the wellhead. A well is the direct supply source to the customer, and such contaminants entering the well could then be pumped out and discharged directly into the distribution system. Therefore, essential to any wellhead protection program are proper well design, construction, and site grading to prevent intrusion of contaminants into the well from surface sources.

Wellhead protection is performed primarily during design and can include requiring annular seals at the well surface, providing adequate drainage around wells, constructing wells at high locations, and avoiding well

locations that may be subject to nearby contaminated flows. Wellhead protection is required for potable water supplies and is not generally required, but is still recommended, for agricultural wells.

Municipal and agricultural wells constructed by the member agencies are designed and constructed in accordance with DWR Bulletin 74-81 and 74-90. Also, a permit is needed from the County to construct a new well. In addition, the member agencies encourage landowners to follow the same standards for privately owned wells. DWR Bulletins 74-81 and 74-90 provide specifications pertaining to wellhead protection including:

- Methods for sealing the well from intrusion of surface contaminants
- Covering or protecting the boring at the end of each day from potential pollution sources or vandalism
- Site grading to assure drainage is away from the wellhead

2.4.3 Migration of Contaminated Groundwater

Groundwater contamination can be human induced or caused by naturally occurring processes and chemicals. Sources of groundwater contamination can include irrigation, pesticide applications, septic tanks, industrial sources, stormwater runoff, and disposal sites. Contamination can also spread through improperly constructed wells that provide a connection between two aquifers or improperly abandoned/destroyed wells that provide a direct conduit of contaminants to aquifers. Groundwater within the Plan Area is primarily limited to agricultural use due to the relatively high salinity.

Information on existing contaminant plumes is voluminous, particularly for those plumes that have been assessed and are in various stages of remediation. Therefore, specific information on the plumes is not provided here. However, some of the main constituents of concern related to groundwater plumes in the greater Central Valley region include nitrate, DBCP, TCP, and gasoline. **Section 3.1** explores groundwater quality specifically in the Pleasant Valley Subbasin.

Several State of California online databases provide information and data on known groundwater contamination, planned and current corrective actions, investigations into groundwater contamination, and groundwater quality from select water supply and monitoring wells. These databases are discussed below:

California Water Resources Control Board
The State of California Water Resources Control Board (**SWRCB**) maintains an online database that identifies known contamination cleanup sites, known leaky underground storage tanks, and permitted underground storage tanks. The online database contains records of investigation and actions related to site cleanup activities at http://geotracker.waterboards.ca.gov.

The Department of Toxic Substances Control
The State of California Department of Toxic Substances Control (**DTSC**) provides an online database with access to detailed information on permitted hazardous waste sites, corrective action facilities, as well as existing site cleanup information. Information available through the online database includes investigation, cleanup, permitting, and/or corrective actions that are planned, being conducted, or have been completed under DTSC's oversight. The online database can be accessed at http://www.envirostor.dtsc.ca.gov.

Groundwater Ambient Monitoring and Assessment Program
The State Water Resources Control Board Groundwater Ambient Monitoring and Assessment (**GAMA**) program collects data by testing untreated raw water for naturally occurring and man-made chemicals and compiles all of the data into a publicly accessible online database. The online database can be accessed at http://geotracker.waterboards.ca.gov/gama/.

2.4.4 Well Abandonment/Well Destruction Program

Well abandonment generally includes properly capping and locking a well that has not been used in over a year. Well destruction includes completely filling in a well in accordance with DWR standard procedures. Proper well destruction and abandonment are necessary to protect groundwater resources and public safety. Improperly abandoned or destroyed wells can provide a conduit for surface or near surface contaminants to reach the groundwater. In addition, undesired mixing of water with different chemical properties from strata with different depths can occur in improperly destroyed wells.

The administration of a well construction, abandonment, and destruction program has been delegated to the Counties by the State legislature. Fresno County requires that wells be abandoned according to State standards documented in DWR Bulletins 74-81 and 74-90. California Health & Safety Code Section 115700 considers an inactive well "abandoned" if it has not been used for a period of one year and must be destroyed. Due to staff and funding limitations, enforcement of the well abandonment policies is limited.

The Plan Participants will encourage private landowners with abandoned wells to properly destroy their wells that are no longer used. In addition, the GSAs may encourage landowners and developers to convert some unusable wells to monitor wells, rather than destroy them, so that they can become a part of the region's groundwater monitoring program.

2.4.5 Replenishment of Groundwater Pumpage

Replenishment of groundwater is an important technique in the management of a groundwater supply to mitigate groundwater overdraft. Groundwater replenishment in Pleasant Valley occurs naturally through stream/river seepage and through other means including deep percolation of crop and landscape irrigation and intentional treated wastewater effluent percolation. The primary local water sources for groundwater replenishment include imported CVP water and various local streams.

For more information, refer to **Section 2.3.3**. Refer to **Section 3.3** for discussions on how groundwater recharge is quantitatively accounted for.

2.4.6 Well Construction Policies

Proper well construction is important to ensure reliability, longevity, and protection of groundwater resources from contamination. All of the member agencies follow state standards (DWR Bulletin 74-81 and 74-90) when constructing municipal and agricultural wells. Fresno County has adopted a well construction permitting program consistent with State Well Standards to help assure proper construction of private wells. The County maintains records of all wells drilled in the Plan Area. As of 2017, there were no limits on well construction, which is in the process of being revisited by the County.

The City of Coalinga does not allow construction of private wells in their water service boundary, except under very limited circumstances. The purpose of these regulations is to keep the water system under central control by the municipal water agency. Outside of the City of Coalinga, private domestic or agricultural wells can be drilled with a County permit.

State well standards address annular seals, surface features, well development, water quality testing, and various other topics. Refer to DWR Bulletins 74-81 and 74-90 for more details. Well construction policies intended to ensure proper wellhead protection are discussed in Section 2.4.2 – Wellhead Protection.

Fresno County has designated Pleasant Valley Subbasin as a Water Short Area and will only issue building permits or permits granting mobile home occupancy once evidence that adequate water is

available and can be served to the property upon which construction is proposed. For properties served by a community water system, evidence consists of written confirmation by the system operator. For properties to be served by a private well, evidence consists of sustainable well yield testing following a procedure developed by the county.

This section has discussed the current policies for well construction; when future policies are developed, the opportunity to address those policies may be available during the development of future GSP Updates.

2.4.7 Groundwater Projects

All the Plan Participants share responsibility for development and operation of recharge, storage, conservation, water recycling, and extraction projects. The Plan Participants in general develop their own projects to help meet their water demands and will develop additional future projects to meet sustainability within their GSA. Developing more groundwater recharge and banking projects is considered key to stabilizing groundwater levels. **Chapter 6** provides descriptions, estimated costs, and estimated yield for numerous proposed projects. The role of the Subbasin's GSAs is to promote cooperation and sharing of information and ideas between the agencies.

The GSAs will also support measures to identify funding and implement regional projects that help the region achieve groundwater sustainability. This can include recharge projects that take advantage of local areas conducive to recharge and areas where recharge provides the most benefit to the Subbasin. This can reduce the burden for certain agencies from having to recharge within their boundaries if they do not have suitable land or soils.

2.4.8 Efficient Water Management Practices

Water conservation has been and will continue to be an important tool in local water management, as well as a key strategy in achieving sustainable groundwater management. All of the Plan Participants engage in some form of water conservation, which can include water use restrictions, water metering, education, tiered rates, and more. These water conservation programs were tested during the 2014-2015 drought, which included State-mandated urban water restrictions for the first time.

Details of water conservation programs can be found in various documents, such as the City of Coalinga's Urban Water Management Plan. Efficient water management practices primarily include furthering the City's effort to secure water reliability and continued use of surface water. Future efforts may include an increased focus on elevating awareness on groundwater overdraft and land subsidence and explaining the requirements of SGMA. Some or all of these conservation efforts will be helpful in achieving groundwater sustainability.

For more information on efficient water management practices being considered, see **Chapter 6**.

2.4.9 Relationships with State and Federal Agencies

From a regulatory standpoint, the Plan Participants have numerous relationships with State and Federal agencies related to water supply, water quality, and water management. Those relationships that are common to all water agencies, such as regulation of municipal water by the California Division of Drinking Water, are not discussed here. Relationships unique to the region are briefly summarized below.

United States Bureau of Reclamation – South of Delta CVP Water: Imported water from the Coalinga Canal by way of the San Luis Canal (California Aqueduct) provides the majority of the surface water used in the

area. The City of Coalinga receives CVP water imported from the Coalinga Canal through a water contract with the USBR.

California Department of Corrections and Rehabilitation – Pleasant Valley State Prison: The approximately 320-acre PVSP is a treated drinking water customer of the City of Coalinga. Treated wastewater effluent from the PVSP is applied for agricultural purposes.

California Department of State Hospitals – Coalinga Facility: The Department of State Hospitals owns and operates a maximum-security 1,500-bed psychiatric hospital for those who have completed their prison sentence and are committed for extended treatment. The Facility is adjacent to the PVSP on about 320 acres and receives treated drinking water from the City of Coalinga. Wastewater from the CSH is placed in evaporation ponds on site.

California Department of Fish and Wildlife: The Pleasant Valley Ecological Reserve contains about 1,200 acres, is owned and operated by the Department, and consists of three separate units, two of which are located outside of the Subbasin. The purpose of the acquisition was to protect valley annual grasslands and saltbush scrub habitats for sensitive animal species. Only a portion of the Southern Unit is located within the subbasin north of Zapato Creek and west of Sutter Avenue, for about 130 of the approximate 160 acres of Reserve. The Southern Unit has at least two abandoned wells, but the Department does not use or plan to rehabilitate these wells, nor does it plan to drill new wells on the property.

In addition to the State and Federal facilities and water sources identified above, many of the Plan Participants receive grants from various agencies for water related projects. Grants are obtained from the DWR, SWRCB, USBR, and others. The member agencies work closely with these State and Federal agencies to track grant programs and administer and implement grant contracts.

2.4.10 Land Use Planning

Some of the member agencies have direct land use planning authority while others do not. However, all of the Plan Participants have an interest in land use planning policies and how they will impact their continued development and water supplies. **Figure 2-5**, **Figure 2-6**, and **Figure 2-7** depict the land use in the various GSAs of the Plan Area, including areas that are developed for urban (domestic) and agricultural use.

Land use policies are documented in various reports, such as General Plans, Specific Plans, and plans for proposed developments. Updating some of these plans is a multi-year process and not all could be fully updated concurrently with the GSP development. Some smaller communities have no formal land use policies or rely on County policies. These smaller communities will need to develop new policies and long-term plans as part of the SGMA process.

2.4.11 Impacts on Groundwater Dependent Ecosystems

Groundwater Dependent Ecosystems (**GDEs**) are defined under SGMA as "*ecological communities of species that depend on groundwater emerging from aquifers or on groundwater occurring near the ground surface*" (23 CCR § 351(m)). The Subbasin GSP Participants coordinated and conducted an evaluation of potential GDEs based on depth to water and proximity to surface water bodies within the Subbasin. See **Section 3.2** for additional information on methodology and figures depicting the possible GDEs in the Subbasin.

2.5 Notice and Communication

2.5.1 Description of Beneficial Uses and Users

Regulation Requirements:
§354.10 Each plan shall include a summary of information relating to notification and communication by the Agency with other agencies and interested parties including the following:
(a) A description of the beneficial uses and users of groundwater in the basin, including the land uses and property interests potentially affected by the use of groundwater in the basin, the types of parties representing those interests, and the nature of consultation with those parties.
(b) A list of public meetings at which the Plan was discussed or considered by the Agency.
(c) Comments regarding the Plan received by the Agency and a summary of any responses by the Agency.

Stakeholders and interested parties are invited to public meetings through distribution of meeting notices to the Subbasin GSAs' member agency distribution lists, community organizations' contact lists, and press releases and public service announcements.

A list of public meetings and more information on the methods of notification, communication, and outreach are available in **Appendix B**.

Table2-7 Beneficial Uses and Users

SGMA, Section 10723.2. Consideration of All Interests of All Beneficial Uses and Users of Groundwater		
Agricultural Users	Domestic Well Owners	Municipal Well Operators
Public Water Systems	Local Land Use Planning Agencies	Environmental Users of Groundwater
Surface Water Users	Federal Government	California Native American Tribes
Disadvantaged Communities	Entities monitoring and reporting groundwater elevations in all or part of a groundwater basin	

A flyer has been sent out to the Lost Hills Community in regards to communicating with those landowners regarding the GSP and their groundwater wells.

2.5.2 Decision-Making Process

Regulation Requirements:
§354.10 (d) A communication section of the Plan that includes the following:
An explanation of the Agency's decision-making process.

The Subbasin GSAs recognize the responsibilities of the Groundwater Sustainability Agencies and their associated member agencies to adhere to the agreed upon decision-making protocols and voting structure of the Pleasant Valley Subbasin GSP.

During the GSP development process, the Pleasant Valley GSAs formed a Policy Advisory Committee (**PAC**) and a Technical Advisory Committee (**TAC**) charged with coordinating implementation of the required policy and technical elements of the GSP (e.g., water budgets, monitoring networks) as well as implementing the Communication and Engagement Plan (workshops, outreach). The PAC is comprised of up to three representatives from the Pleasant Valley GSA, one from the City of Coalinga GSA, and one from the Fresno County Pleasant Valley GSA Area, working cooperatively to achieve sustainable groundwater management in the Subbasin. The TAC includes a hydrogeologist, an engineer, and an agronomist.

In general, the Pleasant Valley Subbasin's decision-making process includes developing agendas for each meeting of the Pleasant Valley GSP development and public workshops and the PAC and TAC working together to develop consensus and make recommendations to the Agency decision-making bodies. The agendas are developed and agreed upon by a respective representative of each GSA Group. Agenda items are either educational, informational, or requiring direction or decision.

Pleasant Valley GSA has a MOU with City of Coalinga GSA and also with the Fresno County Pleasant Valley GSA Area to take the lead in preparing the Subbasin-wide GSP, while communicating and collaborating with management of the other two GSAs throughout the development, public review, and implementation phases. See **Appendix A** for copies of the MOUs. The City of Coalinga GSA and Fresno County Pleasant Valley GSA Area each respectively in the MOU with Pleasant Valley GSA will provide advisory input to Pleasant Valley GSA in the preparation of the Pleasant Valley Subbasin GSP.

The coordination framework in the MOUs stipulates the following:

- That each party will consider the interests of the other Party
- That the PVGSA will consider advisory input in the development and implementation of the GSP by the City of Coalinga and Fresno County
- That the PVGSA shall notify the other GSAs at least 90 days before adoption or modifying the GSP or policies or procedures
- That the PVGSA shall consider any comments or recommendations provided by the other GSAs
- That the City of Coalinga and County of Fresno shall provide written notice at least 90 days before adopting or taking any action related to groundwater resources within the Subbasin
- That the City of Coalinga and Fresno County shall consider any comments or recommendations provided by PVGSA

2.5.3 Public Engagement / Public Outreach Plan

Regulation Requirements:
§354.10 (d)(2) Identification of opportunities for public engagement and a discussion of how public input and response will be used.

See **Appendix B – Stakeholder Communication and Engagement Plan** for more information regarding the development of opportunities for public engagement and methods of incorporating public input. Also see Appendix O for information on communication with domestic well owners.

2.5.4 Encouraging Active Involvement

Regulation Requirements:
§354.10 (d)
(3) A description of how the Agency encourages the active involvement of diverse social, cultural, and economic elements of population within the basin.
(4) The method the Agency shall follow to inform the public about progress implementing the Plan, including the status of projects and actions.

To encourage active involvement that recognizes the diverse social, cultural, and economic elements of the Subbasin, the GSAs are reaching out through their websites and to individual stakeholders in the Subbasin. More information on methods of Public Outreach regarding plan implementation and development can be found in **Appendix B.**

2.5.5 Interbasin Communications

The GSP development process is made more helpful with regional discussions and coordination. Interbasin coordination that includes Pleasant Valley GSP participants' engagement includes a meeting held with representatives of the Westside Subbasin on December 22, 2021 to discuss the contents of this GSP. Although employee turnover and schedule conflicts have thus far prevented a meeting with staff of Kings County, email communication has been ongoing throughout the finalization process.

3 Basin Setting

3.1 Hydrogeologic Conceptual Model

Regulation Requirements:
§354.12 Introduction to Basin Setting
This Subarticle describes the information about the physical setting and characteristics of the basin and current conditions of the basin that shall be part of each Plan, including the identification of data gaps and levels of uncertainty, which comprise the basin setting that serves as the basis for defining and assessing reasonably sustainable management criteria and projects and management actions. Information provided pursuant to this Subarticle shall be prepared by or under the direction of a professional geologist or professional engineer.

3.1.1 Introduction

Regulation Requirements:
§354.14(a) Each Plan shall include a descriptive hydrogeologic conceptual model of the basin based on technical studies and qualified maps that characterizes the physical components and interaction of the surface water and groundwater systems in the basin.

The purpose of a Hydrogeologic Conceptual Model (**HCM**) is to provide an easy-to-understand description of the general physical characteristics of the regional hydrology, land use, groundwater-surface water interaction, geology, geologic structure, water quality, principal aquifers, and principal confining beds in the basin setting. Once developed, an HCM is useful in providing the context to develop water budgets, identification of data gaps, and monitoring networks.

An HCM is not a numerical groundwater model or a water budget model. An HCM is rather a written and graphical description of the hydrologic and hydrogeologic conditions that lay the foundation for future evaluation. In addition, this HCM supports and provides the hydrogeologic setting to support Groundwater Conditions, **Section 3.2**, and Water Budget, **Section 3.3**, of this GSP.

This HCM has been written by adhering to the requirements set forth in the California Code of Regulations, Title 23, Division 2, Chapter 1.5, Subchapter 2, Article 5, Subarticle 2 (§354.14). Several topics are touched on in the HCM, including groundwater flow, groundwater budget, land subsidence, and groundwater quality which are discussed in greater detail in Groundwater Conditions (**Section 3.2**) and Water Budget (**Section 3.3**).

The narrative HCM description provided in this chapter is accompanied by graphical representations to portray the geographic setting, regional geology, basin geometry, and general water quality. This HCM will be periodically updated as data gaps are addressed and new information becomes available.

3.1.2 Lateral Basin Boundaries

Regulation Requirements:
§354.14(b)(2) The hydrogeologic conceptual model shall be summarized in a written description that includes lateral basin boundaries, including major geologic features that significantly affect groundwater flow.

According to DWR Bulletin 118 (2006) Pleasant Valley Subbasin (DWR Groundwater Subbasin 5-22.10) is in the San Joaquin Valley Groundwater Basin in the Tulare Lake Hydrologic Region. As shown in **Figure 3-1**,

the Subbasin lies along the west side of the San Joaquin Valley, north of the Fresno-Kings County Line. The major geologic features surrounding the Subbasin are anticlinal structures and an intervening syncline within Pleasant Valley. These anticlinal features include: Anticline Ridge on the north-northeast, the Jacalitos and Kreyenhagen Hills on the west, and the Guijarral and Kettleman Hills to the east (KDSA, 2016). These anticlines are major barriers to groundwater flow from the Pleasant Valley Subbasin to the San Joaquin Valley except through the Pasajero and Polvadero Gaps. The Pasajero and Polvadero Gaps are north and south of Guijarral Hills and the Pleasant Valley Subbasin abuts the Westside Subbasin on the east side of these two gaps. South of the Fresno-Kings County line Pleasant Valley Subbasin shares a border with the Kettleman Plains Subbasin. The Subbasin is surrounded throughout most of its perimeter by folded Tertiary continental and marine sedimentary rocks of the Coast Ranges and the west flank of the Kettleman Hills. The Subbasin includes the older and younger alluvium (DWR, 2006). The Subbasin boundaries have been derived from both hydrologic and institutional criteria. Several intermittent streams enter the basin from the mountains to the west; these streams include Los Gatos, Warthan, Jacalitos, and Zapato Chino Creeks (DWR, 2006).

A basin boundary modification for the Pleasant Valley Subbasin was approved by DWR in September 2016. The basin boundary modification removed Pliocene-Pleistocene non-marine rocks from the Subbasin margins and split the original Pleasant Valley Subbasin into the Pleasant Valley Subbasin north of the Fresno-Kings County line and the Kettleman Plains Subbasin south of the county line. Unless specified otherwise, figures presented herein are based on the 2016 basin boundary modification.

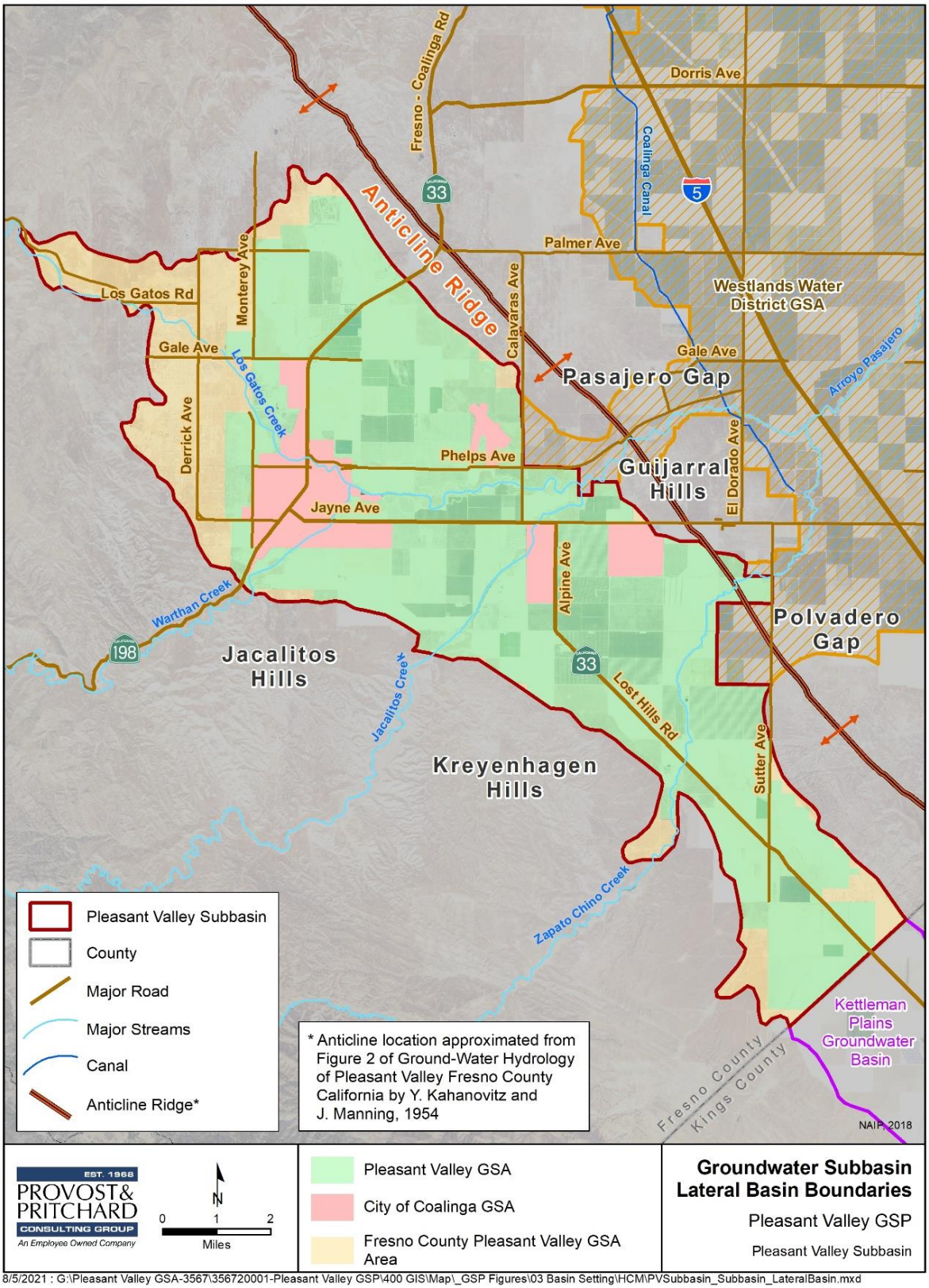


Figure 3-1 Groundwater Subbasin Lateral Basin Boundaries

3.1.3 Regional Geologic and Structural Setting

Regulation Requirements:
§354.14(b)(1) The hydrogeologic conceptual model shall be summarized in a written description that includes the regional geologic and structural setting of the basin including the immediate surrounding area, as necessary for geologic consistency.

Regulation Requirements:
§354.14(b)(3) The hydrogeologic conceptual model shall be summarized in a written description that includes the definable bottom of the basin.

The San Joaquin Valley is surrounded on the west by the Coast Ranges, on the south by the San Emigdio and Tehachapi Mountains, on the east by the Sierra Nevada and on the north by the Sacramento-San Joaquin Delta and Sacramento Valley. The central portion of the San Joaquin Valley drains toward the Delta by the San Joaquin River and its tributaries, the Fresno, Merced, Tuolumne, and Stanislaus Rivers. The southern portion of the valley is internally drained by the Kings, Kaweah, Tule, and Kern Rivers that flow into the Tulare drainage basin including the beds of the former Tulare, Buena Vista, and Kern Lakes. The Subbasin lies along the west side of the San Joaquin Valley, north of the Fresno-Kings County line. The Subbasin is surrounded throughout most of its perimeter by Tertiary continental and marine sediments of the Coast Ranges and west flank of the Kettleman Hills. The Subbasin includes the older and younger alluvium. The eastern boundary of the Subbasin abuts the Westside Subbasin at the Pasajero and Polvadero Gaps. The southern boundary abuts the Kettleman Plains Subbasin. These Subbasin boundaries have been derived from geologic, hydrologic, and institutional criteria. Several intermittent streams enter the basin from the surrounding mountains; these streams include Los Gatos, Warthan, Jacalitos, and Zapato Chino Creeks (DWR, 2006). Below the confluence of these streams is the Arroyo Pasajero. **Figure 3-1 Groundwater Subbasin Lateral Basin Boundaries** depicts the regional geology of the Pleasant Valley Subbasin. In general terms, the Subbasin is essentially a closed basin with limited connection to the greater San Joaquin Valley.

Oil production, regulated by the California Department of Conservation – Division of Oil and Gas, occurs generally in the northern portion of the Subbasin.

For the practical purposes of this HCM, the definable bottom of basin is assumed to be the bottom of the usable aquifer, which based on water quality (TDS) in most of the Subbasin, is at approximately 3,000 feet below ground (KDSA, 2016). It thins towards the mountain fronts to about 1,000 feet deep or less. Shallow oil is located west of the Coalinga Airport and usable groundwater is present only above approximately 500 feet in some westerly locations (KDSA, 2016).

3.1.1 Topographic Information

Regulation Requirements:
§354.14(d)(1) Physical characteristics of the basin shall be represented on one or more maps that depict topographic information derived from the U.S. Geological Survey or another reliable source.

A topographic map of the Subbasin is presented as **Figure 3-2**. The topography of the Subbasin is shaped like an elongated trough tilted to the northeast. The Subbasin is drained to the east. The northern Subbasin boundaries are at elevations of approximately 1,060 feet above mean sea level (**msl**). From the northern boundaries in the hills, the topography slopes to the southeast towards Los Gatos Creek and Jacalitos Creek that are at elevations of approximately 580 feet above msl where they leave the Subbasin at its northeast boundary through the Pasajero Gap. From the south the topography slopes from the flanks of the surrounding hills from elevations of approximately 880 feet to the valley floor and then northeast through the valley to about Zapato Chino Creek. From about Zapato Chino Creek the topography slopes northeastward

towards the Polvadero Gap where Zapato Chino Creek leaves the Subbasin south of Guijarral Hills at approximately 560 feet above msl.

The general geomorphology of the Subbasin is of several alluvial fans originating from the creeks to the west, including the Los Gatos Creek, Warthan Creek, Jacalitos Creek, and Zapato Chino Creek. Relatively steep slopes exist in the areas adjacent to the Coast Ranges, particularly between Warthan Creek and Zapato Chino Creek.

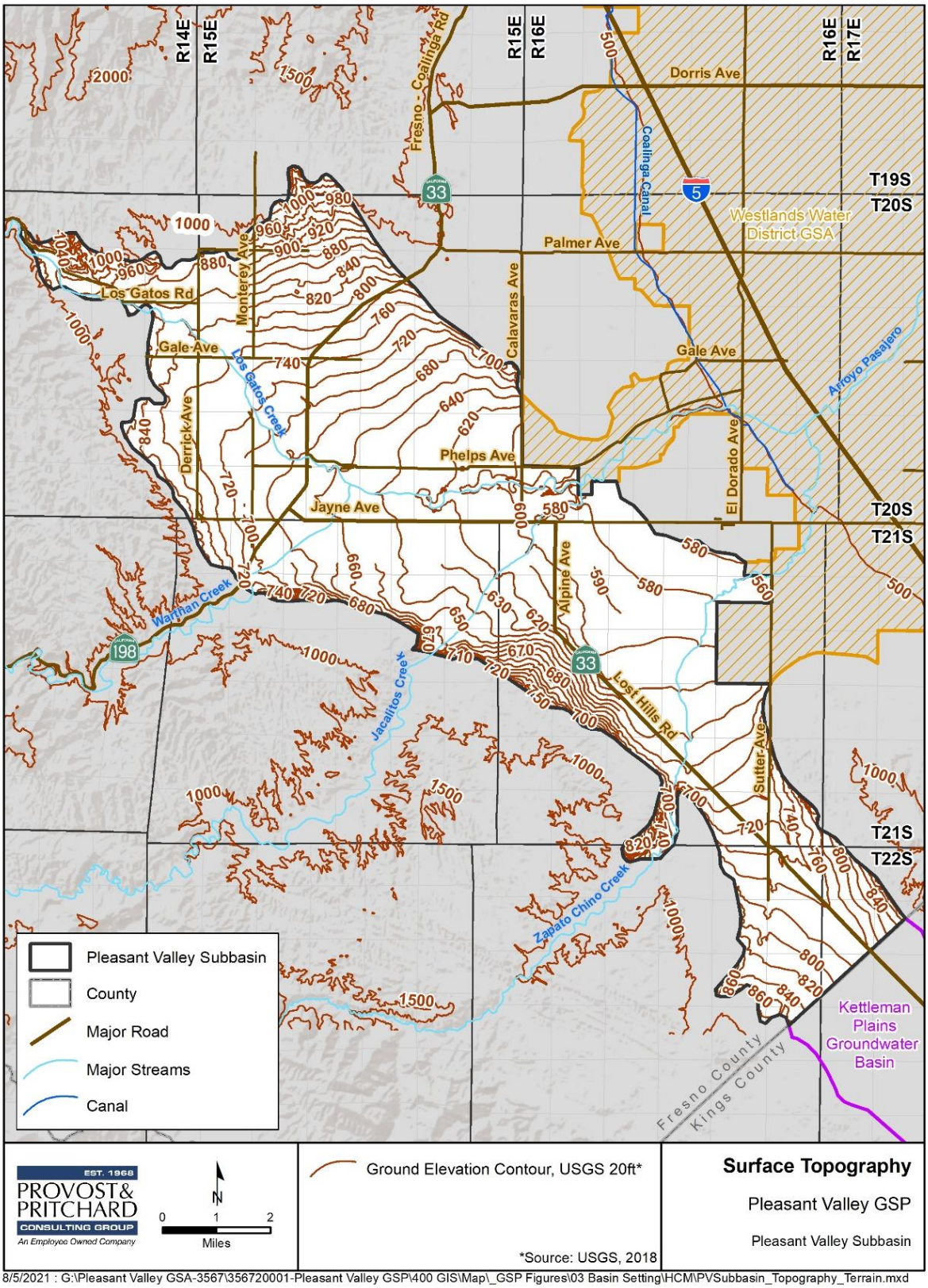


Figure 3-2 Topographic Map

3.1.2 Surficial Geology

Regulation Requirements:
§354.14(d)(2) Physical characteristics of the basin shall be represented on one or more maps that depict surficial geology derived from a qualified map including the locations of cross-sections required by this Section.

As shown in on **Figure 3-3**, Quaternary alluvium (Q) (2.6 million years ago to present) covers the majority of the Subbasin. Pockets of older Quaternary alluvium (Qoa) are located around the margins of the basin and between the streams, where more recent Quaternary stream channel deposits are present. The Quaternary alluvium within the Subbasin is a result of erosion of the mountain ranges to the west and subsequent deposition on the valley floor.

The Subbasin is generally bound on the east and the southwest by non-marine deposits. On the eastern side of the Subbasin, Anticline Ridge is formed by folded Nonmarine Pliocene and (or) Pleistocene sandstone, shale, and gravel deposits (QPc) and Marine Pliocene sandstone, siltstone, shale, and conglomerate (P). To the northwest, northeast, and southeast, the Subbasin is bounded by Lower to Middle Pliocene marine deposits (P).

For additional information see Appendix P pertaining to compaction of sediments underlying areas of land subsidence.

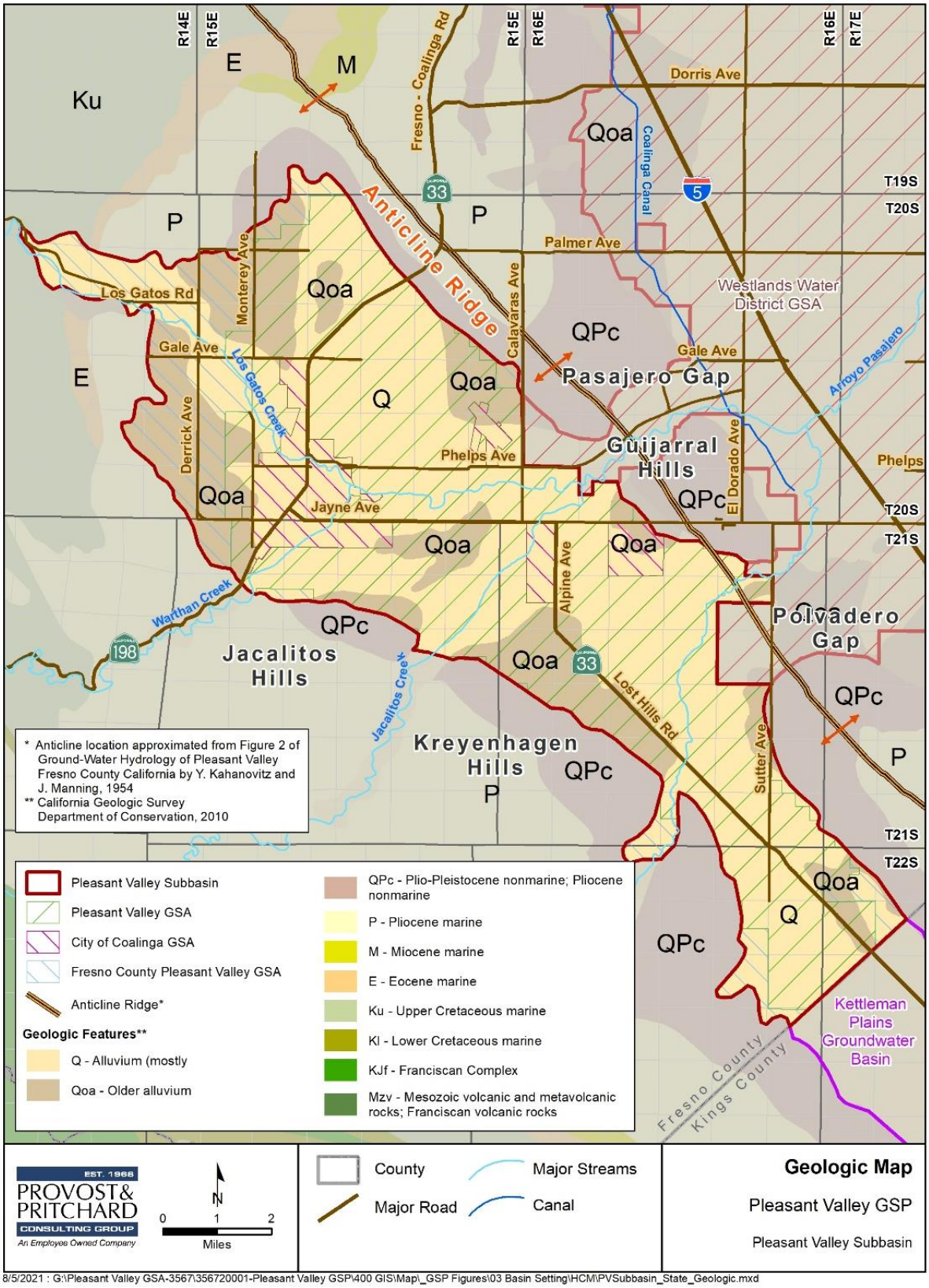


Figure 3-3 Geologic Map

3.1.3 Soil Characteristics

Regulation Requirements:
§354.14(d)(3) Physical characteristics of the basin shall be represented on one or more maps that depict soil characteristics as described by the appropriate Natural Resource Conservation Service soil survey or other applicable studies.

A soils map based on Natural Resources Conservation Service (NRCS) soil textural classes is presented as **Figure 3-4**. Other than recent alluvium along stream channels, the topsoil within the basin is loamy sand, sandy loam, loam, and clay loam. Loamy sand is generally the most permeable of these four soil types. One of the largest areas mapped as loamy sand is east of Highway 33 and west of Zapato Chino Creek in parts of T21S, R16E, Sections 15, 16, 21, and 22 Mount Diablo Base and Meridian (M.D.B.&M). Although soils mapped as loamy sand or sandy loam are generally highly permeable within the upper several feet, the underlying subsoil may contain silt loam layers of much lower permeability (Provost & Pritchard Consulting Group & KDSA, 2003).

In **Figure 3-5**, topsoil textural classes have additionally been related to Saturated Hydraulic Conductivity based on NRCS general categories. For the Subbasin, the NRCS has generally described soils to depths of less than 3 to 5 feet. The hydraulic conductivity values shown on the map are expressed in general terms ranging from relatively rapid for coarse grained soils to relatively slow for fine and very fine-grained soils. **Figure 3-5** can be useful for initial screening of potential surficial recharge and groundwater banking sites, but the information should be supplemented with information on deeper deposits with on-site investigations before projects are pursued. Deeper conditions, down to at least 50 feet deep, are important for recharge projects.

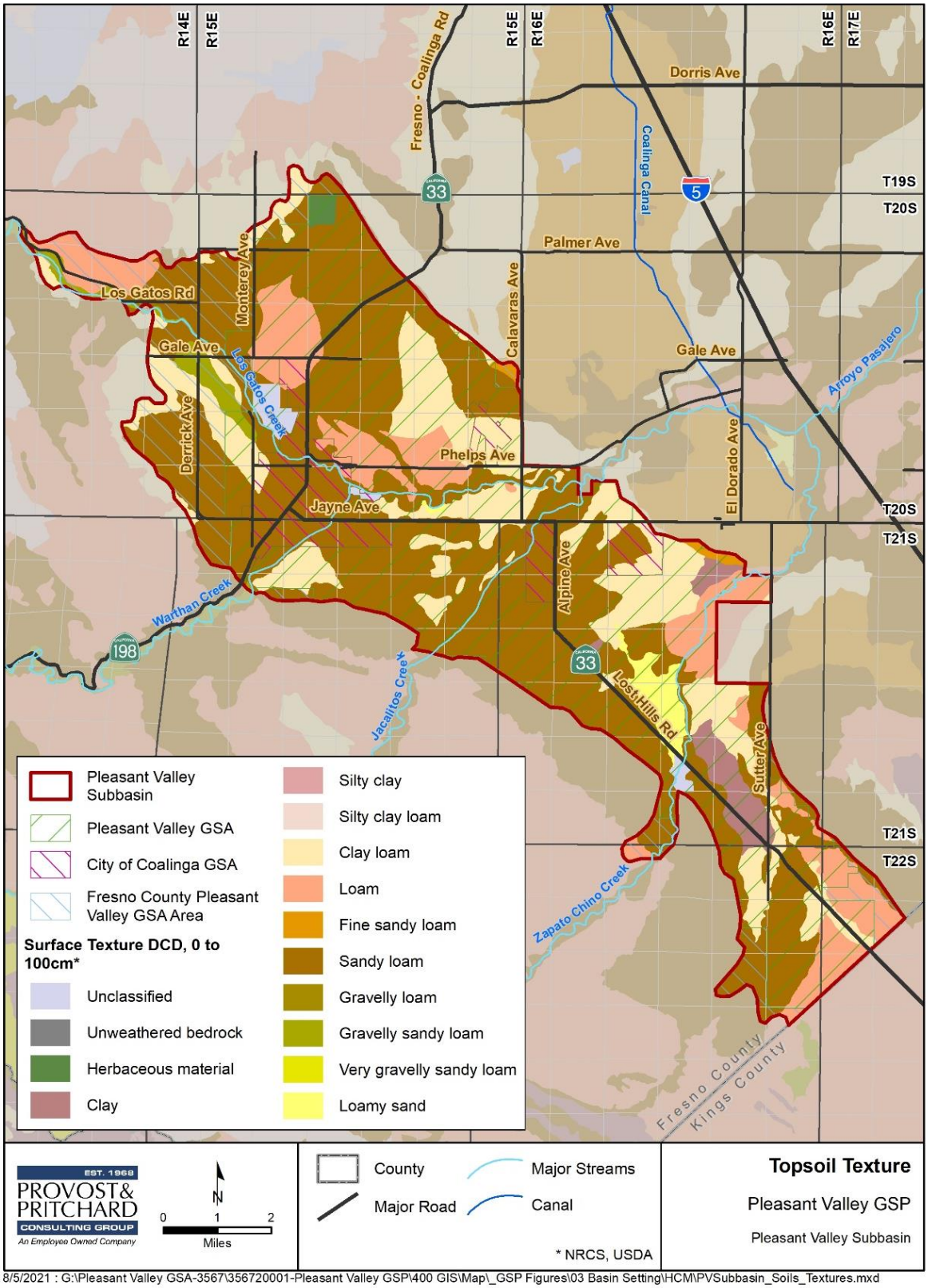


Figure 3-4 Topsoil Texture

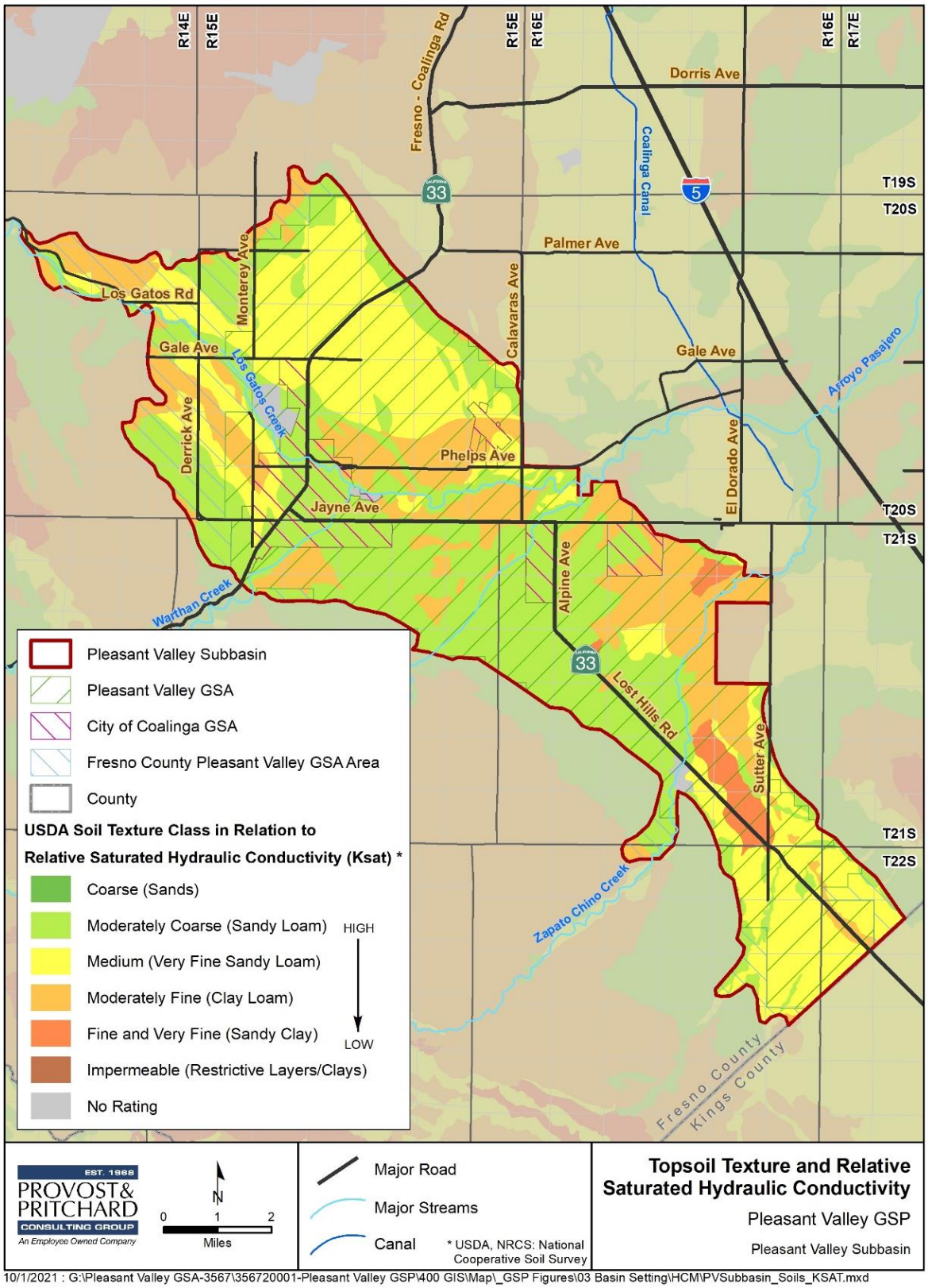


Figure 3-5 Topsoil Texture and Relative Saturated Hydraulic Conductivity

3.1.4 Subsurface Geologic Cross-sections

Regulation Requirements:
§354.14(c) The hydrogeologic conceptual model shall be represented graphically by at least two scaled cross-sections that display the information required by this section and are sufficient to depict major stratigraphic and structural features in the basin.

Kenneth D. Schmidt and Associates (KDSA, 2020) prepared four subsurface geologic cross-sections through the Subbasin. A cross-section location map is shown on **Figure 3-6**. Subsurface geologic cross-sections from KDSA that transverse the Subbasin are presented as **Figure 3-7** through **Figure 3-10**. Geologic Cross-Section A-A' extends just east of Coalinga to east of the Pasajero Gap (**Figure 3-7**). Cross-Section B-B' (**Figure 3-8**) extends from the southern end of the Subbasin to east of the Polvadero Gap. Cross-Section C-C' (**Figure 3-9**) runs southeast from north of Coalinga to where Los Gatos Creek exits the Subbasin on the east. Cross-Section D-D' (**Figure 3-10**) runs approximately due east from approximately southeast of Coalinga through the Polvadero Gap to outside the Subbasin. Cross-Section E-E' was developed from information from the previous cross sections and runs generally longitudinal through the trough of the valley. These cross-sections are discussed in more detail by KDSA in **Appendix E**, (KDSA, 2020). Since the majority of wells in the Subbasin have been located within the Pleasant Valley GSA, the sections are limited to the areas within PVGSA or Pleasant Valley WD and do not transverse the entire Subbasin. The cross-sections may be extended in future updates.

Cross-Section A-A'
This cross-section extends from depths of approximately 1,290 feet below ground inside the Subbasin, near the Pasajero Gap, to 1,885 feet below ground outside the Subbasin east of the gap. The unconsolidated alluvial deposits at Wells 28D and 21Q1 extend to depths of at least 1,200 feet, and the cross-section indicates that the alluvial deposits are thick beneath the gap. Spring water level elevations plotted on Cross-Section A-A' indicate groundwater flows from Pleasant Valley through the Pasajero Gap into the main San Joaquin Valley (KDSA, 2020). The presence and magnitude of flow through this gap needs to continue to be evaluated.

Cross-Section B-B'
This cross-section extends from as deep as 1,762 feet inside the Subbasin to as deep as approximately 1,300 feet just outside the Subbasin and across the Polvadero Gap. The unconsolidated alluvial deposits extend to depths of at least 1,240 feet near the Polvadero Gap. Spring 2019 groundwater elevations along the cross-section indicate a cone of depression in Pleasant Valley and a groundwater divide near Polvadero Gap. No groundwater flow was indicated through the gap at this time (KDSA, 2020).

Cross-Section C-C'
In general, wells along the cross-section are as deep as approximately 2,000 feet. Stream channel deposits (coarser than sand) are primarily present above the Spring 2019 groundwater levels but extend to depths of 900 to 1,100 feet near Los Gatos Creek. Clay is predominant below depths of 1,000 feet and above a depth of about 1,600 feet along the northwest part of the cross-section and below a depth of about 600 feet and above a depth of about 1,600 feet along the east part. Deep sands are common along the section below a depth of about 1,600 feet (KDSA, 2020).

Cross-Section D-D'
Stream channel deposits extend to a depth of about 1,000 feet along the central part of the section. Most of the shallow wells along the section tap stream channel deposits. Substantial clays are indicated along the section below a depth of about 1,000 feet and above a depth of about 1,600 feet. Where data are available, thick sand layers extend to at least 2,300 to 2,700 feet in depth (KDSA, 2020).

Cross-Section E-E'
This is a summary of the cross sections and well information along the center of the valley. See other cross-section descriptions.

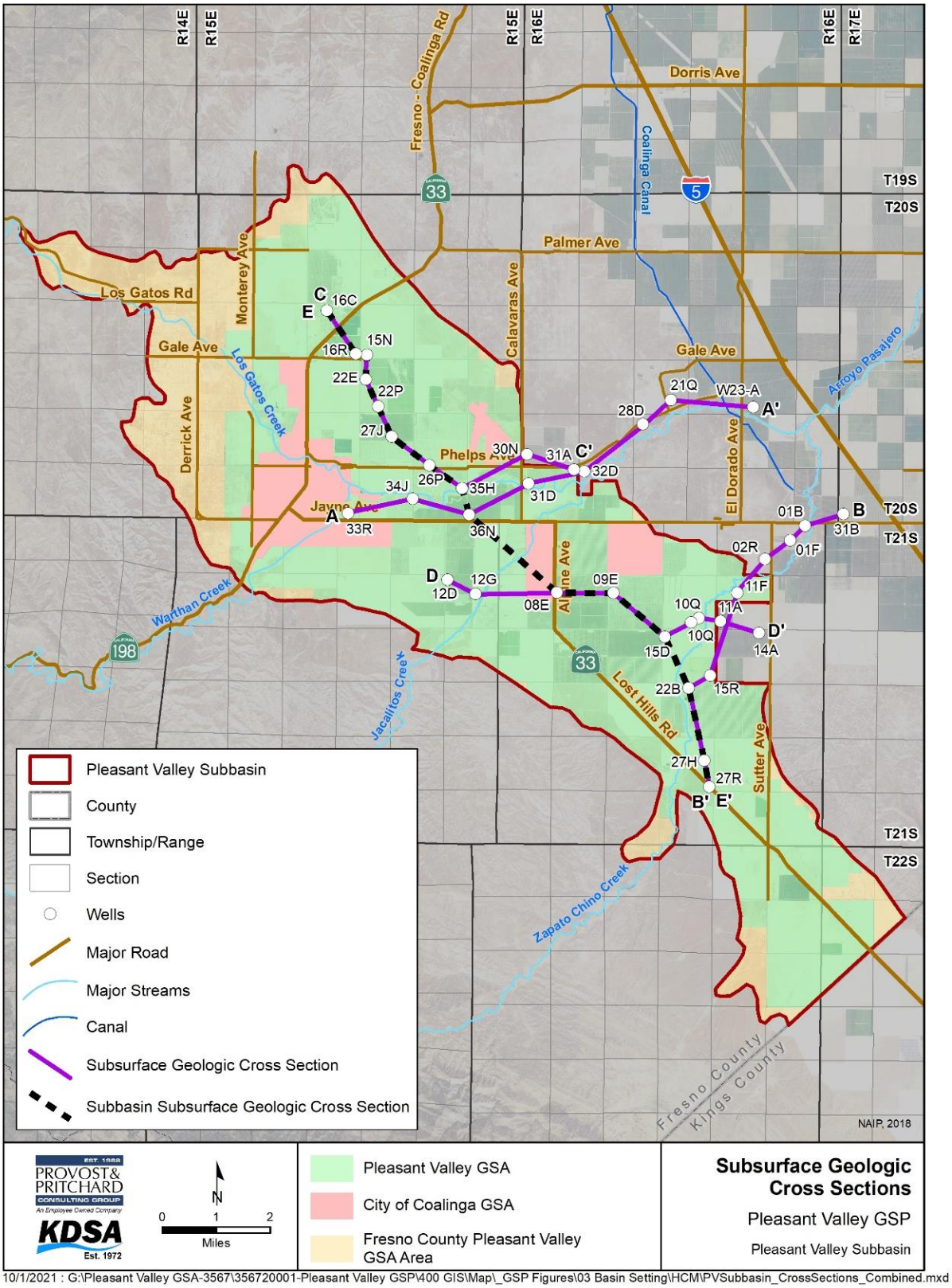


Figure 3-6 Location of Subsurface Geologic Cross Sections

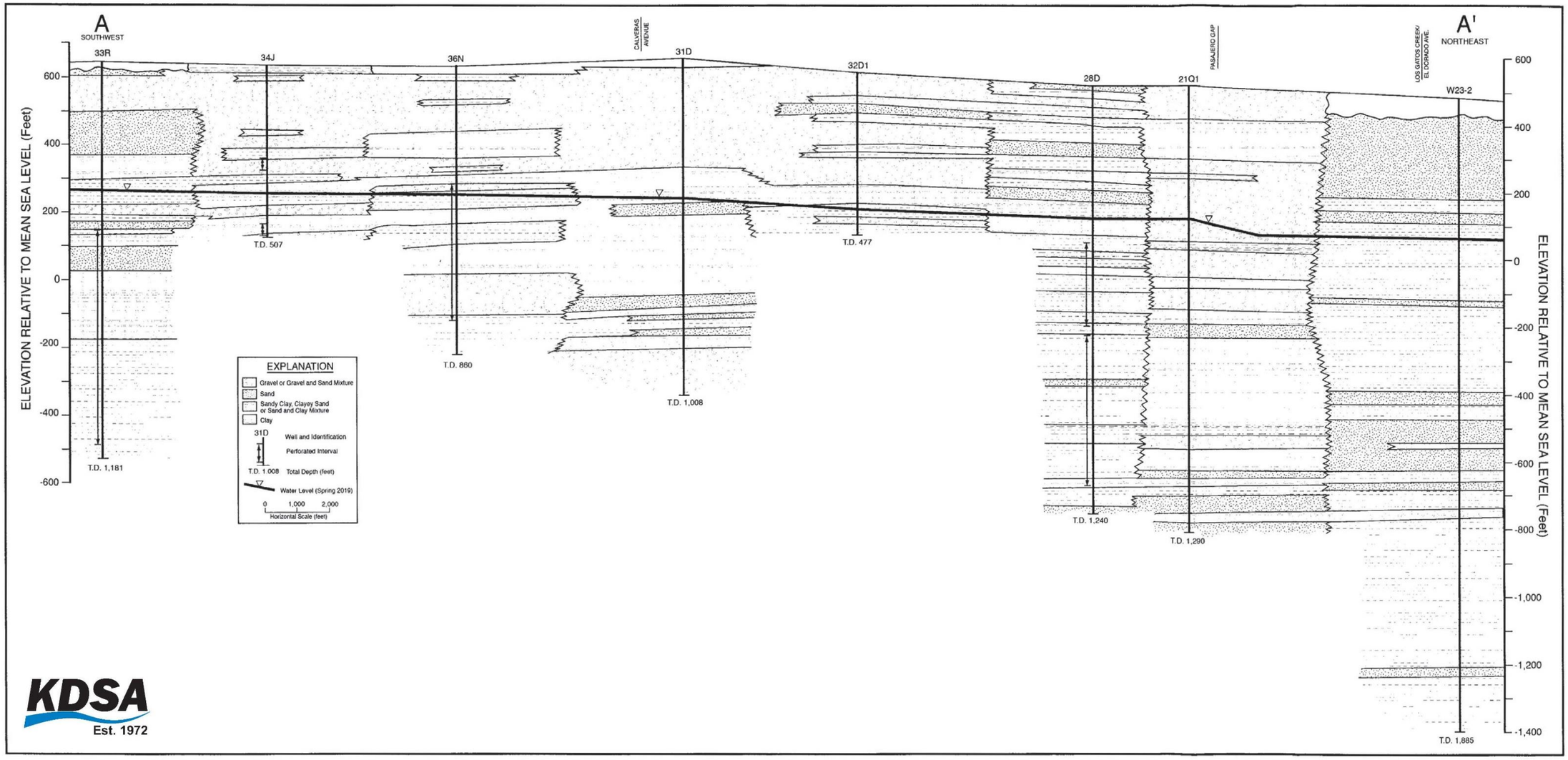


Figure 3-7 Cross Section A-A'

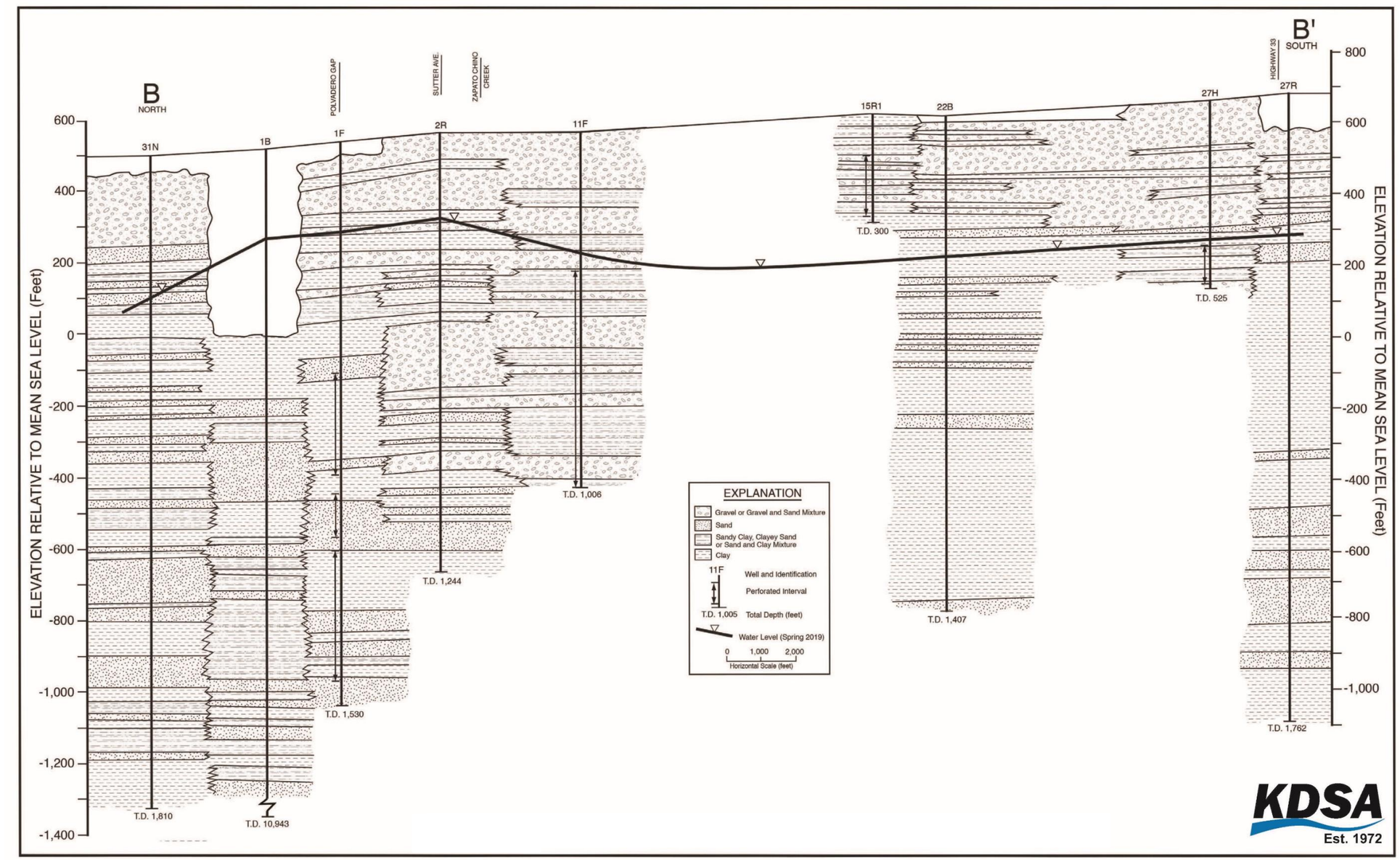


Figure 3-8 Cross Section B-B'

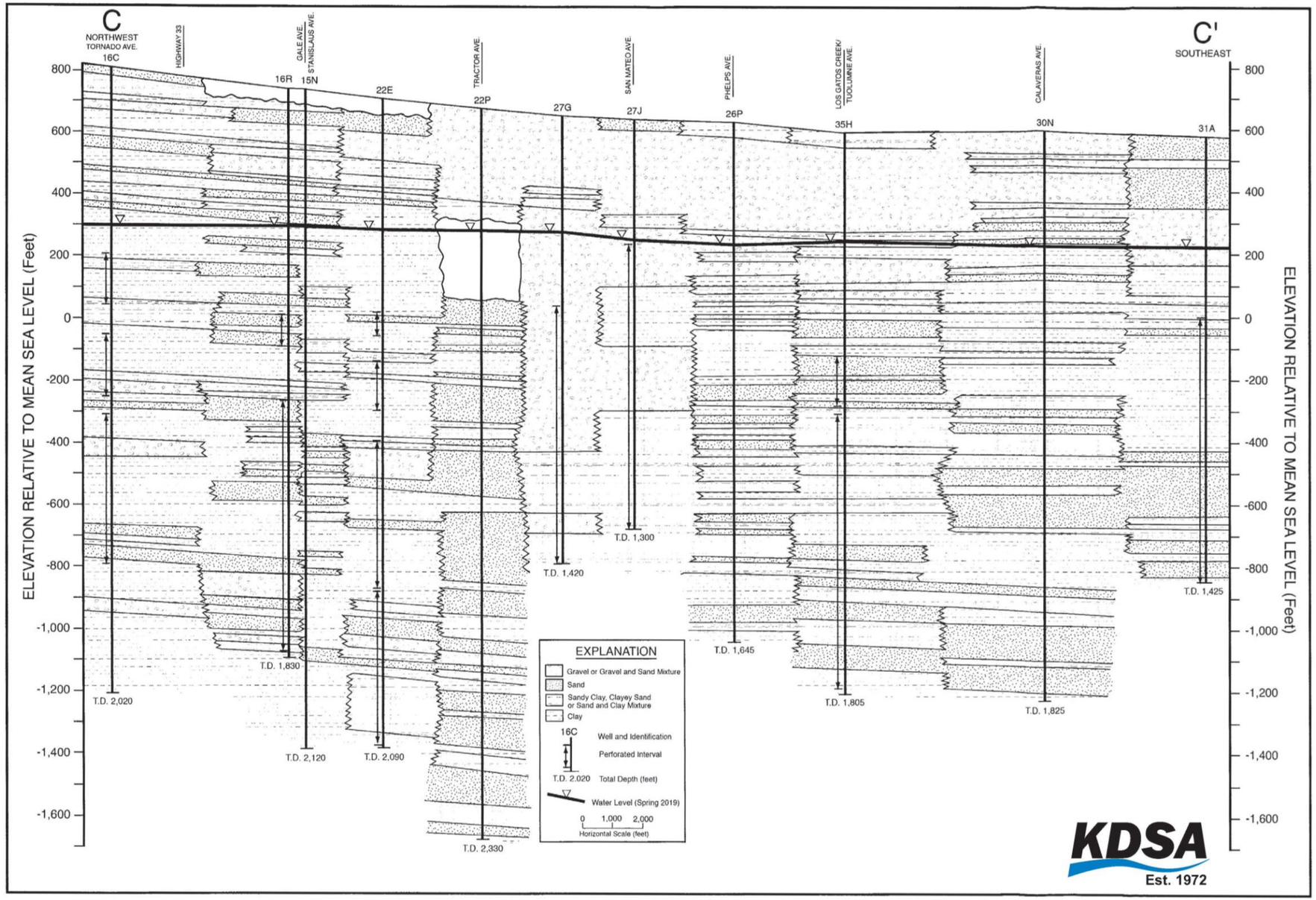


Figure 3-9 Cross Section C-C'

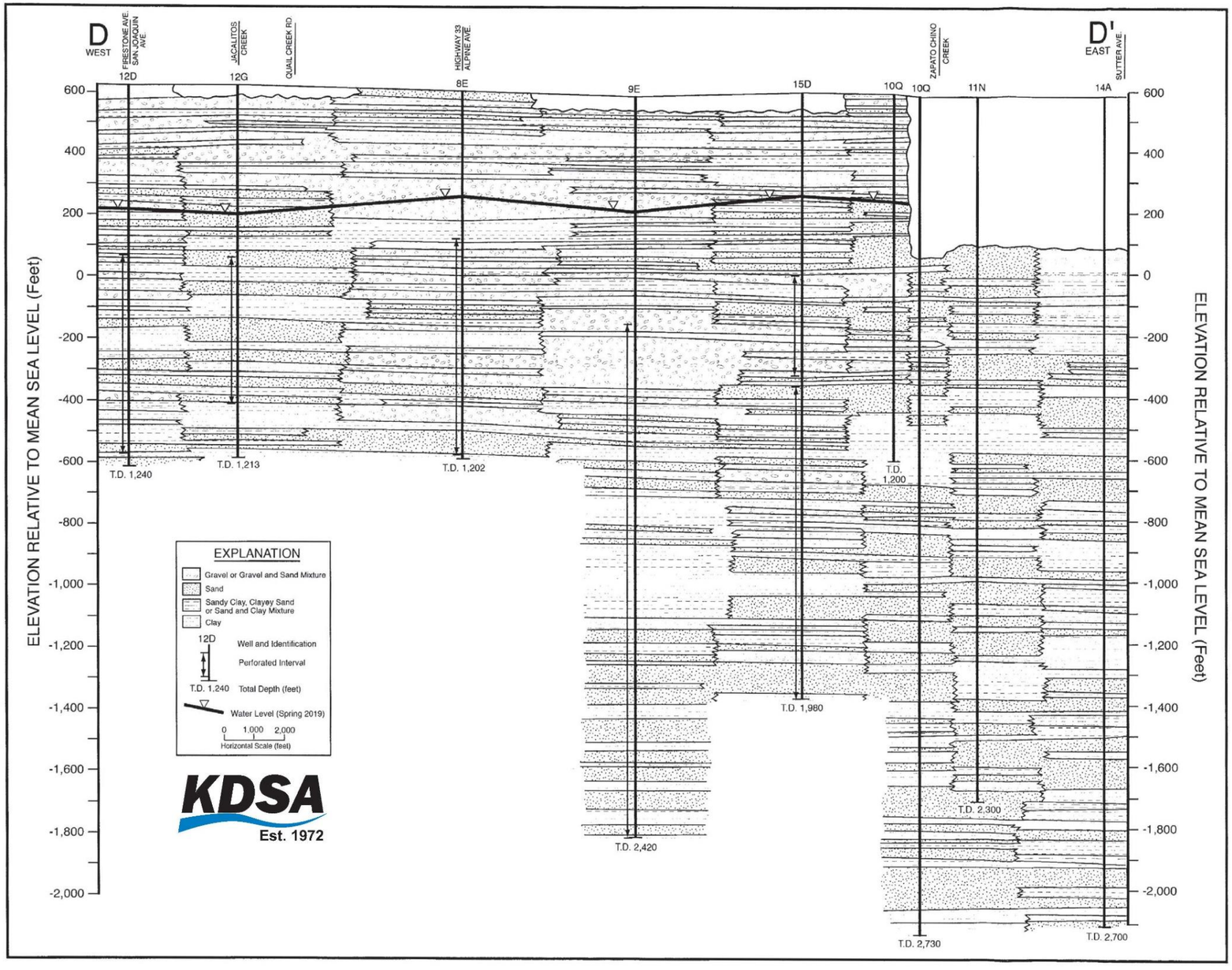


Figure 3-10 Cross Section D-D'

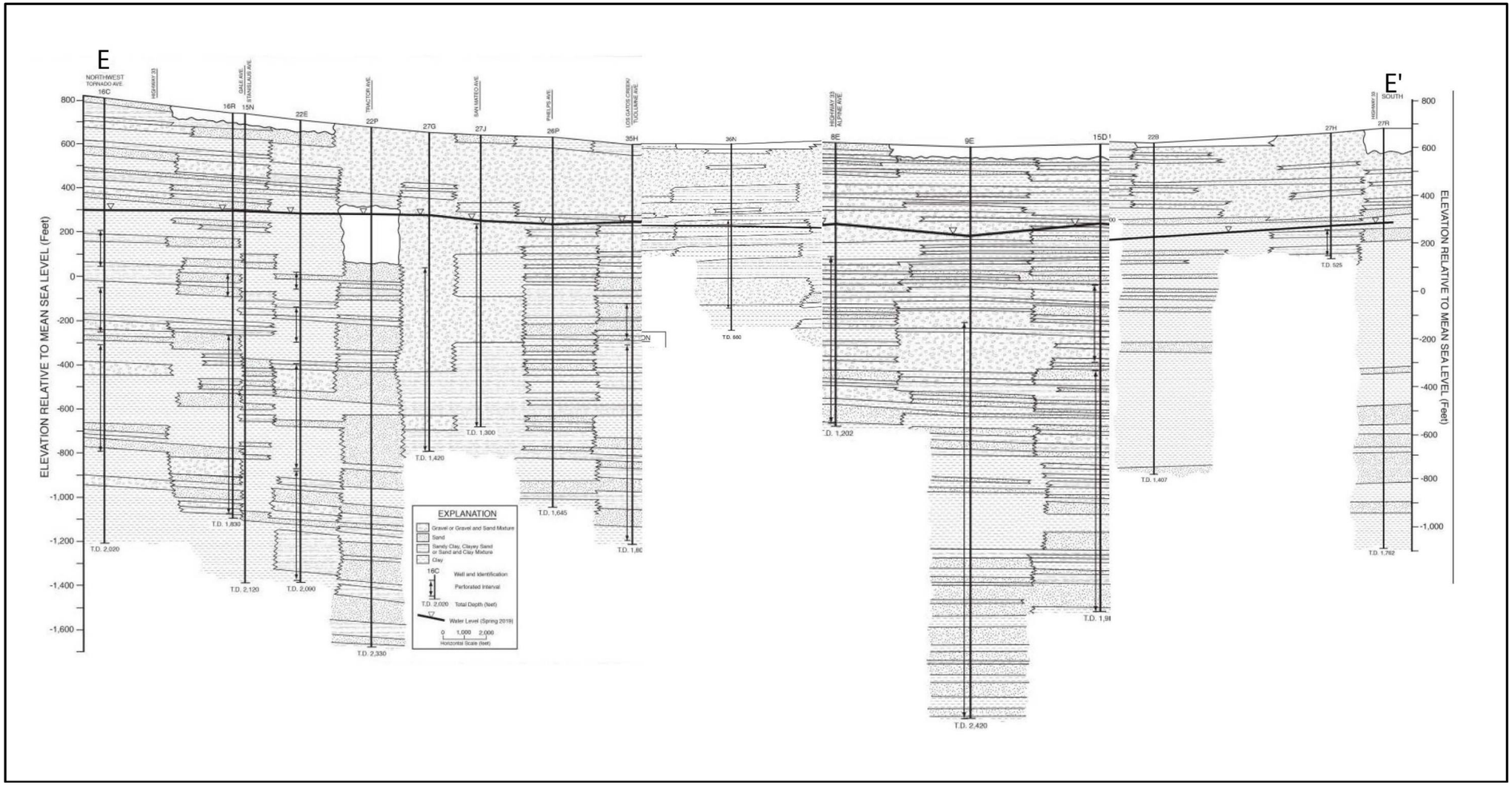


Figure 3-11 Cross Section E-E'

'

3.1.5 Aquifer System

Regulation Requirements:
§354.14(b)(4) The hydrogeologic conceptual model shall be summarized in a written description that includes the principal aquifers and aquitards.

Regulation Requirements:
§354.14(b)(4)(c) Structural properties of the basin that restrict groundwater flow within the principal aquifers, including information regarding stratigraphic changes, truncation of units, or other features.

The groundwater system in the Subbasin was generally thought o be comprised of an upper unconfined aquifer and a semi-confined aquifer at deeper depths, most recent information suggests that even the shallow groundwater is confined. The major component of aquifer recharge comes from streamflow seepage (Kahanovitz & Manning, 1954) and to a lesser degree mountain front recharge from the ranges that define the western boundary of the Subbasin. As shown in **Figure 3-12**, the depth to water in the Subbasin ranges from approximately 350 feet in the south to 500 feet below ground in the north.

As shown in **Figure 3-13**, as a result of pumping, the groundwater flow in the Subbasin is from the north and south towards southwest of the confluence of Jacalitos Creek and Los Gatos Creek in the central eastern portion of the Subbasin. Groundwater now flows toward a pumping depression located near the east central portion of the Subbasin between Jacalitos and Zapato Chino Creeks south of Pleasant Valley State Prison.

Under natural conditions, groundwater generally flowed easterly and exited Pleasant Valley through both the Pasajero and Polvadero Gaps. Due to the lowered water levels in Subbasin from overdraft, groundwater no longer flows easterly through the Polvadero Gap. A recent evaluation indicates that some groundwater still flows through the Pasajero Gap.

Oil production occurs on a limited basis within the Subbasin; and it is regulated by the California Department of Conservation – Division of Oil and Gas.

3.1.5.1 Aquifer Characteristics and Properties

Regulation Requirements:
§354.14(b)(4)(b) Physical properties of aquifers and aquitards, including the vertical and lateral extent, hydraulic conductivity, and storativity, which may be based on existing technical studies or other best available information.

Aquifer Extent

Based on groundwater quality (TDS), the bottom of the usable aquifer in most of the Subbasin is at approximately 3,000 feet (KDSA, 2016). It thins towards the mountain fronts to about 1,000 feet deep or less. Relatively shallow oil is located west of the Coalinga Airport and usable groundwater is present only above approximately 500 feet in some westerly locations (KDSA, 2016).

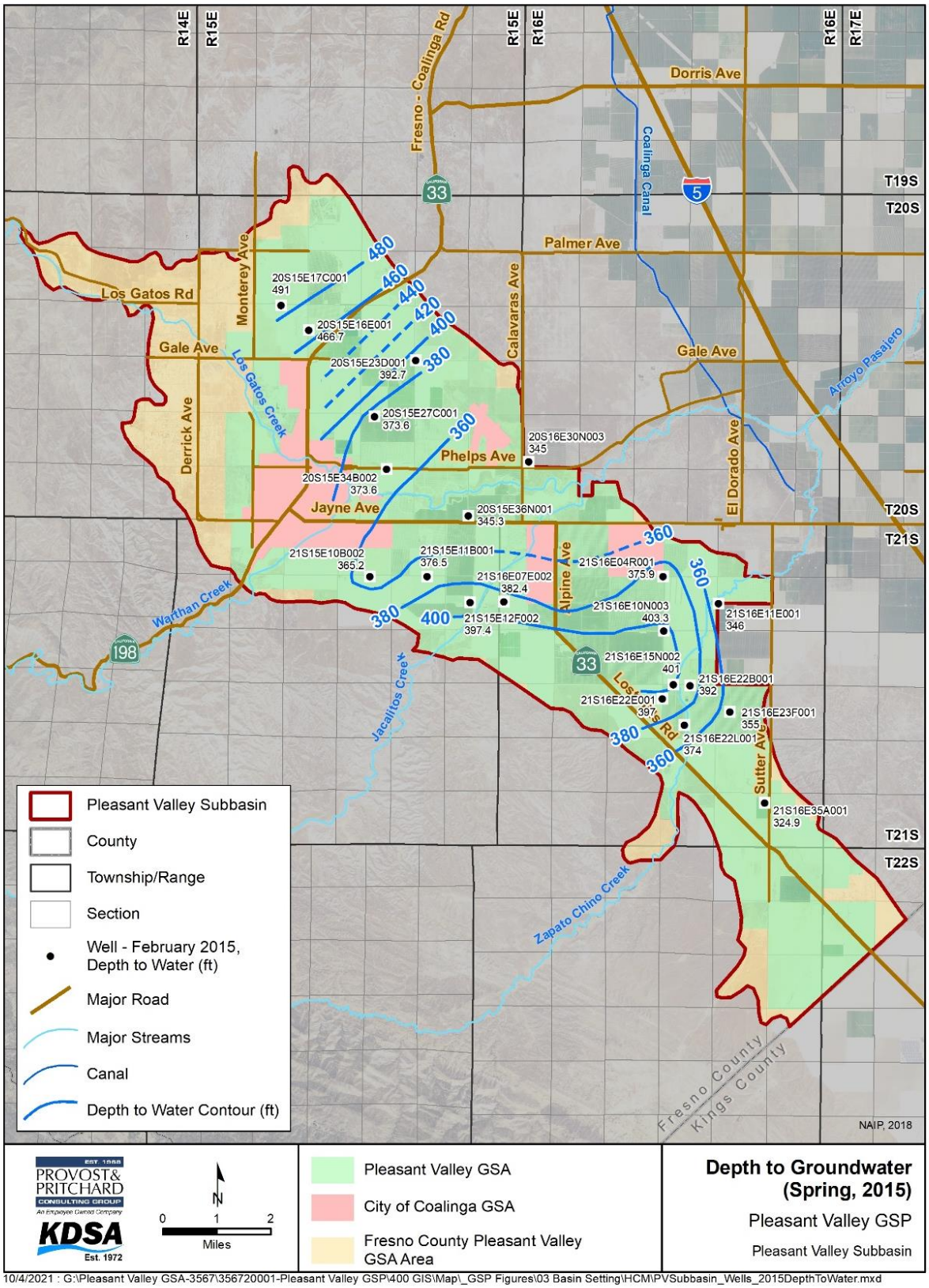


Figure 3-12 Depth to Groundwater (Spring, 2015)

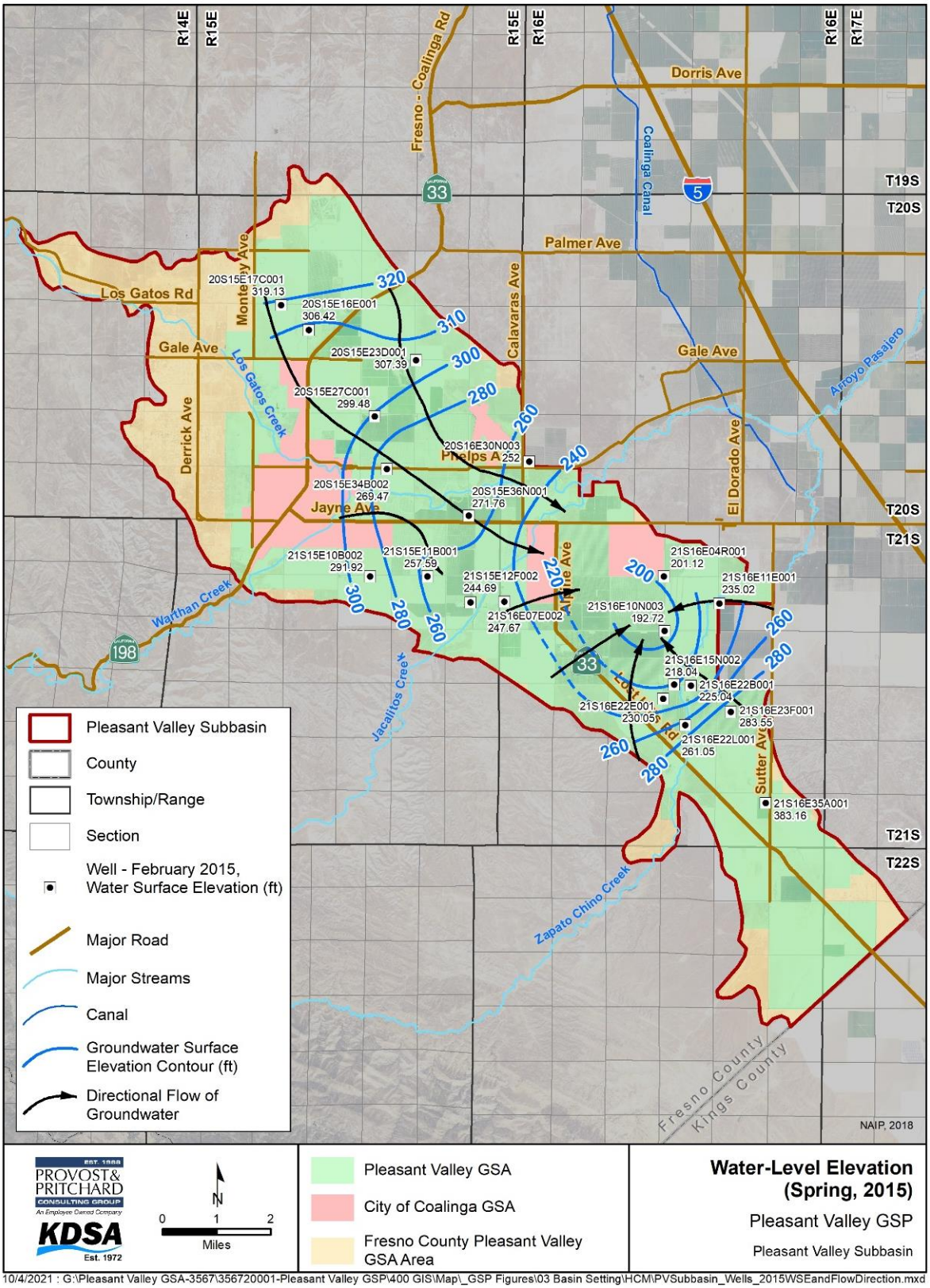


Figure 3-13 Water-Level Elevations (Spring 2015)

Specific Capacities

Pacific Gas & Electric pump test data are available for some irrigation wells in Pleasant Valley. The pumping rates for most irrigation wells range from about 600 to 1,100 gpm. The specific capacities (pumping rate divided by drawdown) of most of these wells range from about 10 to 40 gpm/ft **(Provost & Pritchard Consulting Group & KDSA, 2003)**. A more recent evaluation of specific capacities was performed by KDSA in 2020 (KDSA, 2020), in which specific capacities in Pleasant Valley ranged from 7 to 32 gpm/ft for wells with bottom perforations to depths ranging from 764 feet to 1,200 feet. Deeper wells, with the bottoms of the perforations ranging from 1,760 feet to 2,070 feet, had specific capacities of 11 to 26 gpm/ft.

Aquifer Transmissivities

K.D. Schmidt and Associates (KDSA, 2020) evaluated aquifer transmissivity values at numerous well locations within Pleasant Valley based on specific capacities of the wells from available pump test data. As shown in **Appendix E**, transmissivity values from most tests ranged from 15,000 gallons per day per foot (**gpd/ft**) to 73,000 gpd/ft. A transmissivity of 119,000 gpd/ft was indicated at one site by a 96-hour aquifer pump test (Provost & Pritchard Consulting Group & KDSA, 2003).

Specific Yield

Specific yield is defined as the ratio of the volume of water that a given mass of saturated rock or soils will yield by gravity to the volume of that mass. Williamson and others (1989) provide estimates of specific yields in the Subbasin based on texture of logged deposits utilizing a weighted average method whereby clay layers were assigned a value of 3%, sandy clay 5%, fine sand 10%, and sand and gravel 25%. As shown on **Figure 3-14**, the specific yield values estimated by Williamson and others (1989) by weighted averages ranged from 0.08 in the southern portion of the GSA to 0.13 in the northern portion of the GSA.

The specific yield of the coarse-grained deposits within the upper several hundred feet have previously been estimated to be around 12 to 15 percent, based on texture (Provost & Pritchard Consulting Group & KDSA, 2003). A value of 10.3% was estimated by Summers Engineering, Inc. (Summers Engineering, Inc., 1986) and a value as high as 15.7% was estimated by HydroDevelopment, Inc. (HydroDevelopment, Inc., 1967).

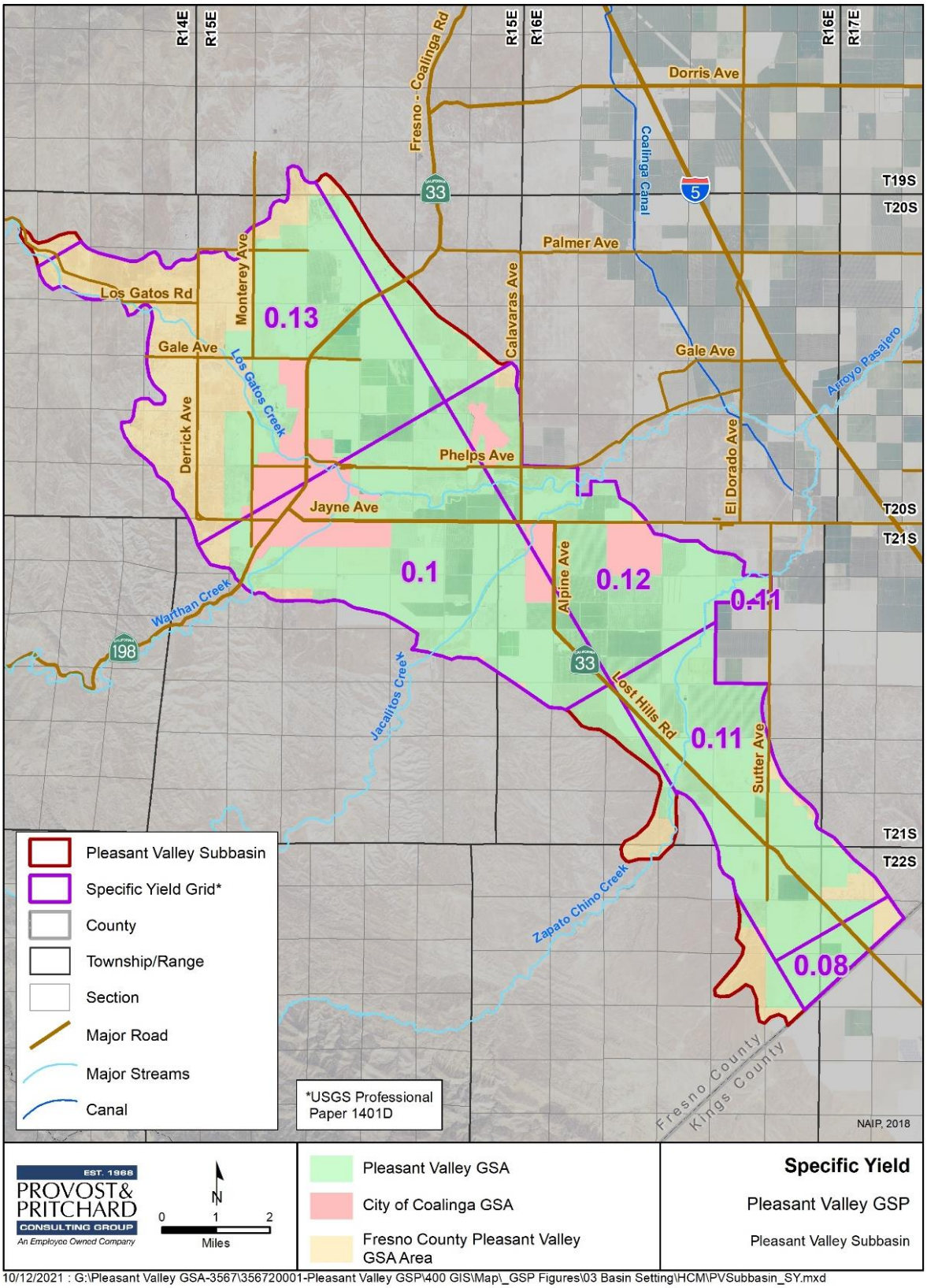


Figure 3-14 Specific Yield Map

3.1.5.2 Aquifer Uses

Regulation Requirements:
§354.14(b)(4)(e) Identification of the primary use or uses of each aquifer, such as domestic, irrigation, or municipal water supply.

Groundwater quality in the Subbasin is generally not as good as it is in many other parts of the San Joaquin Valley, and due to high concentrations of total dissolved solids, sulfate, and other constituents, pumping for drinking water is not present. The primary use of groundwater is agricultural and the moderate salinity groundwater is still suitable for irrigating some crops, such as pistachios. Small amounts of groundwater are pumped from individual domestic wells, typically in isolated areas without access to City of Coalinga water. The City of Coalinga does not use groundwater for potable uses and has met their demands with surface water from a diversion off the Coalinga Canal since 1971 (**Figure 3-15**).

3.1.5.3 Geologic Formations

Regulation Requirements:
§354.14(b)(4)(a) Formation names, if defined.

Geologic units that comprise the Subbasin include the following formations, which have been listed in general sequence from the land surface to greater depths:

- Holocene Alluvium: which consists of highly lenticular deposits of poorly sorted clay, silt, and sand with occasional interbeds of well-sorted fine-to-medium-grained sand; assumed to have an approximate thickness of no more than 300 feet (DWR, 2006). These deposits are above the water level in most of the valley.

- Plio-Pleistocene Tulare Formation: which is alluvium consisting of highly lenticular deposits of poorly sorted clay, silt, and sand with occasional interbeds of well-sorted fine-to-medium grained sand. (DWR, 2006). The Tulare Formation has been estimated at approximately 3,000 feet thick and unconformably overlies the San Joaquin Formation; and in places upper Tulare beds overlap the San Joaquin and cover nearly all of the older formations (Kahanovitz & Manning, 1954).

- San Joaquin Formation: which consists of non-fossil-containing silt and clay beds alternating with beds of sandstone and conglomerate that contains marine and non-marine fossils (Kahanovitz & Manning, 1954).

3.1.6 General Groundwater Quality

Regulation Requirements:
§354.14(b)(4)(d) General water quality of the principal aquifers, which may be based on information derived from existing technical studies or regulatory programs.

Kenneth D. Schmidt and Associates (KDSA, 2000) have stated that the TDS of groundwater in Pleasant Valley WD ranged from 1,000 to 3,000 mg/L with an average of 1,500 mg/L. The major constituents of concern in groundwater for irrigation use include sodium adsorption ratio, bicarbonate, boron, and pH.

More in-depth discussions on groundwater quality are included in this GSP in **Section 3.2.5 Groundwater Quality Issues.**

3.1.7 Surface Water Features

Regulation Requirements:

§354.14(d)(5) Physical characteristics of the basin shall be represented on one or more maps that depict surface water bodies that are significant to the management of the basin.

The surface water features significant to the management of the Subbasin are illustrated on **Figure 3-15**. The most significant feature in terms of imported water supply is the Coalinga Canal located to the east of the basin along the eastern side of Anticline Ridge. The City of Coalinga surface water treatment facility is also located on the eastern side of Anticline Ridge where the Coalinga Canal intersects Palmer Avenue. The point of diversion from the Coalinga Canal that is currently used for the importation of agricultural surface water supplies is also shown on **Figure 3-15**.

Additional surface water features within the Subbasin include the intermittent streams (Los Gatos Creek, Warthan Creek, Jacalitos Creek, and Zapato Chino Creek) and the City of Coalinga Wastewater Treatment ponds located just east of the City of Coalinga at the confluence of the Los Gatos Creek and the Warthan Creek.

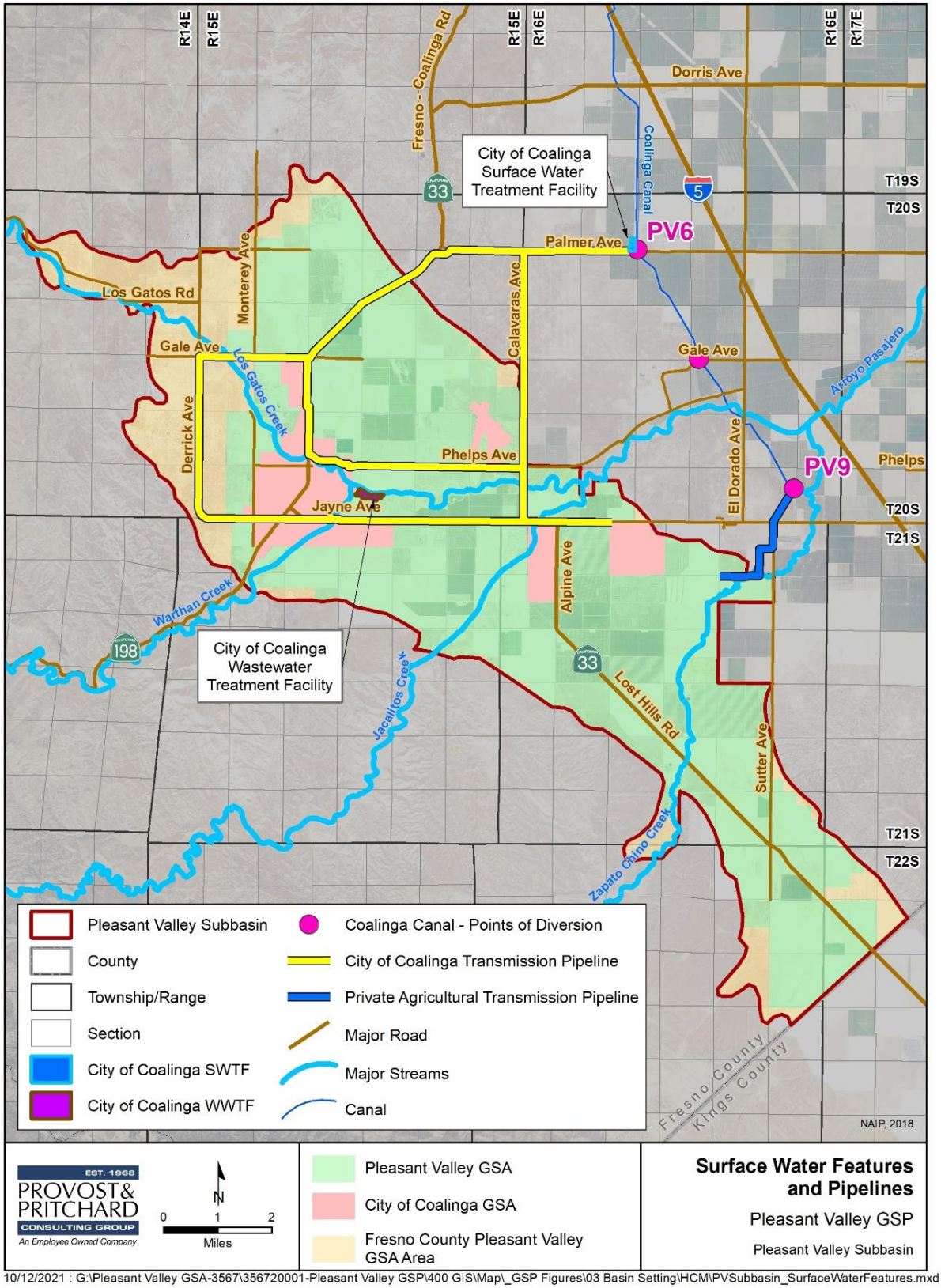


Figure 3-15 Surface Water Features and Pipelines

3.1.8 Source and Point of Delivery of Imported Water

Regulation Requirements:
§354.14(d)(6) Physical characteristics of the basin shall be represented on one or more maps that depict the source and point of delivery for imported water supplies.

As shown in **Figure 3-15**, treated surface water is imported into the Subbasin from off the Coalinga Canal and the City of Coalinga Surface Water Treatment Plant at Coalinga Canal Turnout PV6 located east of the Subbasin. Untreated surface water from off the Coalinga Canal is imported into the Subbasin at Turnout PV9 located at the southern end of the canal for agricultural uses.

Significant oil fields exist within the Subbasin. Pumping oil from these deposits generates some amount of water that comes from the same depths as the oil deposits. Water generated due to oil pumping is discussed in more detail in **Section 3.2.5.3**.

3.1.9 Recharge and Discharge Areas

Regulation Requirements:
§354.14(d)(4) Physical characteristics of the basin shall be represented on one or more maps that depict delineation of existing recharge areas that substantially contribute to the replenishment of the basin, potential recharge areas, and discharge areas, including significant active springs, seeps, and wetlands within or adjacent to the basin.

The main source of groundwater recharge in the Subbasin is from streamflow seepage (Kahanovitz & Manning, 1954). Streamflow sources include the Los Gatos, Warthan, Jacalitos, and Zapato Chino Creeks.

Areas favorable for intentional recharge by basins or in creeks within the Pleasant Valley Water District (PVWD) were previously assessed in 2000 by KDSA (**Figure 3-16**). In this study, areas adjacent to Los Gatos Creek and Zapato Chino Creek within the PVWD were identified as areas favorable for intentional groundwater recharge by surficial means. An additional smaller area was identified adjacent to Jacalitos Creek, approximately between the alignments of Jayne Avenue to the north and Lost Hills Road to the south.

Figure 3-5, which shows topsoil texture and relative saturated hydraulic conductivity, can be useful for initial screening of potential surficial recharge and groundwater banking sites. Information should be confirmed with on-site investigations. Deeper conditions are important, down to a depth of at least 50 feet, in order to evaluate the potential for basin recharge.

No active springs, seeps, or wetlands are known or have been observed by the GSAs. However as shown on **Figure 3-17**, the National Wetland Inventory shows several possible wetlands within the Subbasin, generally along the intermittent streams. Due to the deep groundwater levels and perennial, intermittent nature of the local streams, the accuracy of these mapped wetlands is questionable and is currently under assessment by the GSAs. The small Freshwater Ponds dotted throughout **Figure 3-17** are farm ponds and are not considered to be potential wetlands.

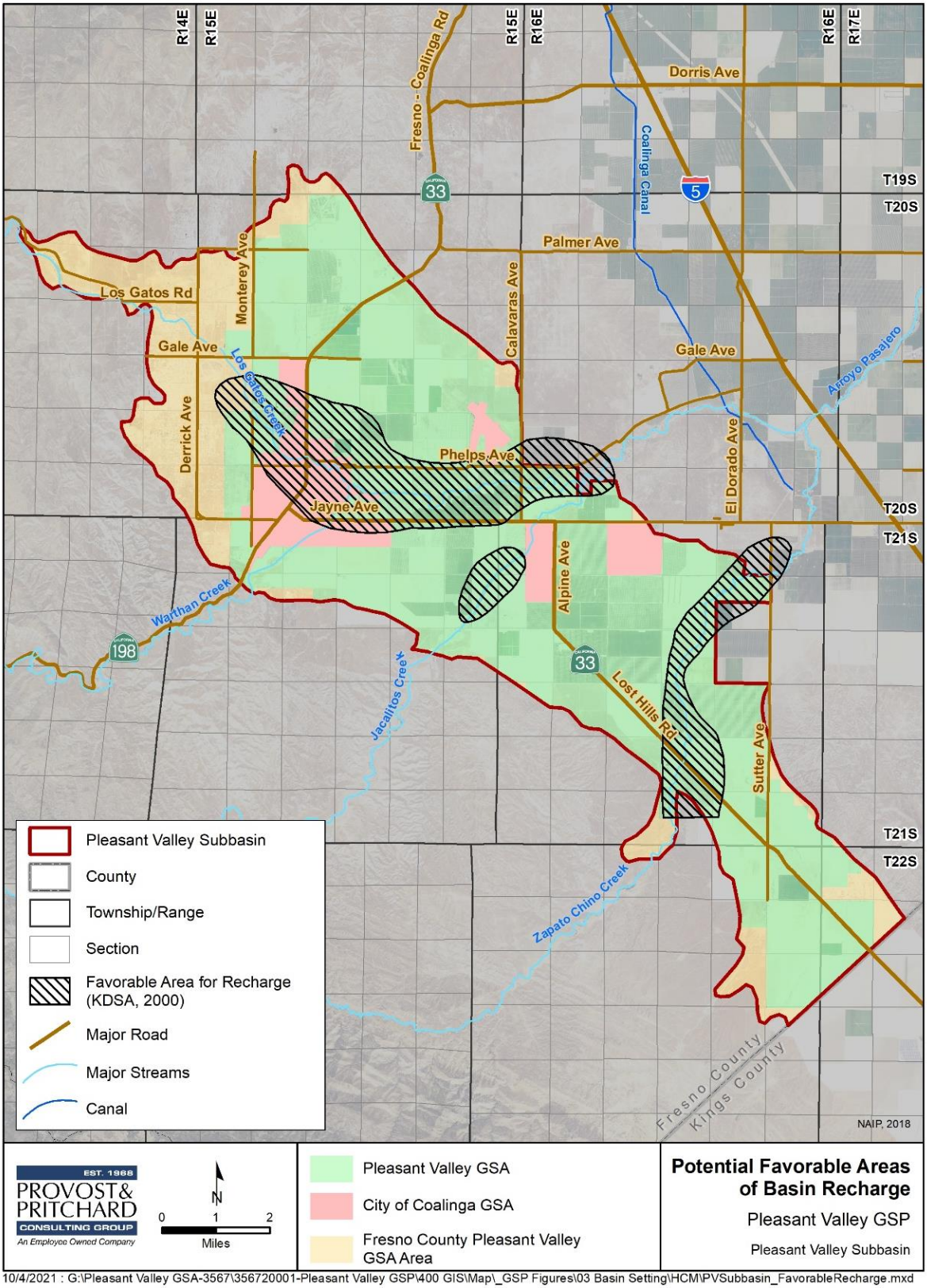


Figure 3-16 Potential Favorable Areas of Basin Recharge

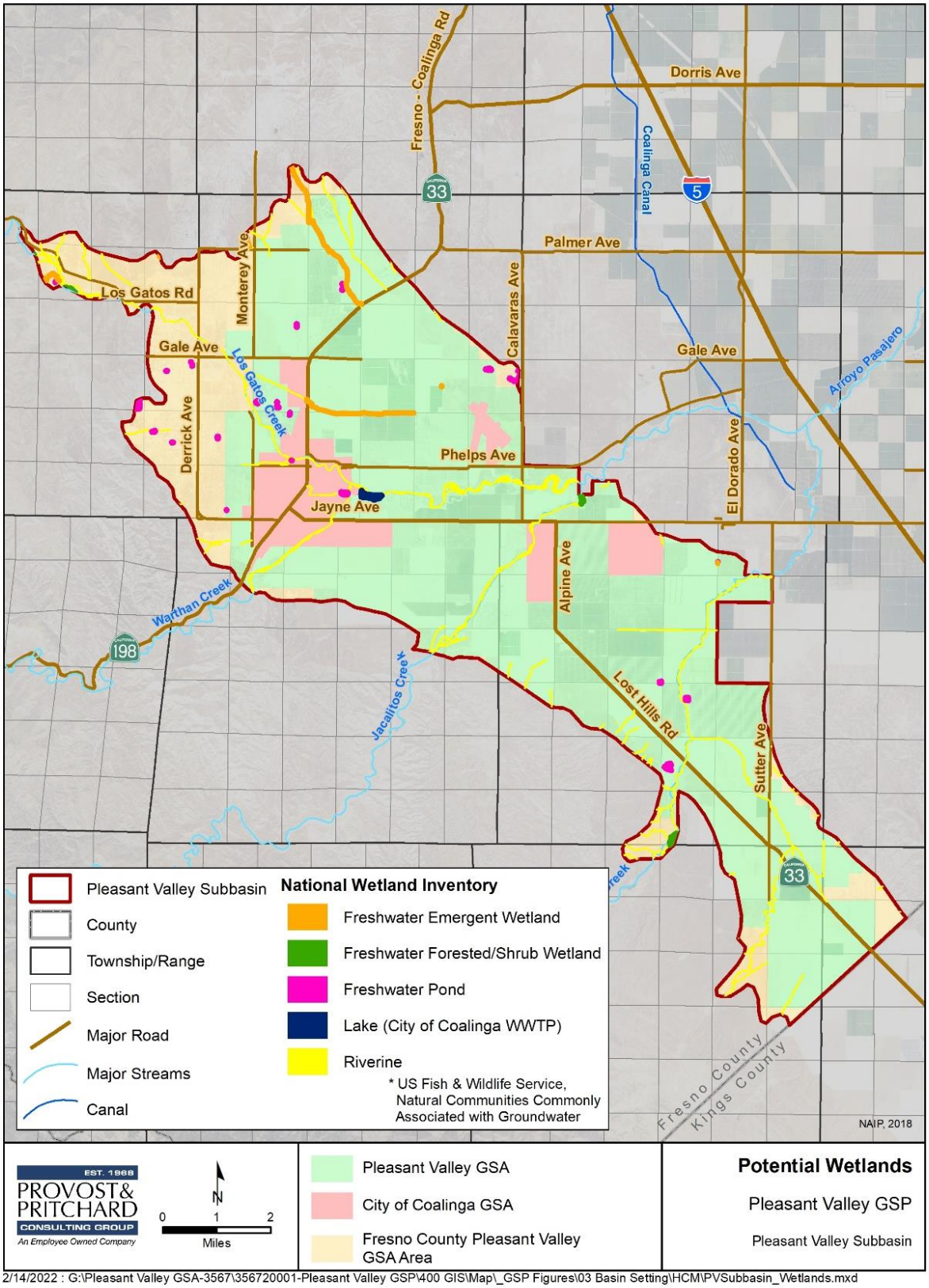


Figure 3-17 Pleasant Valley Subbasin Potential Wetlands Map

3.1.10 Identification of Data Gaps in Hydrologic Conceptual Model

Regulation Requirements:
§354.14(b)(5) Identification of data gaps and uncertainty within the hydrogeologic conceptual model.

Data gaps and uncertainties within the HCM include the following:

- Annual Crop surveys have not been conducted.
- Transducer water level measurements are not available in parts of the basin.
- The magnitude of groundwater flow through the Pasajero Gap.
- Water level data from the southeast portion of the Subbasin and on both sides of the Fresno-Kings County line.
- The extent to which oil field derived water is used and or disposed of in the Subbasin.
- The accuracy of mapped wetlands by the National Wetland Inventory.

These will be investigated in the future, pending available funding.

3.2 Current and Historical Groundwater Conditions

Regulation Requirements:
§354.16 Each Plan shall provide a description of current and historical groundwater conditions in the basin, including data from January 1, 2015, to current conditions, based on the best available information that includes the following:

This section includes discussions on the current and historical groundwater conditions in the Subbasin. Available data was used to establish groundwater trends in the Subbasin. The main topics addressed in this section include these sustainability indicators:

- Groundwater Levels
- Groundwater Storage
- Groundwater Quality
- Land Subsidence
- Surface Water and Groundwater Interconnections
- Groundwater Dependent Ecosystems

As will be documented later in this chapter, the most significant condition that impacts the historical and current groundwater levels in the basin is cropping patterns and the resultant groundwater demand. **Section 3.3.1** documents historical and current information which recognizes the historical development of field crops, the changing agricultural economics that caused a large reduction in crop cultivation in the 1990s through the early part of this century, and then the more recent establishment of permanent planting of pistachios in the late 1990's.

This section provides monitoring data collected by various agencies. Refer to **Chapter 5** for descriptions of the monitoring programs used to collect the data going forward. **Section 3.1** (HCM), provides background information on the hydrogeologic setting, aquifers, soils, and stratigraphy that relate to this section. The groundwater system in the Subbasin is generally comprised of an upper unconfined aquifer and a semi-confined aquifer at greater depths. The major component of aquifer recharge comes from streamflow seepage (Kahanovitz & Manning, 1954). Relatively little aquifer recharge comes from mountain front recharge from the ranges that define the eastern boundary of the Subbasin. Also, losses of well production, air production, and well plugging are discussed in this section. References contributing to these evaluations include HydroDevelopment (1967), Summers Engineering (1985), and Kenneth Schmidt and Associates (2000, 2016).

3.2.1 Groundwater Level Data

Regulation Requirements:
§354.16(a) Groundwater elevation data demonstrating flow directions, lateral and vertical gradients, and regional pumping patterns, including:
1. Groundwater elevation contour maps depicting the groundwater table or potentiometric surface associated with the current seasonal high and seasonal low for each principal aquifer within the basin.
2. Hydrographs depicting long-term groundwater elevations, historical highs and lows, and hydraulic gradients between principal aquifers.

A basin boundary modification for the Pleasant Valley Subbasin was approved by DWR in September 2016. The basin boundary modification removed Pliocene-Pleistocene non-marine rocks from the Subbasin margins and split the original Pleasant Valley Subbasin into the Pleasant Valley Subbasin north of the Fresno-Kings County line and the Kettleman Plains Subbasin south of the county line (see **Figure 3-1**). Unless specified otherwise, figures presented herein are based on the 2016 basin boundary modification.

This section presents historical groundwater level data in the form of groundwater depth maps, groundwater elevation maps, and water-level hydrographs. Contour maps are presented for Spring 1998 and Spring 2017

(which represent the beginning and end of a water budget period evaluated in Section **3.3**). Spring represents seasonal high groundwater levels in the Subbasin.

Depth to Water

Depth to water maps are provided for Spring 1998 and Spring 2017. Depth to water in Spring 1998 ranged from less than 300 feet near Los Gatos Creek, west of Calaveras Avenue, to more than 500 feet in the north part of the valley (**Figure 3-17).** Depth to water in the Spring 2017 ranged from less than 350 feet near Coalinga and the south part of the basin to more than 475 feet in the north part of the basin **(Figure 3-18).** These maps are developed from measurements of irrigation wells both in production as well as unused wells. In general, the depth of the irrigation wells vary from _600 to over 2,400 feet with the average depth on the order of 1,200 feet. Perforated intervals range from approximately 400 to 2400 feet with the average length of about 400 feet._

In the southern end of the subbasin near the Lost Hills Community the water levels have not declined much over time, due to minimal cropping and groundwater usage in the area.

Water Level Elevations and Direction of Groundwater Flow

Figure 3-20 shows water level elevations and the direction of groundwater flow in Spring 1998. There was a groundwater flow divide between Jacalitos and Zapato Chino Creek. Northwest of the divide, groundwater flowed to the east or southeast. Southeast of the divide the direction of groundwater flow was to the northwest. The highest water level elevations exceed 380 feet above mean sea level and were in the central part of the basin. The lowest water level elevations were near the divide and were less than 240 feet above mean sea level.

Figure 3-21 shows water level elevations and the direction of groundwater flow for Spring 2017. The same directions of groundwater flow were present as in Spring 1998. The highest water level elevations exceeded 360 feet and were in the southeast part of the basin. The lowest water level elevations were near the divide and were less than 180 feet.

With the drop in groundwater levels in Pleasant Valley, it was believed that the Subbasin became isolated with regards to groundwater flows to or from the San Joaquin Valley Subbasin (Summers Engineering, Inc., 1985). The Subbasin is comprised primarily of alluvium. Approximately parallel to and easterly of the valley is the geologic feature known as Anticline Ridge, which is an arch-shaped fold in rock in which rock layers are upwardly convex. Anticline Ridge, shown on **Figure 3-22**, is the hydrogeologic separation between Pleasant Valley and the more easterly rest of the San Joaquin Valley groundwater basins. When groundwater levels were shallower, groundwater historically flowed through the Polvadero and Pasajero Gaps (Summers Engineering, Inc., 1986). Kenneth D. Schmidt and Associates as part of this work has estimated the groundwater outflow through the Pasajero Gap, which is indicated to still be occurring. Groundwater movement is discussed in Section **3.2.2**.

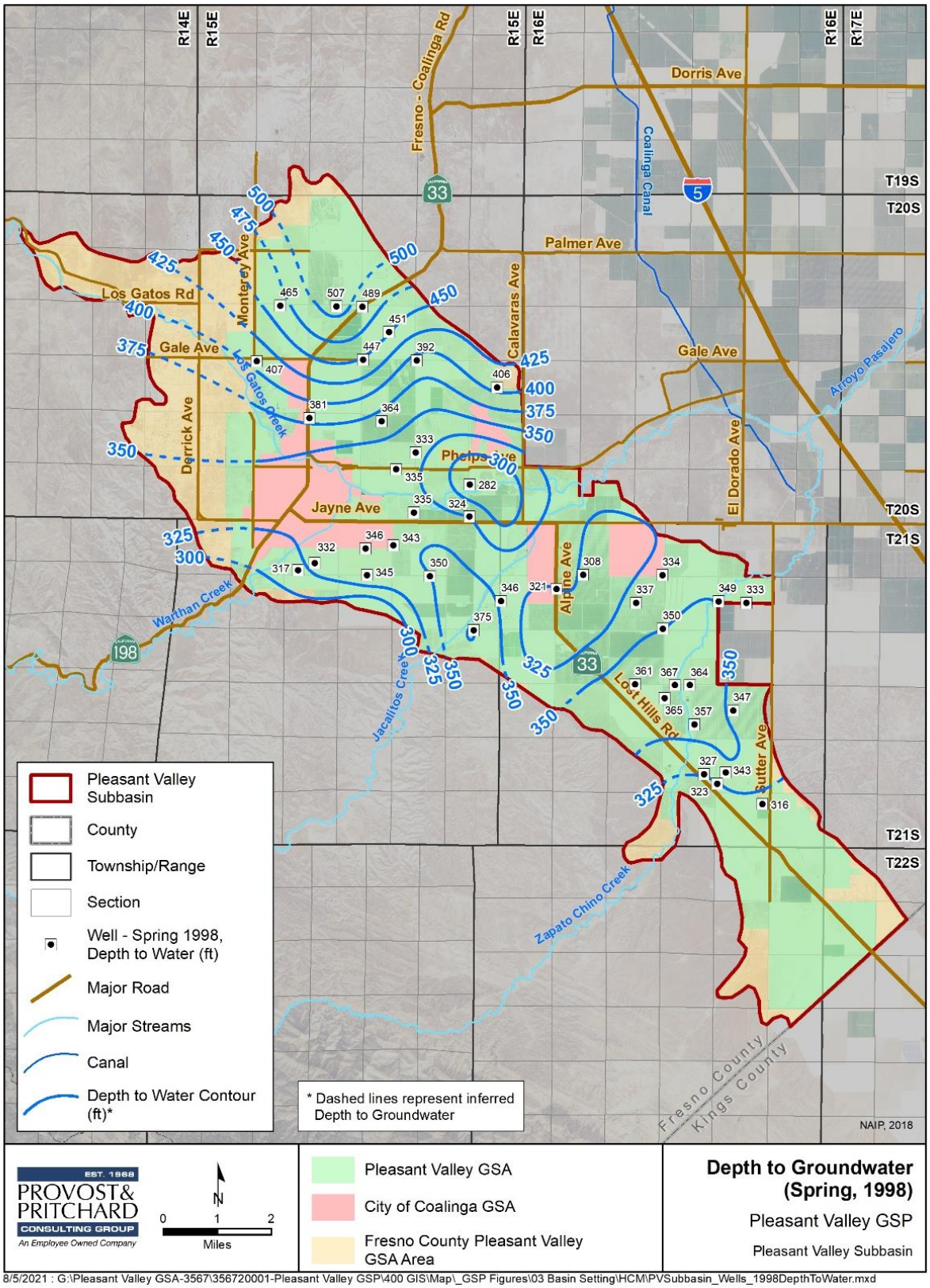


Figure 3-18 Depth to Groundwater (Spring 1998)

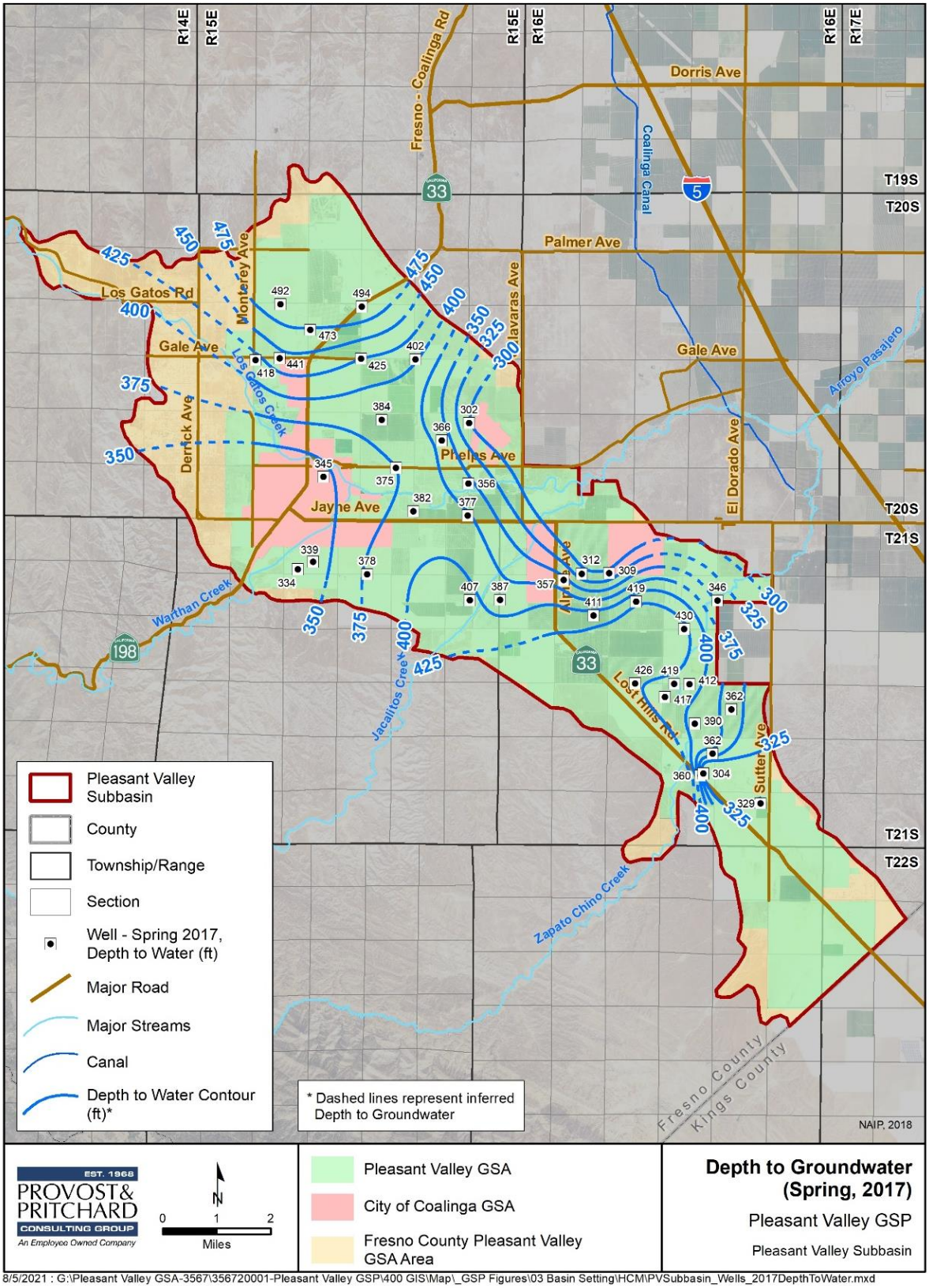


Figure 3-19 Depth to Groundwater Map (Spring 2017)

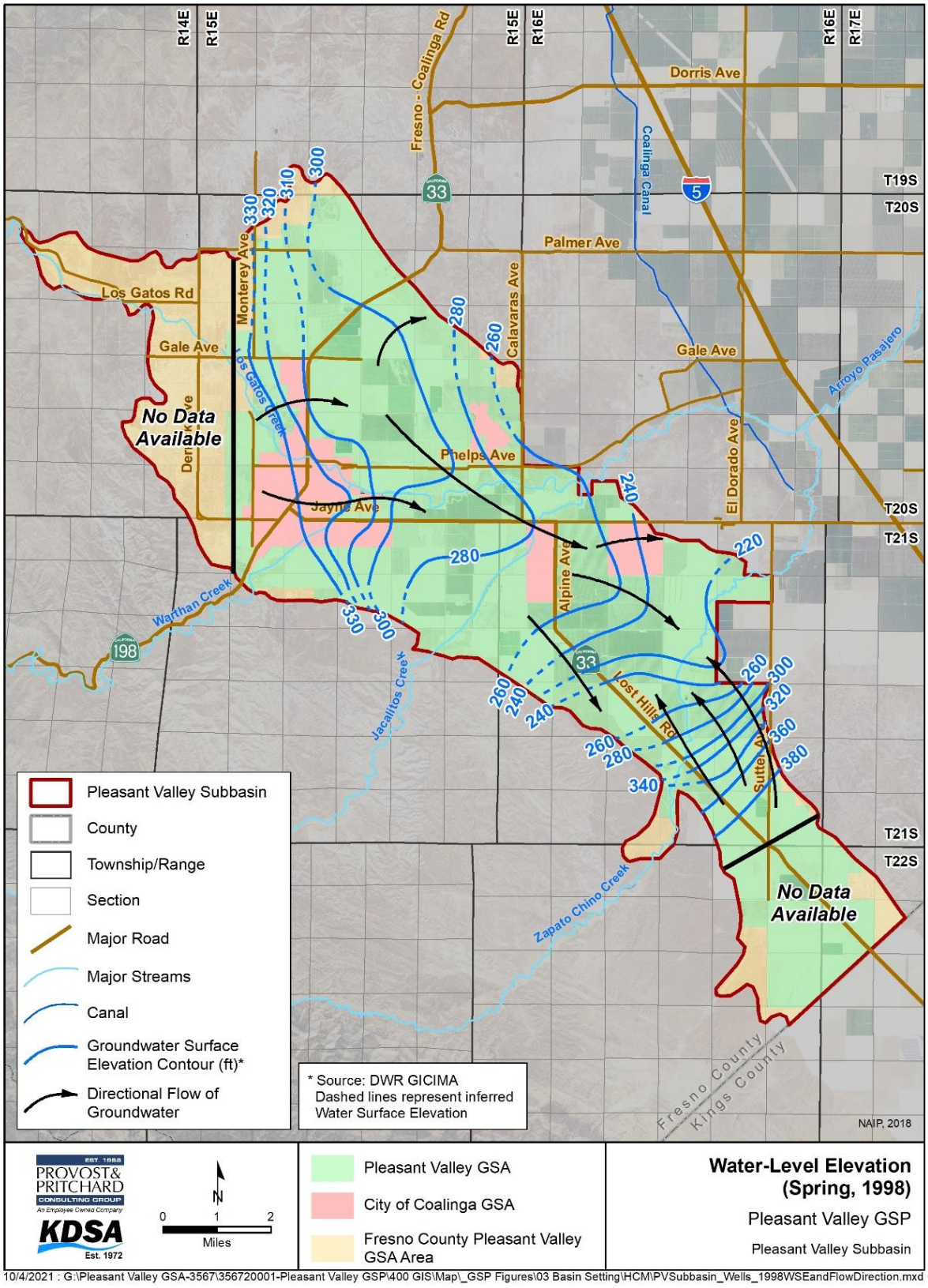


Figure 3-20 Water-Level Elevations and Direction of Groundwater Flow (Spring 1998)

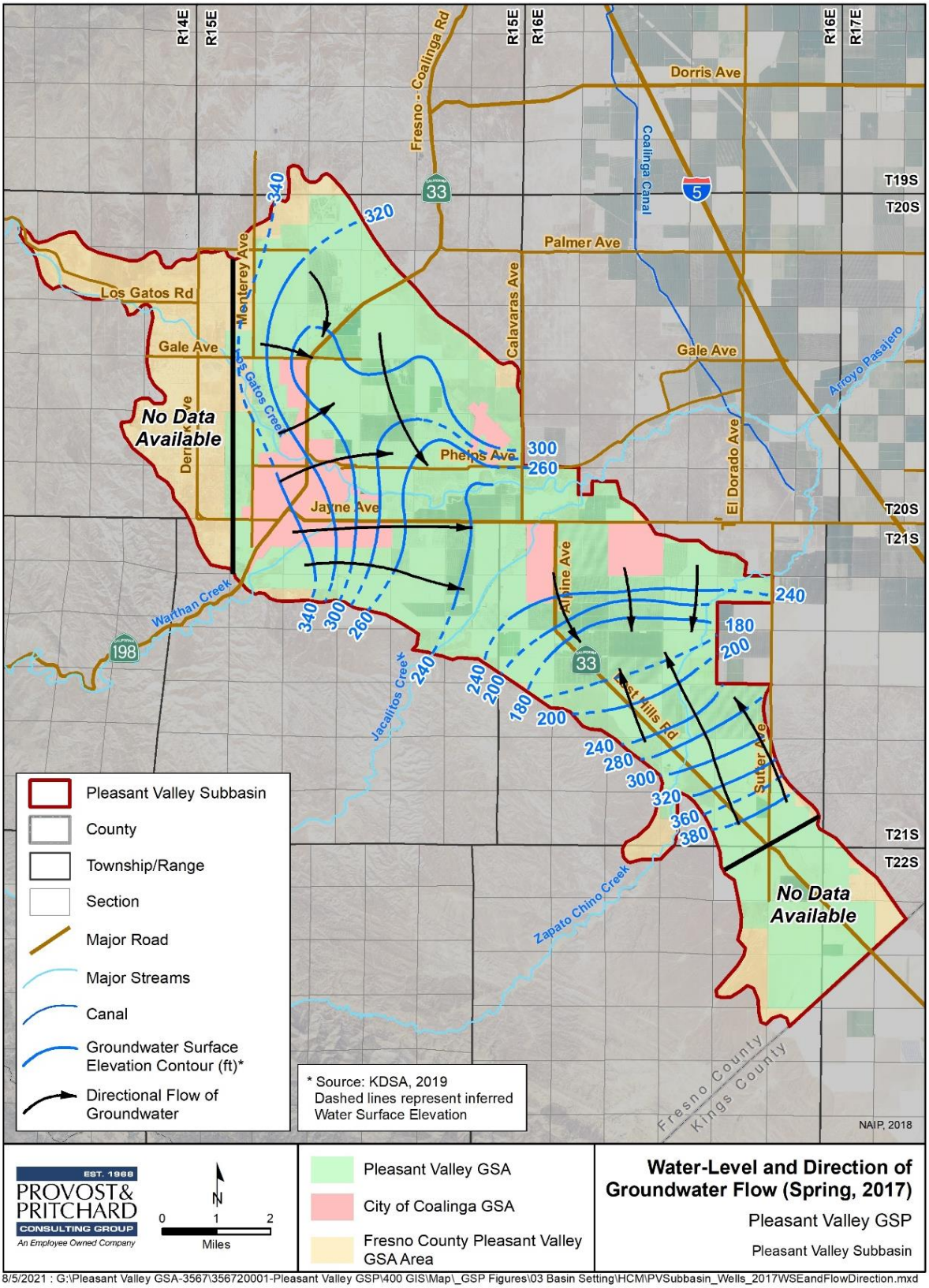


Figure 3-21 Water-Level Elevations and Direction of Groundwater Flow (Spring 2017)

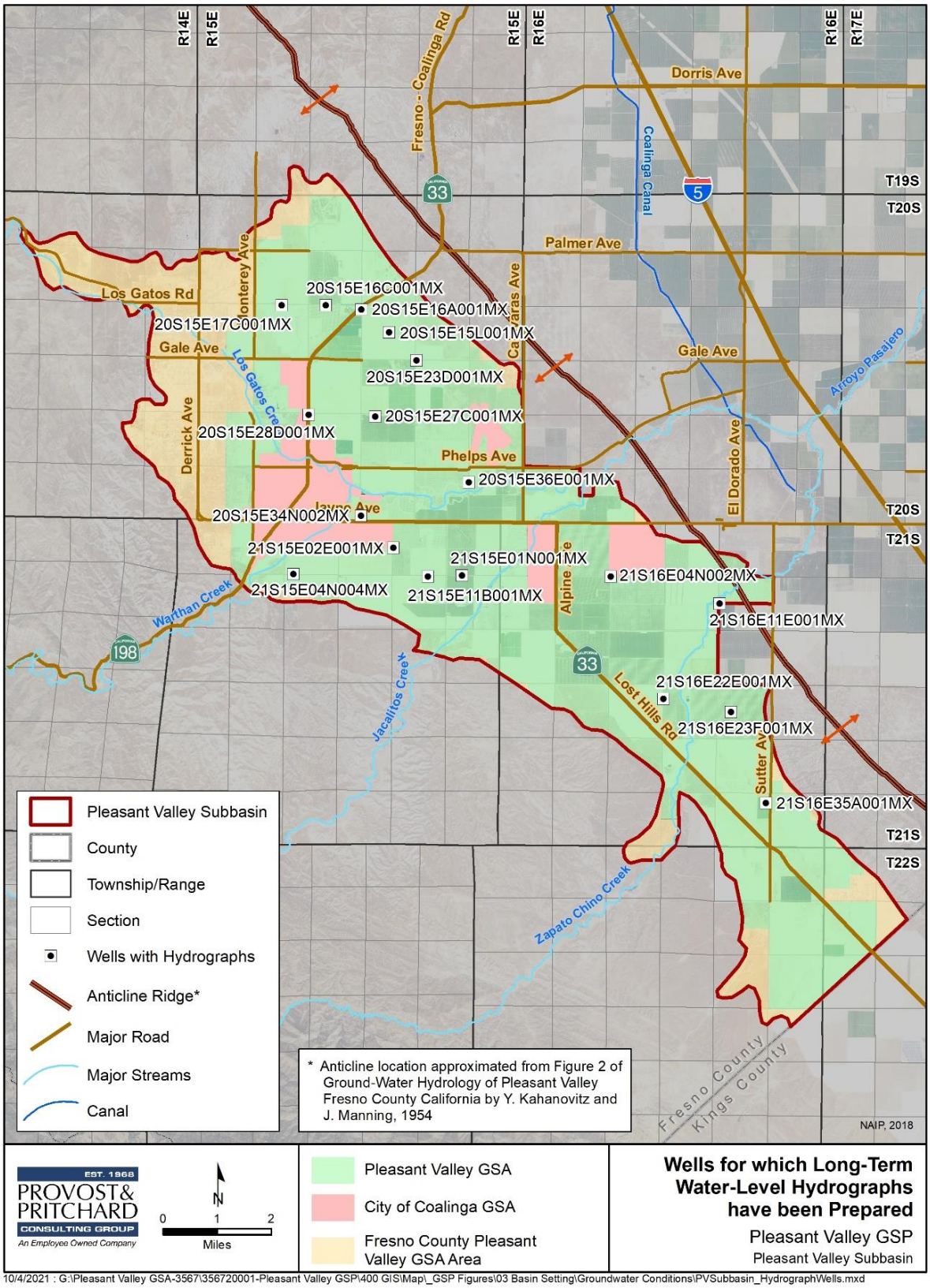


Figure 3-22 Wells for which Long-Term Water-Level Hydrographs have been Prepared

3.2.2 Groundwater Movement

The main source of groundwater recharge into the Subbasin is from streamflow seepage (Kahanovitz & Manning, 1954). The main streams are Los Gatos, Warthan, Jacalitos, and Zapato Chino Creeks originating west of the Subbasin in the foothills and flowing east.

Figure 3-21 shows the Spring 2017 groundwater surface elevation contours and general direction of groundwater flow within the Subbasin. As a result of pumping, the current groundwater flow in the Subbasin is from the north and south towards the pumping depression near the confluence of Jacalitos Creek and Los Gatos Creek in the central eastern portion of the Subbasin south of Pleasant Valley State Prison. South of the depression groundwater flows in a northerly direction.

The southern end of the Subbasin includes an approximately three-mile border with the Kettleman Plains Groundwater Subbasin. This is also the Fresno County/Kings County line or border. No recent groundwater level data are available within several miles of the border in either subbasin. Hence, no groundwater contours can be developed in the area for estimating groundwater flows or storage change. Lacking specific data, flow across the boundary is assumed to be negligible for the following reasons:

- As part of the basin boundary modification discussed in **Section 3.2.1**, Kenneth D. Schmidt Associates (KDSA, Technical Report on Hydrogeologic Conditions in Pleasant Valley Subbasin, 2016) suggested that groundwater flows at the boundary flow north into Pleasant Valley and south into Kettleman Plains, which would result in essentially no flow across the boundary. In other words, there is believed to be a groundwater divide near the County Line.

- The southern boundary of Subbasin generally lines up with the southern end of the Zapato Chino Creek watershed and the northern end of the Arroyo Ramoso/El Rincon watershed. The topographic divide splits runoff in this area. Hydrogeologic boundaries are not necessarily the same as surface watershed divides; however, there are no significant geologic barriers known that would affect groundwater flow patterns, so the surface watershed divide may also represent a hydrogeologic divide.

- Crop maps developed with 2017 USDA Cropscape as well as DWR mapping data show that many areas within a few miles of the boundary are fallow or are winter wheat. In addition, the City of Avenal in Kettleman Plains Groundwater Subbasin uses surface water. These factors indicate that groundwater pumping in the area is minimal, and hence there is minimal pumping to induce groundwater flows in the area.

Water-Level Hydrographs

Two types of water-level hydrographs have been prepared for wells in the PVWD. The first type shows long-term water-level trends, generally extending from about 1960 to 2021. These are generally based on semi-annual (spring and fall) water-level measurements that were acquired from a DWR website (see **Figure 3-22**). These semi-annual measurements were more useful when field crops were grown in the valley. At that time, pumpage usually stopped in about late August and was minimal during the winter. The fall measurements weren't intended to represent the lowest seasonal levels, but rather the measurements were usually not done until most pumping had stopped for the season. This was necessary to obtain representation of static water-level measurements. The spring measurements can be used to determine changes in water levels and changes in groundwater storage for specific periods. Long-term hydrographs are not available for the deeper wells that have been drilled beyond a depth of about 1,200 feet in recent years. The second type of hydrographs are based on continuous measurements made with pressure transducers installed in the wells. Both static and pumping levels are shown. This type of hydrograph is generally only available in the valley for the past two or three years. A number of these are available for

the newer deeper wells. This type of hydrograph is especially valuable for several reasons. First, the annual shallowest and deepest water levels can readily be determined. These levels (particularly the deepest) aren't necessarily shown by the semi-annual measurements. With the development of orchards, significant pumping is often still occurring in the fall. In addition, drawdowns due to well pumping can readily be determined by comparing static water levels with pumping levels on the hydrographs. Third, at a number of sites, pumping rates are measuredwith totalizing flowmeters. Pumping rates can be shown on the hydrographs along with the pumping levels for when the well is pumping. This allows specific capacities (pumping rate divided by drawdown) to be frequently determined. Reductions in specific capacities can provide indications of well plugging, due to encrustation or other factors.

Long Term Hydrographs

Appendix F contains long-term water-level hydrographs for 48 wells in the PVWD. A review of hydrographs for most of these wells indicates either three or four major trends (See **Figure 3-24 for a summary of the water level hydrographs' spring readings.**).

The first trend is from about 1960 to the mid- or late-1980s. The maximum historical irrigated crop acreage during that period was indicated to be about 29,000 acres. Field crops such as cotton were grown during this period. Water-level declines during this period averaged about 5.8 feet per year in the area north of Jayne Avenue and about 6.7 feet per year in the area south of Jayne Avenue.

A second trend occurred from about the early-1990s through the mid-2000s, when crop acreages and pumping were reduced significantly. Water levels in some wells rose and were relatively stable in many wells.

As more orchards were developed in the valley in the mid to late 2000s, water-level declines ensued. Water-level declines between about 2007-09 through about 2016 ranged from 3.8 to 6.8 feet per year and averaged 5.1 feet per year in the area north of Jayne Avenue. Water-level declines between about 2007-09 through about 2017 ranged from 4.0 to 8.8 feet per year and averaged 5.6 feet per year in the area south of Jayne Avenue (extending four miles to the south). These declines were slightly less than those that occurred between about 1960 and the mid- to late-1980s.

After about 2017, rates of water-level declines increased again, as the pumping for orchards increased. The irrigated crop acreage in the valley as of 2020 was estimated to have been about 18,000 acres. The most recent water-level trends (2017-21) are discussed for four geographic areas. The northern area is generally north of Phelps Avenue, and the average water-level decline in this area for 2017-21 is 7.6 feet per year. The second area is between Los Gatos Creek and Jayne Avenue and the average tracking water-level decline is 11.0 feet per year during this period. The greatest water-level declines are in the area south of Jayne Avenue, extending to the south for about four miles. The average water-level decline in this area is about 17 feet per year during 2017-21. The fourth area is for the southern two rows of sections in T21S, where the average water-level decline was about 5.4 feet per year during 2017-21. There are fewer wells in this area than in the other three areas.

Relation of Long-Term Water-Level Changes and Pumpage

Provost & Pritchard have estimated the crop consumptive use for the Pleasant Valley WD for a number of years between 1975 and 2019, using average ET values, but are now using actual flowmeter readings to calculate overdraft. The consumptive use (rounded) was 45,000 acre-feet in 1975 and 49,000 acre-feet in 1982. Consumptive use decreased to about 26,000 to 28,000 acre-feet per year during 1995-98. The consumptive use decreased to about 21,000 acre-feet in 1999 and about 18,000 acre-feet in 2000. The lowest consumptive use for an estimated year was about 9,300 acre-feet in 2002. By 2007, following development of a number of orchards, the consumptive use increased to 18,000 acre-feet per year, and by

2014 had increased to about 32,500 acre-feet per year. During 2016-18, the consumptive use averaged about 41,000 acre-feet per year. In 2019, the consumptive use was about 46,000 acre-feet, close to the values in 1975 and 1983.

Table3-1 Estimated Crop Consumptive Use Over Time

Year	Consumptive Use (AF)
1975	45,000
1982	49,000
1996	27,000
1999	21,000
2000	18,000
2002	9,300
2007	18,000
2014	32,500
2017	41,000
2019	46,000

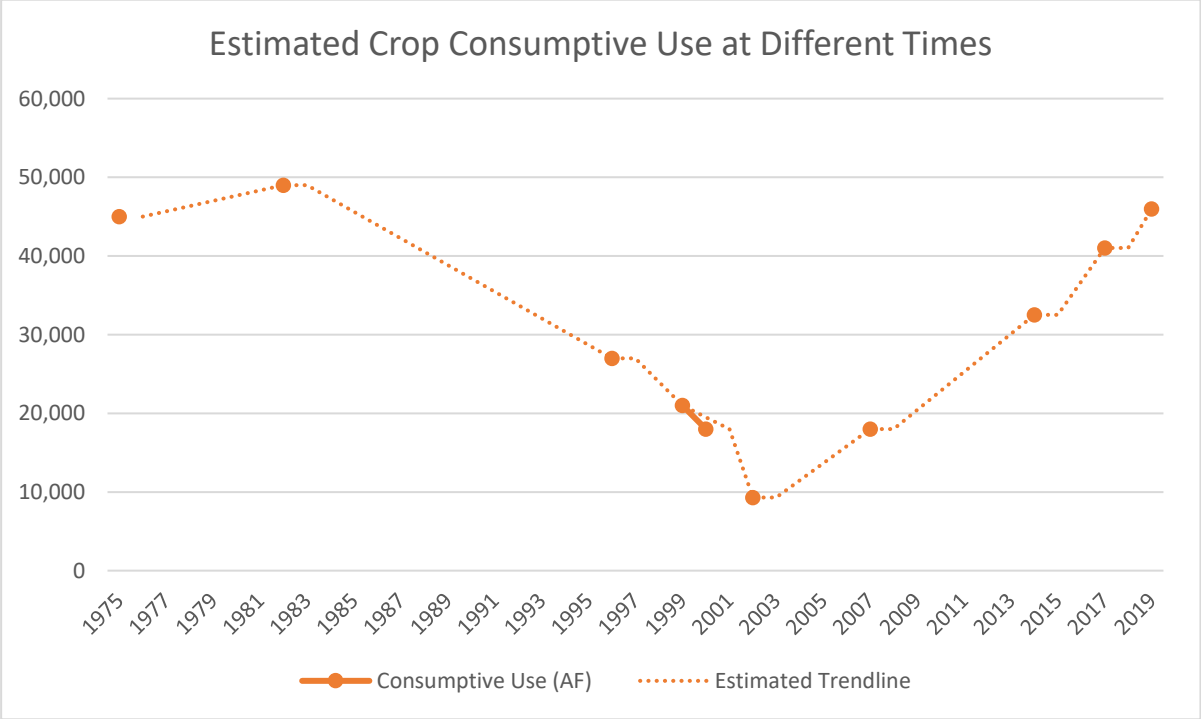


Figure 3-23 Estimated Crop Consumptive Use Over Time

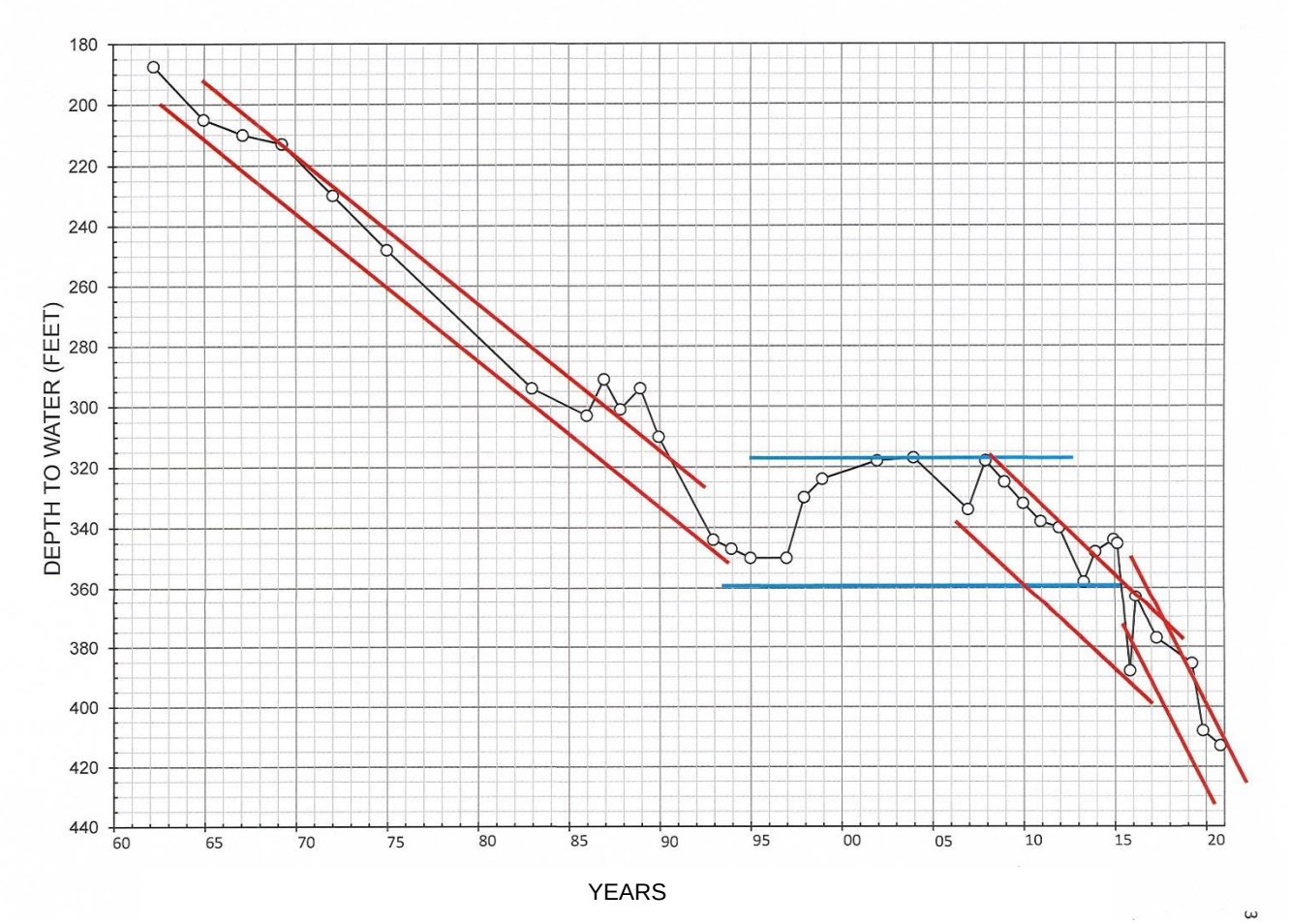


Figure 3-24 Representative and Time Trends Water-Level Hydrograph

Pumpage can be estimated by dividing the consumptive use of applied water by the irrigation efficiency. For the period prior to 2000, when field crops were predominant, sprinkler irrigation was widely used and the average irrigation efficiency was about 67 percent. This means that the estimated pumpage was about 67,000 acre-feet per year in 1975 and about 73,000 acre- feet in 1987. During 1995-98, the pumpage averaged about 40,000 acre-feet per year. In 2002, the pumpage was about only 14,000 acre-feet. By 2014, orchards were predominant. For drip irrigation, the average irrigation efficiency is about 85 percent. This means that the estimated pumpage was about 39,000 acre-feet per year in 2014, about 49,000 acre-feet per year in 2016, and about 54,000 acre-feet per year in 2019. Most recent pumpage based on flowmeter records indicated an average of about 36,000 acre-feet per year.

Losses of Well Production, Air Production, and Well Plugging

There have been reports of significant decreases in pumping rates with the falling water levels in Pleasant Valley. These decreases can be caused by several factors. One is a decreased pump capacity with increased pumping levels. The flatter the pump curve is, the less water the pump can produce with a greater pumping level. If pump curves and perforated intervals are available for specific wells, one can determine whether or not the pump is the problem for the decreased pumping rate.

Another factor is increased air production with declining pumping levels. In general, the deeper the pumping level is below the top of the perforations, the more air that can be produced. Because there are clay layers at various depths, groundwater can be perched above these layers, and where perforations or other openings are present in the well casing, water can enter the casing and fall down the well. This water is termed falling water or cascading water, and air is commonly entrained in the water.

Recent Transducer Measurements

Appendix G contains hydrographs based on transducer measurements for 20 wells in the PVWD. Many of these wells with transducer hydrographs are deep wells (more than about 1,200 feet deep). In contrast to the long-term hydrographs, which are based only on static water levels, the transducer hydrographs show both static and pumping levels. The drawdowns during pumping can be readily determined by subtracting the shallowest levels from the deeper levels. **Figure 3-25** is a transducer hydrograph for Well T20S/R15E-16HI. Static levels are the shallowest levels and in this well, the level ranged from about 485 to 500 feet deep during July 2019 to April 2021. The pumping levels ranged from about 580 to 660 feet during this period. Drawdowns during pumping ranged from about 100 to 150 feet. The drawdowns can be variable for wells equipped with variable speed pumps, that may not have constant pumping rates. Of particular interest are the shallowest static water levels each year. For Well 16Hl, the shallowest static level was about 481.8 feet on December 31, 2019, and 490.9 feet on November 30, 2020. This indicates a 9.1-foot water level decline in one year. Water levels shown in **Figure 3-25** are well above the perforated interval of the well. Thus, there would have been no reduction in the saturated thickness of the deposits tapped by the well. In this case, the only reason for a decrease in specific capacity would be well plugging.

Flowmeters have been installed at a number of wells with transducers, and pumping rates can be readily determined and plotted on the hydrographs. This allows one to determine the specific capacity (pumping rate divided by drawdown). Reductions in specific capacities are an indication of well plugging, in cases where the water level is under pressure.

Figure 3-26 is a water-level hydrograph for another well (T20S/R15E-26Ql), that has pumping levels well below the top of the perforations. In such cases, specific capacities could decrease over the long term due to water-level declines and a decreasing saturated thickness of the aquifer. For Well T20S/R15E-26Ql,

the pumping levels have been about 800 feet deep, which is almost 400 feet below the top of the perforations. This is a very conducive situation for having an air problem. The drawdowns in this well have approached 400 feet, which are considered very large. Plugging, commonly due to calcium carbonate encrustation or biological plugging, can exacerbate air production problems by increasing the drawdowns in wells.

Drawdowns in the wells equipped with transducers have been as small as 15 to 25 feet (indicative of either unconfined conditions or very low pumping rates) to as high as 400 feet (indicative of a confined aquifer). Drawdowns in many of the wells with transducers ranged from about 100 to 200 feet.

A comparison of the shallowest levels each year indicated annual water-level declines averaging about seven feet per year (within the past two or three years) in the mid area of the subbasin and two feet per year on the outer southern and northern ends.

Hydrographs depicting long-term groundwater elevations in the Subbasin are presented in **Appendix F**.

Well Plugging

Well plugging due to encrustation is common, particularly for wells that are idle for long periods. Drawdowns in wells are due to 1) formation losses (occurring outside of the well casing and gravel pack), and 2) plugging of the perforations. The drawdowns due to formation losses are directly related to the pumping rate. That is, if the pumping rate is doubled, the drawdown is doubled. In contrast to this, the drawdowns due to well losses are directly related to the square of the pumping rate. Well losses can be considered as friction losses and turbulent flow, which is enhanced by well plugging. Well efficiency is often used to show the extent of well plugging. A 100 percent efficient well would have no well losses. Well efficiencies were determined for hundreds of wells in the west part of the San Joaquin Valley in the 1990s as part of a PG&E energy rebate program. Conventionally constructed wells had average efficiencies of about 50 percent. These wells generally had inferior well gravel and were constructed with inferior well development techniques. In contrast, wells constructed with better gravel and better drilling and development techniques had well efficiencies averaging about 90 percent.

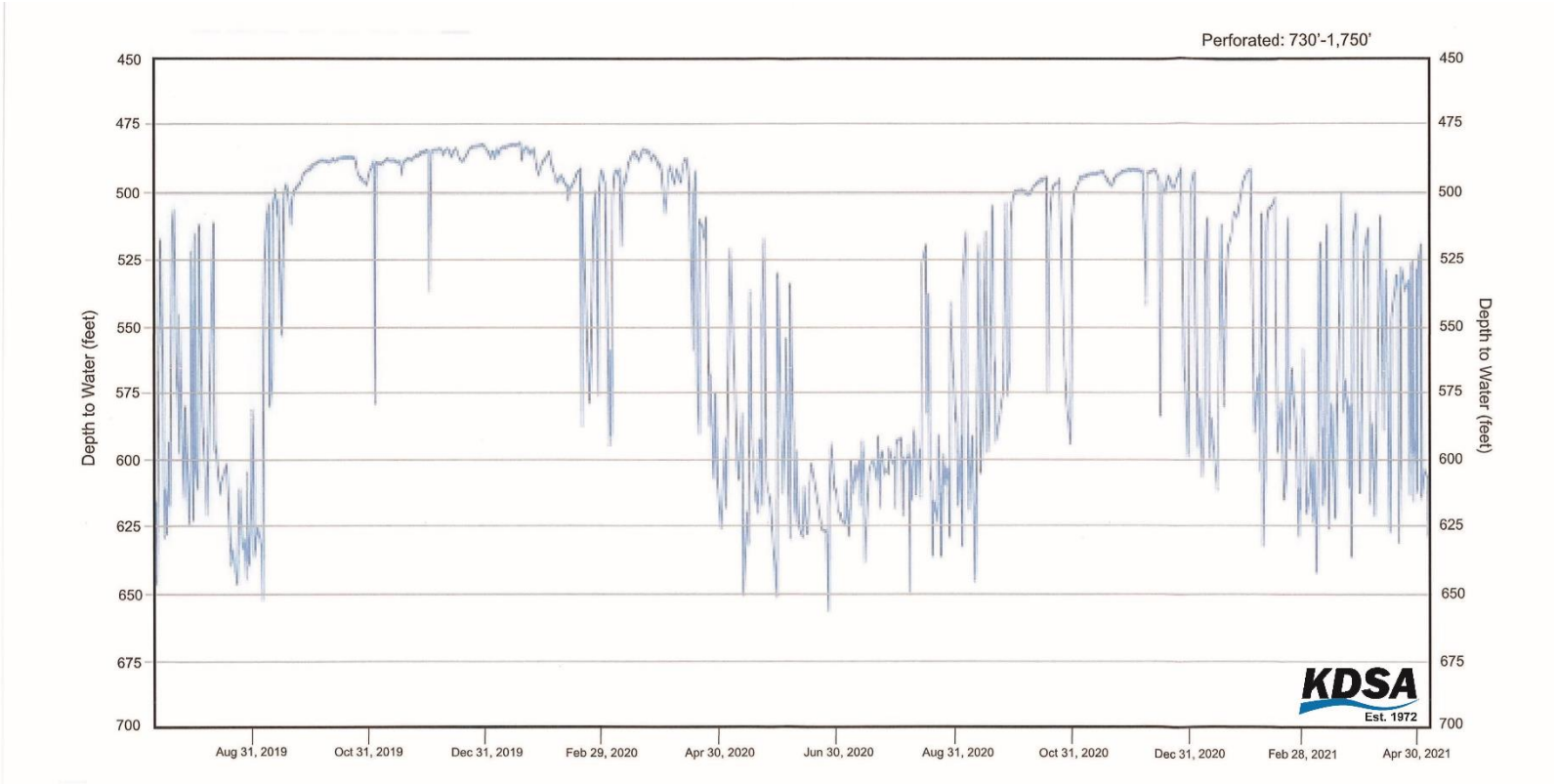


Figure 3-25 Transducer Water-Level Hydrograph for Well T20S/R15E-16H1

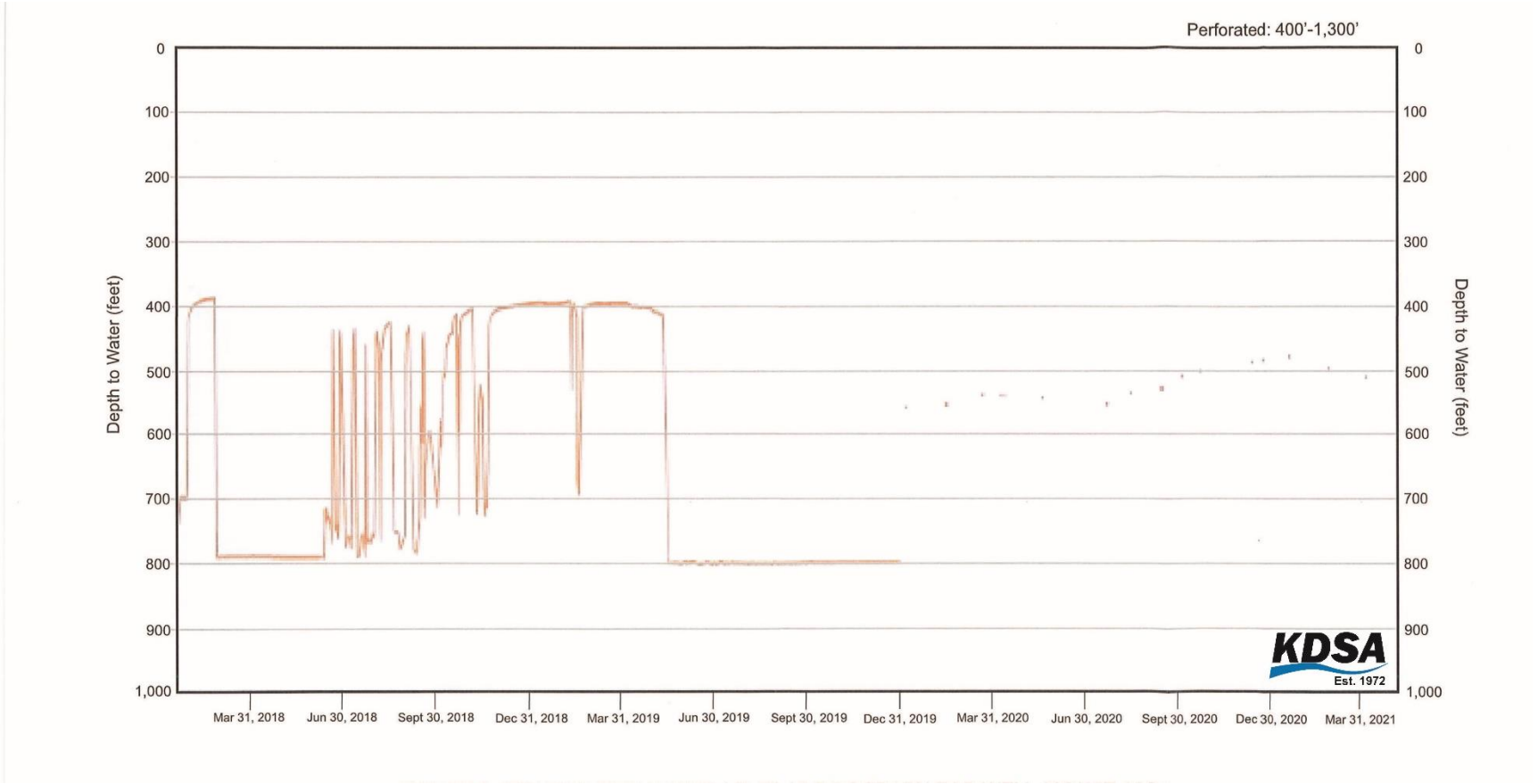


Figure 3-26 Transducer Water-Level Hydrograph for Well T20S/15E-26Q1

Well Efficiencies

Well efficiencies can be determined from step drawdown tests.Thus an evaluation was done of step tests that are available for wells in the valley. Step drawdown tests from which well efficiency can be determined were available for 14 wells that were constructed since 2000. Well efficiencies are the percentage of the drawdown due to formation losses, as opposed to well losses. The equation used is:

$$s = AQ + BQ^2 ,$$

where s= drawdown in feet
Q = pumping rate in cfs

The formation loss part of the drawdown (A) is directly related to the pumping rate, while the well loss part of the drawdown (B) is directly related to the square of the pumping rate. Most of the step tests in Pleasant Valley were done during or after 2011. **Table 3-2** summarizes the results of the evaluation. The range in well efficiencies (45 to 87 percent) is considered typical for wells tapping alluvial deposits in the San Joaquin Valley. Relatively high well efficiencies (75 to 87 percent) were indicated for eight wells. Five of these are considered higher technology wells, where special drilling fluid handling, gravel gradation, and well development techniques were used, whereas the other three of these are considered conventional wells.

In contrast, four wells had well efficiencies ranging from 45 to 54 percent, which are considered relatively low. Of these four wells, two were higher technology wells and the other two were conventional wells. Two other wells had well efficiencies ranging from 63 to 70 percent, which are considered moderate. The average well efficiency in Pleasant Valley when the wells were new was 70 percent.

Efficiencies of wells that are not new could be considerably less than the values discussed for new wells. This means that more than half of the drawdowns for wells could be due to well losses, which can be minimized by good management. Determination of specific capacities from transducer measurements can provide a periodic review of possible well losses.

Table3-2 Well Efficiencies in Pleasant Valley

State Well Location	Local No.	Perforated Interval (ft)	Date of Test	Pumping Rate (gpm)	Well Efficiency (%)
T20S/R15E-16C	Dust Bowl No. 2	740-1,760	Dec 2011	2,500-3,500	54
T20S/R15E-22E	HTW Farms	686-2,070	Oct 2016	1,500-3,000	83
T20S/Rl5E-26P	Valley Nut Growers No. 3	660-800 & 845-1,625	Mar 2011	1,000-1,400	63
T20S/R15E-32C	City of Coalinga No. 3	400-1,115	Aug 2012	585-945	75
T20S/R15E-35J	PV Pistachios No.1	360-972	Feb 2011	1,500-3,000	77
T20S/R16E-21R	Turk SP Well No. 5	675-1,300	Oct 2018	700-1,500	70
T20S/R16E-30Q	Turk SP Well No. 3	470-710	May 2011	600-1,000	45
T21S/R15E-2B	Valley Nut Growers No. 1	460-780	Oct 2011	1,006-2,000	87
T21S/R15E-12C	Jacalitos Ck Pist	557-1,200	Jun 2019	1,000-1,500	87
T21S/Rl5E-12L	Jacalitos Ck Pist 3	435-952	Dec 2015	1,400-2,200	75
T21S/R16E-8H	Devine Farms AS&R	500-1,000	Nov 2000	2,000-3,000	82
T21S/R16E-10L	Double D Farms	570-1,730	Oct 2013	1,200-1,800	85
T21S/R16E-16J	Kreyenhagen Farm No. 1	600-1,960	Dec 2014	1,245-2,730	47
T21S/R16E-16J	RTS C-16	460-750 & 810-1,130	Dec 2008	900-1,500	52

Vertical Gradients

Vertical (downward) head gradients are downward in most of the San Joaquin Valley. In some areas of the San Joaquin Valley, vertical gradients vary considerably, and it has been shown that they vary through time with lesser vertical gradients generally in the winter and early spring and increased gradients during summer months with increased pumping.

At this time, the existence and magnitude of vertical gradients within Subbasin are a data gap and will be assessed in the future as data become available.

3.2.3 Estimate of Groundwater Storage Change

Regulation Requirements:
§354.16(b) A graph depicting estimates of the change in groundwater in storage, based on data, demonstrating the annual and cumulative change in the volume of groundwater in storage between seasonal high groundwater conditions, including the annual groundwater use and water year type.

Because the water levels in most of the supply wells are indicated to be pressure levels, they cannot be used to estimate groundwater storage changes. Rather, the water budget approach is used. The lowest overdraft has been for years when streamflow recharge was larger in high precipitation years. The highest overdraft has been when streamflow recharge has been zero, in below normal precipitation years. A map of the estimated specific yield values based on Williamson and other (1989) estimates for the Subbasin was prepared as part of the HMC **Section 3.1** For the entire basin a specific yield value of 0.12 was calculated based on a weighted average of the specific yield values in **Figure 3-14.** This number falls within the ranges estimated by several others as discussed in **Section 3.3**

Historical Estimates

Historic estimated overdraft has ranged from 0 to 29,000 acre-feet per year (AF/yr). As was discussed in **Section 3.2.1** and shown on **Figure 3-24**, and as can be found later in **Table 3-3,** overdraft occurred during the periods from 1945 through 1951, from the 1960s through the 1980s and now more recently from 2006 to the present. There were periods when overdraft slowed and was essentially zero from 1937 through 1945 and then again from the 1980s through 2000.

The change in rates of decline in water levels, either flatter or steeper slopes of the line on the hydrographs, corresponds to changes in pumpage and recharge. At one time the area was heavily planted in cotton, and then there were more fallow areas. Then, many fallow or less intensively farmed areas were followed recently by large areas of pistachios, which take years to mature and reach full water demand. Recent data indicates the average overdraft has been about 20,000 acre-feet per year.

Simplified Method by Change in Level in Wells

Groundwater storage change was estimated for the period of 2017 to 2021, which was selected to be the most recent period for determining overdraft (see **Section 3.3**). The average difference between groundwater levels between 2017 and 2021 was calculated at approximately 40 feet for the area identified by the maps in the Subbasin. The area covers approximately 27,000 acres of the basin. The difference was calculated for each well and then an average taken of the wells with data. Since this number can only be calculated where groundwater information for both years is available, the portions of the Subbasin where water level measurements were lacking (i.e., northwest and southern portions of the Subbasin) are not included in the average depth difference.

Using the method described above, the average depth to water difference, the total area of the Subbasin for which there is data is about 27,000 acres, with the specific yield value of 0.12. A storage change was estimated for the Subbasin to be approximately 130,000 acre-feet (AF) during the period from Spring 2017 to Spring 2021, or an average of about 30,000 AF/year. Because the levels in the wells are pressure levels, this approach is not as accurate as the water balance approach, but both methods will be used.

Change in Groundwater Elevation Surface
Estimates of year-to-year storage change (annual storage change) can be found in **Table 3-3**. Water Balance Method is to be used in the plan now that reliable stream flow and values for pumpage are accurate.

3.2.4 Seawater Intrusion

Regulation Requirements:
§354.16(c) Seawater intrusion conditions in the basin, including maps and cross-sections of the seawater intrusion front for each principal aquifer.

By definition, seawater intrusion occurs when saline water from the ocean infiltrates the groundwater system and begins to flow into areas of freshwater due to water level decline, in many cases caused by groundwater pumping. The Coastal Range lies between the Central Valley and the Pacific Ocean. The Subbasin is over 100 miles from the Sacramento-San Joaquin Delta, which would be the only means for seawater to enter the Central Valley. Due to the great distance and the current groundwater elevations, the Subbasin does not need to account for seawater intrusion.

3.2.5 Groundwater Quality Issues

Regulation Requirements:
§354.16(d) Groundwater quality issues that may affect the supply and beneficial uses of groundwater, including a description and map of the location of known groundwater contamination sites and plumes.

A substantial amount of groundwater quality data is available for Pleasant Valley Subbasin. Kahanovitz and Manning (1954) reported that the total dissolved solids (TDS) concentrations ranged from about 1,200 to 2,000 mg/1 and boron concentrations ranged from about 1.5 to 5.2 mg/1 in groundwater in Pleasant Valley as of the 1950s. The alluvium in Pleasant Valley contains significant amounts of gypsum, and much of the groundwater is of the calcium-sodium sulfate type. Hydro Development Inc. (1969) reported on the results of sampling water from a 3,000-feet deep test hole in Section 9, T21S/R15E. The results of this hole indicated that the chemical quality of groundwater below a depth of 1,500 feet and above a depth of 2,400 feet at this location was similar to that pumped from most wells in the valley, which were less than about 1,000 feet deep at that time. Water samples were collected from three depth intervals between 1,874 and 2,427 feet in depth. TDS concentrations ranged from 1,007 to 1,629 mg/1 and were lowest (less than 1,030 mg/1) in samples from above a depth of 2,150 feet. The waters were of the sodium sulfate type, and boron concentrations ranged from 0.6 to 0.8 mg/1.

As part of an AB3030 grant funded study, water samples were collected from 16 wells in the valley during 2004-5. Chemical analyses were available for an additional 53 wells. Electrical conductivities of well water were shown in **Figure 3-27** by Provost & Pritchard. Electrical conductivities ranged from about 1,600 to 3,560 micromhos/cm at 25°C. These are equivalent to TDS concentrations of about 1,070 to 2,370 mg/l. Moderate problems for micro-plugging of drip irrigation systems can occur when TDS concentrations exceed 500 mg/l, and severe problems can occur when TDS concentrations exceed 2,000 mg/l. The highest ECs were generally in water from wells within a few miles of Jayne Avenue, to

the north and south.

Figure 3-28 shows boron concentrations in well water. Boron concentrations ranged from about 0.4 to 3.2 mg/1. The desirable boron concentration for boron sensitive crops is less than 0.5 mg/1. The lowest boron concentrations (0.4 to 0.8 mg/1) were found in water from wells near Zapato Chino Creek. As for TDS, the highest concentrations in water were from wells within about two miles of Jayne Avenue.

Figure 3-29 shows chloride concentrations in well water. Chloride concentrations ranged from 26 to 301 mg/1. The lowest concentrations (26 to 106 mg/1) were found near Zapato Chino Creek. The highest chloride concentrations were in wells within about two miles of Jayne Avenue. The desirable chloride concentration for irrigation for some crops is less than 106 mg/1. The recommended MCL for public water supplies is 500 mg/L. Sulfate concentrations in well water ranged from 251 to 1,910 mg/1 (**Figure 3-30**). The lowest sulfate concentrations (251 to 500 mg/1) were found in water from wells near Zapato Chino Creek.. Sulfate is generally not a concern for irrigation.

Problems can occur with plugging of drip systems for bicarbonate concentrations exceeding about 120 mg/1. Severe problems can occur when bicarbonate concentrations exceed about 245 mg/1. Of the wells sampled in 2004-05, almost all had bicarbonate concentrations exceeding 120 mg/1. Two of these wells had bicarbonate concentrations exceeding 245 mg/1.

In summary, the inorganic chemical quality of groundwater in Pleasant Valley is unsuitable for public supply and marginal for irrigation of some crops. The groundwater quality is generally suitable for irrigation of pistachios, except for the micro irrigation system plugging hazard. Moderate plugging problems are indicated when TDS concentrations exceed 500 mg/1 and bicarbonate concentrations exceed about 120 mg/1. Severe problems are indicated when TDS concentrations exceed 2,000 mg/1 and bicarbonate concentrations exceed about 245 mg/1.

3.2.5.1 Groundwater Quality - Historical Aspects

Provost & Pritchard (2005) provided a fairly comprehensive review of the available information on groundwater quality in Pleasant Valley Water District through 2005. Additional data covering other areas of the basin and data collected since 2005, were gathered as part of this GSP.

Before the arrival of the Central Valley Project (CVP) water in the 1970s, the local groundwater was generally the only source of supply for agriculture, municipal, and industrial uses. It should be recognized that because of groundwater quality issues, drinking water has always been a problem in Pleasant Valley, and as a result Coalinga's drinking water has almost always been imported. Until 1972, every Coalinga residence had three water faucets in the kitchen; hot water, cold water, and drinking water. Until 1960 the major source of drinking water was water wells in Armona. This water was shipped to Coalinga in rail tank cars by Southern Pacific for distribution. In 1960, Coalinga was a site selected for experimental systems to desalt groundwater to a point where it was palatable for human consumption. The first of these was an ionic system that was later replaced by the reverse osmosis method that was eventually to be commonly used throughout the world to convert even sea water to a drinkable state. A separate irrigation system was also plumbed to the residences within the city to allow for untreated groundwater to be used for irrigation. This separate system was used until 1972 when Coalinga received its first delivery of Central Valley Project surface water.
With recent data being compared to historic data, one can deduce that the water quality does not degrade due to lowering of the GW within PV Subbasin. The following table shows the period of data versus quality.

Measurement	2/25/14	7/24/19	11/7/19	5/29/20	7/8/20	8/12/20	5/14/21	5/5/22	8/17/22	9/1/23	4/5/24
(pH)	7.8	7.9	7.7	7.3	7.4	7.6	7.7	7.5	7.4	7.6	7.8
(EC)	2.8	2.5	2.9	3.0	2.9	2.8	2.8	2.7	2.8	2.9	2.7
(B)	2.1	1.7	2.4	2.5	2.4	2.1	2.3	2.0	2.2	2.3	2.2
(Ca)	403.0	236.0	382.0	406.0	370.0	401.0	400.0	384.0	397.0	404.0	379.0
(Mg)	261.0	224.0	251.0	278.0	257.0	278.0	277.0	231.0	262.0	286.0	268.0
(Na)	908.0	832.0	902.0	922.0	898.0	937.0	944.0	826.0	888.0	981.0	770.0
(K)	18.3	13.6	14.1	16.4	16.1	14.9	13.5	14.4	16.2	17.1	22.2
(HCO_3)	557.0	452.0	359.0	518.0	504.0	338.0	557.0	473.0	479.0	418.0	445.0
(Cl)	601.0	508.0	469.0	472.0	471.0	458.0	485.0	467.0	472.0	472.0	488.0
(NO_3-N)	11.7	4.9	18.0	15.6	16.1	14.6	14.5	13.9	15.4	13.0	14.3
(SO_4-S)	1,431.0	1,423.0	1,837.0	1,952.0	1,806.0	1,941.0	1,870.0	1,690.0	1,850.0	2,120.0	1,700.0
(TDS)	1,933.0	1,737.0	1,970.0	2,043.0	2,011.0	1,949.0	1,910.0	1,840.0	1,910.0	1,970.0	1,820.0
(SAR)	5.2	5.6	5.3	5.2	5.3	5.3	5.4	5.0	5.2	5.5	4.5
(SEC)	1.9	2.2	1.9	1.8	1.8	1.9	1.9	1.9	1.9	1.9	1.7
(pHc)	7.0	7.3	7.3	7.1	7.2	7.2	7.0	7.2	7.2	7.1	7.2

The City of Coalinga's 2015 Draft Urban Water Management Plan (City of Coalinga, 2015) indicated:

- *Due to the poor groundwater quality in the area, all potable water utilized by the City of Coalinga is imported through the federal Central Valley Project (CVP) – U.S. Bureau of Reclamation (Reclamation).*
- *The City of Coalinga does not currently use groundwater as part of its potable water supply as groundwater in the area is unsuitable for drinking without treatment or blending. Due to poor groundwater quality, potable water utilized by the City consists of surface water from the California Aqueduct that is treated at the City's surface water treatment plant.*
- *The City's groundwater is of poor quality due to the high concentrations of sodium, sulfates and total dissolved solids (TDS). This condition occurs at depths between 500 and 1,500 feet; therefore, groundwater is not considered a viable source of potable water within the Coalinga planning area.*
- *Due to the poor groundwater quality in the area, the City of Coalinga intends to meet its projected water demands through the continued use of surface water alone.*

3.2.5.2 Groundwater Quality - Contemporary Aspects

While current day groundwater levels are lower than in the early-to-mid-1900s, groundwater quality in the Subbasin has apparently degraded only slightly.. The groundwater in much of the Subbasin is of moderate to high salinity and has high concentrations of sodium and sulfate. Furthermore, from the experience of the major agricultural operations in the valley, the total salt content and the potential for micro plugging of irrigation systems due to high bicarbonate and pH in the groundwater are the most limiting factor for irrigation use in the area.

Groundwater Quality in Zapato Chino Area

Based on the 2005 water quality study (P&P, 2005), EC and Sulfate were identified as the main conditions of concern with regards to drinking water standards. Boron and Chloride were identified as chemicals of concern with regards to USBR quality standards for acceptance into the Coalinga Canal;, which is principally an issue only if future management plans call for groundwater to be pumped from Pleasant Valley and transported via the canal, which at one time was being considered for a proposed water banking project along Zapato Chino Creek. This is now considered unlikely due to the area being planted in permanent crops and as surface water is being brought into Pleasant Valley via pipeline for recharge or direct irrigation of crops. At the time, the area along Zapato Chino Creek was a potentially favorable area for recharge as it appeared to be an area of better groundwater quality and was closer to the Coalinga Canal than other areas in Pleasant Valley. As described below, the 2005 water quality study generally indicates that groundwater quality in the area around Zapato Chino Creek is of higher quality than the other areas within the Subbasin.

Electrical Conductivity (EC)
California drinking water standards list an upper secondary MCL of 1,600 micromhos/cm for EC. An EC values map is presented as **Figure 3-27**. As shown on the map, EC values less than 1,600 micromhos/cm are generally found around Zapato Chino Creek. EC values in other areas of the Subbasin ranged between 1,601 to 3,560 micromhos/cm.

Bicarbonate
One of the most common problems with irrigation water is excess bicarbonates. Bicarbonates get into water when it passes through a calcium carbonate or magnesium carbonate (limestone or dolomite) rock formation. The stone dissolves into calcium and/or magnesium ions and bicarbonate ions.

Sodium Adsorption Ratio (SAR)
High sodium ions in water affects the permeability of soil and causes infiltration problems. This is because sodium when present in the soil in exchangeable form replaces calcium and magnesium adsorbed on the soil clays and causes dispersion of soil particles (i.e., if calcium and magnesium are the predominant cations adsorbed on the soil exchange complex, the soil tends to have a permeable and granular structure).

This dispersion results in the breakdown of soil aggregates. The soil becomes hard and compact when dry and reduces infiltration rates of water and air into the soil affecting its structure.

This problem is also related to salinity and type of soil. For example, sandy soils may not get damaged as easily as other heavier soils when it is irrigated with a high SAR water.

pH
Water quality is a key factor affecting pH and nutritional management in crops. Water pH is important for crop management. Water pH affects the solubility of fertilizers and the efficacy of insecticides and fungicides before they are applied to the crop. Generally, the higher the water pH is, then lower the solubility of these materials.

Boron
There are no California drinking water standards for Boron; however, concentrations above 0.5 mg/L have been recognized as detrimental to boron sensitive crops. The USBR Water Quality Standards for Acceptance of Water into the Coalinga Canal is 0.8 mg/L. As shown on **Figure 3-28**, boron concentrations of 0.4 to 0.8 are generally found around Zapato Chino Creek. Boron concentrations in other areas of the Subbasin ranged between 0.81 to 3.20 mg/L. These are acceptable for irrigation of pistachios.

Chloride
California drinking water standards list an upper secondary MCL for chloride of 500 mg/L. Concentrations above 105 mg/L have been recognized as detrimental to yield for certain crops such as almonds. The USBR Water Quality Standard for Acceptance of Water into the Coalinga Canal is 106 mg/L. As shown on **Figure 3-29**, chloride concentrations ranging from 26 to 106 mg/L have been found in groundwater in the general areas around Zapato Chino Creek. Chloride concentrations in other areas of the Subbasin have concentrations that ranged from 107 to 301 mg/L.

Sulfate
California drinking water standards list an upper secondary MCL for sulfate of 500 mg/L. The USBR Water Quality Standard for Acceptance of Water into the Coalinga Canal is 250 mg/L for sulfate. As shown on **Figure 3-30**, sulfate concentrations ranged from 251 mg/L to 500 mg/L have been

detected in groundwater in the general areas around Zapato Chino Creek. Sulfate concentrations in other areas of the Subbasin have concentrations that ranged from 601 to 1,910 mg/L.

16 wells were sampled for chemical analysis in 2004-2005 as part of the DWR funded program. Chemical analysis were also available for 53 other wells.

- The average EC was 2,300 micromhos/cm
- The average boron concentration was 1.1 mg/l
- The average sulfate concentration was 102 mg/l
- The average nitrate concentration was 12 mg/l

2023 Well Sampling

In August 2023, the District sampled water from 20 large capacity wells in the subbasin, as part of the GSP.

- The average EC was 2,430 micromhos/cm
- The average boron concentration was 1.3 mg/l
- The average sulfate concentration was 993 mg/l
- The average chloride concentration was 140 mg/l
- The average nitrate concentration was 11 mg/l

Comparing the earlier (2004-2005) and later results, one can see that the average nitrate concentrations were slightly less for the more recent samples. The average EC increased about 5 percent over the 19-year period. The average apparent boron concentration increased about 19% over this period. But is expected to remain within the MOs and MTs.

The average sulfate concentration increase was about 9% for the 19-year period. The average apparent chloride concentration increase was 38% for the 19-year period.

The increases of EC and sulfate concentration from 5% to 10% over a 19-year period are consistent with some deep percolation reaching the water level and influencing the chemical quality of well water. Nitrate concentrations haven't increased, likely due to improved nitrogen fertilizer management practices.

Pistachios are the predominant crop in the valley and they are salt tolerant. Well water with up to 3,410 micromhos/cm is suitable for irrigation of pistachios. TDS concentrations up to 2,550 mg/l are suitable for irrigation of pistachios. Chloride concentrations up to 224 mg/l are suitable for pistachios.

There could be several reasons for the increasing concentration. First, is the influence of deep percolation from irrigation. In general, it takes a number of decades for the deep percolation to reach the groundwater level. For the sampling in the 1950's, it is likely that the deep percolation from previous irrigation had not yet reached the water level. By 2005-2006, some of the evidence indicates that deep percolation had reached the water level. Figures 27, 28 and 29 indicate that the highest values for EC, chloride and sulfate in well water were in an area within several miles of Jayne Avenue, which coincides with the area of the earliest irrigation in the valley. Recent monitor well data (2024) indicates that some areas, deep percolation for irrigation hasn't reached the water table.

Another reason for constituent concentration increases could be related to the differences in well depths. As of 2005-2006 most irrigation wells in Pleasant Valley ranged from 700 to 900 feet deep. Due to declining water levels, as of 2023 irrigation wells were drilled from about 1,000 to 1,800 feet deep. However, an examination of the quality of water from deeper wells indicates an overall similarity in groundwater quality to that for shallower wells. Electric logs are available for many

dozens of deep wells that have been installed since 2005-2006. These generally indicate similar EC values for groundwater in deeper sands as for shallower sands.

Besides monitoring electrical conductivity annually and irrigation suitability parameters in well water every three years, the District is having three specifically designed monitor wells installed in early 2024. These will allow soil EC and nitrate values about the water table be determined. This will provide information on the influence of changes in irrigation efficiencies (as sprinkler irrigation was largely replaced with drip irrigation). Also, irrigation suitability parameters will be determined in the shallowest saturated zones at the three sites. The results will be compared to chemical analysis of water for nearby wells.

Groundwater Ambient Monitoring and Assessment Program

A review of the California Water Boards GAMA Groundwater Information System (https://gamagroundwater.waterboards.ca.gov/gama/gamamap/public/) indicates that pesticides 1,2-Dibromo-3-chloropropane (DBCP) and 1,2,3-Trichloropropane (1,2,3-TCP), or naturally occurring uranium, are not groundwater issues within the Pleasant Valley Subbasin, as they are within other parts of the San Joaquin Valley.

Lost Hills Community

Fresno County provided information from well permits and subsequently performed one-time sampling of six domestic wells in the rural residential "Lost Hills Community" (**Figure 3-27** through **Figure 3-30** show location of the Lost Hills Community) at the time of well construction for the years 1993 to 1999. The Lost Hills Community is located along State Route 33 (Lost Hills Road) and approximately 12 miles southeast of the City of Coalinga and approximately one-mile northwest of the Kings County line. The community includes 172 parcels totaling approximately 162 acres, though only a portion of the parcels are developed. Private wells provide water to the residents of the community and only one well drilling permit was approved (for a mobile home) from 2009 to 2019. Groundwater analytical results for the sampled domestic wells indicated that constituents of concern for groundwater in this area included:

- Nitrate as NO3, ranging from 9 mg/L to 64 mg/L (California Drinking Water Standard MCL of 45 mg/L), with one well out of the six sampled exceeding the MCL;
- Sulfate, ranging from 385 mg/L to 926 mg/L (California Drinking Water Standard Secondary MCL of 500 mg/L), with four wells out of the six sampled exceeding the MCL; and
- EC, ranging from 1050 micromhos/cm to 1850 micromhos/cm (California Drinking Water Standard Secondary MCL of 1600 micromhos/cm) with three wells out of the six sampled exceeding the MCL.

Summary

In summary, the groundwater in Pleasant Valley is generally of poor quality for drinking water. The area has been known to have poor quality water for many decades. These conditions are the result of natural processes, and groundwater treatment is not practical on a large scale.

However, with proper irrigation management, the Pleasant Valley groundwater is usable for irrigation of some crops. Landowners select crops that are somewhat tolerant to salinity. Crops like cotton, hay and pistachios have been planted in Pleasant Valley since they are more tolerant to salinity and boron. Pistachios also have the ability to tolerate much higher levels of boron than other crops.

3.2.5.3 Oil and Gas Fields

Oil fields in the Subbasin around the City of Coalinga have been in production since about 1909 with the first well drilled in the area in 1887. Large quantities of salt water are usually associated with the oil reservoir. Since

the water is typically under pressure, as oil is produced, the water follows the oil, causing this salt water or brine to also come to the surface with the oil. Prior to approximately the 1950s, brine that came up with the oil or gas was at times sprinkled on the ground in the hills in the oil fields or placed in unlined oilfield sumps. The oilfield sumps were open depressions used to separate the oil and water mixture. Depending on the configuration of these sumps, the brine sprinkled on the ground or placed in the sumps could over time have percolated to the groundwater. In 1964, there were approximately 17 sumps being used for water disposal with an average areal size of one acre each (McIntyre, Meffley, & Stetson, 1964). Ponds are apparently no longer used. Based on a review of aerial photographs, several ponds are observable today. A map of the oil field locations is presented in **Chapter 2** as **Figure** 2-10.

Today, steam injection wells may be used to assist in the production of oil and to dispose of the brine which may come to the surface. This water is supposed to be injected much deeper than the useable groundwater. The process is highly regulated, and a cement seal is placed outside the well casing from the surface to the base of the fresh water to prevent the brine from contaminating the useable groundwater. Of note, the California Division of Oil and Gas has maintained an office in Coalinga since 1918 for the supervision of the oil and gas industry. Current information on the oil field operations has been requested from the oil companies, but as of the date of the GSP, no additional information has been provided. This discussion is for general information only to provide some context on the historical development and history of the area. Produced water from oil operations is not regulated under SGMA and both the produced water and any water placed in ponds has been regulated by the State of California Division of Oil and Gas and any percolated water has been required to recharge lower geologic formations and not those geologic formations that contribute to water production from the Pleasant Valley Subbasin.

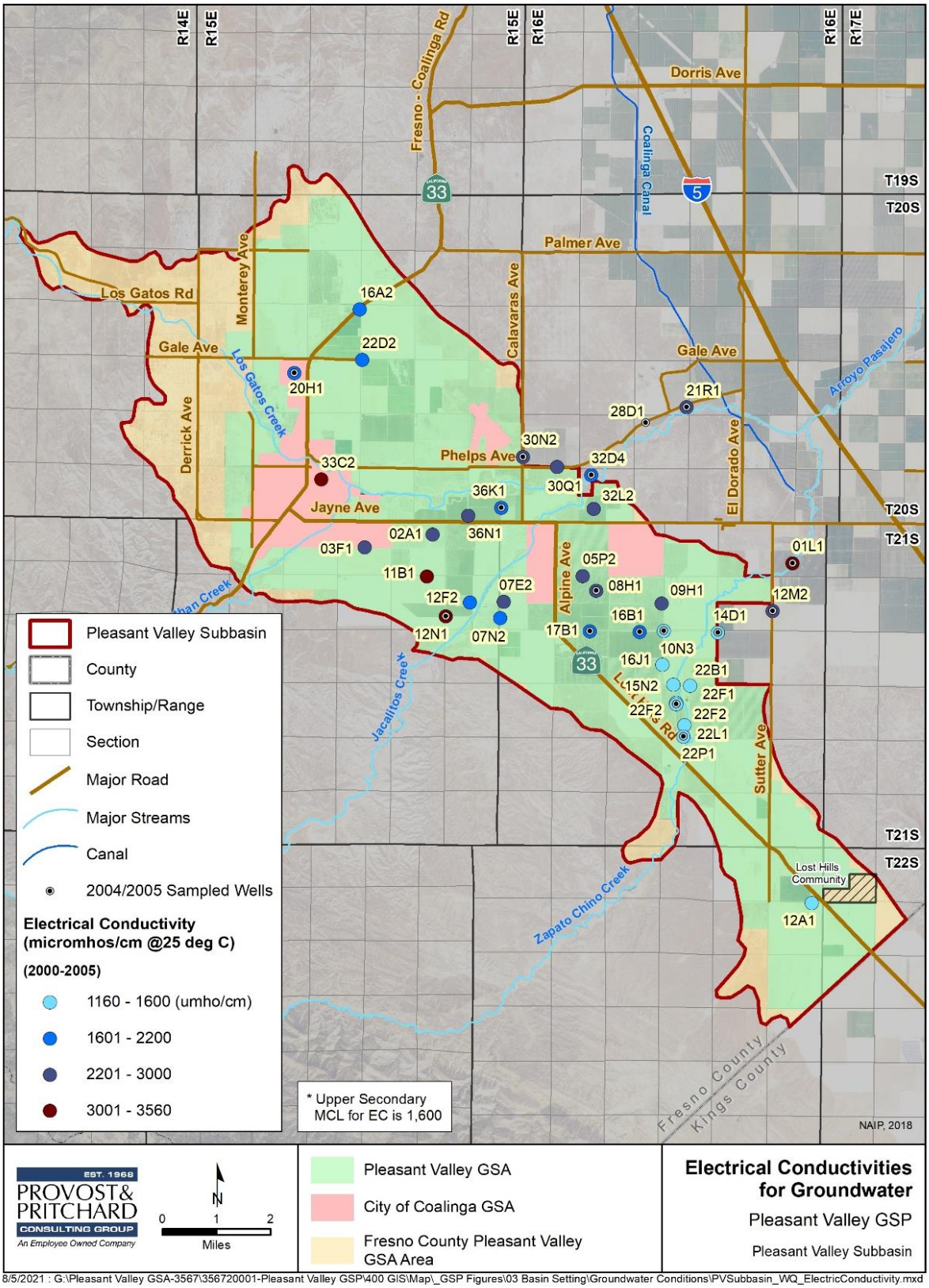


Figure 3-27 Electrical Conductivities for Groundwater

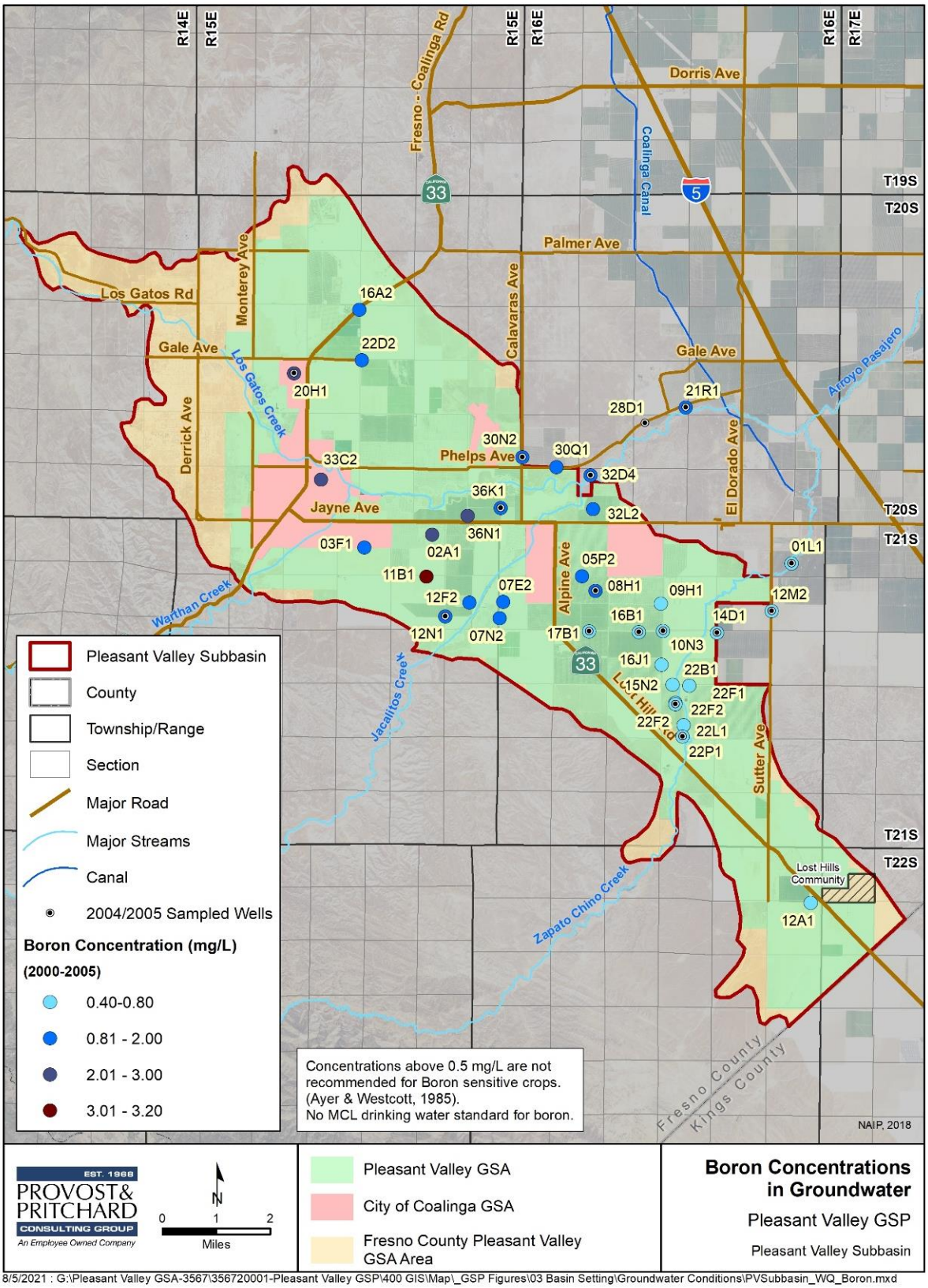


Figure 3-28 Boron Concentrations in Groundwater

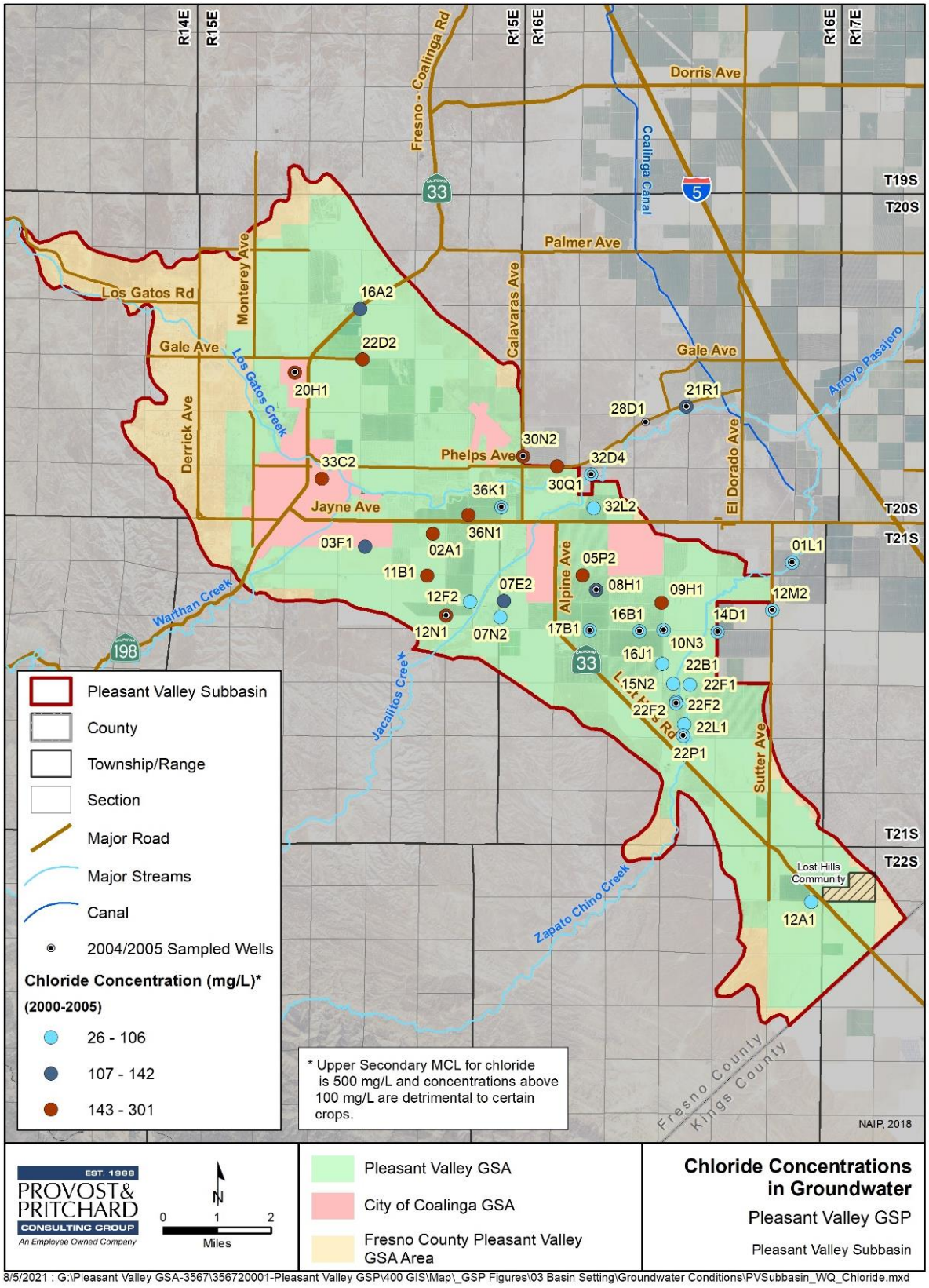


Figure 3-29 Chloride Concentrations in Groundwater

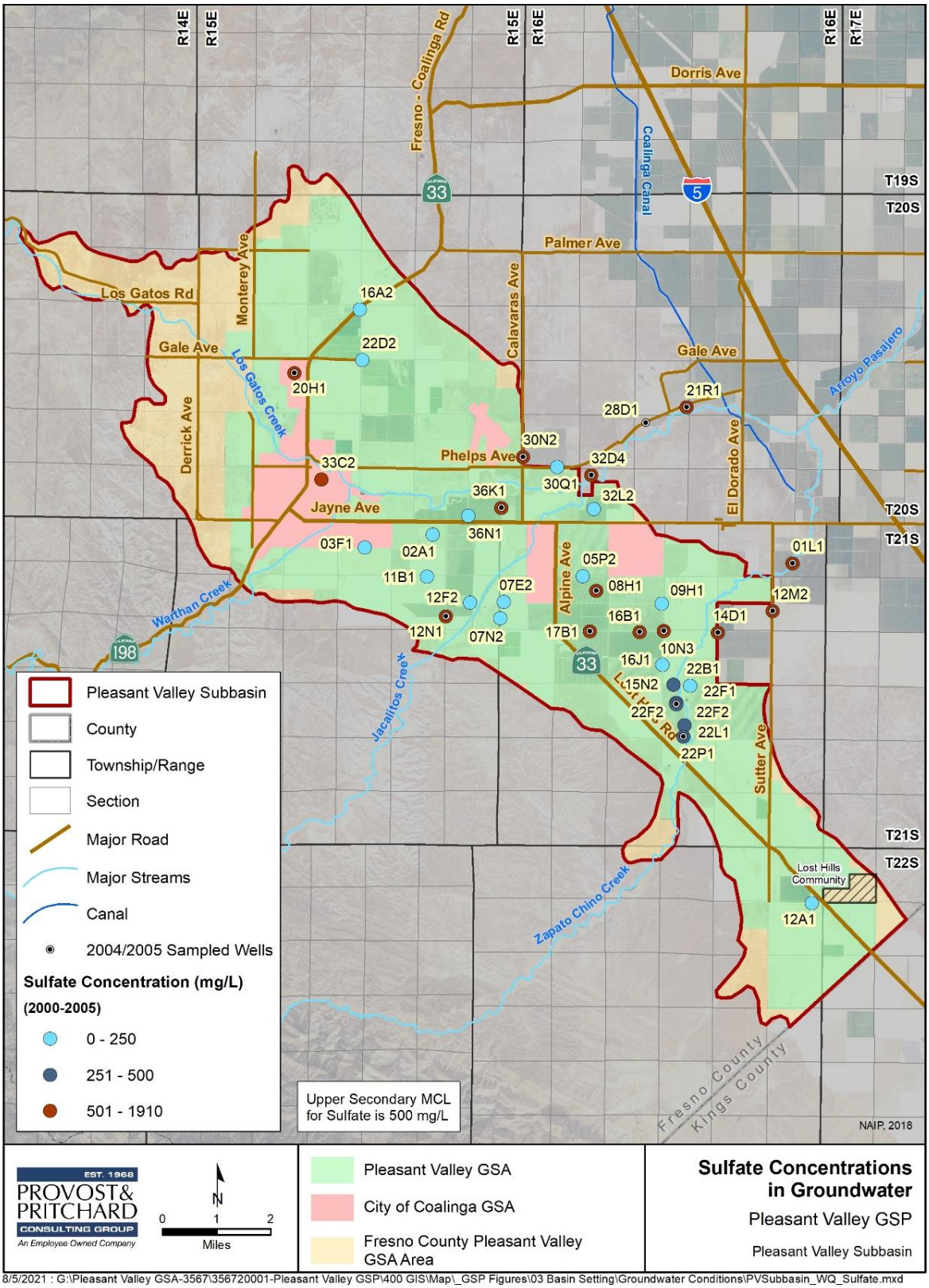


Figure 3-30 Sulfate Concentrations in Groundwater

3.2.6 Land Subsidence

Regulation Requirements:
§354.16(e) The extent, cumulative total, and annual rate of land subsidence, including maps depicting total subsidence, utilizing data available from the Department, as specified in Section 353.2, or best available information.

Relative subsidence or land surface elevation changes in Subbasin could be the result of a combination of a number of activities, including groundwater pumping, tectonic activity, and to lesser extent possibly oil pumping. To date, measured subsidence in recent years is considered small and no long-term data are available.

Land subsidence can occur when groundwater levels decline due to excessive withdrawals of groundwater. There are two types of subsidence due to excessive withdrawals of groundwater from the groundwater aquifer: elastic and inelastic. The majority of elastic subsidence occurs in the coarser-grained deposits, sands, and gravels and is recoverable if water levels later rise. Inelastic subsidence is caused by the rearrangement of clay minerals, especially montmorillonite, and is permanent.

Although there are several causes of inelastic land subsidence, the compression of clay as a result of groundwater extraction from confined aquifers is the cause of the vast majority of subsidence documented in the San Joaquin Valley. This results in compaction of fine-grained confining beds (clays) predominately within the confined portion of the aquifer system as water is removed from pores between the sediment grains. Once water is squeezed out of the compressible clay, the clay compacts, resulting in the lowering of the overlying land surface. The compressed clays, in which the clay particles have been re-arranged, can no longer re-absorb water, thus the subsidence in these areas cannot be reversed. This process is known as aquifer system compaction.

The Corcoran clay has been mapped beneath much of the western side of the San Joaquin Valley and the aquifer beneath it is confined. Most of the permanent subsidence in the San Joaquin Valley has historically been correlated to overdraft in the confined aquifer below the Corcoran clay. The Corcoran clay does not underlie the Subbasin; however, other clays that may compact are present, particularly below a depth of about 1,000 feet. For additional information on subsidence see Appendix P.

Review of Existing Data

Available land subsidence data was reviewed to assist in determining what information is available. The effort included a review of hydrogeologic conditions, available recorded subsidence data, historic groundwater levels, historic infrastructure impacts, remote sensing data, and Continuous Global Positioning System stations. A summary of existing data is provided below. Refer to **Section 5.1.3 – Description of Monitoring Network** for detailed discussions on the technologies available for monitoring subsidence and the existing monitoring programs in the region.

Review of historic range of groundwater levels in the principal aquifer of the Subbasin.

Groundwater levels are discussed in **Section - 3.2.1 Groundwater Levels.** Groundwater levels have been declining, leading to the potential for land subsidence.

Review of historic records of infrastructure impacts, including, but not limited to, damage to pipelines, canals, roadways, bridges, or well collapse potentially associated with land surface elevation changes. The amount of subsidence are the already large gradients within the subbasin will not have an undesirable effect on any of infrastructure listed here.

There are no known infrastructure impacts in the Subbasin area.

Review of existing CGPS stations.

Continuous Global Positioning System (**CGPS**) stations can be used to monitor land subsidence. One CGPS station (CACO–IGS14) has Leica SmartNet North America network listed as the Observer/Agency and the data can be obtained from the Nevada Geodetic Laboratory. This station is located north of the City of Coalinga on the West Hills Community College Farm of the Future. Several other CGPS stations are located in the surrounding watersheds to monitor tectonic induced movement and are part of the Plate Boundary Observatory by UNAVCO, Inc. (**Figure 3-31 through Figure 3-33**).

Review of remote sensing results such as InSAR or other land surface monitoring data.

A review of existing land subsidence data from remote sensing is discussed below.

3.2.6.1 Subsidence Monitoring Results

No data collected prior to 2015 on subsidence were found during this assessment and there were no physical observations of subsidence either. For the Subbasin, Interferometric Synthetic Aperture Radar (**InSAR**) land subsidence data, provided by DWR, is available for the years 2015 through 2019. Continuous Global Positioning System Station (CGPS) data, provided by Nevada Geodetic Laboratory, is available from approximately the beginning of 2017 until the present. In the discussions and maps below, a decline in land surface elevation is reported as a negative number, and a rise in land elevation is shown as a positive number.

InSAR Subsidence Data represents measurements of vertical ground surface displacement rates derived from InSAR data that are collected by the European Space Agency Sentinel-1A satellite and processed by the National Aeronautics and Space Administration (**NASA**) Jet Propulsion Laboratory (**JPL**), under contract with to the DWR. GeoTIFF pixel values are in inches equal to the cumulative vertical displacement from the first date. The advantage of using the InSAR data is the ability to map surface deformation of a fraction of an inch over large areas at spatial resolutions of 100 feet or finer. This is the most recent data available that covers the Subbasin. "Uncertainties associated with the vertical displacement (subsidence/uplift) measurements were determined to be less than 1-inch and usually less than 0.5 inches" (Farr, Jones, & Liu, 2016).

As shown in **Figure 3-31**, from 2015 to 2017 subsidence ranged from 0 to 0.5 of an inch in the Subbasin.

As shown in **Figure 3-32**, similar measurements across the Subbasin are shown for the time period of 2015 to 2018. An area of measured subsidence of 0.5 inches to 0.99 of an inch was shown near the intersection of Jayne Avenue and Alpine Avenue. As shown on **Figure 3-33**, the reported area of subsidence of 0.5 to 0.99 of an inch has grown approximately four times larger by 2019. This area of apparent subsidence corresponds to the pumping depression shown in **Figure 3-21.**

CGPS data for the station located in Coalinga (**Figure 3-34**) shows measured subsidence of -24 millimeters (-0.94 of an inch) between January 2017 and July 2020.

In summary, land subsidence in the Basin has been small and will continue to be monitored. The northern area of the PV Subbasin is approximately at an elevation (feet above sea level) of 850 feet, the middle area of the PV Subbasin is approximately at an elevation of 590 feet, and the south end is approximately at an elevation of 814 feet.

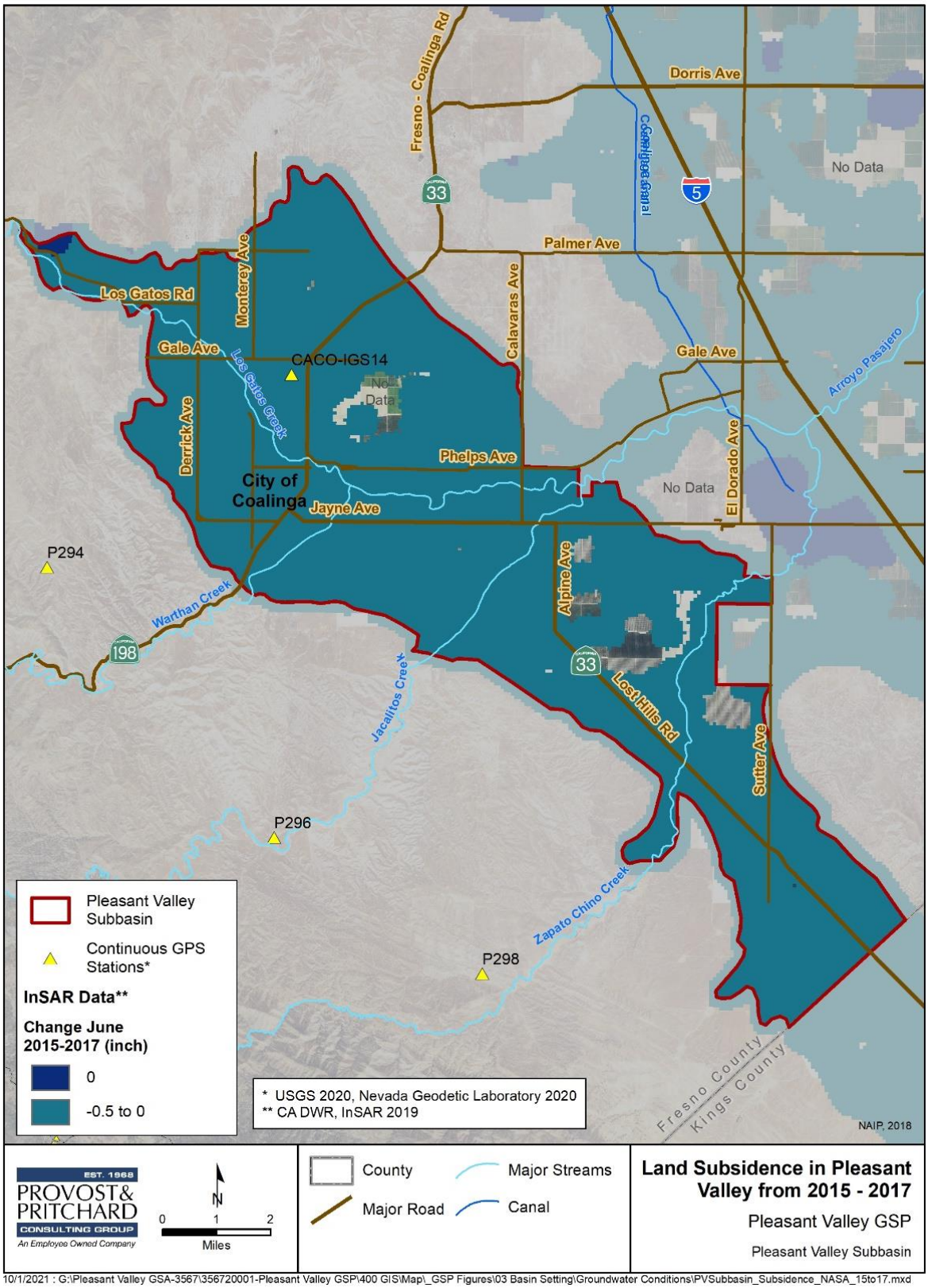


Figure 3-31 Regional Land Subsidence in Pleasant Valley from 2015 to 2017 (InSAR Data)

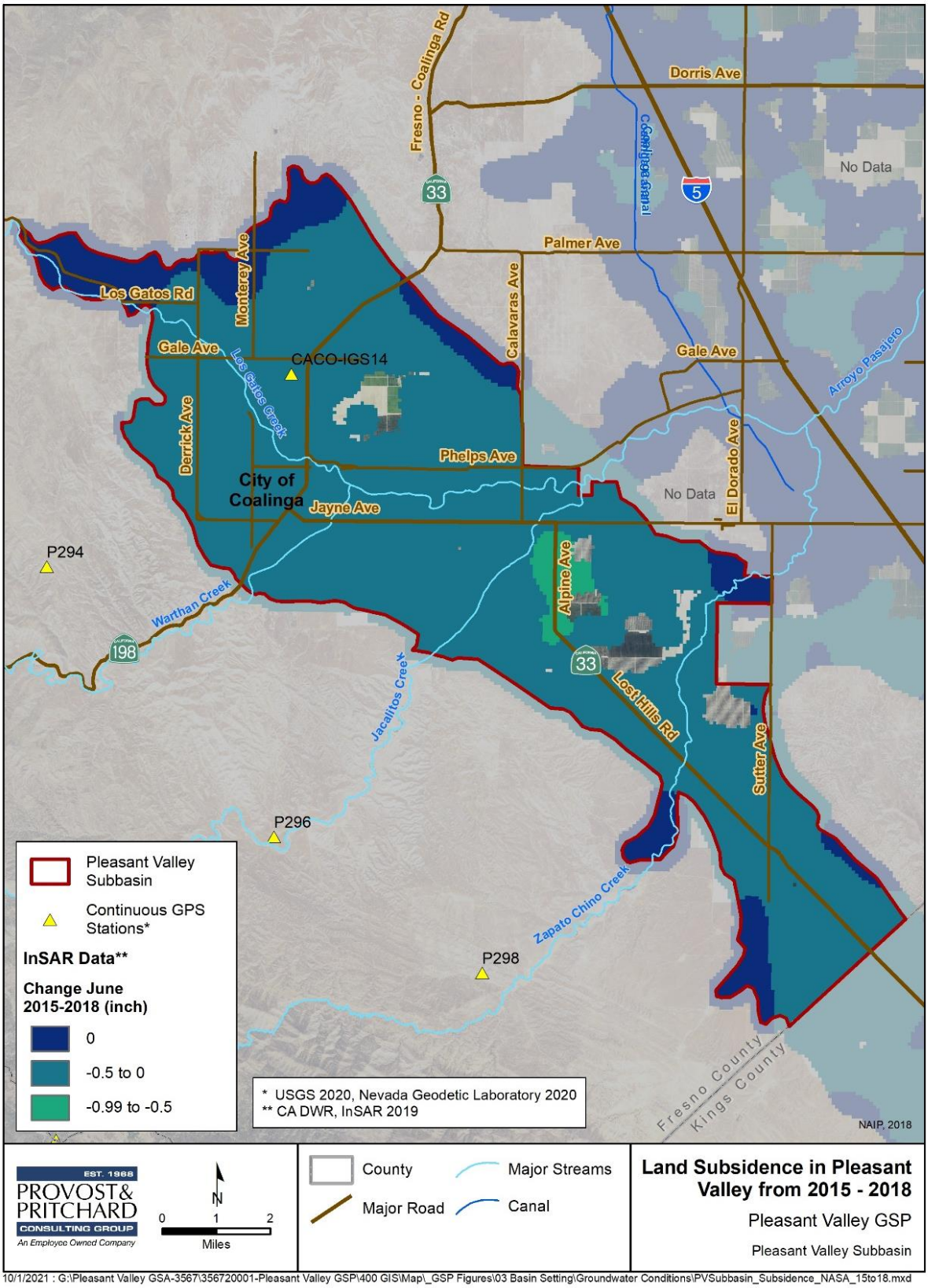


Figure 3-32 Regional Land Subsidence in Pleasant Valley from 2015 to 2018 (InSAR Data)

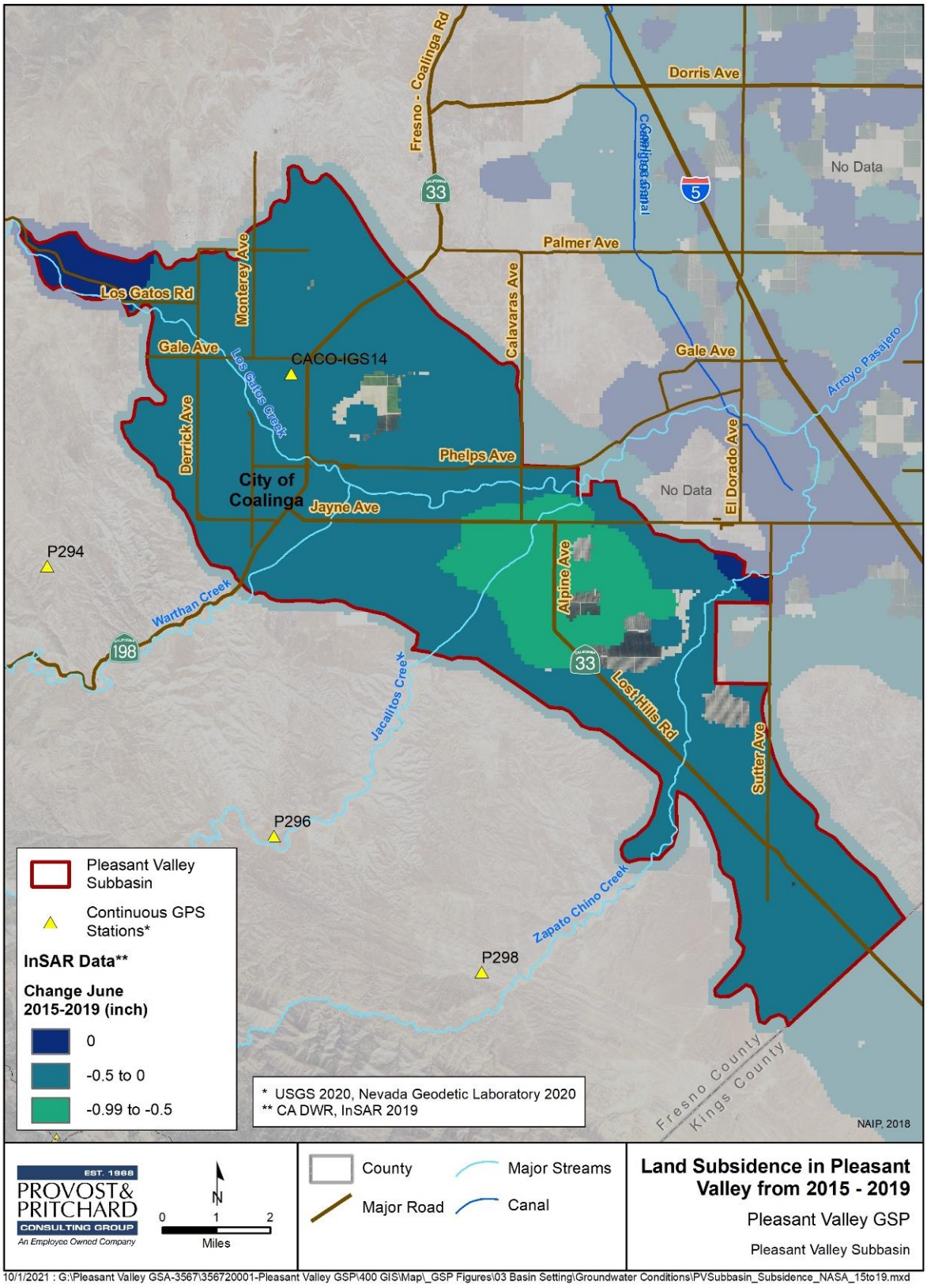


Figure 3-33 Regional Land Subsidence in Pleasant Valley from 2015 to 2019 (InSAR Data)

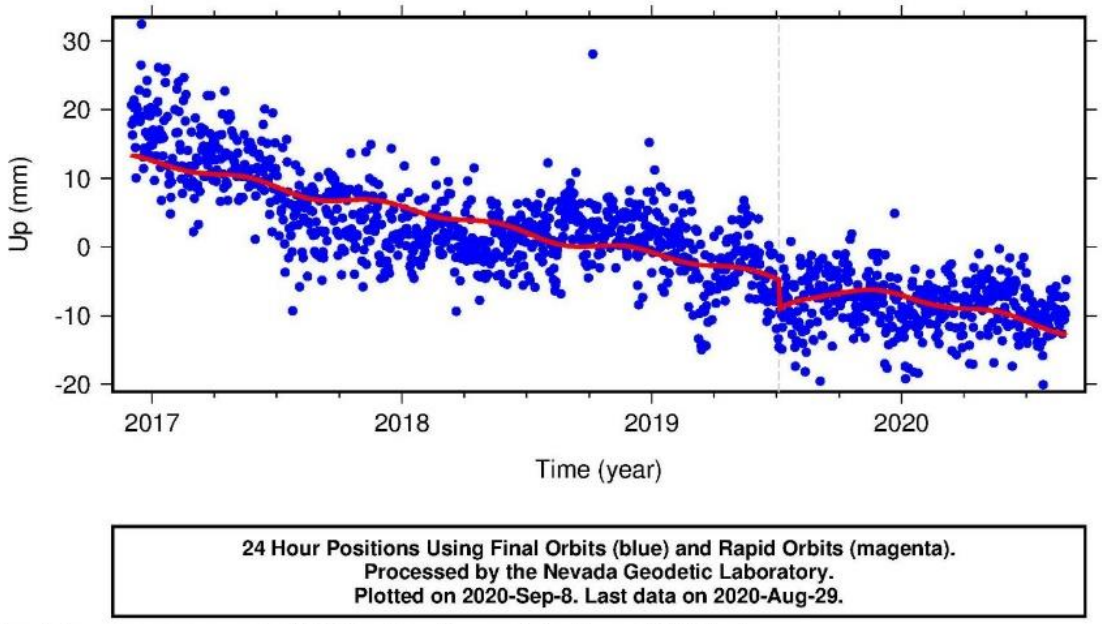


Figure 3-34 Nevada Geodetic Laboratory – Station CACO-IGS14 Subsidence Data (2017-2020)

3.2.7 Surface Water and Groundwater Interconnections

Regulation Requirements:
§354.16(f) Identification of interconnected surface water systems within the basin and an estimate of the quantity and timing of depletions of those systems, utilizing data available from the Department, as specified in Section 353.2, or best available information.

SGMA Regulations require the GSA to quantify the volume or rate of surface water depletion caused by groundwater pumping in basins where surface water and groundwater are interconnected. Interconnected surface water systems are defined as surface water that is hydraulically connected at any point by a continuous saturated zone to the underlying aquifer.

As discussed in other parts of this GSP, surface water within the Subbasin is limited to the local intermittent and perennial streams that flow generally from west to east through the Subbasin. Water only flows in the streams after periods of moderate or substantial rainfall, which typically only occurs between November and April. In between rain events the streams are typically dry. As a result, the streams can be dry any time of the year. Records for Los Gatos Creek show that, during significant droughts, no flow occurs for a period of 12 months or more.

Groundwater within the Subbasin is generally encountered at depths between 300 to 500 feet below ground. Due to the natural intermittent nature of surface water in the Subbasin and the depths to groundwater, the Subbasin does not have interconnected surface water and groundwater as defined in the SGMA regulations.

3.2.8 Groundwater Dependent Ecosystems

Regulation Requirements:
§354.16(g) Identification of groundwater dependent ecosystems within the basin, utilizing data available from the Department, as specified in Section 353.2, or best available information.

Groundwater Dependent Ecosystems (**GDEs**) are defined under SGMA as "ecological communities of species that depend on groundwater emerging from aquifers or on groundwater occurring near the ground surface" (23 CCR § 351(m)). While GDEs are not one of the six groundwater conditions that can lead to undesirable results, they can be related to sustainable management criteria identified in Chapter 4. The Nature Conservancy's Natural Communities Dataset Viewer (https://gis.water.ca.gov/app/NCDatasetViewer/) (**NC**) Vegetative GDE and Wetland GDE map with basin-wide marked revisions is provided below as **Figure 3-35**. Recognizing that the Subbasin has a depth to groundwater greater than the generally accepted 30-foot proxy for confirming that polygons in the NC dataset are supported by groundwater, the GDEs identified in the NC Dataset Viewer are believed to be largely mischaracterized.

As a conservative approach, Spring 2019 depth to groundwater contours and NC Dataset Viewer GDEs were overlaid to identify NC Dataset Viewer called out GDEs in areas with depth to groundwater greater than 200 feet. By assigning a 200-foot vertical buffer, the assessment accounts for variability in rooting depth exceeding the reported deepest GDE rooting depth of thirty-feet. NC Dataset Viewer-called out GDEs located in areas with groundwater depths exceeding the 200-foot vertical buffer were categorized as "Incorrectly Characterized as a GDE" and are therefore rejected as potential GDEs. The aquifer is thinner near the edges of the Subbasin and the 200-foot vertical buffer may or may not be appropriate in the areas of limited to no information. The Subbasin GSAs will continue to investigate the areas indicated in **Figure 3-36** in order to fill the data gap. The areas in **Figure 3-36** are the only potential locations for GDEs in the Subbasin.

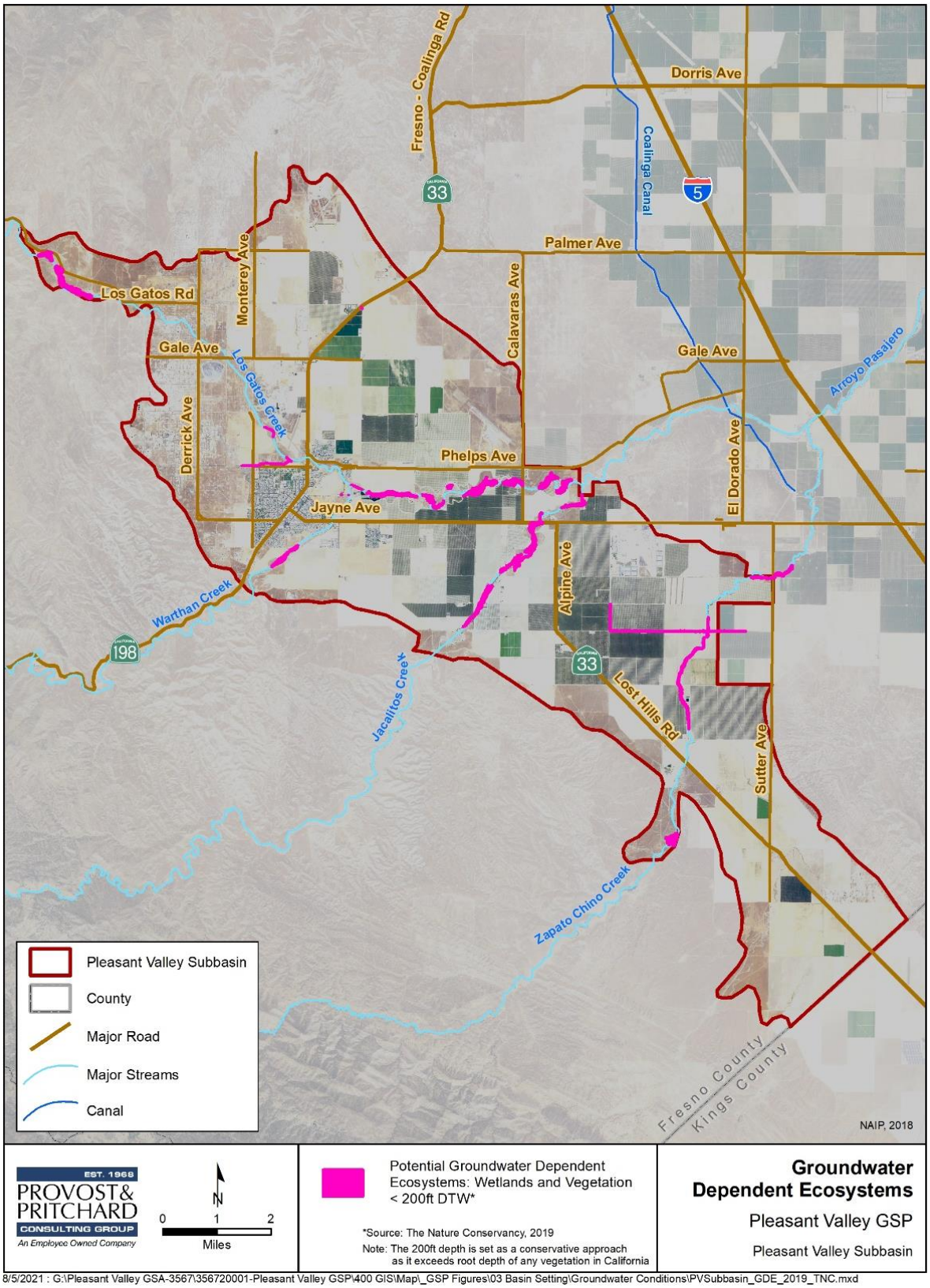


Figure 3-35 Potential Wetlands and Vegetation of Groundwater Dependent Ecosystems

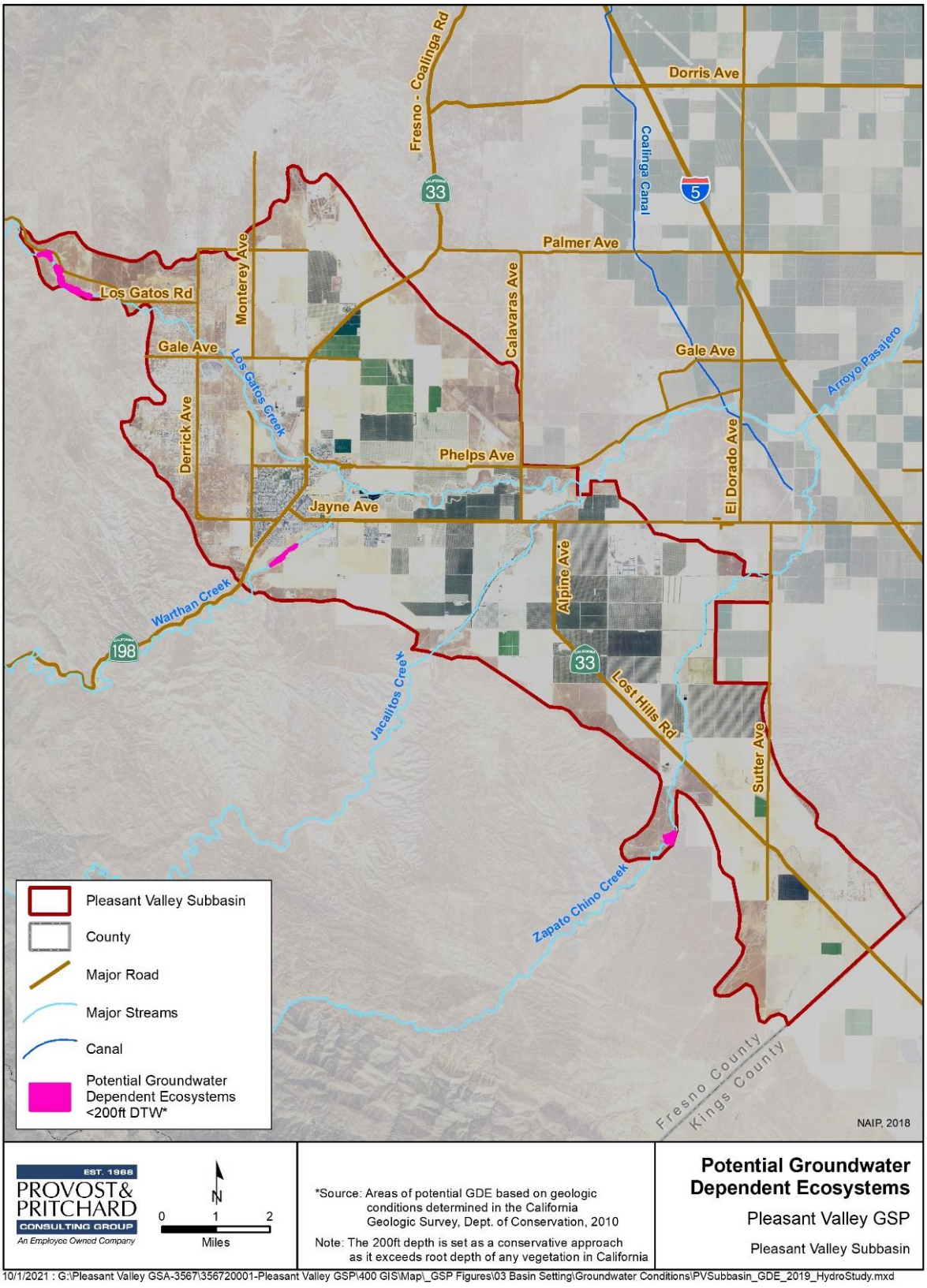


Figure 3-36 Potential Groundwater Dependent Ecosystems

3.3 Water Budget Information

3.3.1 Introduction

Regulation Requirements:
§354.18 (a) Each Plan shall include a water budget for the basin that provides an accounting and assessment of the total annual volume of groundwater and surface water entering and leaving the basin, including historical, current and projected water budget conditions, and the change in the volume of water stored. Water budget information shall be reported in tabular and graphical form.

A water budget is an accounting of all the water that flows into and out of a specified area and any resulting water storage change; it also describes the various components of the hydrologic cycle. Categories of a water budget includes all the water supplies, demands, groundwater recharge, and change in storage. A water budget can be used to identify how much water is stored in a groundwater system as well as changes in groundwater storage during a given period. The purpose of a water budget will be further explained in this section. A schematic diagram of a water budget indicating the primary inflows and outflows and impacts on the groundwater system is shown in **Figure 3-37** below:

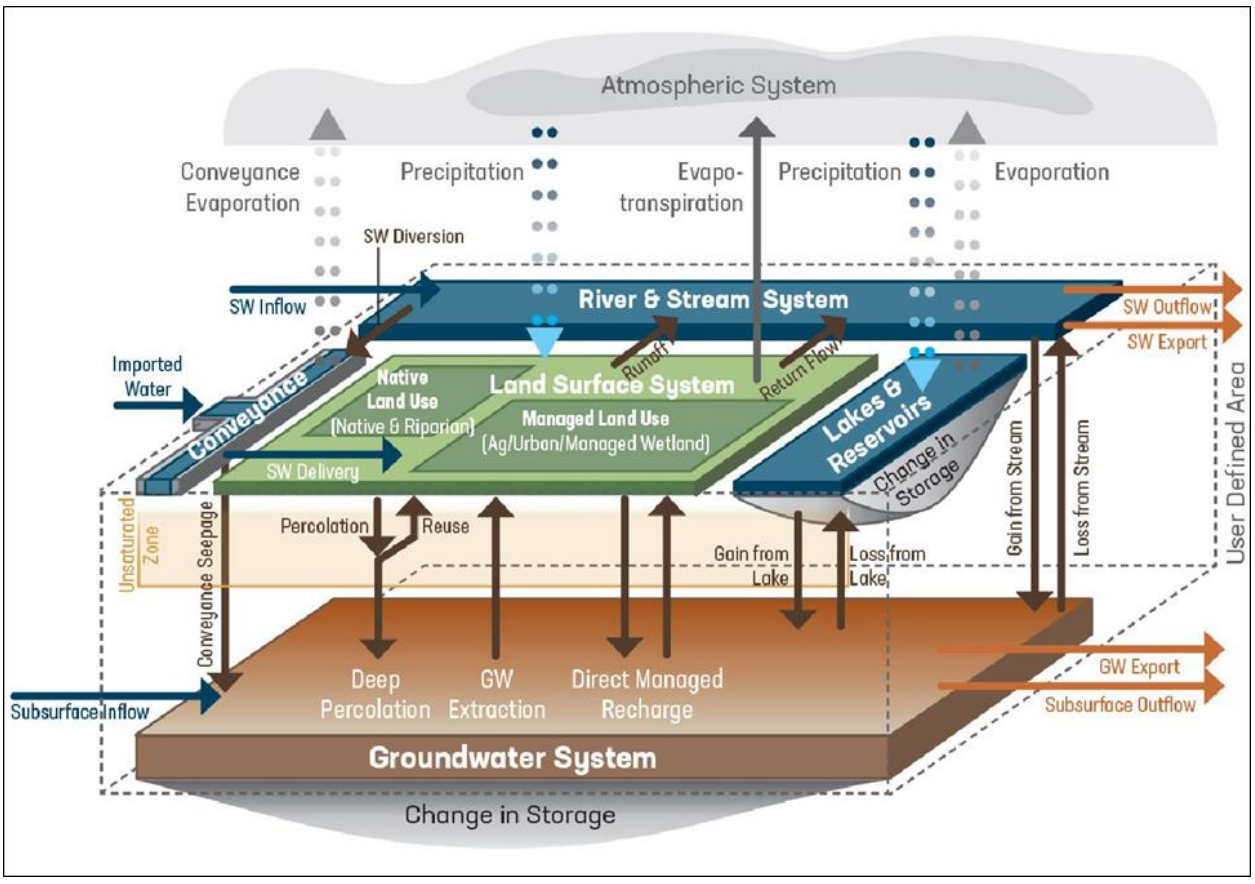


Figure 3-37 Water Budget Schematic

Purpose of Water Budget
Water budgets quantify the components of water supply, water use, and change in groundwater storage. The water budgets can be used as tools in numerous aspects of groundwater sustainability management including:

- Determining sustainable yield

- Determining changes in groundwater storage
- Identifying data uncertainties and monitoring needs
- Quantifying the effects of proposed projects and management actions

Water Budget Methodology

The methods used in developing the water budgets vary depending on the water budget (historical, current, or projected) being discussed. Historical, current, and projected water budgets have been developed from direct measurements and/or estimates based on available data. An analytical water budget (spreadsheet) approach has been used, which has the advantage of clearly showing the origin of data used for the water budget, as opposed to extracting disaggregated data from a numerical groundwater model that does not explicitly identify the data source or computation method. Overall, the GSAs in the Subbasin agreed that an analytical water budget would be a more practical and useful tool and, therefore, offer greater value in managing groundwater. Limited data was available for several water budget variables, so additional monitoring and water budget enhancements will be needed in the future. Due to these data limitations, the water budget has limited accuracy but is still considered a valuable tool. The data for each variable was also rounded to the nearest 100 AF, which represents the relative accuracy of the measured and calculated data. For Pleasant Valley, the water budget approach is more valid than the use of water-level changes and specific yields to determine groundwater storage changes. This is because the water levels in most supply wells are indicated to be pressure levels, which reflect a confined aquifer. However, groundwater levels will also be measured and used as a measure of overdraft.

Water Budget Requirements

Water budgets shall quantify the following information in conformance with §354.18 (b) of the GSP requirements, either through direct measurements of estimates based on data:

(1) Total surface water entering and leaving the Subbasin

(2) Inflows to the groundwater system by water source type, including subsurface groundwater inflow infiltration of precipitation, applied water, and surface water systems, such as lakes, streams, rivers, canals, springs, and conveyance systems

(3) Outflows from the groundwater system by water use sector, including evapotranspiration, groundwater extraction, groundwater discharge to surface water sources, and subsurface groundwater outflow.

(4) The change in the annual volume of groundwater in storage between seasonal high conditions

(5) Identification of overdraft over a period of years during which water year and water supply conditions approximate average conditions

(6) The water year type associated with the annual supply, demand, and change in groundwater stored

(7) An estimate of sustainable yield for the Subbasin

Two approaches were utilized to quantify the changing groundwater and specific yield levels and the groundwater overdraft. The first was by an evaluation of change in groundwater levels and specific yields c. The second was by identifying and quantifying the individual categories in the water budget.

Historic Period Evaluation

A review of the water-level hydrographs since 1960 and an examination of data for 1937-51 from the Stanford University studies indicate that there are six historical periods that should be examined. Examination of groundwater budgets for these periods, provides an insight into the importance of streamflow seepage. Estimates of pumpage and water-level declines for each of these periods are available. For the two earlier periods (before 1952), water from the California Aqueduct was not yet available in the valley. Groundwater supplied virtually all of the irrigation use. Water levels were relatively stable during two of the periods (1937-45 and mid-1980s to 2005). During three other periods, water levels fell from 5.3 to 6.2 feet per year.. Other than pumpage, streamflow seepage is the main item in the groundwater budget. During two of the periods (1945-51 and 2006-17), there was little or no streamflow seepage indicated. In contrast, streamflow seepage was significant during 1937-45, 1960-mid-1980s, mid-1980s to early 2000s,2017-21, and in 2023.

Another source of recharge is deep percolation from irrigation. Deep percolation is the part of the water applied for irrigation that is not consumed by evapotranspiration. Records indicate that significant groundwater pumping for irrigation in the valley began between 1914 and 1924. Records indicate that about 8,000 acres of crops were irrigated during 1937-45 and 10,000 acres during 1945-51. During 1960 to the mid-1980s, about 29,000 acres were irrigated (the maximum historical average). During the mid-1980s to the early 2000s about 16,000 acres were irrigated, and during 2006-17 about 11,500 acres were irrigated. In 2020 about 17,600 acres were irrigated. Prior to the 2000s, when orchards were planted that used drip irrigation, sprinkler irrigation was common. The percentage of the applied water that is consumed by evapotranspiration is termed the irrigation efficiency. An irrigation efficiency of about 67 percent is typical for sprinkler irrigation. This means that about one-third of the water applied for irrigation before 2000 percolated to the groundwater. Recharge from deep percolation likely moves downward at a rate of less than about 10 to 20 feet per year. This means that in areas where the water level is 300 feet deep, the deep percolation may not reach the groundwater level until about 15 to 30 years after the water was applied at the land surface. In addition, it is believed that the alluvial deposits away from streams were moisture deficient prior to irrigation. In this case, some of the deep percolation had to satisfy this deficiency (field capacity minus wilting point) before downward flow could occur. Recent information from two of the districts monitor wells indicates that in some areas deep percolation has not yet reached the groundwater level.

Table 3-3 shows major components of the groundwater budget for the six periods. It can be seen that pumpage ranged from about 28,000 to 55,000 acre-feet per year. Streamflow recharge ranged from about zero to 23,000 acre-feet per year. The streamflow recharge from 1937-45 and from the early 1980s to the mid-2000s ranged from 22,000 to 23,000 acre-feet per year. These values are larger than previous estimates but are necessary to balance the water budgets for these two periods, and due to not accounting for the recharge from the upper watershed. Some of the recharge attributed to streamflow seepage was from mountain front recharge to the west part of the basin.

Average water-level declines in wells in the irrigated areas ranged from about zero to 6.2 feet per year. Average water-level declines ranged from 5.3 to 6.3 feet per year during 1945-51, 1960 to the mid-1980s, and 2006-17. Stable water levels were predominant during 1937-45 and from the early 1980s to the mid-2000s. The pumpage ranged from 28,000 to 35,000 acre-feet per year and the streamf1ow seepage ranged from about 22,000 to 23,000 acre-feet per year during these two periods.

Totalizing flowmeters have been installed in almost all of the irrigation wells in Pleasant Valley, and two years of record are now available. The annual pumpage for 2022 and 2023 ranged from about 32,000 to 36,000 acre-feet. This indicates that the original pumpage estimate for **2019-2021 was too high**.

Table3-3 Summary of Groundwater Budgets

Period	Pumpage (AF/yr)	Imported Surface Water (AF/yr)	Streamflow Recharge (AF/yr)	Change in Storage (AF/yr)
1937-45	28,000	0	22,000	-6,000
1945-51	35,000	0	0	-35,000
1960 to Mid-1980s	55,000	0	16,000	-39,000
Mid-1980s-Early 2005	35,000	0	23,000	-12,000
2006-17	40,000	3,000	0	-36,000
2022	36,000	0	0	-36,000
2023	32,000	7,400	21,500	-3,100

Prior to 1960, the City of Coalinga imported groundwater from Armona for M&I use. From 1960 to 1972, the City pumped and desalinated local groundwater for M&I use. After 1972, the City used aqueduct water for M&I use. For the 2017-21 period, an average of 3,700 acre-feet per year of surface water was used for irrigation, 1,800 acre-feet per year of effluent was recharged, 550 acre-feet per year of effluent was consumed by crops, and the groundwater outflow through Pasajero Gap was about 1,700 acre-feet per year. Prior to 2017, no surface water was used for irrigation.

Other items in the water budget that were considered are sur face water used for M&I and irrigation, consumptive use and deep percolation of sewage effluent, and groundwater outflow. KDSA determined a groundwater outflow of about 1,700 acre-feet per year through the Pasajero Gap in 2020. The City has supplied water to the former prison, the state hospital, the community college, the Coalinga-Huron Recreation and Parks District, and oil companies.

Table 3-3 indicates that the average streamflow recharge between 1937 and 2022 has been about 14,000 acre-feet per year. However, there have been periods when the streamflow recharge was insignificant. The sustainable pumpage in the future would include this 14,000 acre-feet per year and deep percolation (15 percent of 12,000 acre-feet per year, or 1,800 acre-feet per year, or about 15,800 acre-feet per year). In addition, surface water is planned to be imported (3,700 + 2,350 acre-feet per year as of 2020), which would add to the sustainable yield if it was all recharged. As of 2020 the **sustainable pumpage** would be about **21,850 acre-feet per year** if all the surface water were to be recharged.

Water Budget Periods

Development of water budgets were performed for historical, current, and future (projected) periods.

Historical. Historical groundwater budgets were developed as shown in **Table 3-2**. For the development of the water budget based upon individual inputs, the period of 1998 through 2017 was chosen. This historical period was selected based on surface water recharge from streams. The crop patterns are the most recent and represent conditions in the past twenty years, and this period represents the most recent period after the Subbasin saw relatively stable ground water level conditions. **Figure 3-38** represents a simplified diagram of the calculations considered for the Historical Water Budget.

Current. A current water budget was prepared to represent recent hydrologic conditions. This water budget includes water demands from 2020 and long-term average recharge and surface water supplies.

Future. Future water budgets were prepared for 2042, which is the year when the Subbasin must reach sustainability, and 2072, which represents a 50-year planning horizon. These water budgets include estimated changes in demands and impacts from climate change as well as incorporation of planned surface water deliveries.

The historical water budget includes a long-term average water budget.

As required by the SGMA regulations, the water budget was prepared according to the Water Year (October to September). For example, the 2010 Water Year would cover October 1, 2009 to September 30, 2010. When data was not available for the Water Year, then calendar year data were used.

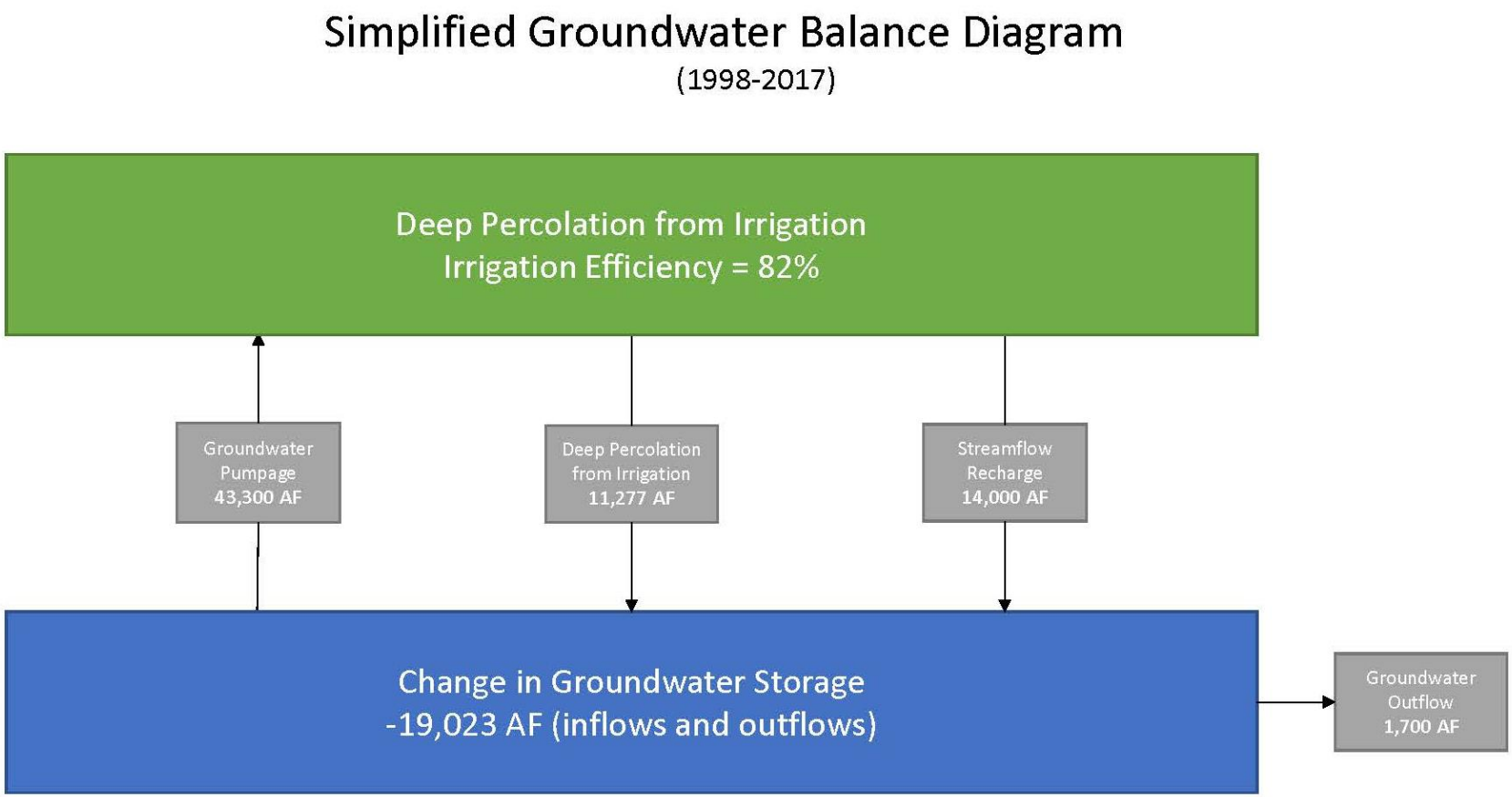


Figure 3-38 Simplified Groundwater Balance Diagram

3.3.2 Best Available Information

Regulation Requirements:
§354.18 (e) Each Plan shall rely on the best available information and best available science to quantify the water budget for the basin in order to provide an understanding of historical and projected hydrology, water demand, water supply, land use, population, climate change, sea level rise, groundwater and surface water interaction, and subsurface groundwater flow. If a numerical groundwater and surface water model is not used to quantify and evaluate the projected water budget conditions and the potential impacts to beneficial uses and users of groundwater, the Plan shall identify and describe an equally effective method, tool, or analytical model to evaluate projected water budget conditions.

GSP regulations stipulate the need to use the *best available information* and the *best available science* to quantify the water budget for the Subbasin. Best available information is common terminology that is not defined under SGMA or the GSP Regulations. Best available science, as defined in the GSP Regulations, refers to the use of sufficient and credible information and data, that is specific to the decision being made and the time frame available for making that decision, which is also consistent with scientific and engineering professional standards of practice. It is understood that initial steps to compile and quantify water budget components may be constrained by GSP timelines, limited data, and limited funding and may consequently need to rely on the best available information obtainable at the time the GSP is developed. The best available data for the water budget was often incomplete, had to be estimated, or was based on assumptions. The confidence intervals for the parameters vary from 5% to as high as 50%. As a result, the water budgets only give an approximation of the hydrologic system in the Subbasin.

3.3.3 Description of Water Budget

Regulation Requirements:
§354.18 (f) The Department shall provide the California Central Valley Groundwater-Surface Water Simulation Model (C2VSIM) and the Integrated Water Flow Model (IWFM) for use by Agencies in developing the water budget. Each Agency may choose to use a different groundwater and surface water model, pursuant to Section 352.4.

Following is a description of the water budget including the selection of the hydrologically average period for the historical water budget, a description of different water year types analyzed, and a list of variables in the water budget.

Hydrologically Average Period

Based upon **Table 3-2**, an average period would be from the mid-1990s through 2021. This hydrologic period was selected since it is a relatively long period during which "…*water supply conditions approximate average conditions*" as specified in DWR Groundwater Regulations at §354.18 (b) (5). A hydrologically average period is generally best for calibrating a water budget, as opposed to a period with abnormal weather. This period was identified by review of the hydrographs as well as review of streamflow records to identify a near current period when hydrology approximates normal conditions as well as capturing the more normal development of agriculture within the valley.

Water Year Types

The annual water budgets consider average conditions and do not necessarily reflect the variations that occur in dry and wet years. There is a lack of precipitation data from the weather stations within the water shed above the Subbasin. This is because streamflow associated with this precipitation contributes to the runoff in the streams that cross the valley and recharge the basin. The following **Table 3-3** estimates the volume of recharge that corresponds to different type years and the average precipitation in the lower watershed, values for the upper water shed are estimated to be double the amounts of the lower water shed.

Table3-4 Water Year Type

Water Year Type	Streamflow Recharge (AF)	Average Precipitation
Dry	0	4.39
Normal	14,000	7.40
Wet	22,500	12.50

Table 3-4 is based on past hydrologic conditions, including stream hydrology and the frequency of wet and dry years, resulting in higher standard deviations for total water supplies. This could impact several variables in the water budget. While this is difficult to predict, the Subbasin will continue to monitor climate and stream flows for long-term changes. It should also be noted that these watersheds are precipitation driven and little to no snowpack accumulates due to the location on the easterly side of the Coast Range. Climate change is discussed in more detail in **Section 3.3.10**.

The following sections describe the variables used in the water budget, as well as assumptions and criteria used. **Table 3-5** below lists the water budget inflows and outflows.

Table3-5 Groundwater Water Budget Variables

A. Surface Water Entering and Leaving (Section 3.3.4)	B. Inflows to Groundwater System (Section 3.3.5)
A.1 - Surface Water for Irrigation A.2 - Surface Water for M&I	B.1 - Groundwater Inflows B.2 - Deep Percolation of Irrigation Water B.3 - Deep Percolation of M&I Water B.5 - Seepage of Channels and Pipelines B.6 - Seepage of Reservoirs B.7 - Urban Stormwater – Recharge B.8 - Streams – Recharge
C. Outflows from Groundwater System (Section 3.3.6)	**D. Change in Groundwater Storage (Section 3.3.7)**
C.1 - Groundwater Pumping for Irrigation C.2 - Groundwater Pumping for M&I C.10 - Groundwater Exports C.11 - Groundwater Outflows	D.1 - Groundwater Storage Change

3.3.4 Surface Water Entering and Leaving

Regulation Requirements:
§354.18(b) The water budget shall quantify the following, either through direct measurements or estimates based on data:
(1) Total surface water entering and leaving a basin by water source type.

Quantities of water entering the Subbasin at the surface, either as surface flows or precipitation, are described and quantified in this section.

A.1 - Surface Water for Agricultural Irrigation
Surface water for agricultural irrigation comes from a group of private landowners that purchase and import surface water through the CVP off the Coalinga Canal. These landowners are able to make short-term purchases from the City of Coalinga and/or other CVP contract agencies. These purchases began in 2017 and averaged about 3,700 AF/year between 2017 and 2019. The water is delivered to properties within the Subbasin through the "Southern Pipeline" off the Coalinga Canal as shown on **Figure 3-15**. Private landowners are in the process of developing plans to construct additional pipelines and import more water in the future.

Wastewater effluent from the Pleasant Valley State Prison has been used by a landowner for irrigation of non-edible crops since about 1996. The average supply was about 540 AF/year (2005 to 2019). In the early years, the landowner indicated that the supplies were higher than the 2005 to 2019 average, but supporting data were not available.

A.2 - Surface Water for M&I
The City of Coalinga uses surface water to meet all of their demands. From 1998 to 2017, they diverted on average about 5,500 AF/year from the Coalinga Canal. The City of Coalinga provides water to several types of water users including City residents, some rural residents outside of the City (indoor use only), oil companies, the local Community College, Coalinga-Huron Recreation and Parks District, Pleasant Valley State Prison, and the Coalinga State Hospital.

A.3 - Precipitation
Precipitation data was gathered from the National Climatic Data Center (NCDC) Station No. 041864 (Coalinga). Precipitation data is available from 1942 to 2020. The average precipitation was 7.46 inches from 1942 to 2019, and the average precipitation during the historical period (1998-2017) was 7.05 inches. As stated earlier, the Coalinga station does not represent the climatic conditions of the watersheds. It is more important to be able to gather data from weather stations at higher elevations within the watershed as the rainfall. Resultant stream flows are the major local contributor to recharge of the basin. Average precipitation in the lower watershed, values for the upper water shed are estimated to be double the amounts of the lower watershed in the range of 14 to 18 inches.

A.4 - Spill Inflows
This represents spills of surface water into an irrigation or water district and therefore is a source of water. No operational spills into the Subbasin were identified, and consequently they were assumed to be zero.

3.3.5 Inflows to Groundwater System

Regulation Requirements:
§354.18(b) The water budget shall quantify the following, either through direct measurements or estimates based on data:
(2) Inflow to the groundwater system by water source type, including subsurface groundwater inflow and infiltration of precipitation, applied water, and surface water systems, such as lakes, streams, rivers, canals, springs and conveyance systems.

Inflows to groundwater in the Subbasin are groundwater inflow, streamflow seepage, and deep percolation from irrigation are described and quantified in this section using the procedures described below.

B.1 - Groundwater Inflows
No groundwater is believed to flow into the Subbasin through adjacent alluvial basins to the east. Some groundwater may enter the Subbasin from mountain-front inflow from the west (from mountain bedrock to alluvial basin). It is believed that water from the mountains enters the alluvial basin primarily through stream flows. There is some streamflow seepage upstream of the alluvial basin. Consequently, in the water budget evaluations, the recharge for both stream seepage and other groundwater inflow will be computed and shown under one classification (see B.8 - Streams – Recharge below). Refer to **Section 3.2.2** for more details on groundwater flow conditions and the potential locations for groundwater flows across subbasin boundaries.

B.2 - Deep Percolation of Irrigation Water
Deep percolation of irrigation was estimated by assuming that the amount of water applied above and beyond the evapotranspiration rate (due to irrigation inefficiencies or over-irrigation) infiltrates past the root zone and into the groundwater system. As a result, the quantity of deep percolation of irrigation water is computed as a function of irrigation efficiency. The Subbasin irrigation efficiency was estimated to be 82% during the historical period based on the mix of annual and permanent crops. As a result, deep percolation of irrigation water is estimated at 100% – 82% = 18% of the applied water for that period.

Rates of Downward Flow of Deep Percolation
There are two basic situations to consider when evaluating the rate of downward flow of deep percolation beneath irrigated lands. One is in an area that has been irrigated for many decades, perhaps up to a century or more. In this case, the sub-surface deposits above the water level are expected to be at field capacity. When more water is added, such as from deep percolation, this added water will tend to move downward. A second case is in areas not previously irrigated, such as arid lands that were newly developed for irrigation on the west side of the San Joaquin Valley, once aqueduct water became available. In this case, the subsurface deposits away from streams were indicated to be moisture deficient. When a source of water such as deep percolation is added, this moisture deficiency must first be satisfied, before downward movement can occur. That is, the moisture content would have to be raised from near the wilting point to the field capacity, before downward flow of deep percolation could occur. This situation results in longer travel time before the deep percolation reaches the groundwater level, than in areas that have been irrigated for many decades. Field capacity is a soil scientist term, that is probably nearly equivalent to the specific yield, a term used by hydro-geologists. The wilting point is another soil scientist term, that is probably nearly equivalent to specific retention, a term used by hydrogeologists. Recent data from the Pleasant Valley monitor wells, indicate that deep percolation from irrigation hasn't reached the water level yet at some sites.

Studies on East Side of the San Joaquin Valley
In much of this area, fairly permeable deposits are present above the water level, which are often less than about 100 feet deep. The average specific yield of these deposits is about 15 percent. This means there is a storage space of about seven feet for each foot of downward percolating water. If the deposits above the water level are not saturated, then one foot per year of deep percolation would have to move downward at least seven feet. Thus, the downward low rate of deep percolation would be at least about 10 feet per year. There are two constituents in the deep percolation that can be used as tracers as part of the eastside areas. These are nitrate and DBCP. Fertilizer sources of nitrogen, such as anhydrous ammonia, began to be used by

the early 1950s. DBCP was used to control nematodes and began to be used by the late 1950s. Both of these constituents reached the groundwater. By the late 1970s, both of those reached the groundwater and were primarily present above a depth of about 250 feet. Thus, for nitrate, a rate of downward flow of deep percolation was at least 250 feet divided by 25 years or 10 feet per year. For DBCP, a rate of downward flow of about 250 feet in 20 years or 12.5 feet per year was apparent.

In summary, for the east side of the San Joaquin Valley in Fresno County, deep percolation beneath irrigated lands probably takes an average of about 7 years to move to a depth of about 50 feet or an average of about 15 years to move to a depth of 100 feet.

An interesting evaluation of deep percolation was done in 1968 by The California Department of Water Resources in the Delano-McFarland area. High nitrate concentrations in the groundwater as of the late 1960s were attributed to large water-level rises following the importation of Friant-Kern Canal water to the area, beginning in the 1950s. The increases in nitrate concentrations were attributed to the interception of downward moving deep percolation by the rising groundwater levels, which in some cases rose by more than 200 feet.

Studies in Arizona

In central southern Arizona, water-level declines in basins where only groundwater was available for irrigation ranged from about 15 to 20 feet per year. Sampling of irrigation well water in these areas generally indicated no influence of deep percolation. The irrigation wells were generally perforated over intervals that exceeded 400 feet. However, sampling of cascading water (water entering the well from openings above the water level) indicated an influence of deep percolation (the salinity was about triple that of the water pumped from the well). This deep percolation may have moved only about half or two-thirds of the way to the water level since irrigation began. In this situation, the water level was apparently falling at a faster rate than the deep percolation was moving downward. Thus most of the deep percolation had not reached the groundwater level.

Monitoring of deep percolation was accomplished in the Salt River Valley of central Arizona in the mid-1970s. This area had been irrigated for more than a century, and a lot of deep percolation has reached the groundwater. Both samples of cascading water and samples from specially installed shallow monitor wells were collected and analyzed. The deep percolation (away from canals) had TDS concentrations about three times greater than that of the applied water, consistent with an average irrigation efficiency at the time of about 70 percent. Notably, the primary chemical constituents in the applied water were sodium and chloride, neither of which tends to be removed from solution by precipitation.

SALT CONCENTRATION DUE TO EVAPOTRANSPIRATION

Irrigation Efficiency = Consumptive Use of Applied Water
Applied Water
Furrow Irrigation 50%
Sprinkler Irrigation 67%
Drip Irrigation 85%

If all of the salt constituents in the applied water are not subject to a net precipitation (removal from solution) in the topsoil and vadose zone, then the deep percolation would contain all of the salts in the applied water. A salt concentration occurs because these salts then are in a smaller volume of water in the deep percolation, compared to in the applied water.

For a 50% irrigation efficiency, the TDS concentration in the deep percolation would be double the TDS concentration in the applied water.

For a 67% irrigation efficiency, the TDS concentration in the deep percolation would be triple the TDS concentration in the applied water.

For an 85% irrigation efficiency, the TDS concentration in the deep percolation would be 8.5 times the TDS concentration in the applied water.

If the average TDS concentration in well water in Pleasant Valley is 1,500 mg/1, then the TDS concentration in deep percolation from sprinkler irrigated lands would be 4,500 mg/1. For drip irrigation, the TDS in the deep percolation would be almost 13,000 mg/1.

However, not all of the cations and anions in the applied water are considered 100 percent mobile in the topsoil and vadose zone. In particular, calcium and bicarbonate can be precipitated from solution and become solid calcium carbonate. This could occur during drying out periods between irrigation periods. All of this removed calcium carbonate may not re-enter solution during subsequent irrigation events. Calcium and sulfate can also precipitate from solution and become solid gypsum. This could also occur during drying out periods between irrigation periods. All of this gypsum may not re-enter solution during subsequent irrigation events. The U.S. Salinity Laboratory in Riverside has conducted a substantial amount of research on irrigation and deep percolation.

It would appear that TDS concentrations of at least 4,500 mg/1 would readily have occurred in deep percolation in Pleasant Valley. However, greater increases in TDS would at least partly be controlled by salt precipitation.

Because of the expected eventual TDS increases in the groundwater, as more and more deep percolation reaches the groundwater, it is recommended that a monitoring program be developed to evaluate this process in more detail.

MIXING OF DEEP PERCOLATION WITH GROUNDWATER

Most irrigation wells in Pleasant Valley are perforated opposite at least several hundred feet of saturated deposits. Once the deep percolation reaches the groundwater, it is not expected to mix with all of this groundwater but rather to reside in the upper part of the aquifer, probably within the uppermost 100 feet or so of the water level. Sampling of water from irrigation wells represents a mixture of water from many permeable layers of alluvium at different depths that are tapped by the wells. Because the deep percolation would be present only in the upper part of the aquifer, increases in TDS concentrations due to deep percolation would be difficult to detect by supply well sampling. However, information on deep percolation in the vadose zone (above the water table) can be obtained by analyzing water samples from cascading wells. Cascading water occurs when water trapped above clay or other low permeability layers enters shallow perforations or other openings above the water level, then falls down inside the casing to the water level. Samples of this water can be obtained when the pump is removed by bailing water from the well below where the water enters the casing. In addition, shallow monitor wells can be installed, tapping groundwater within about 30 feet of the water level.

B.3 - Deep Percolation of Precipitation

The following empirical equation was developed for the San Joaquin Valley by estimating soil moisture budgets over a 50-year period.

DP = 0.64 x P – 6.2

Where:

DP = Deep percolation (inches)
P = Annual precipitation (inches)
Source: Williamson, Prudic and Swain, 1989

Note, that when using this equation, if annual precipitation is less than 9.69 inches, then deep percolation will not occur.

Several references suggest that deep percolation of precipitation is relatively low or negligible in the subbasin and thus is estimated to be zero. Kahanovitz (1954) says "*It therefore seems safe to assume that all of the direct rainfall on the valley floor either evaporates or infiltrates and is subsequently lost by evapotranspiration*."

B.4 - Deep Percolation of M&I Water

Deep percolation of M&I water includes two components: 1) Indoor water usage sent to treatment plants and septic systems and 2) Outdoor landscape and wash water that percolates past the root zone to the groundwater.

When sewer flows are known, the volume percolated is equal to wastewater plant deliveries minus percolation pond evaporation. Data from the City of Coalinga from 2014-2019 showed that 11% of the wastewater is lost through the treatment process. An additional 4% is assumed lost to evaporation resulting in 15% total lost before the effluent is percolated. As a result, it was assumed that 85% of effluent percolates to the groundwater.

It is assumed that 15% of outdoor water percolates to the groundwater with the remainder lost primarily to evapotranspiration of landscaping and smaller amounts to evaporation of swimming pool water and wash water.

City of Coalinga water is used in five different ways: 1) Urban (domestic) use, 2) Rural Use, 3) Oil Companies, 4) Pleasant Valley State Prison, and 5) Coalinga State Hospital. Each of these have different percentages of water that eventually percolate into the aquifer based on records provided by the City of Coalinga and several assumptions.

- Urban (domestic) Use: This represents single- and multi-family home use and other uses not listed below. All of the water is sent to a wastewater treatment plant and the effluent is percolated.
- Rural Use: This represents indoor drinking water that the City of Coalinga sends to an estimated 300 people in areas near Coalinga. Ninety percent of the water is returned to the groundwater through septic systems.
- Oil Companies. This water is used by oil companies for various purposes. All of the water is assumed to be lost due to evaporation or deep injection below the usable groundwater.
- Prison and State Hospital. Water use data for these two facilities was available, but the amount used indoors versus outdoors was not provided. It was assumed that 20% was used outdoors and that indoor water is treated and sent to percolation ponds for the State Hospital, and the Prison water was sent to a combination of percolation ponds and agricultural irrigation as previously indicated.

Deep percolation of M&I water is an important component in the water budget and was estimated at about 1,800 AF/year during the historical period of 1998-2017.

B.5 - Seepage of Channels and Pipelines

There are no open channels in the Subbasin. Water is conveyed through pipelines in the City of Coalinga system and the Southern Pipeline used for agricultural irrigation surface water (see **Figure 3-15** for location). No information was available on pipeline leakage rates. As a result, leakage rates were assumed to be 4% for the City of Coalinga system, which is a typical rate for a city water system, and essentially 0% for the recently constructed Southern Pipeline.

B.6 - Seepage of Reservoirs
The City of Coalinga has several steel water tanks; these are assumed to have no seepage. Percolation from small grower-owned irrigation ponds was assumed to be negligible. This variable does not include wastewater effluent percolation ponds which are covered under B.4 - Deep Percolation of M&I Water. Several reservoirs owned by oil companies are located in the Subbasin. These are used for storing surface water purchased from the City of Coalinga or "produced water," which is water that is brought up to the surface with oil. These types of ponds are typically lined, and it is assumed that there is no seepage and all the water evaporates or is injected back in the oil wells below the usable aquifer.

B.7 - Urban Stormwater – Recharge
The City of Coalinga has several stormwater basins for collecting urban runoff. The City does not monitor flow into the basins or estimate the volume infiltrated. Consequently, guidelines established by other stormwater management agencies were researched. Fresno Metropolitan Flood Control District (FMFCD) operates stormwater ponds that capture runoff from the Fresno/Clovis urban area, located east of the Subbasin. FMFCD maintains records of operations, and based on local rainfall records over the Fresno-Clovis areas, their records indicate that about 20% of the local rainfall percolated through stormwater basins. It was assumed that deep percolation of precipitation in landscape and bare soils areas is negligible in urban areas. It was therefore assumed that 20% of the rainfall in the City of Coalinga percolates in their stormwater basins.

B.8 - Streams – Recharge
Four primary streams flow into the Subbasin: Los Gatos Creek, Warthan Creek, Jacalitos Creek, and Zapato Chino Creek. These four streams ultimately combine to form the Arroyo Pasajero. The Arroyo Pasajero begins at the confluence of Los Gatos and Zapato Chino Creeks and flows easterly into a retention basin east of Huron. The Los Gates Creek passes through the Pasajero Gap, and Zapato Chino Creek passes through the Polvadero Gap. The Arroyo Pasajero Watershed encompasses approximately 529 square miles over an area of about 35 miles wide by 16 miles long. The watershed area is illustrated in **Figure 3-39**.

As shown in **Figure 3-39**, four watersheds drain into Pleasant Valley and are the major source of recharge to groundwater. Some of the streamflow entering the valley percolates, but some in the Arroyo Pasajero flows out of the Valley. Flow in these streams is intermittent due to the watershed's relatively low precipitation rates

Kahanovitz and Manning (Kahanovitz & Manning, 1954) attempted to estimate stream flows into Pleasant Valley from some limited Los Gatos Creek flow data. They stated, "The total runoff in Pleasant Valley is unknown but, based on the figures for Los Gatos Creek above Nunez and the rainfall at Parkfield, at least the magnitude of total runoff can be estimated. Assuming the runoff in the entire valley is proportional to that in Los Gatos Creek drainage, a rough estimate of average runoff for the period 1937 to 1951 would be about 16,000 AF/year for the valley." This represents flow into Pleasant Valley but not all of this flow would necessarily percolate in the valley.

Los Gatos' stream flow has been measured since the 1930s by the DWR. The other streams have been measured sporadically over time. The Pleasant Valley Water District has recently expanded streamflow measurements effort with the installation of several new stream gauges.

Flow in the streams are difficult to measure because of the flashy nature of the streamflow. DWR (1990) stated that "Accurate streamflow measurements along the Arroyo and its tributaries are difficult to obtain by conventional means during high flows, due to extremely high velocities, unstable streambeds on some tributaries, and considerable floating debris." After several years of data are collected with the new gauging stations, future estimates of the flows will be more reliable.

The watershed also contributes water to the Subbasin through mountain-front groundwater inflow. Consequently, streamflow seepage in the watershed is estimated to average about 14,000 AF/year based on

evaluation of historical water budgets. It is recognized that the historic information is sporadic and of a definition and detail that should continue to be better defined and documented.

Since the first submittal of this report, the Subbasin has installed flow measurement devices in the stream to measure flow coming into the subbasin and leaving the subbasin, this information will be used to measure recharged water in the streams. The recharged water from the watershed is not tabulated as it unknown how water makes it down into the subbasin. These will be discussed later in the report.

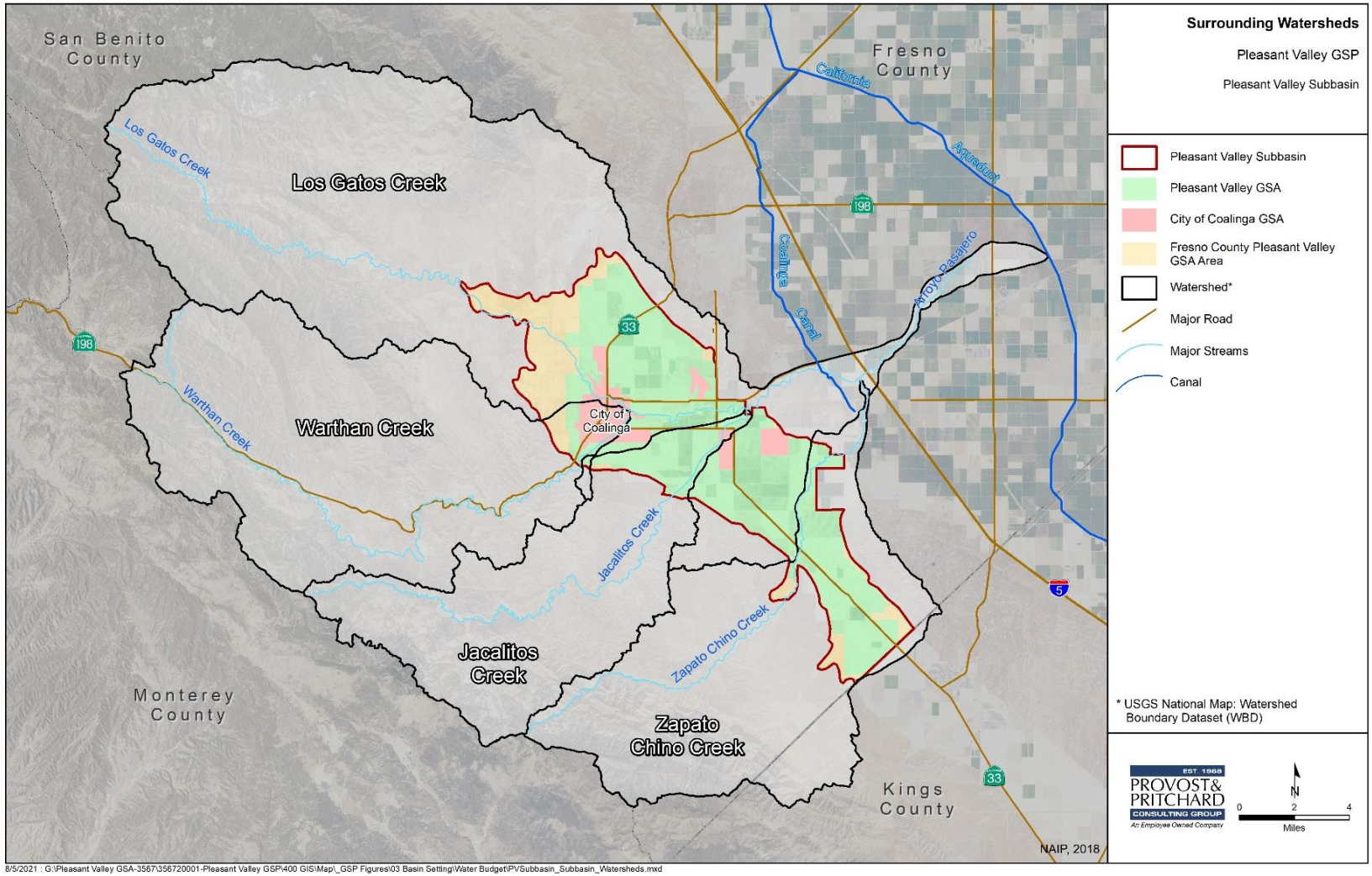


Figure 3-39 Tributary Watersheds

3.3.6 Outflows from Groundwater System

Regulation Requirements:
§354.18(b) The water budget shall quantify the following, either through direct measurements or estimates based on data:
(3) Outflows from the groundwater system by water use sector, including evapotranspiration, groundwater extraction, groundwater discharge to surface water sources, and subsurface groundwater outflow.

The primary outflow from the groundwater is pumping, which was estimated for agricultural and domestic purposes as described below. Other outflows from the groundwater basin are also summarized.

C.1 - Groundwater Pumping for Irrigation
Most irrigation groundwater pumping in the Subbasin has either not been measured or has not been reported to the GSAs prior to the first submittal of this GSP, since then groundwater pumping data is being gathered from about 98% of all wells within the subbasin. In groundwater only areas, the groundwater pumping is the crop evapotranspiration demand less effective precipitation, divided by an average irrigation efficiency. In conjunctive use areas with surface water and groundwater, the groundwater pumping must be back calculated using several water budget variables if well pumpage is not metered. In a simple situation, the following formula is used:

Private Irrigation Pumping = Crop applied water demands – Surface water deliveries to growers

where:

Crop applied water demands = (Crop evapotranspiration less effective precipitation) / Irrigation efficiency

and

Surface Water Deliveries to Growers = Headgate diversions – System leakage

As a result, private irrigation pumping can be calculated with the following formula:

Private Irrigation Pumping = (Crop evapotranspiration less effective precipitation) / Irrigation efficiency – Headgate diversions + System leakage

Agricultural groundwater pumping during the 2011-2021 current period was estimated to average about 43,100 AF/year based on land use maps and crop evapotranspiration rates. Most of the groundwater pumping was performed by private landowners; however, a small amount was pumped by West Hills Community College at their on-campus farm "Farm of the Future." This farm is located within the City of Coalinga GSA. Moving forward, it is recognized that the best way to track and account for groundwater pumpage is to measure it with totalizing flowmeters.

C.2 - Groundwater Pumping for M&I
M&I groundwater pumping comes from domestic water users outside of the City of Coalinga. In some areas near Coalinga, treated surface water is delivered by the City to rural residents for indoor water use only. In these areas, domestic wells may be used to meet outdoor water demands. In other areas of the Subbasin, all domestic demands are met by domestic wells.

The unincorporated population served by the City of Coalinga is estimated to be 300 people based on data from the City of Coalinga, and the population in other unincorporated areas of the Subbasin is estimated at 156 people based on 2010 Census data. Lacking any local data, per capita demands were assumed to be 0.5

AF/capita/year based on an evaluation of rural areas in the Fresno/Clovis area of Fresno County and documented in the North Kings Groundwater Sustainability Plan (Provost & Pritchard Consulting Group, 2020). Indoor water was assumed to comprise 30% of total water use, and outdoor water was assumed to comprise the remaining 70%, which is similar to the trends in the City of Coalinga. Total domestic water pumping in the Subbasin is small and estimated to be about 200 AF/year.

Granite Construction pumps an estimated 75 AF/year for aggregate washing with 95% re-percolating to the groundwater. The net consumptive use is considered negligible, so it was ignored in the water budget.

C.3 - Evapotranspiration of Applied Water – Irrigation
This variable represents crop evapotranspiration minus effective precipitation. This was estimated using cropping land use data and selected crop evapotranspiration rates.

Cropping data was used from DWR Land Use Maps (2000), DWR Land IQ supplemented with USDA Cropscape data (2014), and USDA CropScape data (2007, 2016 and 2019). Cropping data was estimated in years with no data and areas that were not mapped.

Table 3-6 includes the selected crop evapotranspiration rates used. These are a combination of rates published by the Cal Poly Irrigation Training and Research Center for Zone 10 with some adjustments based on input from local PVWD growers who are familiar with actual water use in the area. The GSA will now use actual flowmeter data for actual groundwater pumping volumes. These ET values are high for the PV Subbasin area.

Table3-6 Crop Evapotranspiration Rates

Crop Category	ET Rate (ft/yr)
Alfalfa	3.7
Field Crops	2.0
Grains and Hay Crops	1.5
Pistachios (mature)	3.25
Pistachios (immature)[1]	1.9
Winter Wheat	1.5

Notes:
1 – Average value over 10-year maturation period

The average crop water demands from applied water for the Subbasin after effective precipitation from 1998-2010 were estimated to average 23,700 AF/year.

There are several issues with the cropping and evapotranspiration data:

1) Crop water demands for wheat and winter wheat can vary, depending on whether they are grown year-round, part of the year, or rely largely on rainfall. No specific data were available to assess the multiple parcels plotted in wheat. However, former PVWD staff estimated that 1.5 AF/year was used on grain crops.
2) Grain and hay crops could have widely variable ET rates. The rates shown are estimated for grains.
3) Land use data were only available for a few years and had to be estimated for most years in the historical period. The different data sources used different terminology and crop categories, and some areas had no data available, presenting some challenges in estimating demands. In addition, most crop surveys did not differentiate between mature and immature pistachio trees, which have a significant difference in water demands. The area of immature trees was estimated based on the maturity period and the increase in planting between data sets.

To resolve these issues, it is recommended that the GSA perform their own crop survey annually. This is considered relatively straightforward where permanent crops are planted. In addition, it should be noted if wheat and pasture are irrigated or dry farmed.

C.4 - Evapotranspiration of Applied Water – M&I

Evapotranspiration of M&I water primarily includes landscape irrigation demands plus some additional evaporation from swimming pools and wash water. First, the quantity of M&I water used outdoors needs to be determined. When total water deliveries and sewer flows are known, then outdoor water use is simply the difference between the two values. When total pumping and sewer records are not available, then outdoor water use was assumed to be 70% of total water demands, which is based on outdoor use in the City of Coalinga. It was assumed that 85% of total outdoor water use is lost to evapotranspiration of landscaping and evaporation of swimming pools and outdoor wash water.

C.5 - Evapotranspiration of Effective Precipitation

Effective precipitation is the amount of rainfall beneficially used by crops, either directly as transpiration or through storage in the root zone and evapotranspiration in subsequent periods. The effective precipitation for the Subbasin was developed using a set of empirical formula developed for the San Joaquin Valley (MacGillivray & Jones, 1989). Where EFF is effective precipitation and GROSS is gross rainfall, the formulas for the rainy season and shoulder months are:

Oct:	EFF = -0.06+ (0.635 x GROSS)
Nov – Feb:	EFF = -0.54 + (0.94 x GROSS)
March:	EFF = -1.07 + (0.837 x GROSS)

The effective precipitation averages about 3.2 inches per year and about 4,000 AF/year over the irrigated area from 1998-2017.

C.6 - Evaporation from Conveyance Channels

All water in the Subbasin is transported by pipeline and there are no evaporative losses from conveyance channels. Surface water is delivered to the Subbasin through the Coalinga Canal, which is a concrete lined canal that is located outside of the Subbasin. However, diversions are measured at the canal turnouts where water enters pipelines, so evaporation losses in Coalinga Canal are not relevant.

C.7 - Evaporation from Reservoirs and Recharge Basins

There are no surface reservoirs (except for enclosed steel tanks) or recharge basins in the Subbasin used for domestic or agricultural water. There are plans to install recharge basins or recharge in local creeks in the future. The surface water sold by the City of Coalinga to oil companies is assumed to evaporate in lined ponds or after washing equipment, etc. These losses are not reported here but rather in C.4 - Evapotranspiration of Applied Water – M&I. Lastly, some water is brought to the surface with oil drilling operations. Some may evaporate in lined ponds. However, it was assumed that this water is not pumped from below the usable aquifer and is not a relevant part of the water budget.

C.8 - Evaporation and Runoff of Precipitation

Evaporation and runoff of precipitation are a residual (i.e., left over) value in the water budget. All of the precipitation that is not used in transpiration from crops is considered to be evaporated.

This represents a non-recoverable loss that does not impact either water supplies or demands. This water either evaporates or is utilized by pasture/rangeland.

C.9 - Operational Spills

This represents spills of surface water leaving the boundary of an irrigation or water district and is considered a non-recoverable loss to that district. There are no known operational spills in the Subbasin.

C.10 - Groundwater Exports
This represents the export of groundwater from one agency into another, typically based on metered well pumping. Groundwater exports can occur from water transfers, exchanges, banking agreements, or groundwater deeds. Groundwater exports by landowners that own adjacent properties on an agency boundary (one in the agency and one just outside) were neglected, since it is assumed that they are minor and tend to balance each other out. There are no known groundwater exports from the Subbasin.

C.11 - Groundwater Outflows
A discussion on the potential for groundwater outflows is provided in **Section 3.3.6**. A preliminary analysis by KDSA indicates that there is groundwater flowing out of Pleasant Valley through the Pasajero Gap. Groundwater level data showed an 80-ft water level difference over 2.75 miles across the Gap. From this slope and transmissivity value, the groundwater outflow was estimated to be 1,700 AF/year. This estimate will be refined in the future with more data.

C.12 - Irrigation Efficiencies
Field crops and grains are assumed to use flood/furrow or sprinkler irrigation and have an efficiency of 67%. Trees are assumed to use drip or micro-spray and have an assumed irrigation efficiency of 85%. Urban landscape irrigation efficiencies are assumed to be 75% based on efficiencies in other areas of the San Joaquin Valley (Davids Engineering, 2018).

3.3.7 Change in Groundwater Storage

Regulation Requirements:
§354.18(b) The water budget shall quantify the following, either through direct measurements or estimates based on data:
(4) The change in the annual volume of groundwater in storage between seasonal high conditions.

D.1 - Groundwater Storage Change
Storage change in the aquifer for the historical and current hydrologic period was estimated based on Water budgets and water level hydrographs.

Table 3-7 includes a groundwater storage change of -8,400 AF/year estimated based on a historical water budget analysis.

Note that these groundwater storage changes discussed above represent the average historical conditions, and not current conditions, which have higher overdraft and are discussed later in this section.

D.2 - Groundwater Released from Aquifer Compaction
Water release from aquifer compaction occurs when clay collapses due to lowered water levels in confined aquifers. The land subsidence is caused by groundwater over-pumping, which lowers water tables below the clay layers. This essentially squeezes water out of the clay and creates a new one-time water source that would otherwise not be available. Hence, the water is mined from the clay layers. Land subsidence primarily occurs in areas with confined aquifers.

As discussed in **Section 4.6**, available data indicate that land subsidence has been minimal in the Subbasin during the historical period (1998-2010). Subsidence generally averaged between zero and ½-inch over the Subbasin from 2015-2018. As a result, the groundwater released from aquifer compaction was assumed to be

negligible in the historical water budget. It is assumed that no subsidence occurs in future water budgets (2042 and 2072) as water levels will be stabilized.

3.3.8 Historical Water Budget

Regulation Requirements:
§354.18 (c) Each Plan shall quantify the current, historical, and projected water budget for the basin as follows:
(2) Historical water budget information shall be used to evaluate availability or reliability of past surface water supply deliveries and aquifer response to water supply and demand trends relative to water year type. The historical water budget shall include the following:
(a) A quantitative evaluation of the availability or reliability of historical surface water supply deliveries as a function of the historical planned versus actual annual surface water deliveries, by surface water source and water year type, and based on the most recent ten years of surface water supply information.
(b) A quantitative assessment of the historical water budget, starting with the most recently available information and extending back a minimum of 10 years, or as is sufficient to calibrate and reduce the uncertainty of the tools and methods used to estimate and project future water budget information and future aquifer response to proposed sustainable groundwater management practices over the planning and implementation horizon.
(c) A description of how historical conditions concerning hydrology, water demand, and surface water supply availability or reliability have impacted the ability of the Agency to operate the basin within sustainable yield. Basin hydrology may be characterized and evaluated using water year type.
(d) The Agency shall utilize the following information provided, as available, by the Department pursuant to Section 353.2, or other data of comparable quality, to develop the water budget:
(1) Historical water budget information for mean annual temperature, mean annual precipitation, water year type, and land use.

A historical water budget using data on cropping and other local inputs was prepared for the Pleasant Valley Groundwater Subbasin to compare the methodology previously described covering the period of 1998-2010.

Long-term Historical Average Water Budget
The long-term average water budget for the Subbasin is shown in **Table 3-7.**

Table3-7 Pleasant Valley Subbasin Historical Average Groundwater Budget (1998-2010) (AF/year)

Outflows	Groundwater Pumpage	34,400 AF
	Groundwater Outflow	1,700 AF
	Subtotal	36,100 AF
Inflows	Imported Surface Water	6,200 AF
	Stream Recharge	14,000 AF
	Urban Water Recharge	500 AF
	Subtotal	20,700 AF
	Change in Storage	-15,400 AF

Uncertainty in Water Budgets
There is uncertainty in some of the water budget parameters. The parameters with the least uncertainty, estimated at plus or minus 5%, are limited to surface water diversions which are directly measured. The largest components of water use, evapotranspiration of applied water as well as stream flows and pumpage, are estimated to have an accuracy of plus or minus 15%. There is uncertainty in the downward flow of recharge from stream flows as well as the flow from the upper watershed entering the subbasin floor. Water budgets need to be verified with groundwater level monitoring and documentation of pumping.

3.3.9 Current Groundwater Budget

Regulation Requirements:
§354.18 (c) Each Plan shall quantify the current, historical, and projected water budget for the basin as follows:
(1) Current water budget information shall quantify current inflows and outflows for the basin using the most recent hydrology, water supply, water demand, and land use information.
(d) The Agency shall utilize the following information provided, as available, by the Department pursuant to Section 353.2, or other data of comparable quality, to develop the water budget:
(2) Current water budget information for temperature, water year type, evapotranspiration, and land use.

A Current groundwater Budget was prepared for the Subbasin based on the following criteria:

1. Agricultural demands were based on a 2019 USDA Cropscape use maps, which is the most recent comprehensive land use map for the area. All of the pistachio plantings were assumed to be mature, even though some may have been immature and used less water in 2019. Assuming full maturity maximizes water use and reflects what the actual water use would be in future years.
2. Urban (domestic) surface water supplies were based on the long-term average supplies from the historical water budget and not the actual supplies delivered in 2019.
3. Agricultural surface supplies were based on actual surface water deliveries in 2019.
4. Other variables not described above were assumed to be the same as the historical water budget averages. This was to allow the water budget to reflect current and average conditions, rather than the specific hydrologic conditions in 2019, which were drier than normal.

The Current Water Budget is shown in **Table 3-8.** Overall, the water budget shows a greater decrease in groundwater storage compared to historical conditions, largely the result of higher crop water demands due to increased plantings and maturation of pistachio trees. The net decrease in groundwater storage is based on water-level declines was estimated to be 17,400 AF/year. The water balance method indicates an average annual decrease in storage of 19,700 AF.

Table 3-8 Pleasant Valley Subbasin Average Annual groundwater Budget (AF/year)

Outflows	Groundwater Pumpage	43,100 AF
	Groundwater Outflow	1,700 AF
	Subtotal	44,800 AF
Inflows	Imported Surface Water	10,600 AF
	Stream Recharge	14,000 AF
	Urban Water Recharge	500 AF
	Subtotal	25,100 AF
	Change in Storage	-19,700 AF

The overdraft number the subbasin will be using for the management activities will be 20,000 AF/yr. The groundwater balance method will be used, because 98 % of all wells have flow meters and are monitored for volume of water pumped. Groundwater levels and water quality is gathered from all available wells during this process. The groundwater level changes will also be used in conjunction with the water balance method and be evaluated each year, with an option to update the GSP at the five-year milestone as needed to be sustainable.

Table 3-9 Pleasant Valley Subbasin Groundwater Budget for 2023 (AF/year)

Outflows	Groundwater Pumpage	35,200 AF
	Groundwater Outflow	1,700 AF
	Subtotal	36,900 AF
Inflows	Imported Surface Water	10,900 AF
	Stream Recharge	21,500 AF
	Urban Water Recharge	500 AF
	Subtotal	40,900 AF
	Change in Storage	+4,000 AF

The streams had water flow in them until mid-June due to water that was recharged in the watershed from rain events earlier in the year. Natural springs have begun to run in the watershed as well, this an indication of water moving into the subbasin from the watershed. As of July 2024, it is unknown how much water infiltrates from the watershed to the subbasin floor.

3.3.10 Projected Water Budget

Regulation Requirements:
§354.18 (c) Each Plan shall quantify the current, historical, and projected water budget for the basin as follows:
(3) Projected water budgets shall be used to estimate future baseline conditions of supply, demand, and aquifer response to Plan implementation, and to identify the uncertainties of these projected water budget components. The projected water budget shall utilize the following methodologies and assumptions to estimate future baseline conditions concerning hydrology, water demand and surface water supply availability or reliability over the planning and implementation horizon:
(a) Projected hydrology shall utilize 50 years of historical precipitation, evapotranspiration, and streamflow information as the baseline condition for estimating future hydrology. The projected hydrology information shall also be applied as the baseline condition used to evaluate future scenarios of hydrologic uncertainty associated with projections of climate change and sea level rise.
(b) Projected water demand shall utilize the most recent land use, evapotranspiration, and crop coefficient information as the baseline condition for estimating future water demand. The projected water demand information shall also be applied as the baseline condition used to evaluate future scenarios of water demand uncertainty associated with projected changes in local land use planning, population growth, and climate.
(c) Projected surface water supply shall utilize the most recent water supply information as the baseline condition for estimating future surface water supply. The projected surface water supply shall also be applied as the baseline condition used to evaluate future scenarios of surface water supply availability and reliability as a function of the historical surface water supply identified in Section 354.18**(c)(2)(a)**, and the projected changes in local land use planning, population growth, and climate.
(d) The Agency shall utilize the following information provided, as available, by the Department pursuant to Section 353.2, or other data of comparable quality, to develop the water budget:
(3) Projected water budget information for population, population growth, climate change, and sea level rise.

Projected water budgets (future water budgets) have been developed for 2042 and 2072. The 2042 water budget is the focus of this analysis since it is the year the Subbasin must be sustainable, and it represents near term periods and requires less speculative estimates of projected future climate change impacts, population growth, and land use change. The projected water budgets are shown without the new water supplies or water conservation from future projects, so they show the net impact if no action is taken.

Projected water budgets are based initially on the current water budget with changes made to various variables. **Figure 3-40** lists various variables that could potentially impact future water budgets.

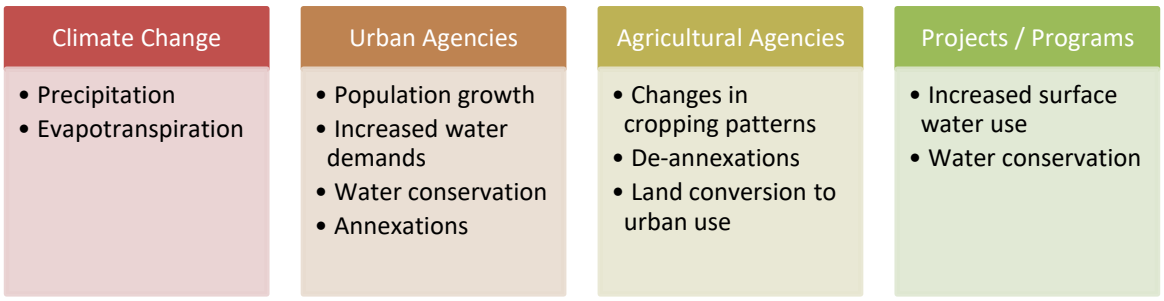


Figure 3-40 Variables Impacting Projected Water Budget

Climate Change

Climate change impacts were based on *Guidance for Climate Change Data Use During Groundwater Sustainability Plan Development* (DWR, 2018) and the related SGMA climate change website: https://data.cnra.ca.gov/dataset/sgma-climate-change-resources. This document provided estimates for 2030 and 2070. Since 2040 is the deadline for sustainability, and therefore the focus of the water budgets, impacts from 2042 were interpolated between the 2030 and 2070 results. The 2072 conditions were assumed to be the same as 2070 estimates.

The DWR climate change datasets were developed for the California Water Commission's Water Storage Investment Program (WSIP). As described by DWR, the WSIP dataset is consistent with other DWR programs, is based on best available science, builds on previous efforts, incorporates the latest advances in projections, and follows the Climate Change Technical Advisory Group's guidance. The available datasets include central tendency projections of ensembles of general circulation models for 2030 and 2070 levels. The datasets also include climatic bookends for 2070 conditions with a drier, extreme warming scenario and a wetter, moderate warming scenario being provided. Only the central tendency simulations were used for preparing the water budgets. For the Subbasin, two DWR datasets were used – projected precipitation and projected evapotranspiration.

Precipitation

The WSIP climate change datasets generally showed minimal changes to precipitation. More details are provided in the figure below.

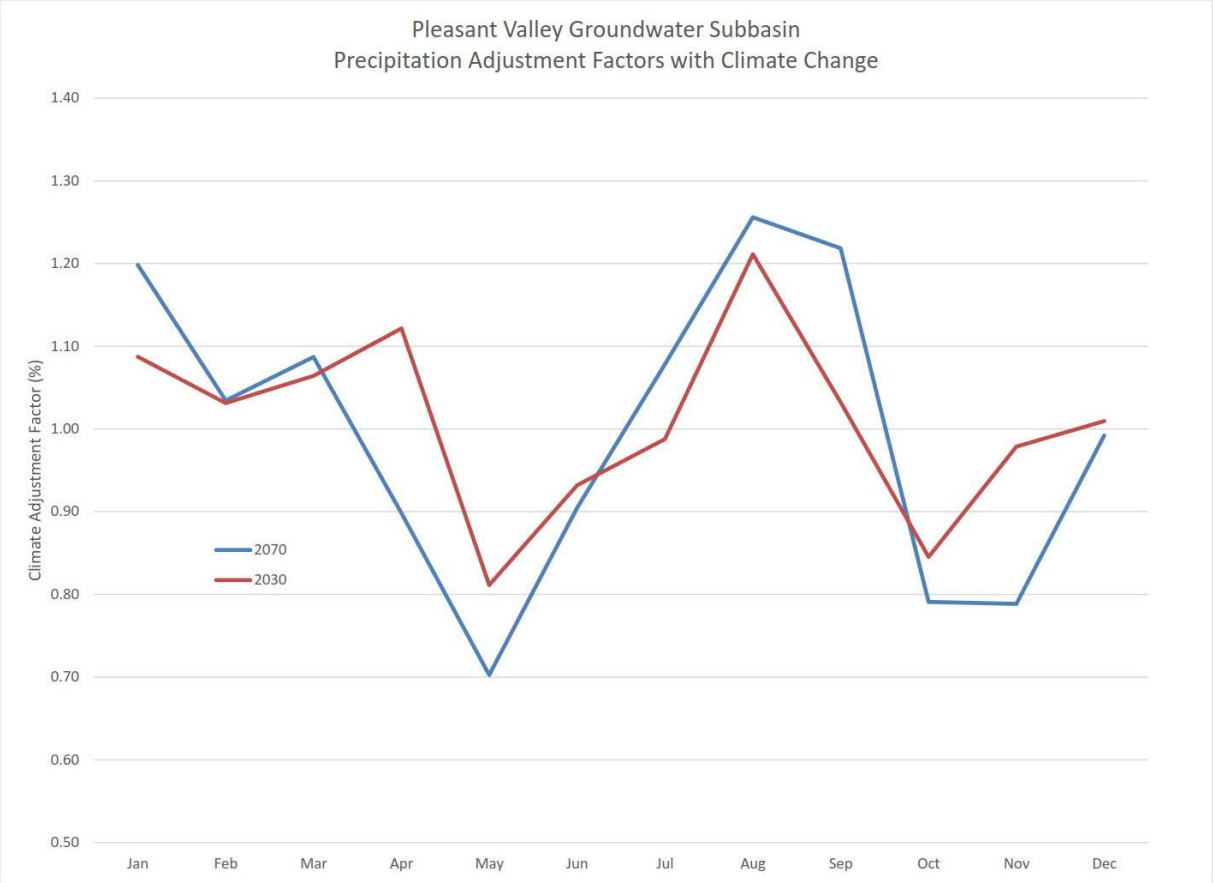


Figure 3-41 DWR Precipitation Adjustment Factors with Climate Change

Precipitation was evaluated by averaging the most recent 50 years of simulated changes to precipitation (1962-2011). The overall precipitation change factors were projected to increase by 0.9% for 2030 conditions and to decrease by 0.4% for 2070 conditions. When interpolated, this results in a 0.5% increase for 2042.

Moreover, the average monthly adjustment factors understate the effect on precipitation, as many of the months with projected decreases in precipitation (e.g., May, June, and October) are low precipitation months while months with indicated increased precipitation tend to be wetter (e.g., January and February). Given the generally low amount of precipitation in the Subbasin and the minimal changes anticipated from climate change, it is assumed that precipitation will remain the same for 2042 and 2072 projections as estimated for the historical period. Precipitation in the PV Basin is dependent on the amount that occurs in the watershed and the resulting streamflow in the streams that cross the valley. Based upon the above, it is assumed that streamflow in the future approximates the historical values.

Evapotranspiration

WISP evapotranspiration estimates were similarly evaluated by taking the average of 50 years of simulated climate change impacts (1962-2011). The projections predicted higher evapotranspiration rates for 2030

(3.1%) and 2070 (7.5%). Using interpolation, the 2042 increase is about 5%. **Figure 3-42** shows the impact on a monthly basis for 2030 and 2070.

The projections show some variation by month with higher rates in low evapotranspiration months (e.g., November, December, and January) when irrigation is small and smaller increases during the irrigation season (April through September).

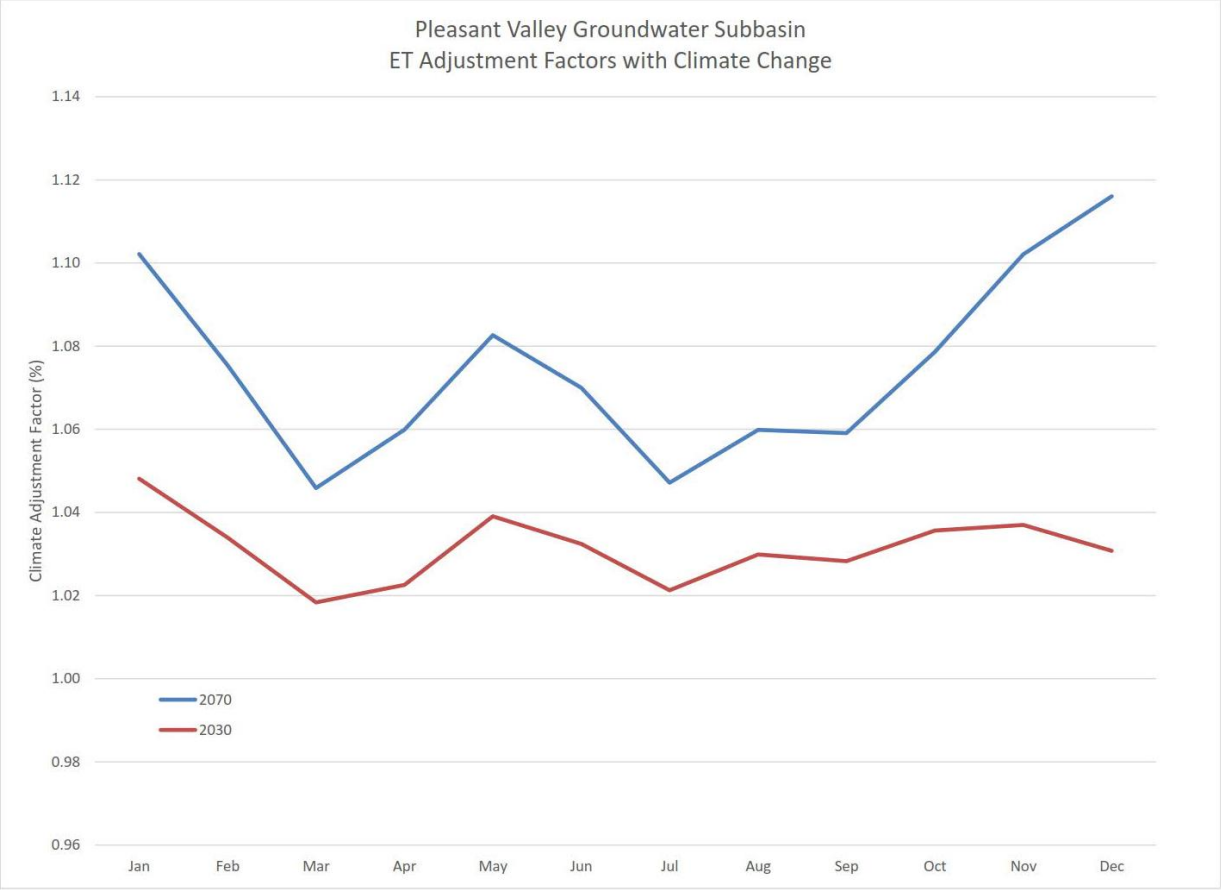


Figure 3-42 DWR ET Adjustment Factors with Climate Change

USBR (2015) predicted different impacts to annual crops versus perennial crops from climate change, as described below:

> "*Annual crop ET is projected to increase for perennial crops, with smaller increases, and sometimes slight decreases, for annual crops. Perennial crop ET increases are due to longer growing seasons and increases in ETo. While annual crops also experience increased ET rates, earlier potential planting dates and reduced growing season due to increased temperatures and crop development sometimes result in decreased annual crop ET." (USBR, 2015)*

As a result, crop evapotranspiration may only increase for perennial crops, but to be conservative, the expected increase was applied to both annual and perennial crops.

Future water use was updated for the City of Coalinga. The ratios of indoor use, outdoor use, and resulting recharge were left unchanged from the historical period. The higher anticipated ET is not expected to impact Urban (domestic) water use through higher landscaping demands, since urban agencies seek to manage water with per capita consumption goals, which will require less landscaping to accommodate the higher ET rates.

Urban and Agricultural Water Agencies

Urban and agricultural water agencies in Subbasin developed assumptions and estimates of future water demands through 2040. These are summarized in the table below.

Table3-8 Future Water Demand Assumptions by Organization

Organization	Future Water Demand Assumptions[1]
City of Coalinga GSA	Demands change in 2040 based on values in 2020 Draft Urban Water Management Plan. Surface water usage increases to 6,200 AF/year up from a long-term average of 5,500 AF/year.
Pleasant Valley GSA	Cropping assumed to be similar to the Current Water Budget (2019). Evapotranspiration rates increase due to climate change, but new crops are being developed.
Fresno County Pleasant Valley GSA Area	Cropping assumed to be similar to the Current Water Budget (2019). Evapotranspiration rates increase due to climate change.

1 – Demands do not include water used for intentional recharge

Projected 2042 Water Budget

The projected water budget for 2042 is shown in **Table 3-10.** The 2042 water budget includes the aforementioned impacts from climate change and estimated demand changes provided by the water agencies. The water budget shows the conditions with mitigation (projects or management actions) amounting to an import of 11,300 AF/yr of surface supplies to address the groundwater overdraft. The blue shaded numbers were modified from the Current Water Budget to account for future changes. Actions proposed to reduce the change in groundwater storage (or overdraft) are discussed in **Chapter 6 – Projects and Management Actions** such that the Subbasin will be sustainable in the future.

This water budget is subject to change as data collection expands and the understanding of the local hydrologic systems improves. It should be noted that the single most significant value is the stream runoff as well as precipitation in the budget.

Table3-9 Pleasant Valley Subbasin 2042 Groundwater Budget (AF)

Outflows	Groundwater Pumpage	23,400 AF
	Groundwater Outflow	5,000 AF
	Climate Change Impacts	500 AF
	Cropping changes from Row to Permanent Crops	1,000 AF
	Subtotal	**29,900 AF**
Inflows	Imported Surface Water	11,300 AF
	Stream Recharge	14,000 AF
	Urban Water Recharge	500 AF
	Deep Peculation	3,500
	Additional Stream Flow due to Climate Change	1,000 AF
	Subtotal	**30,300 AF**
	Change in Storage	**+400 AF**

In the year 2042 it is proposed to have reduce pumping by 20,000 AF, each 5-year period will see a reduction in pumping by 4,000 AF. The water balance method as well as water level declines, will be used to maintain sustainability and will be adjusted to assure sustainability throughout the five-year updates. Climate change impacts are additional Evapotranspiration that is expected to occur with an increase in temperature. Likewise additional stream flow is expected to occur and is accounted for in the table above. Cropping changes will likely happen from row crops to permanent crops and is accounted for in the table above.

Projected 2072 Water Budget

A projected water budget for 2072 conditions was also prepared using the following criteria:

- Crop evapotranspiration rates increased by 7.5% over current levels. This results in an overall increase in demands of (7.5% - 5.0%) x 44,700 AF/year = 1,100 AF/year above 2042 levels.
- Precipitation is estimated to decreased by 0.4%. This change is minor and ignored.
- Stream flow amounts used the historical average. These were included in the budget. More attention should be focused on runoff from watersheds above the basin.
- No changes were made to urban (domestic) groundwater demands. The year 2072 is beyond a practical planning horizon for most urban water agencies, and little data was available for estimating demands in 2072. In the area, urban growth may take over irrigated farmland. While the two use different quantities of water, only the difference in water usage is relevant, so growth impacts may be moderate. These assumptions will be re-addressed in future GSP updates.

Table 3-11 summarizes the impacts to groundwater storage from climate change impacts in 2072.

Table3-10 2072 Groundwater Storage Change without Mitigation

Description	Volume (AF)
Groundwater Storage Change (2042)	-22,500
Climate Change Impacts (2042 to 2072)	-1,100
Groundwater Storage Change (2072)	-23,600

While the local water agencies do not generally plan projects or funding 50 years in advance, the 2072 water budget does provide useful insight into potential challenges. As 2072 approaches and the true impacts of climate change are better understood, this water budget will be modified and updated.

3.3.11 Quantification of Overdraft

Regulation Requirements:
§354.18(b) The water budget shall quantify the following, either through direct measurements or estimates based on data:
(5) If overdraft conditions occur, as defined in Bulletin 118, the water budget shall include a quantification of overdraft over a period of years during which water year and water supply conditions approximate average conditions.

The presence of overdraft in the Subbasin is documented by a historical decline in groundwater levels and is confirmed by the historical water budget presented previously. The historical water budget for the period of Water Years 2006-17 represents the most recent average hydrological period. Using a water budget approach, the historical change in groundwater storage for 2017 is estimated to be slightly different at about 19,000AF/year. The 2017 overdraft number will be used for the planning and the implementation of projects to become sustainable. The overdraft is quantified using direct measurements of well extraction using flowmeters at the well, as well as data loggers at the entrance and exists to the streams. The overdraft will be mitigated using imported surface water, pumping curtailments and demand reductions (crop fallowing, seasonal and permanent).

3.3.12 Water Year Type Associated with Water Budget Comparisons

Regulation Requirements:
§354.18(b) The water budget shall quantify the following, either through direct measurements or estimates based on data:
(6) The water year type associated with the annual supply, demand, and change in groundwater stored.

Water year types were identified for the Subbasin based on streamflow seepage. Water types were identified for Wet, Normal, and Dry Years. Wet Years occur when precipitation is more than 125% of normal and Dry Years occur when streamflow seepage is less than 75% of normal. The water year types are summarized in **Table 3-4.**

3.3.13 Estimate of Sustainable Yield

Regulation Requirements:
§354.18(b) The water budget shall quantify the following, either through direct measurements or estimates based on data:
(7) An estimate of sustainable yield for the basin.

The "sustainable yield" for the Subbasin is defined as the amount of groundwater pumping that can occur while maintaining groundwater at sustainable levels and avoiding undesirable results. On average, maintaining groundwater pumping at levels that result in no long-term storage declines is used as the initial estimate of sustainable yield. The sustainable yield can be estimated as the Total Groundwater Recharge (from natural and artificial sources) minus the Groundwater Outflow. The Groundwater Recharge would include all of the recharge components shown in **Table 3-8**.

Using the change in levels methodology the sustainable yield is estimated at 23,500 AF.

Using the Current Water Budget (**Table 3-8**), the sustainable yield for the Subbasin is estimated to be:

22,600 AF – 0 AF = **22,600 AF/year**, which approximates the current groundwater pumping (43,300 AF/year) minus the overdraft (19,000 AF/year) and the groundwater outflow (1,700 AF/year).

Note: Values are rounded to the nearest 100 AF.

Due to the numerous uncertainties, assumptions, and estimates in the water budgets, the sustainable yield is considered approximate, but it gives a general idea of the groundwater available. This sustainable yield value is based on long-term average supplies under current demand and development conditions. The sustainable yield can and will likely change over time due to increased surface usage, changes in demands, and climate change impacts. As a result, the sustainable yield may go up or down over time.

It should be noted that this is a basin-wide sustainable yield, and this value cannot be used to estimate sustainable yield in local areas. The effective sustainable yield on a per acre basis may be different in different areas.

3.4 Management Areas

Regulation Requirements:
§354.20 (a) Each Agency may define one or more management areas within a basin if the Agency has determined that creation of management areas will facilitate implementation of the Plan. Management areas may define different minimum thresholds and be operated to different measurable objectives than the basin at large, provided that undesirable results are defined consistently throughout the basin.
(b) A basin that includes one or more management areas shall describe the following in the Plan:

3.4.1 Reason for Creation of Each Management Area

Regulation Requirements:
§354.20 (b) (1) The reason for the creation of each management area.

The Subbasin is home to three GSAs, and each GSA is considered its own Management Area. This is appropriate because of the variations in land uses, crop mixes, groundwater conditions, and surface water supplies between the GSAs; all of which will affect the fundamentals and details in the resulting GSP for the Subbasin.

3.4.2 Minimum Thresholds and Measurable Objectives

Regulation Requirements:
§354.20 (b) (2) The minimum thresholds and measurable objectives established for each management area, and an explanation of the rationale for selecting those values, if different from the basin at large.

The Subbasin GSAs have coordinated efforts in establishing minimum thresholds and measurable objectives. Minimum thresholds and measurable objectives for the Subbasin are discussed in **Chapter 4**.

3.4.3 Level of Monitoring and Analysis

Regulation Requirements:
§354.20 (b) (3) The level of monitoring and analysis appropriate for each management area.

The Subbasin GSAs have coordinated monitoring efforts and analysis. Monitoring within the Subbasin is discussed in **Chapter 5**.

3.4.4 Description of Management Areas

Regulation Requirements:
§354.20 (b) (4) An explanation of how the management area can operate under different minimum thresholds and measurable objectives without causing undesirable results outside the management area, if applicable.
(c) If a Plan includes one or more management areas, the Plan shall include descriptions, maps, and other information required by this Subarticle sufficient to describe conditions in those areas.

As noted above, each GSA within the Subbasin is considered its own Management Area. **Figure 2-3** illustrates the three GSAs in the Subbasin. There has been a coordinated approach within the Subbasin for each GSA so that each GSA does not cause undesirable results outside their GSA.

4 Sustainable Management Criteria

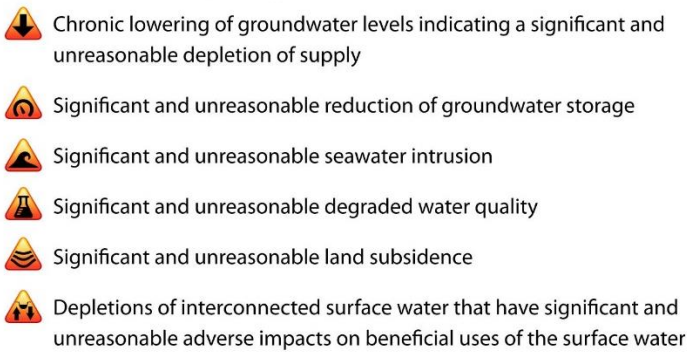
Regulation Requirements:
§354.22 This Subarticle describes criteria by which an Agency defines conditions in its Plan that constitute sustainable groundwater management for the basin, including the process by which the Agency shall characterize undesirable results, and establish minimum thresholds and measurable objectives for each applicable sustainability indicator.

SGMA defines sustainable groundwater management as "*the management and use of groundwater in a manner that can be maintained during the planning and implementation horizon without causing undesirable results.*" The avoidance of undesirable results is important to the success of the GSP. Several requirements from GSP regulations have been grouped together under the heading of Sustainable Management Criteria (SMC), including a Sustainability Goal, Undesirable Results, Minimum Thresholds (MT), and Measurable Objectives (MO) for various indicators of groundwater conditions. Development of these Sustainable Management Criteria is dependent on basin information developed and presented in the hydrogeologic conceptual model, groundwater conditions, and water budget chapters of the Pleasant Valley GSP (DWR, 2017). These terms are provided are provided in the table below:

Table4-1 Sustainability Criteria Definitions

Term	Definition
Sustainability Goal	A succinct qualitative statement including objectives and desired conditions of the groundwater basin, how the basin will get to that desired condition, and why the measures planned will lead to success.
Measurable Objective	Quantitative goals that reflect the basin's desired groundwater conditions and allow the GSAs to achieve the sustainability goal within 20 years.
Minimum Threshold	The quantitative value that represents the groundwater conditions at a monitoring site that, when exceeded individually or in combination with minimum thresholds at other monitoring sites, may cause undesirable result(s) in the basin.
Undesirable Result	A situation that occurs when conditions related to any of the six sustainability indicators become significant and unreasonable.

Indicators for the sustainable management of groundwater were determined by SGMA based on factors that are important to the health and general well-being of the public. Six indicators must be monitored throughout the planning and implementation period of the GSP including groundwater levels, groundwater storage volume, seawater intrusion, water quality, land subsidence, and interconnected surface water. In addition to these six indicators, this GSP recognizes that pumpage and crop consumptive use are critical to managing the resources of the basin and will include policy and actions to measure and record these occurrences on a yearly basis. This chapter will describe the indicators and why they are significant and will define the management thresholds.



The Sustainable Management Criteria described herein were prepared following the requirements set forth in the California Code of Regulations, Title 23, Division 2, Chapter 1.5, Subchapter 2, Article 5, Subarticle 3 (§354.22 through §354.30).

It should be recognized that the Subbasin that is being described for sustainable management is the unconfined/semiconfined aquifer in the Pleasant Valley. As has been described previously, the area has seen large scale oil production as is shown on the following historic photograph.



Figure 4-1 Coalinga in formative years – Pumping of a different type

Water production occurring with oil production is regulated by the State Division of Oil and Gas and is not covered under this plan.

4.1 Sustainability Goal

Regulation Requirements:

§354.24 Each Agency shall establish in its Plan a sustainability goal for the basin that culminates in the absence of undesirable results within 20 years of the applicable statutory deadline. The Plan shall include a description of the sustainability goal, including information from the basin setting used to establish the sustainability goal, a discussion of the measures that will be implemented to ensure that the basin will be operated within its sustainable yield, and an explanation of how the sustainability goal is likely to be achieved within 20 years of Plan implementation and is likely to be maintained through the planning and implementation horizon.

The sustainability goal of the Pleasant Valley GSP is to ensure that by 2042 groundwater pumping is measured and managed to maintain groundwater levels in the Subbasin so that a reliable water supply for current and future beneficial uses is afforded the landowners without experiencing undesirable results. This goal will be met by balancing water demand with available water supply to stabilize declining groundwater levels without significantly and unreasonably impacting water quality, land subsidence, or interconnected surface water. The goal of the subbasin is to correct and end the long-term trend of a declining water table,

understanding that water levels will fluctuate based on the season, hydrologic cycle, and changing groundwater demands within the Subbasin and its proximity.

The conditions within the Subbasin and this GSA will be considered sustainable when:

- Groundwater pumping amounts are in close approximation to the estimate of the sustainable yield; and
- Groundwater levels at Representative Wells, supported by hydrographs and water-level maps, indicate that the groundwater levels are not on a consistent downward trend over a ten-year period.
- Groundwater storage indicated by changing groundwater levels also normalize over a ten-year period do not show a reduction in storage.
- Land subsidence due to the extraction of groundwater does not exceed the past land subsidence due to groundwater pumping. The goal of the GSP is to have zero subsidence by 2024.
- Groundwater quality is not significantly diminished.

It is the intent of Pleasant Valley GSP participants to work collaboratively to continue to better understand the basin characteristics by establishing a coordinated network of monitoring points and reporting requirements. This will help to recognize existing hydrogeological patterns and to better refine SMCs in future Plan updates. It is also the intent of the Pleasant Valley GSP participants to establish criteria and implement programs and projects to monitor and manage groundwater levels and storage, protect water quality, and reduce the effects of subsidence in a manner that is open to the public and stakeholders and considers the needs of all beneficial users.

The intent for this GSP is to provide a tool for managing groundwater that will assist in maintaining Subbasin-wide sustainability for the long term. Sustainability will be determined by the Subbasin's ability to avoid undesirable results by establishing MTs and MOs of each applicable sustainability indicator defined in **Section 4.2. Chapter 3 – Basin Setting** provides insight to current and also historical groundwater conditions demonstrating the natural variability of the region. A water budget is also included, which quantifies factors contributing to inflows and outflows as well as sustainable yield estimates.

The following are some examples of reductions in surface water supplies that have occurred in the San Joaquin Valley that, while not directly attributable to the Subbasin, have had an effect on the variability of surface water supplies that have and will be available to the Subbasin. This lack of available surface supply has resulted in more groundwater pumping and as a result had undesirable results on the sustainable indicators described under each indicator.

The reductions in surface water supplies in the San Joaquin Valley total approximately 2,155,000 acre-feet per year (AF/yr) of surface water:

- The State Water Project (SWP) and Central Valley Project (CVP) water delivery reductions through the Central Valley Project Improvement Act (CVPIA) (circa 1992) have resulted in:
  - a decrease of SWP deliveries by an average of 600,000 AF/yr;
  - decreased pumping due to Fall X-2 restrictions by an average of 300,000 AF on the SWP;
  - a decrease of CVP San Luis Unit deliveries by an average of 780,000 AF/yr;
  - a decrease of diversions of about 400,000 AF/yr due to Oroville releases that cannot be pumped into the SWP; and
  - unallocated project yield being developed into contracted supplies (Cross-Valley Contracts and Mid-Valley Canal efforts).
- Biological Opinions (circa 2007) have resulted in:
  - a decrease of SWP deliveries by an average 240,000 AF/yr; and
  - a decrease of CVP San Luis Unit deliveries by an average of 325,000 AF/yr.
- The San Joaquin River Restoration program (circa 2010) has resulted in:
  - reduced deliveries from the Friant Division CVP by an average 210,000 AF/yr.

Additionally, Subbasin-wide effects to groundwater supplies may result from the following:

- Climate Change
  - Information developed by DWR suggests that warmer conditions could lead to more rain and/or earlier snow melt runoff (DWR 2017b).
  - Studies indicate increased temperatures could result in higher evapotranspiration rates, which could increase demand.
- Changing Crop Patterns
  - An increase in crop changes from annual crops to permanent crops with a higher and more constant water demand could result in an increase in groundwater demand, assuming the same number of acres are irrigated.
- Increased Urbanization
  - Increases in land use for cities and communities in areas not currently irrigated could result in an increase in demand in certain GSAs.

Changes in crop patterns have resulted in an increase in groundwater pumping throughout the Subbasin. The potential for undesirable results to occur for each sustainability indicator due to this increase in pumping is described in the following sections.

In order to achieve the goals outlined in the GSP, continued management practices, monitoring, and projects to secure alternative sources of water will be implemented over the course of the next 20 years. The PV basin has, over the past sixty years, experienced significant declines in groundwater levels and decreases in groundwater storage. The stakeholders are discussing whether unreasonable groundwater conditions have and are occurring that would lead to undesirable results. Plans to increase monitoring of the sustainability indicators will improve analysis of groundwater conditions in the future. Existing and planned projects and management actions to aid in GSP implementation are identified in further detail in **Chapter 6**.

To assess the path to sustainability, the sustainable management criteria will be evaluated in conjunction with the data obtained via monitoring efforts identified in **Chapter 5**. Every five years, the PV GSP participants can revise the GSP with the intention of refining the course to sustainability, based on information learned via monitoring, outreach, and improved data quality and quantity (i.e., adaptive management).

The measurable objective quantitatively reflects the sustainability goal for 2042 and the interim goals quantitatively represent the sustainability goal at five-year increments, corresponding with Plan update periods. Monitoring results will be compared to the interim goals, MO, and MT during Annual Report and GSP update development. The analysis will assess the Subbasin's ability to prevent undesirable results as they relate to the other SMCs.

The sustainability goal for the Pleasant Valley GSP is to increase the importation of surface water to the region for direct irrigation use as well as for intentional recharge to the groundwater basin. If additional mitigation is needed, then the GSAs may consider reductions in crop acreage to further reduce the amount of groundwater pumping in the basin.

4.2 Groundwater Levels

Water level decline has been occurring in the Subbasin since at least the early 1900s when development of the area to agriculture occurred. Over the decades, the cropping pattern has changed to meet the needs of the local area as well as reflective of the agricultural economy of the State. Current and historical information on water level decline is discussed in **Section 3.2.1** and the water level monitoring network is discussed in **Section 5.2**. The key to control groundwater level decline is to measure groundwater pumping and to control pumping to eliminate overdraft. Construction of projects to import surface water is planned to coincide with the reduction of groundwater pumping.

The plan for stabilizing water levels is to implement projects to import surface water and if needed institute demand reduction policies that will reduce the groundwater level declines over a base period first from more than 10 feet to 7 feet per year by 2025, then to 5 feet per year by 2030, to 3 feet by 2035, and to 0 feet per year by 2042. The monitoring plan envisions using all the active agricultural wells in the Subbasin for development of hydrographs to compare to the four representative monitor sites that will be used as the monitor tool for conformance with plan performance and compliance. Minimum thresholds have been developed to allow for seasonal fluctuations and hydrologic variability of watershed conditions above the Subbasin. In general, the minimum thresholds have been set about 50 feet deeper than the measurable objective. See Appendix Q for the worst-case model developed to calculate the groundwater level declines in setting the MO.

4.2.1 Pumpage

Groundwater levels are directly related to stream flow recharge and groundwater pumpage. As has been documented, the groundwater overdraft is directly related to the cultivation of crops. At present the consumptive use of the crops has outpaced the recharge. Either surface water needs to be imported or pumpage needs to be reduced, or a combination of the two needs to be employed to maintain sustainability of the groundwater. If projects are not implemented, then progressive reductions in pumpage will need to be employed to meet sustainability. Since the first submittal a curtailment policy is in draft form which reduce the pumping by 2024 by 20,000 AF. At each five-year milestone the curtailment policy and amounts will be evaluated based on groundwater levels changes, mandatory reductions in groundwater pumping maybe be needed to meet the sustainability goals of this GSP.

4.2.2 Undesirable Results

The terms “significant and unreasonable” are not defined by regulations, rather the conditions leading to this classification are determined by the GSAs, beneficial users, and the subbasin they are a part of. The process used to develop criteria for determining undesirable results began with discussions with stakeholders and landowners.

The critical first step is identifying the specific significant and unreasonable effects that constitute Undesirable Results. As water levels have declined, owners have continued to drill deeper wells and lower pump settings and paid higher costs for pumping water. Corresponding to these conditions, gas is now being experienced in some wells, it is unknown if these gases are naturally occurring or if a mitigation measure is needed, further discussion with well owners is needed. It is possible that conditions currently being experienced could be considered undesirable. Additionally, when water levels have declined to a depth that a new productive well cannot be constructed or when the water level has declined so as to compromise the life of a useful well would be considered undesirable results for groundwater levels. It is also undesirable to have cascading water and reduced pumping rates due to excessive water-level declines.

As shown in **Chapter 3 – Basin Setting**, recent water levels are hundreds of feet above the base of the unconfined/semi-confined aquifer in much of the Subbasin. The requirement to stabilize water levels by 2042 becomes the controlling condition for setting target water levels. The water level elevation at the anticipated point of stabilization is the Measurable Objective, discussed in more detail later in this section.

The goal of this GSP is to start to slow the decline in water levels, over time, as quickly as possible and feasible. The Management Objectives or Minimum thresholds are set to not create undesirable results; by slowing the rate of water level decline at each RMS. Review of the plan will occur at each interim milestone. The goal is to lessen the rate of decline in water levels in the basin. To this end the following is the initial goal of this GSP:

Existing rate of decline in water levels	10 ft/yr
2025 Goal	<7 ft/yr
2030 Goal	<5 ft/yr
2042 Goal	0 ft/yr

A graph of what this transition might look like is shown in Figure 4-2 below.

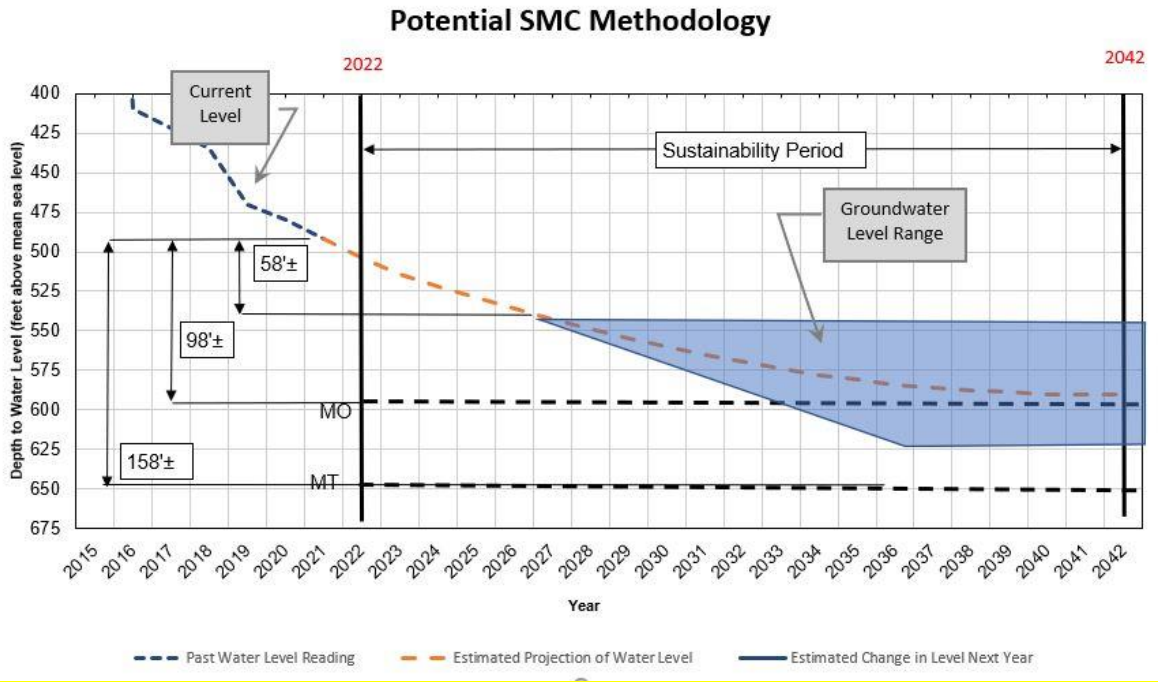


Figure 4-2 Potential SMC Methodology

The MT was set at an elevation to allow operational flexibility of the anticipated water level decline during a prolonged drought which has implications for both regional recharge and the ability to import surface water supplies. A more detailed description is provided later in this section. Also, for the different zones the shape and configuration of the curve will change based upon the local conditions of each area.

An analysis was run comparing the MOs to the perforations in the wells we were able search out using a "Script Program" from the DWR well database. The criteria were to use the lowest MO for the area shown on the map as the blue dashed line-watershed delineation. These areas are being tracked because of their different characteristics, such as different rate of decline in these areas, different cropping and pumpage

amounts, delayed influence from the upper watershed recharge. They are still in evaluation but are used and separated by different MOs and different MTs as you can see in the MT map as well. The goal was to compare MOs and MTs with the amount of submergence for each of these wells as a percentage, being that a trigger would be, if MOs or MTs were set at a level that created a well to have less than 70% submergence of the perforations. Below 70% submergence may cause a reduction in flowrate production of the well, to where the crops cannot be irrigated in time without causing stress to the crop and increase cost to pump the water.

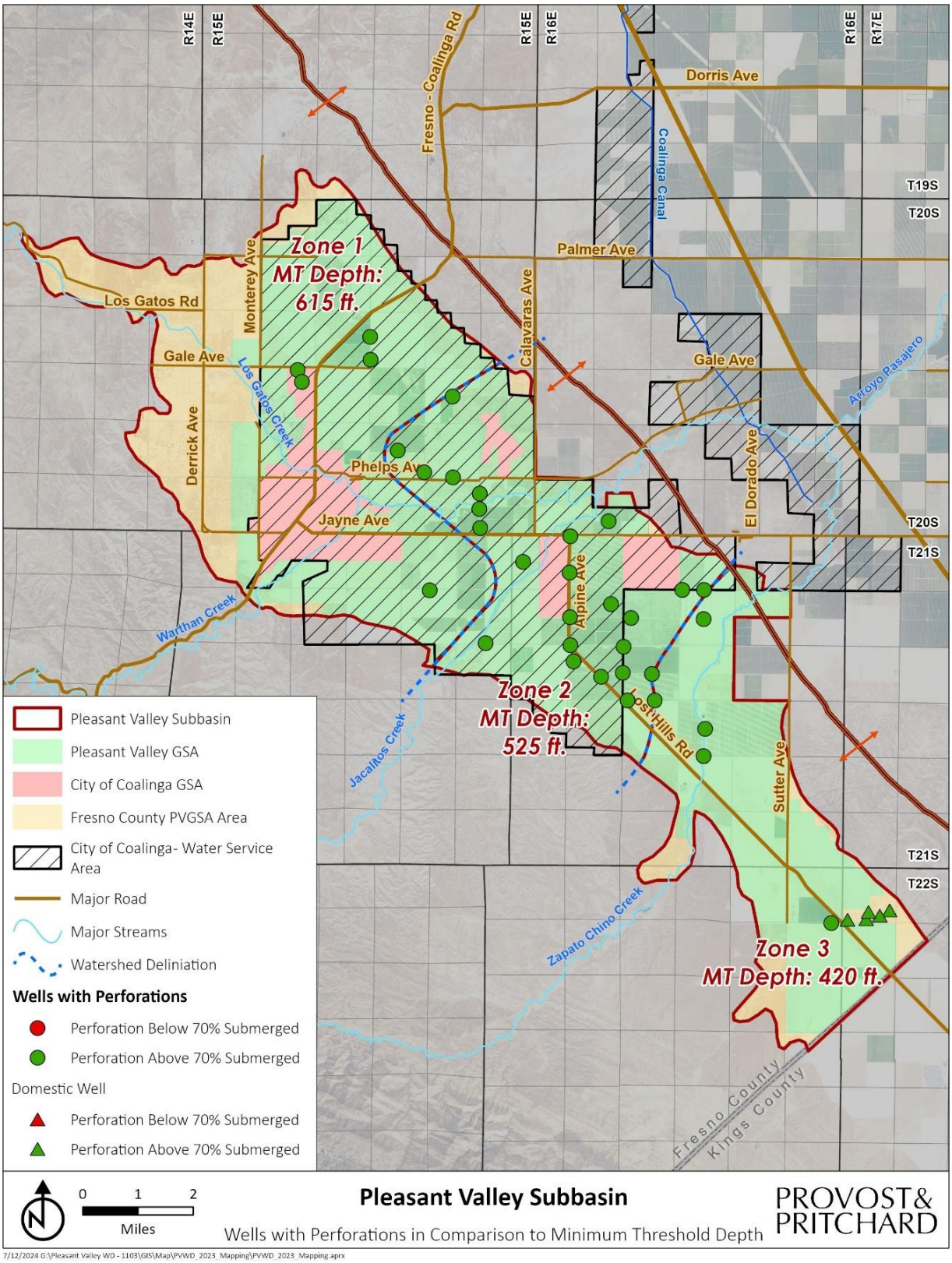


Figure 4-3 MT Analysis

Mitigation Measures:

Mitigation measures should the MTs be exceed are as follows:

1. Technical Assistance: Evaluation of the severity of the impacts to the landowners in the area.
    a. Paid for by PVGSA, up to $4,000 per situation, needs approval by PV Board.
2. Potential mandatory pumping restrictions.
    a. Paid for by landowner
3. Possible surface water importation.
    a. Paid for by landowner
4. Domestic Wells-See Appendix O Technical Assistance Flowchart.

4.2.2.1 Criteria to Define Undesirable Results

Regulation Requirements:
§354.26 (a) Each Agency shall describe in its Plan the processes and criteria relied upon to define undesirable results applicable to the basin. Undesirable results occur when significant and unreasonable effects for any of the sustainability indicators are caused by groundwater conditions occurring throughout the basin.

Undesirable Results occur when ground water levels decline below the MTs in three (3) wells within the area of an RMS. The RMS is meant to represent between 1 to 10 square miles. Our evaluation is based on a radius of 3 miles in and around the RMS or well in which the water level reaches the MT, as described below:

Irrigation Wells: Undesirable Results Below MTs when 3 wells within a 3-mile radius of the RMS experiences the following:

- Static water level submergence is below 70% of the total perforations, for one event, either spring or fall measurement. The following may be experienced due to the water level decline below the MT.
    - Approximate 30% loss in production of well capacity, based on 2024 pumping data rates,
    - Increase in estimated power cost, See Appendix Q, for an example of the model calculation for the increased pumping cost.
        - West area - 14% increase
        - Mid area - 23% increase
        - South area- 20% increase

Domestic Wells: Undesirable Results Below MTs when 1 domestic well experiences the following:

- Static water level submergence is below 70% of the total perforations, for one event, either spring or fall measurement. The following may be experienced due to the water level decline below the MT.
    - Approximate 30% loss in production of well capacity, based on 2024 pumping data,
    - Increase in estimated power cost of 20%,

4.2.2.2 Causes of Groundwater Conditions That Could Lead to Undesirable Results

Regulation Requirements:
§354.26 (b) The description of undesirable results shall include the following:
(1) The cause of groundwater conditions occurring throughout the basin that would lead to or has led to undesirable results based on information described in the basin setting, and other data or models as appropriate.
(2) The criteria used to define when and where the effects of the groundwater conditions cause undesirable results for each applicable sustainability indicator. The criteria shall be based on a quantitative description of the combination of minimum threshold exceedances that cause significant and unreasonable effects in the basin.
(3) Potential effects on the beneficial uses and users of groundwater, on land uses and property interests, and other potential effects that may occur or are occurring from undesirable results.

Based on collected data in the Subbasin, certain areas show long-term decline in groundwater levels, which if not addressed, may eventually lead to a reduction in usable groundwater supplies. However, as shown in **Chapter 3**, as the water levels deepen, it is expected that finer grained materials are present and the water yielding capacity is reduced. Also, the well capacities become reduced, and the costs for both drilling and maintaining the wells are increased.

Measurements of groundwater level depths have been collected intermittently across the Subbasin since the early 1900s as discussed in **Chapter 3.** By the 1950s, pumping had begun to alter groundwater flow conditions, so local groundwater depressions developed. Between 1990 and 2011, groundwater levels were relatively stable owing to the reduced and revised cropping in the Subbasin. Since about 2010 with the change in cropping patterns to more pistachios, groundwater levels declined once again. The more recent groundwater elevations are mostly available for the area where irrigated cropped land is in production. Water level depths range from approximately 350 feet below mean sea level in the very southern -end of the GSP area to approximately 400 feet below mean sea level in the center of the basin and up to 500 feet below mean sea level in the northern portion of the basin.

The cause of groundwater conditions occur due to the amount of groundwater that is pumped, the time it takes for recharge to reach the water table, and lack of surface water imports. Groundwater pumping patterns fluctuate in response to various scenarios described below:.

- Change in cropping patterns, from seasonal to permanent crops,
- Increase in land area being farmed
- Change in surface water use
- Time for recharge to reach water table

4.2.2.3 Evaluation of Multiple Minimum Thresholds

Regulation Requirements:
§354.26 (c) The Agency may need to evaluate multiple minimum thresholds to determine whether an undesirable result is occurring in the basin. The determination that undesirable results are occurring may depend upon measurements from multiple monitoring sites, rather than a single monitoring site.

The plan is to use all the measured wells in the basin to develop water-level hydrographs. These well hydrographs will be compared to Representative Monitoring Sites (RMS). Based upon the foregoing discussion, minimum thresholds have been developed by establishing management objectives and then adding approximately 50 feet in depth to establish the SMC levels. As the plan is implemented, a review and revision of these levels will be undertaken.

An analysis was performed on wells approximately 40 active wells and estimated 8 domestic water wells. The analysis compared the lowest MT water level in the area to the perforations in these wells to determine if the current MT falls below a 70 % perforation submergence. This analysis was developed and is written code owned by Provost & Pritchard Consulting Group.

The analysis shown in Appendix Q, shows an example of the existing water levels through the year 2042 when the GSP projects and management actions are implemented. The minimum threshold levels provide approximately 190,000 acre-feet of usable water between the MO and the MT. This will provide flexibility. Using an average specific yield of 0.08 over 48,000 acres. This provides water for a five-year drought, accounting for a period if no surface water is available and an increase of cropping, (conversion from row crops to pistachios). Also includes the curtailment schedule implementation and historic surface water importation and potential future importation of surface water. Each RMS will be evaluated to its set MT and will be compared to each RMS within the Subbasin.

4.2.3 Minimum Thresholds

Regulation Requirements:
§354.28 (a) Each Agency in its Plan shall establish minimum thresholds that quantify groundwater conditions for each applicable sustainability indicator at each monitoring site or representative monitoring site established pursuant to Section 354.36. The numeric value used to define minimum thresholds shall represent a point in the basin that, if exceeded, may cause undesirable results as described in Section 354.26.
(d) An Agency may establish a representative minimum threshold for groundwater elevation to serve as the value for multiple sustainability indicators, where the Agency can demonstrate that the representative value is a reasonable proxy for multiple individual minimum thresholds as supported by adequate evidence.

This section describes the MTs established for the groundwater levels sustainability indicator. The MTs quantify groundwater conditions at each RMS that, if exceeded, may lead to undesirable results. The MTs for groundwater levels are based on historic groundwater level decline at each individual RMS and are described in the following sections. The measurement and monitoring of MTs, the definition of an exceedance that may result in undesirable results, and the potential effects on beneficial uses and users of groundwater are described in subsequent sections.

For groundwater levels, it is expected that there will be different MTs based upon the location in the Subbasin. As an example, a well adjacent to the contact with the rock at the edge of the Subbasin will have a different MT than a well located in the center of the Subbasin where the aquifer has much more depth. The process for establishing the MTs for the groundwater levels sustainability indicator for the Subbasin is based on the following concepts, each of which was developed using the information developed for the HCM and as described in other portions of the GSP.

1. Groundwater levels in the Subbasin are generally declining, though at different rates in different locations in the Subbasin.
2. The continued decline of groundwater levels in the Subbasin may result in impacts to beneficial uses and users that are significant and unreasonable or undesirable. If this were to occur, it may reach a point where the GSAs may not be able to manage and/or mitigate the effects, so a proactive approach needs to be implemented now.
3. The GSAs of the Subbasin will be implementing projects and management actions designed to reduce the rate of groundwater level decline in the Subbasin and eventually stabilize groundwater levels into the future (Chapter 6).
    - Implementation of the projects and management actions by the GSAs is anticipated to begin in 2023 and be completed by 2040 (Chapter 7).
4. The results of forecast simulations indicate that the implementation of the projects and management actions by the GSAs proposed in this GSP will begin to reduce the rate of groundwater level decline in the Subbasin by 2025 and will stabilize groundwater levels by 2042.

Using the above as a guide, MTs for the groundwater levels sustainability indicator in the Subbasin were established using historical data for RMS wells as follows.

1. RMS sites were chosen based on availability of known well information, location in the GSA, and availability of historical data.
2. Groundwater levels for each RMS site in the Subbasin were graphed for the entire history of recorded data.
3. The estimated groundwater elevation in 2042, based on the current pumping patterns or the last 15 years of elevation data, is the MT at that RMS. The assumptions include:
    - Lands that are currently in production continue to stay in production.
    - Water use, surface water deliveries, etc. in the Subbasin generally remain the same into the future. This is considered a reasonable assumption given the current groundwater conditions

in the Subbasin. It is anticipated that there will be a slight increase in demands due to the maturing of several pistachio plantings in the Subbasin.

An analysis was performed on wells approximately 40 active wells and 8 domestic water wells. The analysis compared the lowest MT water level in the area to the perforations in these wells to determine if the current MT falls below a 70 % perforation submergence. The analysis shows where the MT levels are currently set, there is no undesirable result. This analysis was developed and is written code owned by Provost & Pritchard Consulting Group.

An example hydrograph illustrating this process is shown in **Figure 4-3**. Hydrographs at all the RMSs or substitute locations showing the MTs, MOs, and stabilized groundwater levels by 2042 are presented in **Figure 4-3** through **Figure 4-8**. The MT at each RMS is listed in **Table 4-2**.

The MTs established provide flexibility in the operation of the Subbasin without causing undesirable results.

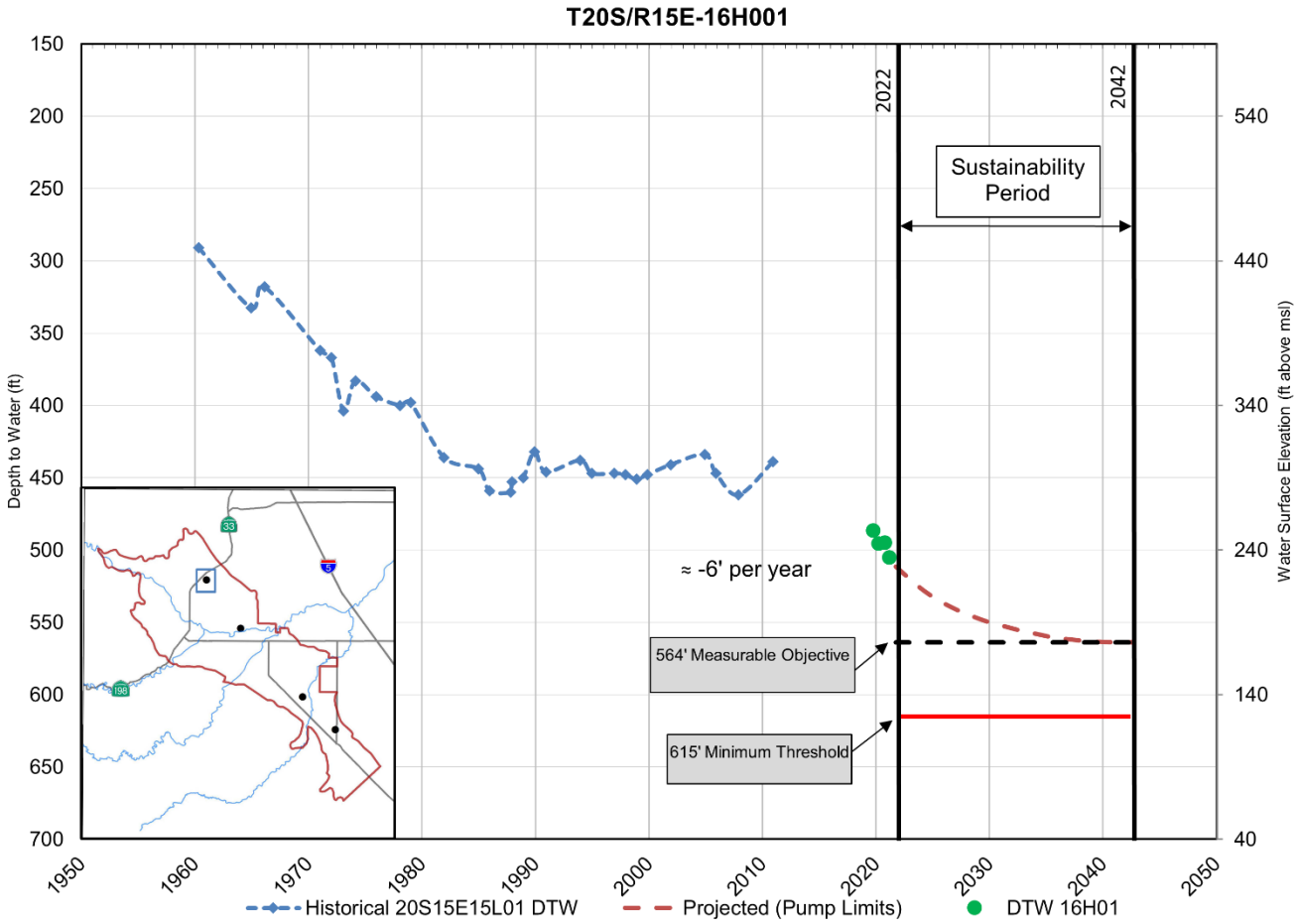


Figure 4-4 Hydrograph T20S/R15E-16H001

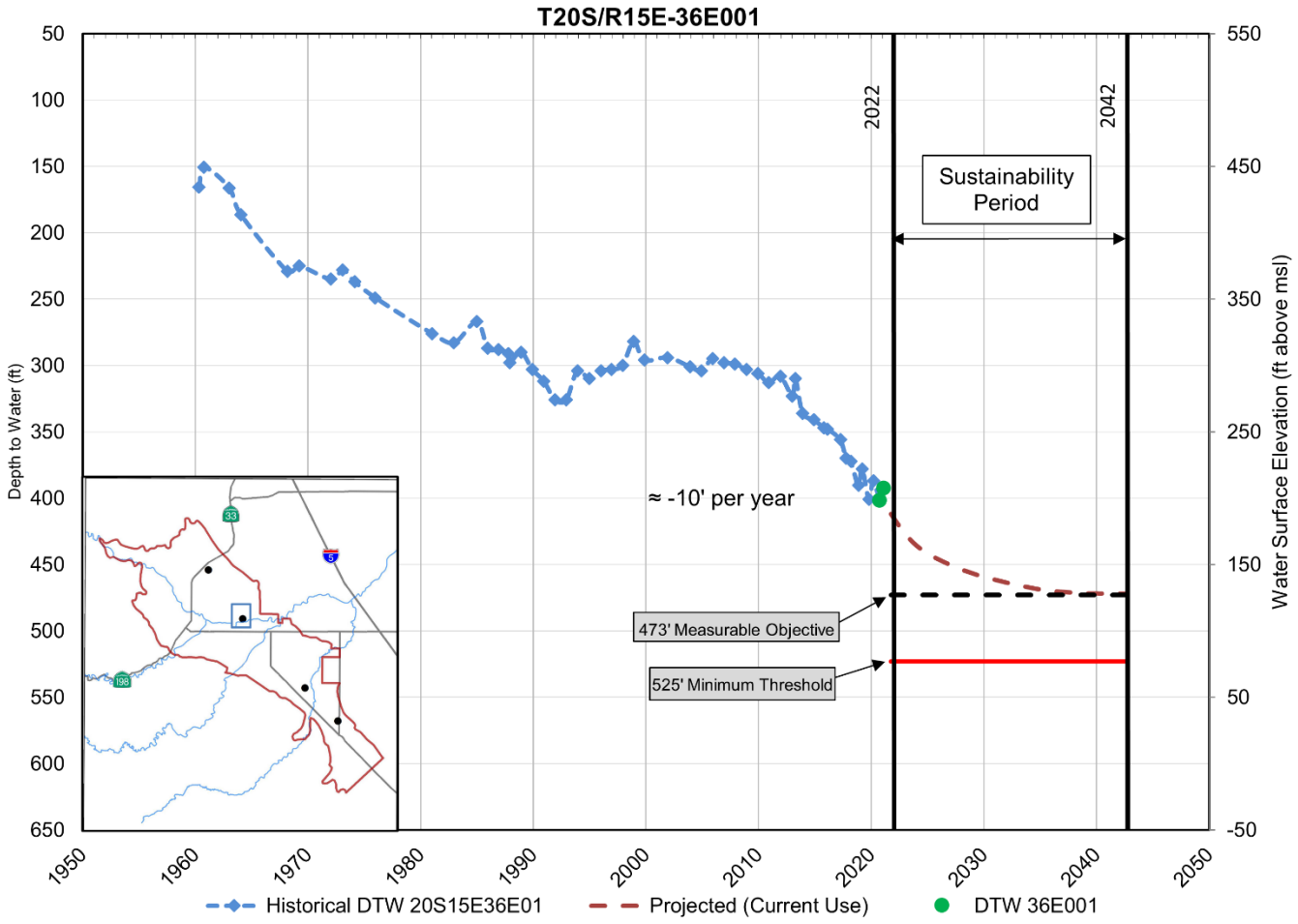


Figure 4-5 Hydrograph T20S/R15E-36E001

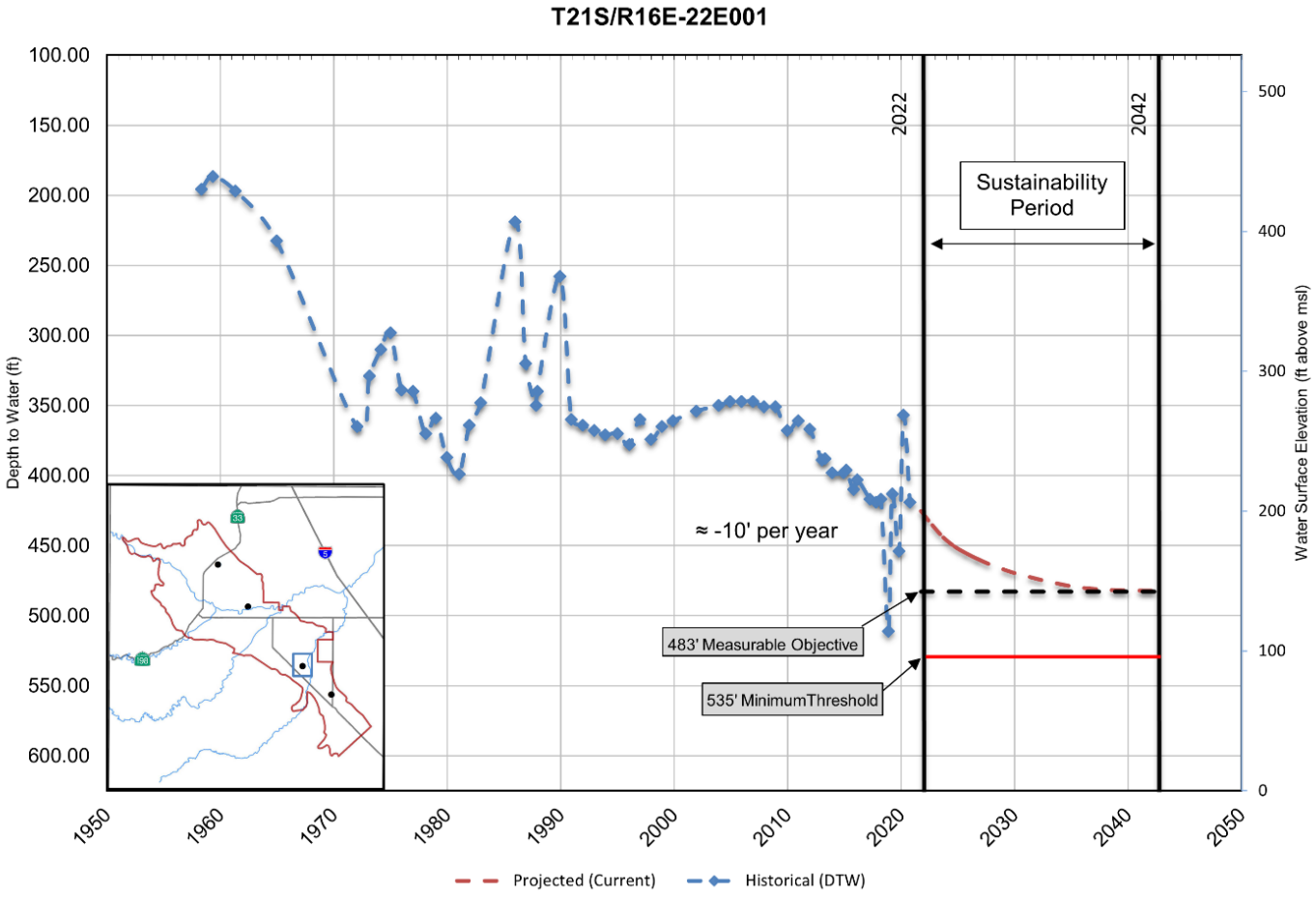


Figure 4-6 Hydrograph T21S/R16E-22E001

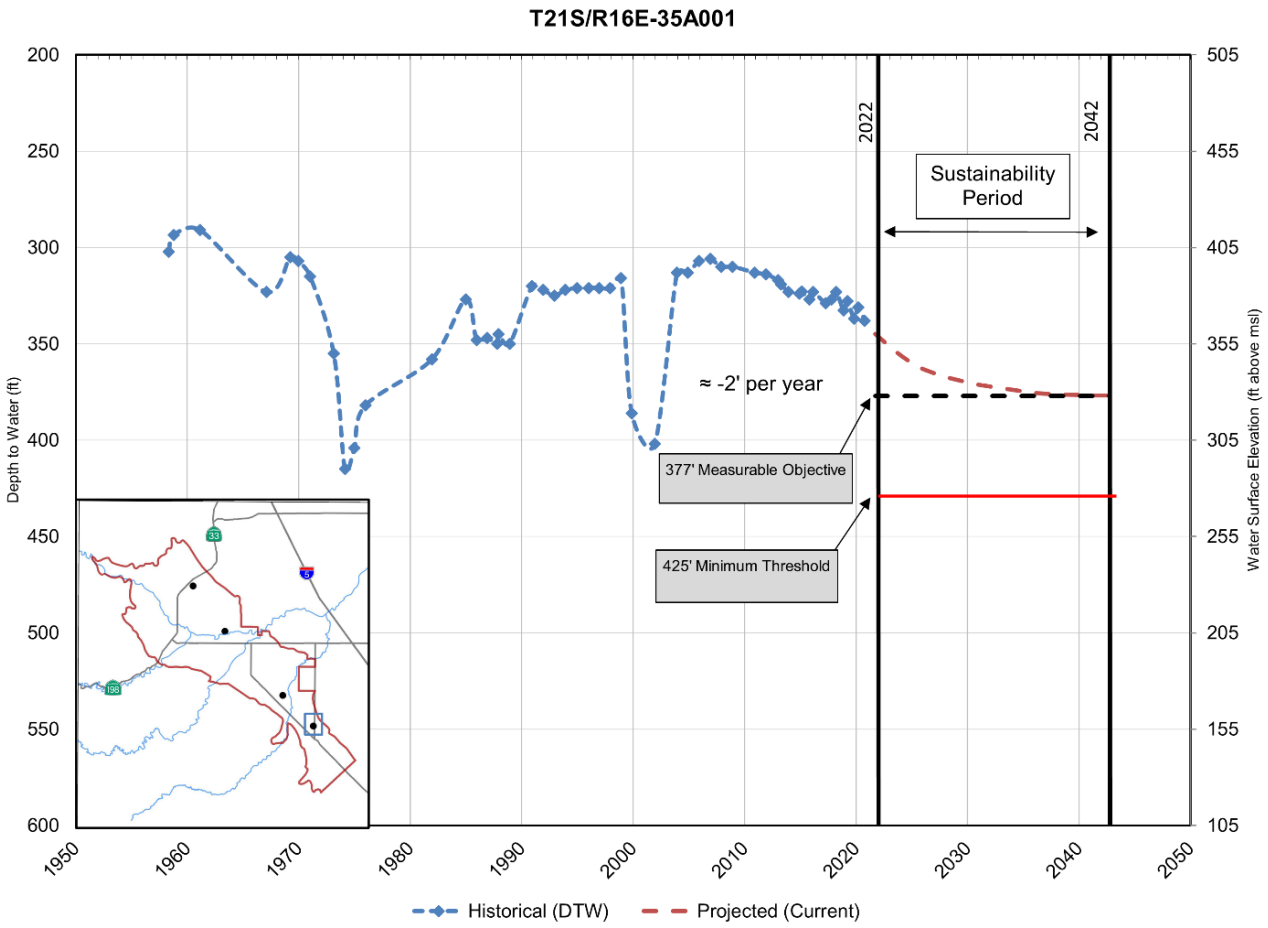


Figure 4-7 Hydrograph T21S/R16E-35A001

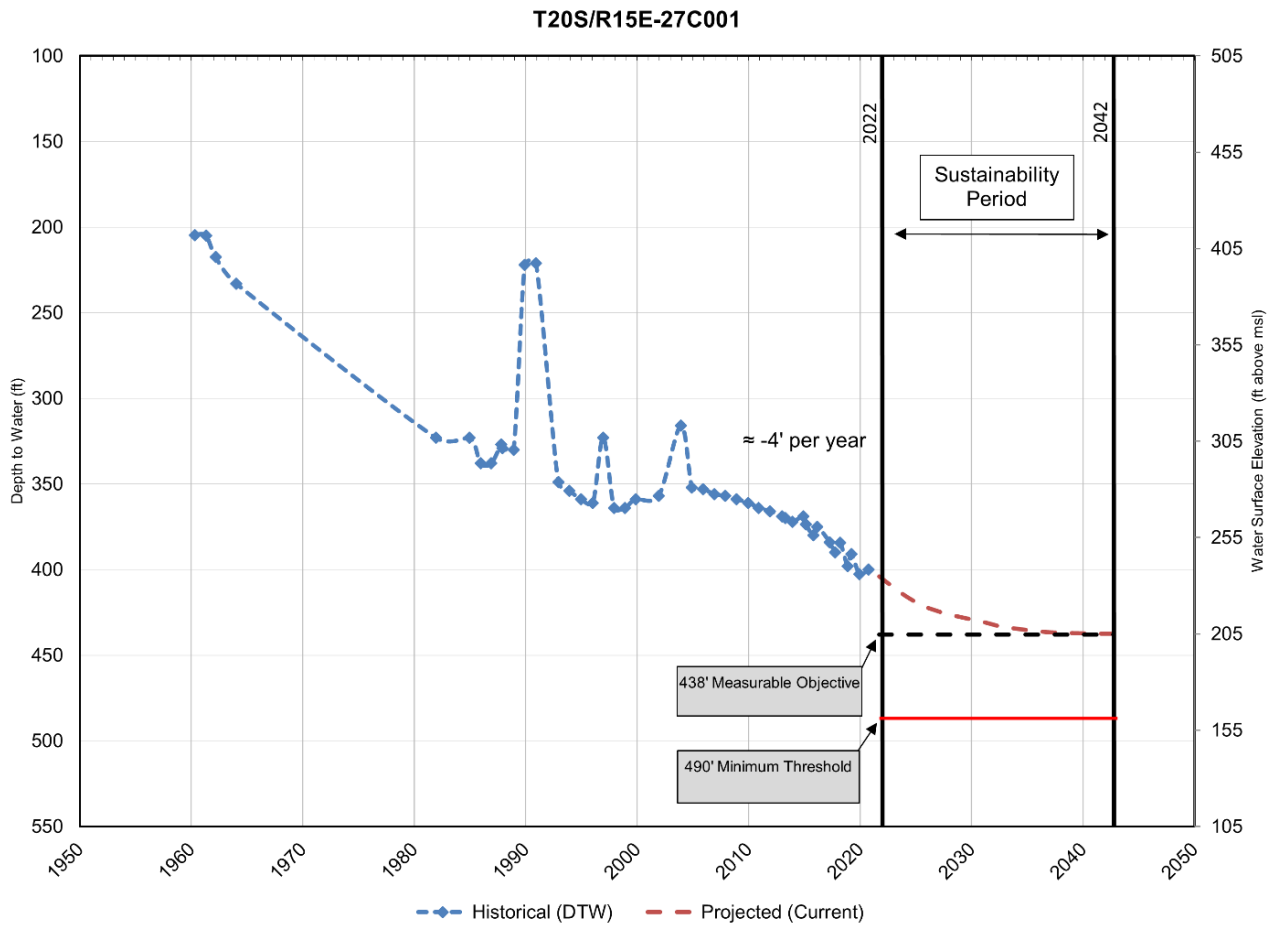


Figure 4-8 Hydrograph-T20S/R15E-27C001

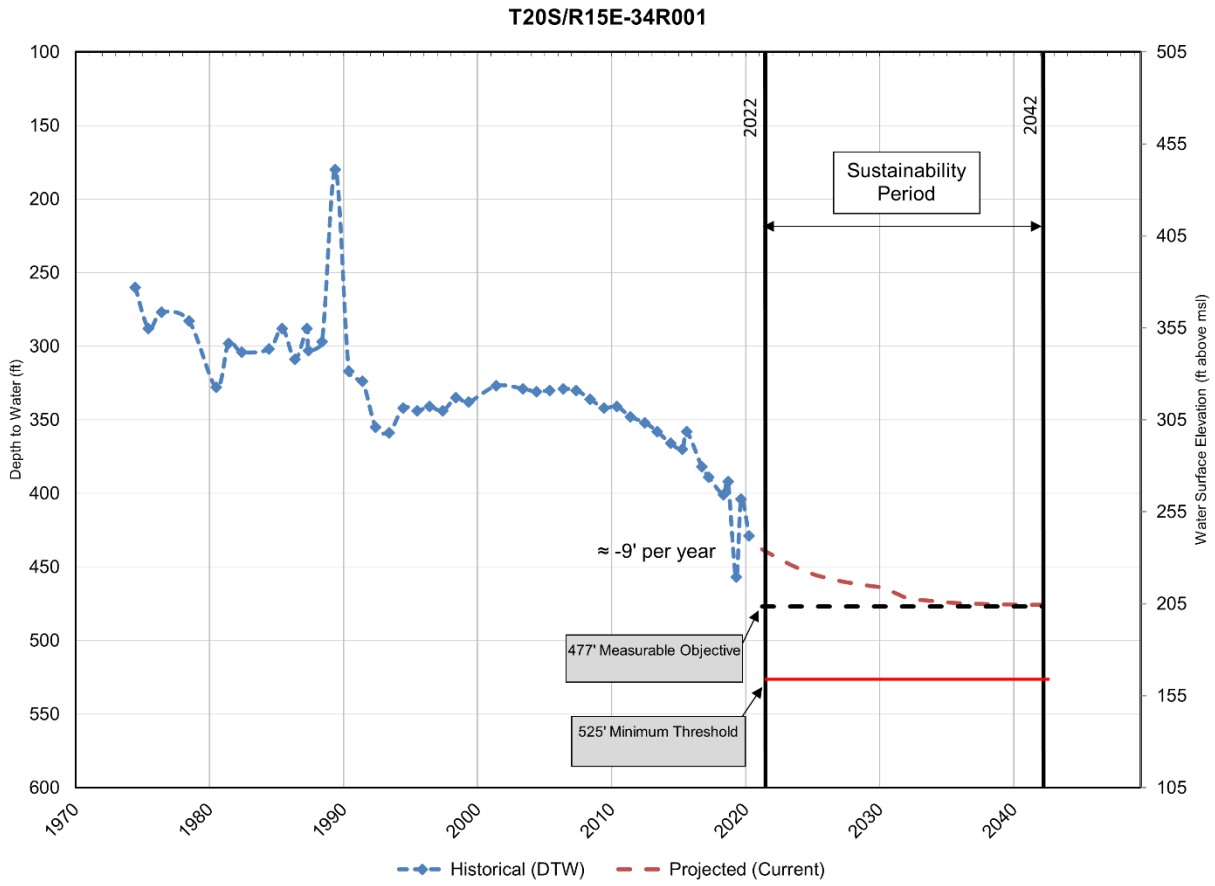


Figure 4-9 Hydrograph-T20S/R15E-34R001

Table4-2 Groundwater Levels - Minimum Thresholds

Description	Minimum Threshold Depth (ft)	Minimum Threshold Elevation (ft)	2015 Groundwater Elevation Levels (ft)	Difference MT vs 2015 GWL EL
T20SR15E-16H01	615 ft	125 ft	280	155
T20SR15E-36E01	525 ft	77 ft	260	183
T21SR16E-22E01	535 ft	91 ft	240	149
T21SR16E-35A01	425 ft	281 ft	385	104
T20SR15E-27C01	490 ft	183 ft	267	84
T20SR15E-34R01	525 ft	107 ft	292	185

These levels will not cause an undesirable result. The landowners within the subbasin are aware of the declining water levels and implemented and funded a majority of the work under SGMA themselves. Water levels ae lower than the 2015 water levels but no undesirable results have occurred historically. The water levels will be monitored and mandatory pumping restrictions as well as other mitigation measures will be administered should the water levels fall below the MTs as stated in Section 4.2.2.1.

4.2.3.1 Criteria to Define Minimum Thresholds

Regulation Requirements:
§354.28 (b) The description of minimum thresholds shall include the following:
(1) The information and criteria relied upon to establish and justify the minimum thresholds for each sustainability indicator. The justification for the minimum threshold shall be supported by information provided in the basin setting, and other data or models as appropriate, and qualified by uncertainty in the understanding of the basin setting.

§354.28 (c) Minimum thresholds for each sustainability indicator shall be defined as follows:
(1) Chronic Lowering of Groundwater Levels. The minimum threshold for chronic lowering of groundwater levels shall be the groundwater elevation indicating a depletion of supply at a given location that may lead to undesirable results. Minimum thresholds for chronic lowering of groundwater levels shall be supported by the following:
(a) The rate of groundwater elevation decline based on historical trends, water year type, and projected water use in the basin.

MTs were defined by criteria and information discussed in the previous section including historic groundwater levels. They rely on the assumption that groundwater will continue to be pumped at a similar rate with reductions imposed by either the importation of surface water or reduction in demand. The MTs have been set at an approximate 50-foot depth lower than the MO discussed later. This represents a worst-case condition, but would also present a condition where groundwater supplies are still available without depleting the groundwater storage in the Subbasin and creating an UR.

4.2.3.2 Relationship of Minimum Thresholds Between Sustainability Indicators

Regulation Requirements:
§354.28 (b) The description of minimum thresholds shall include the following:
(2) The relationship between the minimum thresholds for each sustainability indictor, including and explanation of how the Agency has determined that basin conditions at each minimum threshold will avoid undesirable results for each of the sustainability indicators.

§354.28 (c) Minimum thresholds for each sustainability indicator shall be defined as follows:
(1) Chronic Lowering of Groundwater Levels. The minimum threshold for chronic lowering of groundwater levels shall be the groundwater elevation indicating a depletion of supply at a given location that may lead to undesirable results. Minimum thresholds for chronic lowering of groundwater levels shall be supported by the following:
(b) Potential effects on other sustainability indicators.

The MTs represent an estimated condition which would occur by 2042 if projects or management actions are implemented. From a well canvas prepared and updated in the course of this work, it appears there are about 75 active agricultural production wells in the Subbasin. The hydrographs from these wells will be compared to the RMS.

It is believed that many of these presently operating agricultural wells will have the ability to continue operation should this occur, thus avoiding undesirable results. The groundwater level MTs will be used to set the MTs for groundwater storage change, and thus they are directly related through land area and specific yield. Groundwater quality can be qualitatively related to levels; however, water quality sampling will be utilized to set sustainability conditions.

The governing indicator will be the Lowering of Groundwater levels.

4.2.3.3 Minimum Thresholds in Relation to Adjacent Basins

Regulation Requirements:
§354.28 (b) The description of minimum thresholds shall include the following:
(3) How minimum thresholds have been selected to avoid causing undesirable results in adjacent basins or affecting the ability of adjacent basins to achieve sustainability goals.

The MTs set in this Subbasin are higher than those set in the Westside Subbasin to the east. As stated in Section 3, there are two potential links between the Pleasant Valley Basin and the Westside Subbasin including the Pasajero Gap and the Polvadero Gap. The hydrogeology and groundwater flow in the two areas are discussed in **Chapter 3 – Basin Setting**.

4.2.3.4 Impact of Minimum Thresholds on Beneficial Uses and Users

Regulation Requirements:
§354.28 (b) The description of minimum thresholds shall include the following:
(4) How minimum thresholds may affect the interests of beneficial uses and users of groundwater or land uses and property interests.

As discussed, the MTs were established based on historical operating conditions and groundwater use. Groundwater level decline throughout the Subbasin occurs at varying rates depending on the location; therefore, the MTs and allowable water level decline will differ based on location. While there is limited available information on total well depth and current operating depth throughout the GSA, it is believed that the levels at which the MTs have been established will allow for continued operation of existing operating wells without causing undesirable results. Due to recent information and communication with the Lost Hills Community the MOs and MTs have been set at levels where these domestic wells should not be affected. The following information was gathered from a conversation between the Engineer supporting the subbasin and the local landowner, held on July 2, 2024:

Question	Answer
Is there a well on the property?	Yes

Do you own or rent a home on the property?	No, only own the property.
Do you filter (treat) the well water for drinking water?	No
Do you know the quality of the well water?	No
What year was it installed?	About 30 years ago, purchased the property about 13 years ago.
What is the well depth? Production rate? Horsepower?	700 ft, 45-60 gallons per minute, 1-1/2 Horsepower motor.
Additional Information:	Maintenance: every five years, the well is purged to clean the perforations. Well has never gone dry. Needs more information regarding using his well as a monitoring site.

4.2.3.5 Current Standards Relevant to Sustainability Indicator

Regulation Requirements:
§354.28 (b) The description of minimum thresholds shall include the following:
(5) How state, federal, or local standards relate to the relevant sustainability indicator. If the minimum threshold differs from other regulatory standards, the Agency shall explain the nature of and basis for the difference.

There are no other known regulatory standards related to groundwater levels; and thus, the MTs do not conflict with other regulatory standards.

4.2.3.6 Measurement of Minimum Thresholds

Regulation Requirements:
§354.28 (b) The description of minimum thresholds shall include the following:
(6) How each minimum threshold will be quantitatively measured, consistent with the monitoring network requirements described in Subarticle 4.

Groundwater levels will be directly measured at each RMS according to the monitoring network described in **Section 5.2**. Groundwater elevations will be used to generate contour maps with the available data to show the groundwater elevations throughout the Subbasin. For more information regarding wells and RMSs in the monitoring network, refer to **Chapter 5**.

4.2.4 Measurable Objectives

4.2.4.1 Description of Measurable Objectives

Regulation Requirements:
§354.30 (a) Each Agency shall establish measurable objectives, including interim milestones in increments of five years, to achieve the sustainability goal for the basin with 20 years of Plan implementation and to continue to sustainably manage the groundwater basin over the planning and implementation horizon.
(b) Measurable objectives shall be established for each sustainability indicator, based on quantitative values using the same metrics and monitoring sites as are used to define the minimum thresholds.

The purpose of setting MOs is to define acceptable groundwater conditions that will allow for sustainable and continued use of groundwater over time for all beneficial users. MOs were developed for the Subbasin using the method described in **Section 4.2.2**. The MOs are a result of and assume that projects and management actions such as pumping restrictions have been implemented over time and additional surface water supplies are imported into the basin through project implementation. Water-level trends need to be evaluated for all measured wells to check if representative wells are providing representative data. The following procedure was used for establishing MOs:

1. Groundwater level changes were forecasted for each RMS based on assumed management actions for the Subbasin. The rate of decline in groundwater levels are as follows:
    a. Reduction in existing rate of decline of groundwater level to 7 ft/yr by 2025
    b. Reduction in rate from 7 to 5 ft/yr by 2030
    c. Reduction in rate from 5 to 3 ft/yr by 2035
    d. Reduction in rate from 3 ft/yr to 0 by 2042
    The changes in the hydrographs in wells are reflected in the RMS.
2. The projection started at the lowest water level reading within the last two years at each of the RMSs.
3. Projected groundwater level changes assume:
    a. Existing cropping patterns are maintained, and demand reductions are planned during dry years.
    b. The average natural recharge from the tributary watershed will be calculated.
    c. Pumping reduction (curtailment policy will be implemented) will occur in areas being farmed and are reflective in the RMS, and recognized during the evaluation of each milestone. Mandatory pumping restrictions may need to be implemented if the GSP plan is falling short of its goals.
    d. The specific yield of the basin deposits are uniform and unchanging.
    e. Landowners will adhere to the reduction in pumping schedule.
    f. The reduction in pumping assumes a corresponding importation of surface supplies. The analysis does assume that the reduction will occur no matter the status of import of surface supplies.
    g. Relies on the implementation schedule found in Section 7.
    h. Assumes that no subsidence occurs with the continued decline in groundwater levels.
    i. Recharge projects will need to be in place 2-3 years before groundwater changes are influenced by the recharge of these projects.

The MO at each RMS is listed in **Table 4-3** along with corresponding interim milestones.

Table4-3 Groundwater Levels Measurable Objectives – Elevation

	Pleasant Valley RMS Interim Milestones and Measurable Objective				
Description	Interim Milestones - Elevation (ft)				Measurable Objective (ft)
	2025	2030	2035	2040	
T20SR15E-16HO1	228	212	203	200	200
T20SR15E-36E01	165	149	140	138	138
T21SR16E-22E01	167	152	143	141	141
T21SR16E-35A01	343	334	330	328	328
T20SR15E-27C01	246	238	232	231	230
T20SR15E-34R01	172	164	154	152	151

4.2.4.2 Operational Flexibility

Regulation Requirements:
§354.30 (c) Measurable objectives shall provide a reasonable margin of operational flexibility under adverse conditions which shall take into consideration components such as historical water budgets, seasonal and long-term trends, and periods of drought, and be commensurate with levels of uncertainty.

4.2.4.3 The MOs and MTs have been established to help the landowners set an achievable benchmark while also being realistic about the time it takes to implement management actions and develop surface water projects, if desired. MTs were developed assuming recent historical pumping patterns and no management actions, thus the MT is the groundwater level that will occur should no restrictions occur, while the MO sets a reasonable goal for sustainable management when considering pumping restrictions discussed in Section 6. The difference between the MT and the respective MO at each site is the operational flexibility. The MOs and MTs will not cause undesirable results.

4.2.4.4 Representative Monitoring

Regulation Requirements:
§354.30 (d) An Agency may establish a representative measurable objective for groundwater elevation to serve as the value for multiple sustainability indicators where the Agency can demonstrate that the representative value is a reasonable proxy for multiple individual measurable objectives as supported by adequate evidence.

The RMSs that have been selected for groundwater elevation monitoring and SMCs as well as the other agricultural wells will be used for groundwater storage change as well. Groundwater level MOs will serve as the representative MO for groundwater storage change and is considered a reasonable proxy. The vertical extent of the aquifer is discussed in **Section 3.1.8**. All available wells will be monitored for water levels and water quality, and three new wells have been constructed to fill data gaps, see Appendix N for additional information on the new monitor wells.

4.2.4.5 Path to Achieve Measurable Objectives

Regulation Requirements:
§354.30 € Each Plan shall describe a reasonable path to achieve the sustainability goal for the basin within 20 years of Plan implementation, including a description of interim milestones for each relevant sustainability indicator, using the same metric as the measurable objective, in increments of five years. The description shall explain how the Plan is likely to maintain sustainable groundwater management over the planning and implementation horizon.

The groundwater elevation interim milestones are presented in **Table 4-3** along with the MOs. The interim milestones provide intermediary goals between now and 2042 to make sure the Subbasin is on the correct path to sustainable management. The Subbasin plans to maintain sustainable groundwater management by implementing pumping allocations based on sustainable yield. The implementation of the allocation will occur gradually over time as described in Section 7. An analysis was run using the lowest MO in an area versus the length of well perforations to calculate a 70% submergence of the well the well will be operable is a 5-year drought should occur. See map this section.

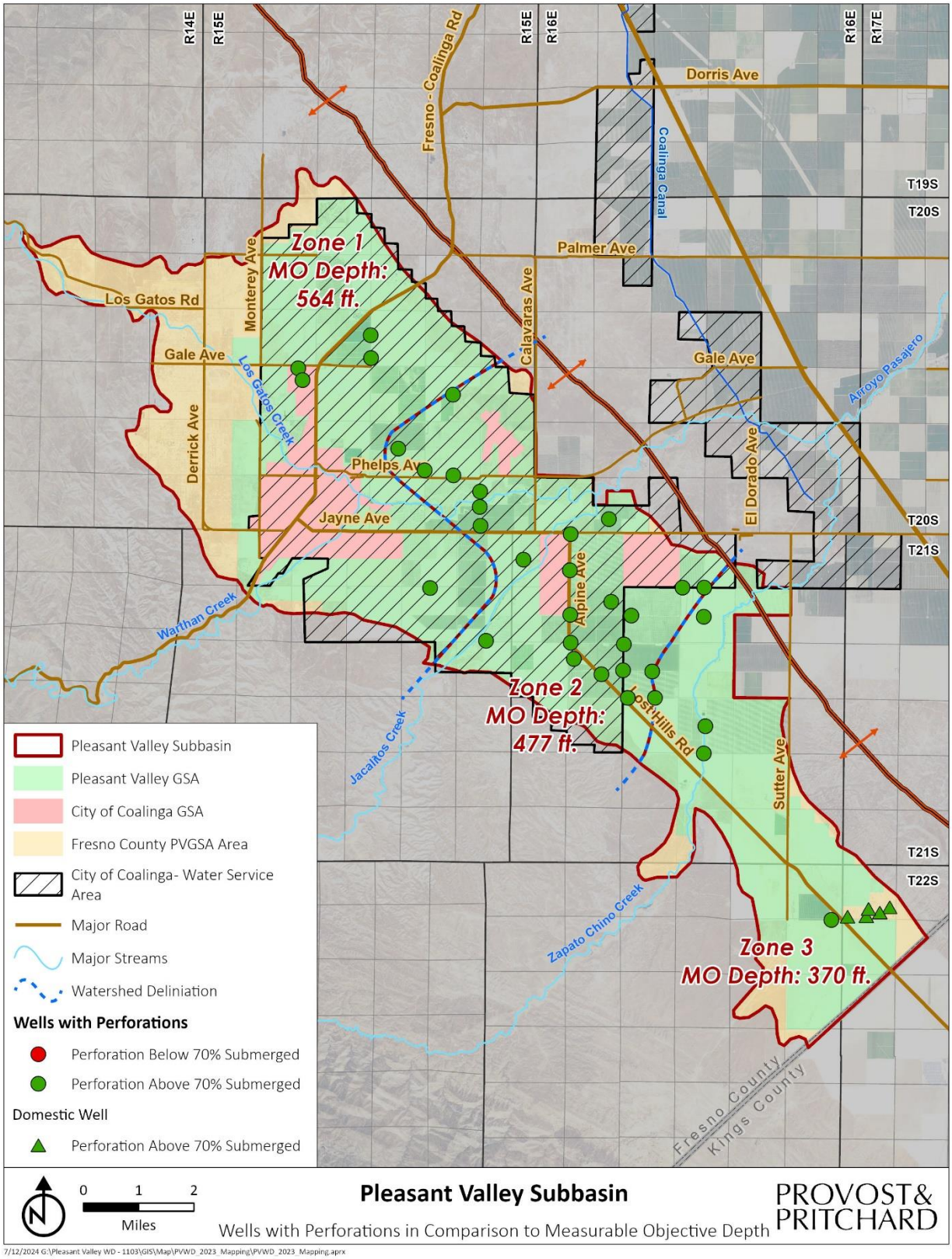


Figure 4-10 Map of Lowest MO in the Area

4.3 Groundwater Storage

Groundwater storage is directly related to water level change and will be calculated using all measurable wells within the Subbasin. From the data identified on water levels, the estimated Minimum Threshold for storage change is 190,000 AF and the Measurable Objective is 140,000 AF, these values were derived using the average depth to groundwater from the 2024 water level data and comparing those values to the average MO or MT for the area, using the RMSs hydrographs (average depth to water = 36 feet). The average specific yield used was 0.08 over an area of 48,000 acres. These values will not create undesirable results and provide flexibility for the GSAs to implement projects and management actions.

The calculation of storage change is as follows:

Storage change = Water level change x Specific yield x area of impact from level change

4.3.1 Undesirable Results

Undesirable results related to groundwater storage change are the same as discussed in the groundwater levels section. The decrease in aquifer volume has the same effects as decreasing water levels and is directly related. Therefore, water levels will be used to calculate storage change. As discussed in the section on groundwater level SMCs, the GSAs within the Subbasin have defined an Undesirable Result to be significant and unreasonable when either the water level has declined to a depth that a new productive well cannot be constructed or when the water level has declined so as to compromise the life of a useful well.

Groundwater storage below the MT is considered an undesirable result as replenishment of the storage becomes more difficult as the water levels decline. The Subbasin will manage to the MTs for groundwater level decline, as the governing criteria. Groundwater storage is not significantly impacted by this plan, as the base of the fresh water is well below the MTs.

Mitigation Measures:

Mitigation measures should the MTs be exceed are as follows:

1. Technical Assistance: Evaluation of the severity of the impacts to the landowners in the area.
    a. Paid for by PVGSA, up to $4,000 per situation, needs approval by PV Board.
2. Potential mandatory pumping restrictions.
    a. Paid for by landowner
3. Possible surface water importation.
    a. Paid for by landowner
4. Domestic Wells-See Appendix O Technical Assistance Flowchart.

4.3.1.1 Criteria to Define Undesirable Results

Regulation Requirements:
§354.26 (a) Each Agency shall describe in its Plan the processes and criteria relied upon to define undesirable results applicable to the basin. Undesirable results occur when significant and unreasonable effects for any of the sustainability indicators are caused by groundwater conditions occurring throughout the basin.

As discussed, this sustainability indicator is directly proportional to the groundwater levels; therefore, criteria to define Undesirable Results is discussed further in **Section 4.2.1**.

4.3.1.2 Causes of Groundwater Conditions That Could Lead to Undesirable Results

Regulation Requirements:
§354.26 (b) The description of undesirable results shall include the following:
(1) The cause of groundwater conditions occurring throughout the basin that would lead to or has led to undesirable results based on information described in the basin setting, and other data or models as appropriate.
(2) The criteria used to define when and where the effects of the groundwater conditions cause undesirable results for each applicable sustainability indicator. The criteria shall be based on a quantitative description of the combination of minimum threshold exceedances that cause significant and unreasonable effects in the basin.
(3) Potential effects on the beneficial uses and users of groundwater, on land uses and property interests, and other potential effects that may occur or are occurring from undesirable results.

See **Section 4.2.1**.

4.3.1.3 Evaluation of Multiple Minimum Thresholds

Regulation Requirements:
§354.26 (c) The Agency may need to evaluate multiple minimum thresholds to determine whether an undesirable result is occurring in the basin. The determination that undesirable results are occurring may depend upon measurements from multiple monitoring sites, rather than a single monitoring site.

The multiple MTs for the RMS have been used to estimate the ultimate storage change related to the SMC. It should be noted that this calculation is only used for an estimate of setting a number on the possible storage change and actual change will be calculated on an annual basis, using all measured wells.

4.3.2 Minimum Thresholds

Regulation Requirements:
§354.28 (a) Each Agency in its Plan shall establish minimum thresholds that quantify groundwater conditions for each applicable sustainability indicator at each monitoring site or representative monitoring site established pursuant to Section 354.36. The numeric value used to define minimum thresholds shall represent a point in the basin that, if exceeded, may cause undesirable results as described in Section 354.26.
(d) An Agency may establish a representative minimum threshold for groundwater elevation to serve as the value for multiple sustainability indicators, where the Agency can demonstrate that the representative value is a reasonable proxy for multiple individual minimum thresholds as supported by adequate evidence.

Water levels are used to calculate storage change. The volume represents the difference in aquifer storage between the current state of the water levels and the anticipated groundwater levels at MT values. This volume accounts for a storage loss.

4.3.2.1 Criteria to Define Minimum Thresholds

Regulation Requirements:
§354.28 (b) The description of minimum thresholds shall include the following:
(1) The information and criteria relied upon to establish and justify the minimum thresholds for each sustainability indicator. The justification for the minimum threshold shall be supported by information provided in the basin setting, and other data or models as appropriate, and qualified by uncertainty in the understanding of the basin setting.

§354.28 (c) Minimum thresholds for each sustainability indicator shall be defined as follows:
(2) Reduction of Groundwater Storage. The minimum threshold for reduction of groundwater storage shall be a total volume of groundwater that can be withdrawn from the basin without causing conditions that may lead to undesirable results. Minimum thresholds for reduction of groundwater storage shall be supported by the sustainable yield of the basin, calculated based on historical trends, water year type, and projected water use in the basin.

See **Section 4.2.2.2** for a description of the criteria to define Minimum thresholds.

The calculation of storage change is as follows:

Storage change = Water level change x Specific yield x area of impact from level change

Where specific yield has been estimated between the range of .08 and .20 throughout the Subbasin and an average of 12% has been used in the water budget and in these calculations. The MTs have been set to achieve sustainability by year 2042. The alluvium in the subbasin is conducive to restoring the water levels. The alluvium in the subbasin will not compact and reduce the potential storage volume capabilities of the subbasin. For additional information on soils see Chapter 3 and for subsidence see Appendix P

4.3.2.2 Relationships Between Minimum Thresholds and Sustainability Indicators

Regulation Requirements:
§354.28 (b) The description of minimum thresholds shall include the following:
(2) The relationship between the minimum thresholds for each sustainability indictor, including and explanation of how the Agency has determined that basin conditions at each minimum threshold will avoid undesirable results for each of the sustainability indicators.

Groundwater storage change is directly proportional to groundwater levels as seen by the calculation in the previous section. It is for this reason that the groundwater level thresholds are used as a proxy to determine whether an undesirable result has occurred. If the Subbasin manages to keep water levels above the MTs for groundwater levels, an undesirable result due to storage change should not occur. The groundwater levels will be the governing indicator in this plan due to wells experiencing undesirable results prior to other indicators.

4.3.2.3 Minimum Thresholds in Relation to Adjacent Basins

Regulation Requirements:
§354.28 (b) The description of minimum thresholds shall include the following:
(3) How minimum thresholds have been selected to avoid causing undesirable results in adjacent basins or affecting the ability of adjacent basins to achieve sustainability goals.

As described previously, the Subbasin is a separate subbasin with the exception of two alluvial deposits which connect it with the Westside Subbasin. Therefore, there are no impacts to adjacent basins.

4.3.2.4 Impact of Minimum Thresholds on Beneficial Uses and Users

Regulation Requirements:
§354.28 (b) The description of minimum thresholds shall include the following:
(4) How minimum thresholds may affect the interests of beneficial uses and users of groundwater or land uses and property interests.

See **Section 4.2.3.4** for a description on potential impacts to beneficial users.

4.3.2.5 Current Standards Relevant to Sustainability Indicator

Regulation Requirements:
§354.28 (b) The description of minimum thresholds shall include the following:
(5) How state, federal, or local standards relate to the relevant sustainability indicator. If the minimum threshold differs from other regulatory standards, the Agency shall explain the nature of and basis for the difference.

See **Section 4.2.3.5**, there are no State, Federal, or local standards that are relevant to this sustainability indicator.

4.3.2.6 Measurement of Minimum Thresholds

Regulation Requirements:
§354.28 (b) The description of minimum thresholds shall include the following:
(6) How each minimum threshold will be quantitatively measured, consistent with the monitoring network requirements described in Subarticle 4.

Groundwater storage change will be calculated based on groundwater levels directly measured at each representative well and other active wells. As the plan is implemented, there will be an ability in the future to quantify pumping as well as surface water seepage to enable a comparison of water use with groundwater storage change.

4.3.3 Measurable Objectives

4.3.3.1 Description of Measurable Objectives

Regulation Requirements:
§354.30 (a) Each Agency shall establish measurable objectives, including interim milestones in increments of five years, to achieve the sustainability goal for the basin with 20 years of Plan implementation and to continue to sustainably manage the groundwater basin over the planning and implementation horizon.
(b) Measurable objectives shall be established for each sustainability indicator, based on quantitative values using the same metrics and monitoring sites as are used to define the minimum thresholds.

The MO for groundwater storage change is represented by the groundwater levels established for each RMS. A surface using the level MOs was created and the difference between the MO surface and the current groundwater levels was calculated and multiplied by the specific yield. This was repeated for each of the interim milestones. The results are displayed in **Table 4-4** and show the change for the period between the dates. For cumulative amounts the values would be added.

Table4-4 Measurable Objective and Interim Milestones for Groundwater Storage Change

	Pleasant Valley RMS Estimates of Storage Change	
	Interim Milestone (AF)	Measurable Objective (AF)

2025	2030	2035	2040	2042
80,000	80,000	50,0000	20,000	0

4.3.3.2 Operational Flexibility

Regulation Requirements:
§354.30 (c) Measurable objectives shall provide a reasonable margin of operational flexibility under adverse conditions which shall take into consideration components such as historical water budgets, seasonal and long-term trends, and periods of drought, and be commensurate with levels of uncertainty.

It is recognized that there will be hydrological variances and some years when seepage and local runoff combined with recharge activities may cause levels to rise within the basin. While there will also be periods of drought conditions and levels may dramatically drop. The goal is to stabilize long-term groundwater trends while allowing for year-to-year swings in water levels due to the hydrological variances.

4.3.3.3 Representative Monitoring

Regulation Requirements:
§354.30 (d) An Agency may establish a representative measurable objective for groundwater elevation to serve as the value for multiple sustainability indicators where the Agency can demonstrate that the representative value is a reasonable proxy for multiple individual measurable objectives as supported by adequate evidence.

Groundwater levels will be used to calculate the storage change annually and for comparison to the MOs and MTs of groundwater storage change and is discussed in Section **4.2.3.3**.

4.3.3.4 Path to Achieve Measurable Objectives

Regulation Requirements:
§354.30 (e) Each Plan shall describe a reasonable path to achieve the sustainability goal for the basin within 20 years of Plan implementation, including a description of interim milestones for each relevant sustainability indicator, using the same metric as the measurable objective, in increments of five years. The description shall explain how the Plan is likely to maintain sustainable groundwater management over the planning and implementation horizon.

See Section 4.2.3.4 for a discussion on path to achieve MOs. **Table 4-4** presents the interim milestones for groundwater storage change as a metric for comparison of the Subbasin's progress.

4.4 Seawater Intrusion

Regulation Requirements: **§354.26 (d)** An Agency that is able to demonstrate that undesirable results related to one or more sustainability indicators are not present and are not likely to occur in a basin shall not be required to establish criteria for undesirable results related to those sustainability indicators.
§354.28 (c) (3) Seawater Intrusion. The minimum threshold for seawater intrusion shall be defined by a chloride concentration isocontour for each principal aquifer where seawater intrusion may lead to undesirable results. Minimum thresholds for seawater intrusion shall be supported by the following: **(a)** Maps and cross-sections of the chloride concentration isocontour that defines the minimum threshold and measurable objective for each principal aquifer. **(b)** A description of how the seawater intrusion minimum threshold considers the effects of current and projected sea levels.
§354.28 (e) An Agency that has demonstrated that undesirable results related to one or more sustainability indicators are not present and are not likely to occur in a basin, as described in Section 354.26, shall not be required to establish minimum thresholds related to those sustainability indicators**.**

This Subbasin is not near the ocean or the influence of the ocean. This indicator is not applicable.

4.5 Groundwater Quality

Groundwater quality in the basin is dominated by the geology of the area as well as the quality of the storm runoff from the Coastal Mountains, many of which are of marine origin per **Chapter 3**. . As such there is a data gap for trends in water quality over time. The implementation goal for this SMC is to collect data over the first five-year implementation period so as to allow for better goal setting in future updates. To do this, analyses for irrigation suitability will be obtained from well owners. Every year one third of the wells are sampled for irrigation suitability, Annual samples will be collected for all irrigation wells for Ec.

4.5.1 Undesirable Results

Groundwater quality conditions in the Subbasin have been detailed in the basin setting section of the GSP and are only summarized here. This basin is under considerable influence of the coastal mountains that are of marine origin. This means the geologic formations under the Subbasin are high in salts, contributing to the historically high concentration of total dissolved salts as well as boron. It is well documented that many of the urban (domestic) and municipal uses of groundwater were replaced with surface water sources due to the high salinity groundwater. **Figure 4-9** below shows the early importation of water for municipal uses. Water quality has been marginal for some crops. Pistachios tolerate the groundwater quality rather well and have become more widespread in Pleasant Valley. Please refer to **Section 3.3.5-B2** for more description of deep percolation of irrigation. Additionally, the microclimate of the area is well suited for this crop. Current data available indicates EC measurements in groundwater ranges between 1,601 to 3,560 micromhos/cm for most of the Subbasin. The southern portion of the Subbasin near the Zapato Chino Creek community has EC measurements below 1,600 micromhos/cm, which is the secondary MCL for EC.



Figure 4-11 Early import of water supplies

There is a small community at the southern end of the basin that relies on groundwater, shown in **Figure 4-10**. With the planned import of surface supplies, it is expected that there will be a slight positive impact on groundwater quality, which will continue to be monitored for changes. The importation of surface supplies is planned to include large volumes of intentional recharge. Monitor wells would be incorporated into the design of recharge basins to allow for testing for water quality.



Figure 4-12 The basin - where agriculture and development coexist

An Undesirable Result related to groundwater quality is defined as the significant and unreasonable degradation of water quality to be determined by the Subbasin and its constituents. Stakeholder meetings are held with the Pleasant Valley Subbasin to determine what is significant and unreasonable locally. Therefore, an Undesirable Result related to groundwater quality in the Subbasin is defined as the degradation of groundwater quality such that pistachios can no longer grow. It has been recognized that the City of Coalinga and surrounding municipal demands have been served surface water due to the inability of the groundwater to meet the requirements and demands of human consumption.

Irrigation wells: The major crop grown in the PV Subbasin are pistachios. Pistachios are salt tolerant and can survive using water with TDS levels of up 5,000 mg/L. The water level declines have little to no effect on the groundwater quality. Three new monitor wells have been constructed and allow monitoring of the shallow ground water. The MOs for water quality is set at 2,500 mg/L. The MTs have been set at 3,000 to accommodate the fluctuations in the quality of water. This value gives the subbasin flexibility to operate as described in the SGMA guidelines and follows the existing water quality data. The water quality hydrographs shown in this section demonstrate the historic lowering of GW levels compared to the stable water quality values over time even though water levels decline significantly the quality remains stable. Water quality monitoring has been implemented since the first submittal and this information was used to set the water quality MTs.

Domestic wells: There are minimal amount of domestic water well users in the PV Subbasin and this water is not used for drinking water. It is used for toilets and for landscape irrigation. GSA will be implementing a domestic water monitoring plan to monitor water quality and water levels. A correspondence letter has been sent to the landowners in the Lost Hills Community, to begin this process. Self-Help Mitigation Measures Guidelines can be found in Appendix O and are also being considered should the domestic well users choose to treat their well water for drinking water.

Undesirable Results:
Historical data and recent data have shown that lowering of the groundwater has little effect on the quality of the groundwater: The lowering of the groundwater to where an undesirable effect would occur would be at a level of more than 500 feet below the minimum threshold. If this occurs, a high percentage of wells would have gone dry. The MT is set and at a TDS of 3000 uS/dm, allowing for future water treatment facilities within the Los Hills Community and allows the farmers to continue to farm Pistachios and row crops. The

undesirable result should the levels exceed the MT, would be a high cost to treat the water and loss of production of the crops within the subbasin.

Mitigation Measures:

Mitigation measures should the MTs be exceed are as follows:

1. Technical Assistance: Evaluation of the severity of the impacts to the landowners in the area.
    a. Paid for by PVGSA, up to $4,000 per situation, needs approval by PV Board.
2. Potential mandatory pumping restrictions.
    a. Paid for by landowner
3. Possible surface water importation.
    a. Paid for by landowner
4. Domestic Wells-See Appendix O Technical Assistance Flowchart.

4.5.1.1 Criteria to Define Undesirable Results

Regulation Requirements:
§354.26 (a) Each Agency shall describe in its Plan the processes and criteria relied upon to define undesirable results applicable to the basin. Undesirable results occur when significant and unreasonable effects for any of the sustainability indicators are caused by groundwater conditions occurring throughout the basin.

Undesirable Results would be the continual degradation of supplies that would not allow for the continued farming of pistachios and other salt tolerant crops. The criteria relied upon to define this result includes historical groundwater conditions related to water quality and the potential for future use. According to Ferguson, Sanden, & Grattan (2010), the groundwater will no longer provide beneficial use to pistachios when EC levels exceed to 3,500 micromhos/cm.

4.5.1.2 Causes of Groundwater Conditions That Could Lead to Undesirable Results

Regulation Requirements:
§354.26 (b) The description of undesirable results shall include the following:
(1) The cause of groundwater conditions occurring throughout the basin that would lead to or has led to undesirable results based on information described in the basin setting, and other data or models as appropriate.
(2) The criteria used to define when and where the effects of the groundwater conditions cause undesirable results for each applicable sustainability indicator. The criteria shall be based on a quantitative description of the combination of minimum threshold exceedances that cause significant and unreasonable effects in the basin.
(3) Potential effects on the beneficial uses and users of groundwater, on land uses and property interests, and other potential effects that may occur or are occurring from undesirable results.

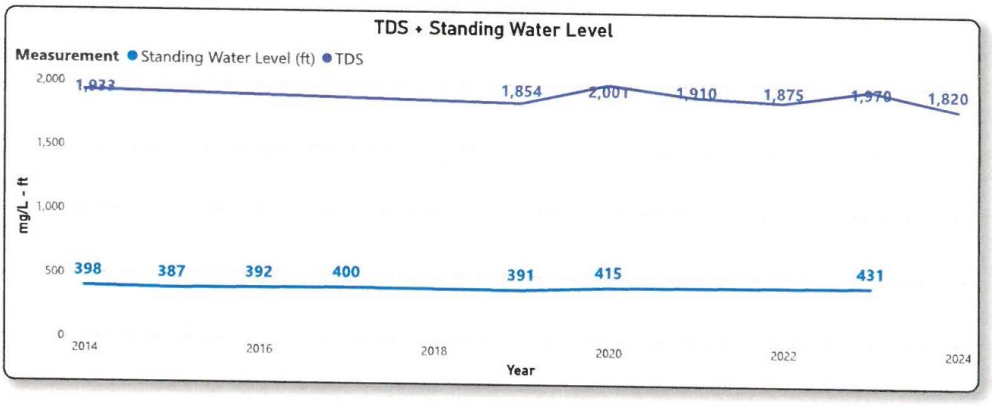
Deep percolation is more concentrated in salts possibly due to drip irrigation.

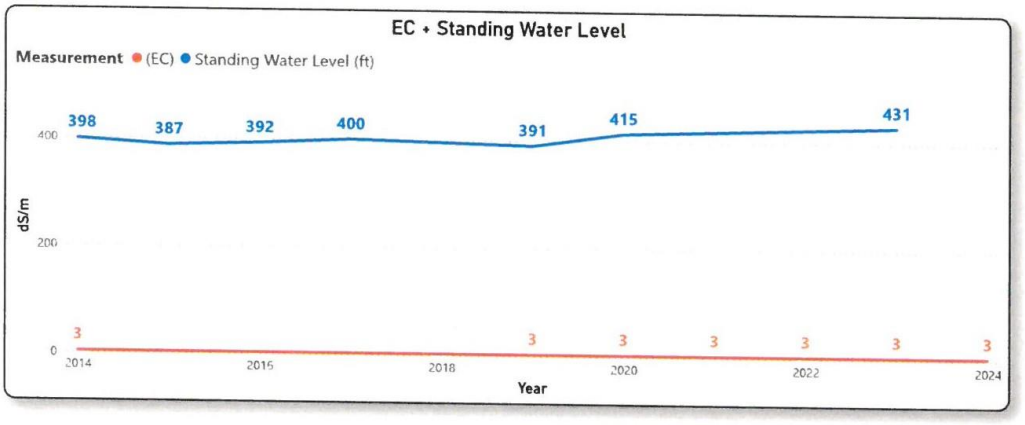
4.5.1.3 Evaluation of Multiple Minimum Thresholds

Regulation Requirements:
§354.26 (c) The Agency may need to evaluate multiple minimum thresholds to determine whether an undesirable result is occurring in the basin. The determination that undesirable results are occurring may depend upon measurements from multiple monitoring sites, rather than a single monitoring site.

Constituent concentrations in the groundwater in Pleasant Valley aren't related to water level decline. Water quality data from wells show there is little to no change in water quality as the water levels have declined over time. See the following graphs.Three specially designed monitor wells are being installed in the valley (in early 2024) to fill data gaps for water levels and downward deep percolation travel.

Over time and with introduction of higher quality surface water it is expected the water quality will stabilize and or increase.





For additional water quality hydrographs see Appendix K.

4.5.2 Minimum Thresholds

Regulation Requirements:
§354.28 (a) Each Agency in its Plan shall establish minimum thresholds that quantify groundwater conditions for each applicable sustainability indicator at each monitoring site or representative monitoring site established pursuant to Section 354.36. The numeric value used to define minimum thresholds shall represent a point in the basin that, if exceeded, may cause undesirable results as described in Section 354.26.
(d) An Agency may establish a representative minimum threshold for groundwater elevation to serve as the value for multiple sustainability indicators, where the Agency can demonstrate that the representative value is a reasonable proxy for multiple individual minimum thresholds as supported by adequate evidence.

The minimum threshold for groundwater quality for the Subbasin will be an EC threshold of 3,000 micromhos/cm and a chloride concentrations of 300 mg/l.

4.5.2.1 Criteria to Define Minimum Thresholds

Regulation Requirements:
§354.28 (b) The description of minimum thresholds shall include the following:
(1) The information and criteria relied upon to establish and justify the minimum thresholds for each sustainability indicator. The justification for the minimum threshold shall be supported by information provided in the basin setting, and other data or models as appropriate, and qualified by uncertainty in the understanding of the basin setting.

§354.28 (c) Minimum thresholds for each sustainability indicator shall be defined as follows:
(4) Degraded Water Quality. The minimum threshold for degraded water quality shall be the degradation of water quality, including the migration of contaminant plumes that impair water supplies or other indicator of water quality as determined by the Agency that may lead to undesirable results. The minimum threshold shall be used on the number of supply wells, a volume of water, or a location of an isocontour that exceeds concentrations of constituents determined by the Agency to be of concern for the basin. In setting minimum thresholds for degraded water quality, the Agency shall consider local, state, and federal water quality standards applicable to the basin.

Criteria used in determining MTs include water quality thresholds that would not allow for the beneficial use of groundwater as it is currently used in the region.

4.5.2.2 Relationships Between Minimum Thresholds and Sustainability Indicators

Regulation Requirements:
§354.28 (b) The description of minimum thresholds shall include the following:
(2) The relationship between the minimum thresholds for each sustainability indictor, including and explanation of how the Agency has determined that basin conditions at each minimum threshold will avoid undesirable results for each of the sustainability indicators.

Based upon the information shown in **Chapter 3**, the basin is dominated by its location and having higher salt content than other areas in the San Joaquin Valley, naturally occurring in the soil and the groundwater. This GSP plans to use this baseline as an MO and to calculate a percent increase to set the MT. The MT when not exceeded will not cause an undesirable result. It is known that the main crop in the subbasin is Pistachio's and this crop has a tolerance for Ec in the range of 5,000 micromhos/cm.

The historic water level declines have little to no effect on the groundwater quality as seen in the historic hydrographs for selected constituents. Three new monitor wells have been constructed and allow monitoring of the shallow water levels and groundwater quality. The MO for water quality is set at 2,500 mg/L. This value gives the subbasin flexibility to operate as described in the SGMA guidelines and follows the existing

water quality data. It is expected if there is a change in water quality it will be due to recharge projects pushing historic over irrigation water down but the quality is expected to remain within the MOs and MTs. Close observation will be conducted with the new monitoring plan. The water quality hydrographs shown in this section are an example of the historic lowering of GW levels compared to the stable water quality values over time. Water quality monitoring has been implemented since the first submittal. This information was used to evaluate the water quality MO. Attached is an example of one well that has been monitored over time, showing groundwater TDS and EC levels versus declining water levels, for more information see Appendix K.

4.5.2.3 Minimum Thresholds in Relation to Adjacent Basins

Regulation Requirements:
§354.28 (b) The description of minimum thresholds shall include the following:
(3) How minimum thresholds have been selected to avoid causing undesirable results in adjacent basins or affecting the ability of adjacent basins to achieve sustainability goals.

As stated in Chapter **3**, there are two potential links between the Pleasant Valley Subbasin and the Westside Subbasin including the Pasajero Gap and the Polvadero Gap. The hydrogeology and groundwater flow in the two areas is discussed in Chapter **3**; however, the groundwater flow is relatively small.

4.5.2.4 Impact of Minimum Thresholds on Beneficial Uses and Users

Regulation Requirements:
§354.28 (b) The description of minimum thresholds shall include the following:
(4) How minimum thresholds may affect the interests of beneficial uses and users of groundwater or land uses and property interests.

If groundwater quality conditions deteriorate, due to deep percolation irrigation, agricultural producers may experience a decrease in crop yield and/or crop quality.

4.5.2.5 Current Standards Relevant to Sustainability Indicator

Regulation Requirements:
§354.28 (b) The description of minimum thresholds shall include the following:
(5) How state, federal, or local standards relate to the relevant sustainability indicator. If the minimum threshold differs from other regulatory standards, the Agency shall explain the nature of and basis for the difference.

State, Federal, and Local standards do not relate to the quality of groundwater, because the use is for irrigated agriculture.

4.5.2.6 Measurement of Minimum Thresholds

Regulation Requirements:
§354.28 (b) The description of minimum thresholds shall include the following:
(6) How each minimum threshold will be quantitatively measured, consistent with the monitoring network requirements described in Subarticle 4.

In general, water samples will be taken from a set of wells identified in Section 5 – Monitoring Network and analyzed primarily for salt and TDS concentrations. The results of these tests will be compared to past test results to identify trends. Additionally, water samples will be taken from cascading water to determine the quality of deep percolating water.

4.5.3 Measurable Objectives

4.5.3.1 Description of Measurable Objectives

Regulation Requirements:
§354.30 (a) Each Agency shall establish measurable objectives, including interim milestones in increments of five years, to achieve the sustainability goal for the basin with 20 years of Plan implementation and to continue to sustainably manage the groundwater basin over the planning and implementation horizon.
(b) Measurable objectives shall be established for each sustainability indicator, based on quantitative values using the same metrics and monitoring sites as are used to define the minimum thresholds.

The MO for groundwater quality in the Subbasin is to maintain a suitable quality of water for continued use in current irrigation practices. The goal is to keep groundwater quality as consistent as possible.

4.5.3.2 Operational Flexibility

Regulation Requirements:
§354.30 (c) Measurable objectives shall provide a reasonable margin of operational flexibility under adverse conditions which shall take into consideration components such as historical water budgets, seasonal and long-term trends, and periods of drought, and be commensurate with levels of uncertainty.

The operational flexibility is the difference between the MO and MT. This is considered adequate to accommodate annual and seasonal changes in groundwater measurements.

4.5.3.3 Representative Monitoring

Regulation Requirements:
§354.30 (d) An Agency may establish a representative measurable objective for groundwater elevation to serve as the value for multiple sustainability indicators where the Agency can demonstrate that the representative value is a reasonable proxy for multiple individual measurable objectives as supported by adequate evidence.

Groundwater levels will not be directly used as a representative MO for groundwater quality. This is because groundwater quality is not affected significantly due to changes in groundwater levels. Water quality data will be monitored directly according to the Monitoring Network and procedures discussed in Section 5.

The indicator will be when water quality decreases to the MO. This lowering shall occur in three wells in area for one event, either the fall or spring measurement, in the area of the RMS. The "undesirable result" would be the loss of production of the pistachios and the inability to plant vegetable crops. Water quality will be measured twice a year.

Every year one third of the wells are sampled for irrigation suitability, Annual samples will be collected for all irrigation wells for Ec.

4.5.3.4 Path to Achieve Measurable Objectives

Regulation Requirements:
§354.30 (e) Each Plan shall describe a reasonable path to achieve the sustainability goal for the basin within 20 years of Plan implementation, including a description of interim milestones for each relevant sustainability indicator, using the same metric as the measurable objective, in increments of five years. The description shall explain how the Plan is likely to maintain sustainable groundwater management over the planning and implementation horizon.

It is anticipated that additional surface water supplies will be brought into the Subbasin during the implementation period of the GSP. The surface water supplies are likely to be low in total dissolved solids, especially compared to the quality of groundwater in the basin.

4.6 Land Subsidence

According to USGS, land subsidence is a settling or sudden sinking of the land surface. Current and historical information on land subsidence is discussed in **Section 3.2.6,** and the land subsidence monitoring network is discussed in **Section 5.6.** Of interest in the GSP is land subsidence caused by groundwater pumping. This Section will discuss the undesirable result, minimum threshold, and measurable objective set for land subsidence. A summary of the Minimum Threshold and Measurable Objective for land subsidence can be seen in **Table 4-5** and **Table 4-6** respectively. More details and the methodology to set the criteria can be found later in this section.

Table4-5 Minimum Threshold for Land Subsidence

Minimum Threshold Parameter	Minimum Threshold Quantity
Annual Land Subsidence Rate	2 inches/year over an area of 36 square miles
Maximum Cumulative Land Subsidence	1 foot over 20 years

Table4-6 Measurable Objective for Land Subsidence

Measurable Objective Parameter	Measurable Objective Quantity
Annual Land Subsidence Rate	1.0 inches/year over an area of 36 square miles
Maximum Cumulative Land Subsidence	0.5 foot over 20 years

The subsurface deposits in the PV Subbasin are not highly conducive of land subsidence, historical declines in water levels have resulted in minimal subsidence in the area. The subsidence data is gathered from InSAR and is measured in millimeters. According to USGS publication 1316G, See Appendix P for additional information in subsidence and forecasted subsidence.

Forecasted subsidence was calculated using two methods:

1. Method 1: Using the historic subsidence and projecting it out to 2024. See Appendix P, for the graph of the forecasted subsidence. The subsidence was approximately 0.34 feet by 2042 and would go to zero as water levels become sustainable or no longer fall.
2. Method 2: Based on the work by Joseph F Poland, Guidebook to studies of land Subsidence due to ground-water withdrawal, Chapter 5. Figure 5.16 on Page 11 of the pdf shows ratios of subsidence to head decline, west side of the San Joaquin Valley, California, 1943-59 (Bull and Poland, 1975). Although the Pleasant Valley Area is not mapped the closest line is 0.01, and this value will be used for the calculation. Using the equal ration value of 0.01 times the head decline of 50 feet gives a forecasted subsidence of 0.5 feet by the year 2024.

From this analysis setting the MT at 1 foot is realistic. Continued elevation monitoring of the concrete pads of the RMS wells will be done and these values will be re-examined at each milestone.

4.6.1 Undesirable Results

Per **Section 3** - Basin Setting, the evidence of subsidence in the Subbasin is minimal with the highest value occurring in the central portion of the Subbasin between approximately 1.0 and 1.5 inches over a four-year span. There is only one actual on the ground measuring station in the Subbasin located at the Farm of the Future for West Hills College. Undesirable results would consist of lowering the ground surface such that buildings and surface structures are impacted, or the land topography changes such that storm runoff and/or stream aggradation or degradation occurs. The proposed monitoring network establishes an additional

subsidence monitor station per **Section 5**. **Figure 4-11** shows the InSar data that suggests that subsidence is correlated with the area of pumping within the Subbasin.

Due to the natural gradient of the topography and the elastic soils in the area, subsidence does not create an undesirable result. The expected movement in 20 years is expected to be 1 foot. The data from the Central Valley Subsidence Data | USGS California Water Science Center, suggests over the period of record there has been minimal subsidence that does not create an undesirable result, at or below the MTs set in this report.

There will not be a reduction in groundwater storage due to subsidence within the PV Subbasin. The subbasin is conducive to rebounding water levels.

The goal of this GSP is to have zero subsidence by the year 2042. The undesirable result is when the ground surface elevation drops below the MT at the concrete well pad of the RMS and the gradient within a minimum of a 3 miles radius of the RMS well exceeds 1/31,680, from the earliest known data reference which is 2019. These values equated to 1 foot of subsidence over a 6-mile length. As subsidence will mostly occur in a larger area all RMS locations will be compared to one another and analyzed.

Mitigation Measures:

Mitigation measures should the MTs be exceed are as follows:

1. Technical Assistance: Evaluation of the severity of the impacts to the landowners in the area.
    a. Paid for by PVGSA, up to $4,000 per situation, needs approval by PV Board.
2. Coordination and evaluation of infrastructure in the area, and agencies, such as Caltrans, Fresno County, and the City of Coalinga.
    a. Paid for by landowner
3. Possible surface water importation.
    a. Paid for by landowner
4. Domestic Wells-See Appendix O Technical Assistance Flowchart.

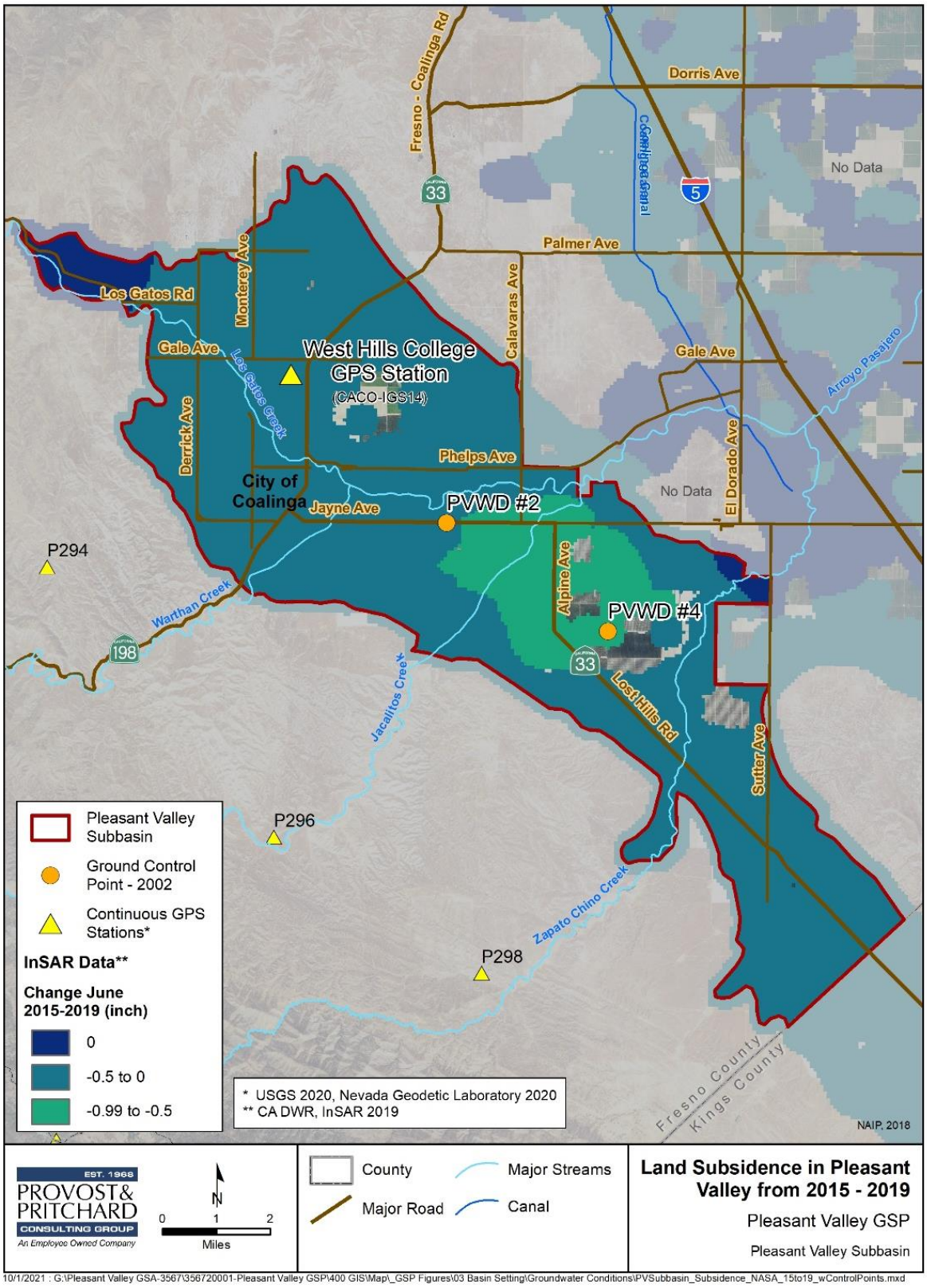


Figure 4-13 InSar Land Subsidence from 2015-2019

It should also be recognized that this area has oil exploration and pumping in deeper geologic zones as well as a recognition of being in an active seismic zone. Therefore, if ground movement is recorded it is not necessarily related to groundwater pumping as it could be associated with a number of different sources.

4.6.1.1 Criteria to Define Undesirable Results

Regulation Requirements:
§354.26 (a) Each Agency shall describe in its Plan the processes and criteria relied upon to define undesirable results applicable to the basin. Undesirable results occur when significant and unreasonable effects for any of the sustainability indicators are caused by groundwater conditions occurring throughout the basin.

Criteria to define UR's due to subsidence are as follows. An UR occurs when:

Water levels will not be used as a proctor for subsidence. Subsidence is minimal in the subbasin and will be monitored using InSAR data and the well pads from the RMS wells. The northern area of the PV Subbasin is approximately at an elevation (feet above sea level) of 850 feet, the middle area of the PV Subbasin is approximately at an elevation of 590 feet, and the south end is approximately at an elevation of 814 feet. Due to the steep gradient across the subbasin, the MTs were set at 1-foot gradient change within a three-mile radius. Communication with Caltrans, City of Coalinga and Fresno County is part of the project to coincide ground surface movement due to tectonic plate movement in this area. This area is known to have many fault lines.

Undesirable Results:
Historical data and recent data have shown that lowering of the groundwater has not caused undesirable results due to subsidence: The lowering of the groundwater to where an undesirable effect would occur would be at an estimated level of more than 500 feet below the minimum threshold. If this occurs, the expected range of subsidence (compaction) would be in the range of 2-3 feet. The alluvium in the subbasin is elastic and will rebound with recharge. Currently, the subsidence is measured in millimeters and could be within a tolerance of the InSAR Data for zero subsidence. The MT is set at 1 foot by 2042. Communication with Caltrans, City of Coalinga and Fresno County is part of the project to coincide ground surface movement due to tectonic plate movement in this area. This area is known to have many fault lines.

4.6.1.2 Causes of Groundwater Conditions That Could Lead to Undesirable Results

Regulation Requirements:
§354.26 (b) The description of undesirable results shall include the following:
(1) The cause of groundwater conditions occurring throughout the basin that would lead to or has led to undesirable results based on information described in the basin setting, and other data or models as appropriate.
(2) The criteria used to define when and where the effects of the groundwater conditions cause undesirable results for each applicable sustainability indicator. The criteria shall be based on a quantitative description of the combination of minimum threshold exceedances that cause significant and unreasonable effects in the basin.
(3) Potential effects on the beneficial uses and users of groundwater, on land uses and property interests, and other potential effects that may occur or are occurring from undesirable results.

The historical data shows a drop in groundwater levels of approximately 200 feet from 1960 to 2020. While some drop in groundwater levels is expected until management actions and projects are implemented, ground subsidence is not expected to be significant and unreasonable based on historical trends. However, significant drought or non-compliance with management actions may result in continued groundwater decline. Measurement and monitoring will enable the plan to determine if this expectation will be realized.

The MTs set do not create UR's due to subsidence.

4.6.1.3 Evaluation of Multiple Minimum Thresholds

Regulation Requirements:
§354.26 (c) The Agency may need to evaluate multiple minimum thresholds to determine whether an undesirable result is occurring in the basin. The determination that undesirable results are occurring may depend upon measurements from multiple monitoring sites, rather than a single monitoring site.

All monitored wells were evaluated when the MTs were set.

4.6.2 Minimum Thresholds

Regulation Requirements:
§354.28 (a) Each Agency in its Plan shall establish minimum thresholds that quantify groundwater conditions for each applicable sustainability indicator at each monitoring site or representative monitoring site established pursuant to Section 354.36. The numeric value used to define minimum thresholds shall represent a point in the basin that, if exceeded, may cause undesirable results as described in Section 354.26.
(d) An Agency may establish a representative minimum threshold for groundwater elevation to serve as the value for multiple sustainability indicators, where the Agency can demonstrate that the representative value is a reasonable proxy for multiple individual minimum thresholds as supported by adequate evidence.

Land subsidence MTs are established based on the risk of an outcome should the level of subsidence occur. The estimated subsidence for the period will not create UR's. Communication with Caltrans, City of Coalinga and Fresno County is part of the project to coincide ground surface movement due to tectonic plate movement in this area. This area is known to have many fault lines.

Forecasted subsidence was calculated using two methods:

3. Method 1: Using the historic subsidence and projecting it out to 2024. See Appendix P, for the graph of the forecasted subsidence. The subsidence was approximately 0.34 feet by 2042 and would go to zero as water levels become sustainable or no longer fall.
4. Method 2: Based on the work by Joseph F Poland, Guidebook to studies of land Subsidence due to ground-water withdrawal, Chapter 5. Figure 5.16 on Page 11 of the pdf shows ratios of subsidence to head decline, west side of the San Joaquin Valley, California, 1943-59 (Bull and Poland, 1975). Although the Pleasant Valley Area is not mapped the closest line is 0.01, and this value will be used for the calculation. Using the equal ration value of 0.01 times the head decline of 50 feet gives a forecasted subsidence of 0.5 feet by the year 2024.

From this analysis setting the MT at 1 foot is realistic. Continued monitoring of the concrete pads of the RMS wells will be done and these values will be re-examined at each milestone.

4.6.2.1 Criteria to Define Minimum Thresholds

Regulation Requirements:
§354.28 (b) The description of minimum thresholds shall include the following:
(1) The information and criteria relied upon to establish and justify the minimum thresholds for each sustainability indicator. The justification for the minimum threshold shall be supported by information provided in the basin setting, and other data or models as appropriate, and qualified by uncertainty in the understanding of the basin setting.

§354.28 (c) Minimum thresholds for each sustainability indicator shall be defined as follows:
(5) Land Subsidence. The minimum threshold for land subsidence shall be the rate and extent of subsidence that substantially interferes with surface land uses and may lead to undesirable results. Minimum thresholds for land subsidence shall be supported by the following:
(a) Identification of land uses and property interests that have been affected or are likely to be affected by land subsidence in the basin, including and explanation of how the Agency has determined and considered those uses and interests, and the Agency's rationale for establishing minimum thresholds in light of those effects.
(b) Maps and graphs showing the extent and rate of land subsidence in the basin that defines the minimum threshold and measurable objectives.

See **Section 4.6.2**.

4.6.2.2 Relationships Between Minimum Thresholds and Sustainability Indicators

Regulation Requirements:
§354.28 (b) The description of minimum thresholds shall include the following:
(2) The relationship between the minimum thresholds for each sustainability indictor, including and explanation of how the Agency has determined that basin conditions at each minimum threshold will avoid undesirable results for each of the sustainability indicators.

See **Section 4.3.2.2**. The sustainability indicator for groundwater declines will govern. The lowering of the groundwater to where an undesirable effect would occur would be at an estimated level of more than 500 feet below the minimum threshold. If this occurs, the expected range of subsidence (compaction) would be in the range of 2-3 feet, and all wells would be in operable.

Minimum Thresholds in Relation to Adjacent Basins

Regulation Requirements:
§354.28 (b) The description of minimum thresholds shall include the following:
(3) How minimum thresholds have been selected to avoid causing undesirable results in adjacent basins or affecting the ability of adjacent basins to achieve sustainability goals.

As described previously, the Pleasant Valley Subbasin is a separate subbasin with the exception of a limited connection with the Westside Subbasin. Therefore, there are few impacts to adjacent basins. Groundwater pumping is not expected to induce subsidence in the Westside Subbasin.

4.6.2.3 Impact of Minimum Thresholds on Beneficial Uses and Users

Regulation Requirements:
§354.28 (b) The description of minimum thresholds shall include the following:
(4) How minimum thresholds may affect the interests of beneficial uses and users of groundwater or land uses and property interests.

No impacts have been observed or documented on beneficial users and no impacts are anticipated at MTs. It will just call for increased attention.

4.6.2.4 Current Standards Relevant to Sustainability Indicator

Regulation Requirements:
§354.28 (b) The description of minimum thresholds shall include the following:
(5) How state, federal, or local standards relate to the relevant sustainability indicator. If the minimum threshold differs from other regulatory standards, the Agency shall explain the nature of and basis for the difference.

There are no State, Federal, or local standards that are relevant to this indicator.

4.6.2.5 Measurement of Minimum Thresholds

Regulation Requirements:
§354.28 (b) The description of minimum thresholds shall include the following:
(6) How each minimum threshold will be quantitatively measured, consistent with the monitoring network requirements described in Subarticle 4.

Measurements will be made per the Monitoring Network – See Chapter 5.

4.6.3 Measurable Objectives

As previously mentioned, it is difficult to quantify the rate of subsidence in the Subbasin, as the current measurements are within the range of error of the measurement devices. There are other local factors that could contribute to the subsidence, making it difficult to attribute the rate of subsidence to groundwater pumping.

4.6.3.1 Description of Measurable Objectives

Regulation Requirements:
§354.30 (a) Each Agency shall establish measurable objectives, including interim milestones in increments of five years, to achieve the sustainability goal for the basin with 20 years of Plan implementation and to continue to sustainably manage the groundwater basin over the planning and implementation horizon.
(b) Measurable objectives shall be established for each sustainability indicator, based on quantitative values using the same metrics and monitoring sites as are used to define the minimum thresholds.

Not applicable.

4.6.3.2 Operational Flexibility

Regulation Requirements:
§354.30 (c) Measurable objectives shall provide a reasonable margin of operational flexibility under adverse conditions which shall take into consideration components such as historical water budgets, seasonal and long-term trends, and periods of drought, and be commensurate with levels of uncertainty.

A subsidence of 0.1 foot per year has been established as the MO while the most recent subsidence was less than 0.1 foot over the course of four years. This provides a reasonable margin of operational flexibility should conditions arise that negatively impact the ground subsidence.

4.6.3.3 Representative Monitoring

> Regulation Requirements:
> **§354.30 (d)** An Agency may establish a representative measurable objective for groundwater elevation to serve as the value for multiple sustainability indicators where the Agency can demonstrate that the representative value is a reasonable proxy for multiple individual measurable objectives as supported by adequate evidence.

Measurements will be made per the Monitor Network – See **Chapter 5**.

4.6.3.4 Path to Achieve Measurable Objectives

> Regulation Requirements:
> **§354.30 (e)** Each Plan shall describe a reasonable path to achieve the sustainability goal for the basin within 20 years of Plan implementation, including a description of interim milestones for each relevant sustainability indicator, using the same metric as the measurable objective, in increments of five years. The description shall explain how the Plan is likely to maintain sustainable groundwater management over the planning and implementation horizon.

Not applicable.

4.7 Interconnected Surface Water and Groundwater

Regulation Requirements:
§354.26 (d) An Agency that is able to demonstrate that undesirable results related to one or more sustainability indicators are not present and are not likely to occur in a basin shall not be required to establish criteria for undesirable results related to those sustainability indicators.

§354.28 (e) An Agency that has demonstrated that undesirable results related to one or more sustainability indicators are not present and are not likely to occur in a basin, as described in Section 354.26, shall not be required to establish minimum thresholds related to those sustainability indicators.

As described in **Chapter 3**, groundwater levels are very deep compared to surface features. There are only small areas of land where groundwater levels may be in close proximity to the surface water feature. These may occur where the creek systems exit the more mountainous terrain in the western portion of the Subbasin. In general, these areas are not developed, are still within the canyon before opening into the Subbasin, have shallow alluvium, have steep slopes, are in areas where the land activity is devoted to cattle grazing, and are more than two miles from active wells used for agricultural production. It is for these reasons that this sustainability indicator is considered not likely to occur and sustainable management criteria are not established. Monitoring of wells in the area will still occur and if there are any changes to the conditions, it will be discussed in subsequent GSP updates.

4.7.1 Undesirable Results

Interconnected surface water is not applicable in the PV Subbasin, the streams within the PV Subbasin are considered ephemeral. Recent information from the three new monitor wells indicate unsaturated conditions were encountered in the mew monitor wells as follows, leading to disconnected surface water:

- MW-1: above 380 feet below ground surface.
- MW-2: above 490 feet below ground surface.
- MW-3: above 480 feet below ground surface.

For additional information see Appendix N.

4.7.1.1 Criteria to Define Undesirable Results

Regulation Requirements:
§354.26 (a) Each Agency shall describe in its Plan the processes and criteria relied upon to define undesirable results applicable to the basin. Undesirable results occur when significant and unreasonable effects for any of the sustainability indicators are caused by groundwater conditions occurring throughout the basin.

4.7.1.2 Causes of Groundwater Conditions That Could Lead to Undesirable Results

Regulation Requirements:
§354.26 (b) The description of undesirable results shall include the following:
(1) The cause of groundwater conditions occurring throughout the basin that would lead to or has led to undesirable results based on information described in the basin setting, and other data or models as appropriate.
(2) The criteria used to define when and where the effects of the groundwater conditions cause undesirable results for each applicable sustainability indicator. The criteria shall be based on a quantitative description of the combination of minimum threshold exceedances that cause significant and unreasonable effects in the basin.
(3) Potential effects on the beneficial uses and users of groundwater, on land uses and property interests, and other potential effects that may occur or are occurring from undesirable results.

4.7.1.3 Evaluation of Multiple Minimum Thresholds

Regulation Requirements:
§354.26 (c) The Agency may need to evaluate multiple minimum thresholds to determine whether an undesirable result is occurring in the basin. The determination that undesirable results are occurring may depend upon measurements from multiple monitoring sites, rather than a single monitoring site.

4.7.1.4 Sustainability Indicators Not Present in Basin

Regulation Requirements:
§354.26 (d) An Agency that is able to demonstrate that undesirable results related to one or more sustainability indicators are not present and are not likely to occur in a basin shall not be required to establish criteria for undesirable results related to those sustainability indicators.

4.7.2 Minimum Thresholds

Regulation Requirements:
§354.28 (a) Each Agency in its Plan shall establish minimum thresholds that quantify groundwater conditions for each applicable sustainability indicator at each monitoring site or representative monitoring site established pursuant to Section 354.36. The numeric value used to define minimum thresholds shall represent a point in the basin that, if exceeded, may cause undesirable results as described in Section 354.26.
(d) An Agency may establish a representative minimum threshold for groundwater elevation to serve as the value for multiple sustainability indicators, where the Agency can demonstrate that the representative value is a reasonable proxy for multiple individual minimum thresholds as supported by adequate evidence.
(e) An Agency that has demonstrated that undesirable results related to one or more sustainability indicators are not present and are not likely to occur in a basin, as described in Section 354.26, shall not be required to establish minimum thresholds related to those sustainability indicators**.**

4.7.2.1 Criteria to Define Minimum Thresholds

Regulation Requirements:
§354.28 (b) The description of minimum thresholds shall include the following:
(1) The information and criteria relied upon to establish and justify the minimum thresholds for each sustainability indicator. The justification for the minimum threshold shall be supported by information provided in the basin setting, and other data or models as appropriate, and qualified by uncertainty in the understanding of the basin setting.

§354.28 (c) Minimum thresholds for each sustainability indicator shall be defined as follows:
(6) Depletions of Interconnected Surface Water. The minimum threshold for depletions of interconnected surface water shall be the rate or volume of surface water depletions caused by groundwater use that has adverse impacts on beneficial uses of the surface water and may lead to undesirable results. The minimum threshold established for depletions of interconnected surface water shall be supported by the following:
(a) The location, quantity, and timing of depletions of interconnected surface water.
(b) A description of the groundwater and surface model used to quantify surface water depletion. If a numerical groundwater and surface water model is not used to quantify surface water depletion, the Plan shall identify and describe an equally effective method, tool, or analytical model to accomplish the requirements of this Paragraph.

4.7.2.2 Relationships Between Minimum Thresholds and Sustainability Indicators

Regulation Requirements:
§354.28 (b) The description of minimum thresholds shall include the following:
(2) The relationship between the minimum thresholds for each sustainability indictor, including and explanation of how the Agency has determined that basin conditions at each minimum threshold will avoid undesirable results for each of the sustainability indicators.

4.7.2.3 Minimum Thresholds in Relation to Adjacent Basins

Regulation Requirements:
§354.28 (b) The description of minimum thresholds shall include the following:
(3) How minimum thresholds have been selected to avoid causing undesirable results in adjacent basins or affecting the ability of adjacent basins to achieve sustainability goals.

4.7.2.4 Impact of Minimum Thresholds on Beneficial Uses and Users

Regulation Requirements:
§354.28 (b) The description of minimum thresholds shall include the following:
(4) How minimum thresholds may affect the interests of beneficial uses and users of groundwater or land uses and property interests.

4.7.2.5 Current Standards Relevant to Sustainability Indicator

Regulation Requirements:
§354.28 (b) The description of minimum thresholds shall include the following:
(5) How state, federal, or local standards relate to the relevant sustainability indicator. If the minimum threshold differs from other regulatory standards, the Agency shall explain the nature of and basis for the difference.

4.7.2.6 Measurement of Minimum Thresholds

Regulation Requirements:
§354.28 (b) The description of minimum thresholds shall include the following:
(6) How each minimum threshold will be quantitatively measured, consistent with the monitoring network requirements described in Subarticle 4.

4.7.3 Measurable Objectives

4.7.3.1 Description of Measurable Objectives

Regulation Requirements:
§354.30 (a) Each Agency shall establish measurable objectives, including interim milestones in increments of five years, to achieve the sustainability goal for the basin with 20 years of Plan implementation and to continue to sustainably manage the groundwater basin over the planning and implementation horizon.
(b) Measurable objectives shall be established for each sustainability indicator, based on quantitative values using the same metrics and monitoring sites as are used to define the minimum thresholds.

4.7.3.2 Operational Flexibility

Regulation Requirements:
§354.30 (c) Measurable objectives shall provide a reasonable margin of operational flexibility under adverse conditions which shall take into consideration components such as historical water budgets, seasonal and long-term trends, and periods of drought, and be commensurate with levels of uncertainty.

4.7.3.3 Representative Monitoring

Regulation Requirements:
§354.30 (d) An Agency may establish a representative measurable objective for groundwater elevation to serve as the value for multiple sustainability indicators where the Agency can demonstrate that the representative value is a reasonable proxy for multiple individual measurable objectives as supported by adequate evidence.

4.7.3.4 Path to Achieve Measurable Objectives

Regulation Requirements:
§354.30 (e) Each Plan shall describe a reasonable path to achieve the sustainability goal for the basin within 20 years of Plan implementation, including a description of interim milestones for each relevant sustainability indicator, using the same metric as the measurable objective, in increments of five years. The description shall explain how the Plan is likely to maintain sustainable groundwater management over the planning and implementation horizon.

4.8 Measurable Objectives for Additional Plan Elements

Regulation Requirements:
§354.30 (f) Each Plan may include measurable objectives and interim milestones for additional Plan elements described in Water Code Section 10727.4 where the Agency determines such measures are appropriate for sustainable groundwater management in the basin.
§354.30 (g) An Agency may establish measurable objectives that exceed the reasonable margin of operational flexibility for the purpose of improving overall conditions in the basin, but failure to achieve those objectives shall not be grounds for finding of inadequacy of the Plan.

The Sustainable Groundwater Management Act allows for Agencies, in collaboration with other local agencies, to set requirements for additional sustainability indicators, including the following:

- Wellhead Protection areas and recharge areas
- Migration of Contaminated water
- A well abandonment and well destruction program
- Replenishment of groundwater extractions
- Activities implementing conjunctive use or underground storage
- Well Construction Policies
- Measures addressing
  - Groundwater cleanup
  - Groundwater recharge
  - In-lieu use
  - Diversion to storage
  - Water recycling
  - Extraction
- Water efficiency
- Relationships with State and Federal Agencies
- Coordination on Land Use planning

Measurable Objectives are not planned to be set for any of these subjects in this plan, but all of these subjects are included in the plan. Specifically, land use planning and well construction and abandonment policies will reside with the County of Fresno and City of Coalinga, and the GSAs will continue to work together to strengthen this relationship and review of appropriate activities. As part of this joint plan, it is envisioned there will be a number of management actions found in **Chapter 6** that will develop and implement policies, ordinances, and requirements associated with:

1. Importation of surface water supplies
2. Requirement for measuring both streamflow amounts and groundwater
3. Rules and regulations regarding replenishment of groundwater extractions
4. Reduction in pumpage by reducing crop acreage

5 Monitoring Network

5.1 Introduction

Regulation Requirements:
§354.34(a) Each Agency shall develop a monitoring network capable of collecting sufficient data to demonstrate short-term, seasonal, and long-term trends in groundwater and related surface conditions, and yield representative information about groundwater conditions as necessary to evaluate Plan Implementation.

The summary of the Monitor Program is presented in **Section 5.2.** The remaining portion of this chapter is presented to conform with SGMA regulations. This chapter describes the current and developing monitoring networks in the Subbasin that will collect data to determine short-term, seasonal, and long-term trends in groundwater and surface conditions related to the sustainability indicators. Data collected from the monitoring networks will yield information necessary to support the implementation of this Plan, evaluate the effectiveness of this Plan, and guide decision making by the GSA management. Information and data from historical monitoring efforts can be found in **Section 3.3.8**.

Figure 5-1 shows all wells measured semi-annually for depth-to-water as well as all wells with flowmeters or transducers. **Figure 5-2** shows the currently proposed representative well locations for groundwater levels. **Figure 5-3** shows the groundwater quality monitoring network. Subsidence monitoring locations are shown on **Figure 5-4**. Wells outside the Subbasin used for monitoring interbasin groundwater levels are shown in **Figure 5-5**.

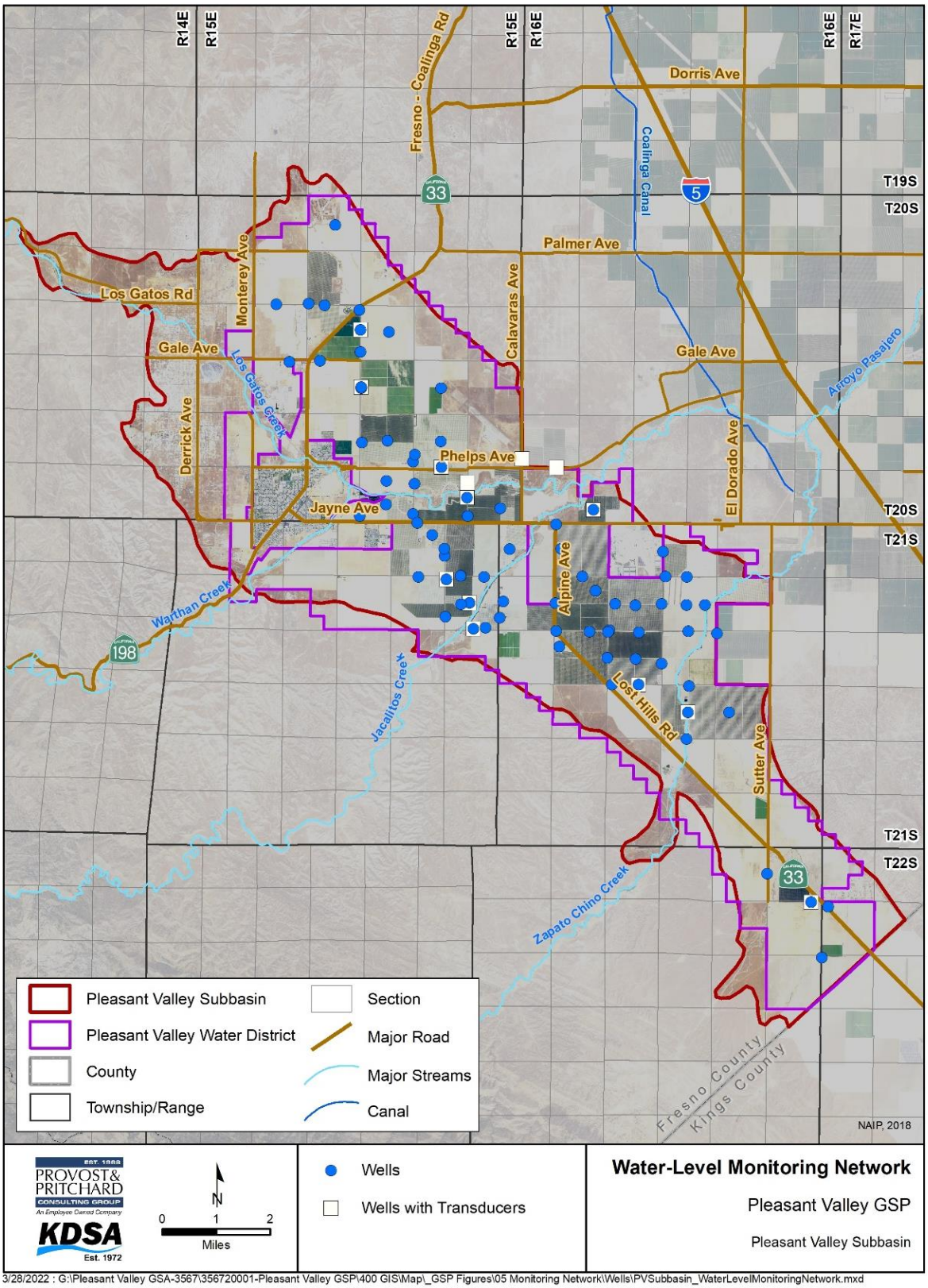


Figure 5-1 Water-Level Monitoring Network

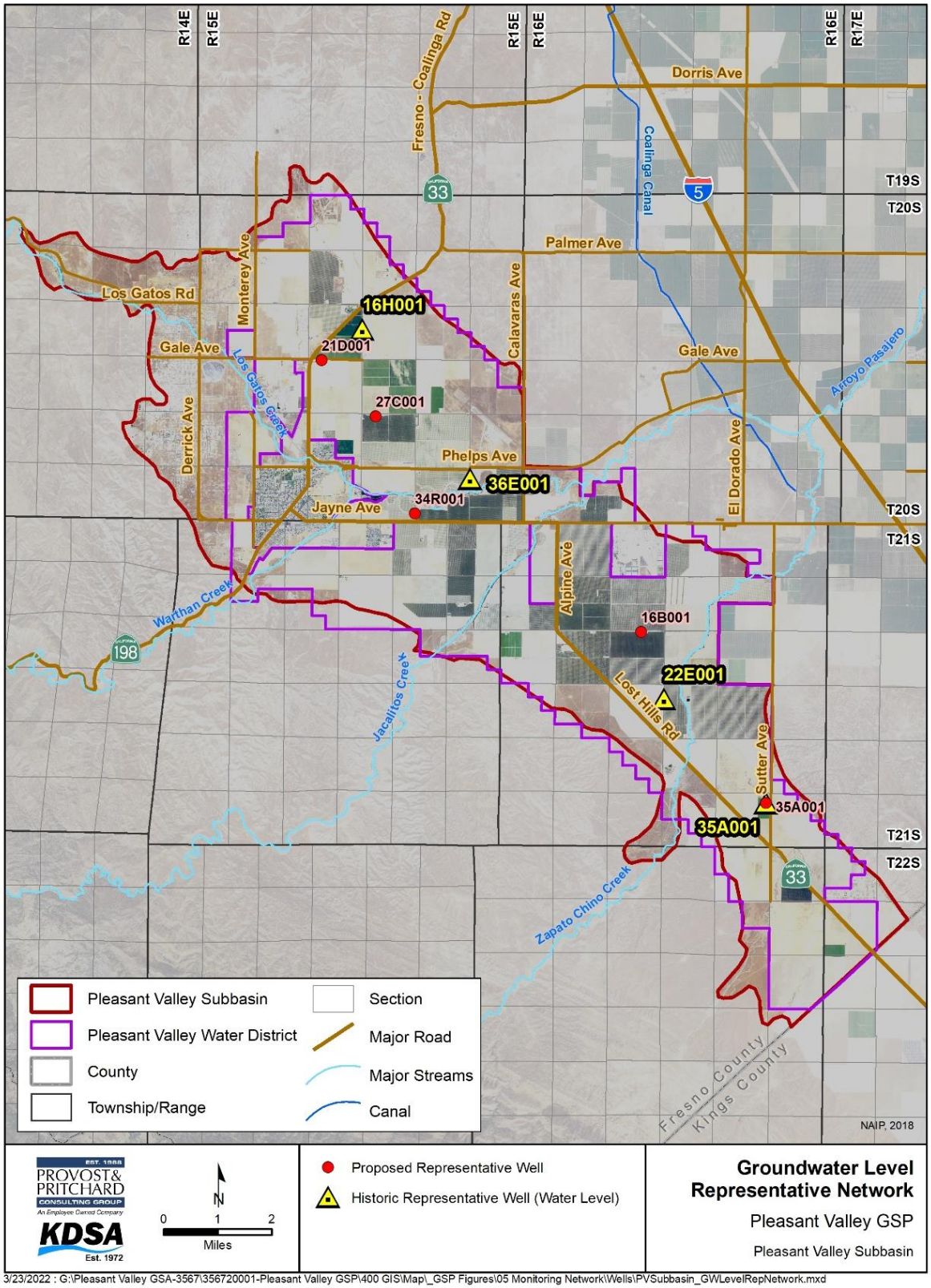


Figure 5-2 Groundwater Level Representative Network

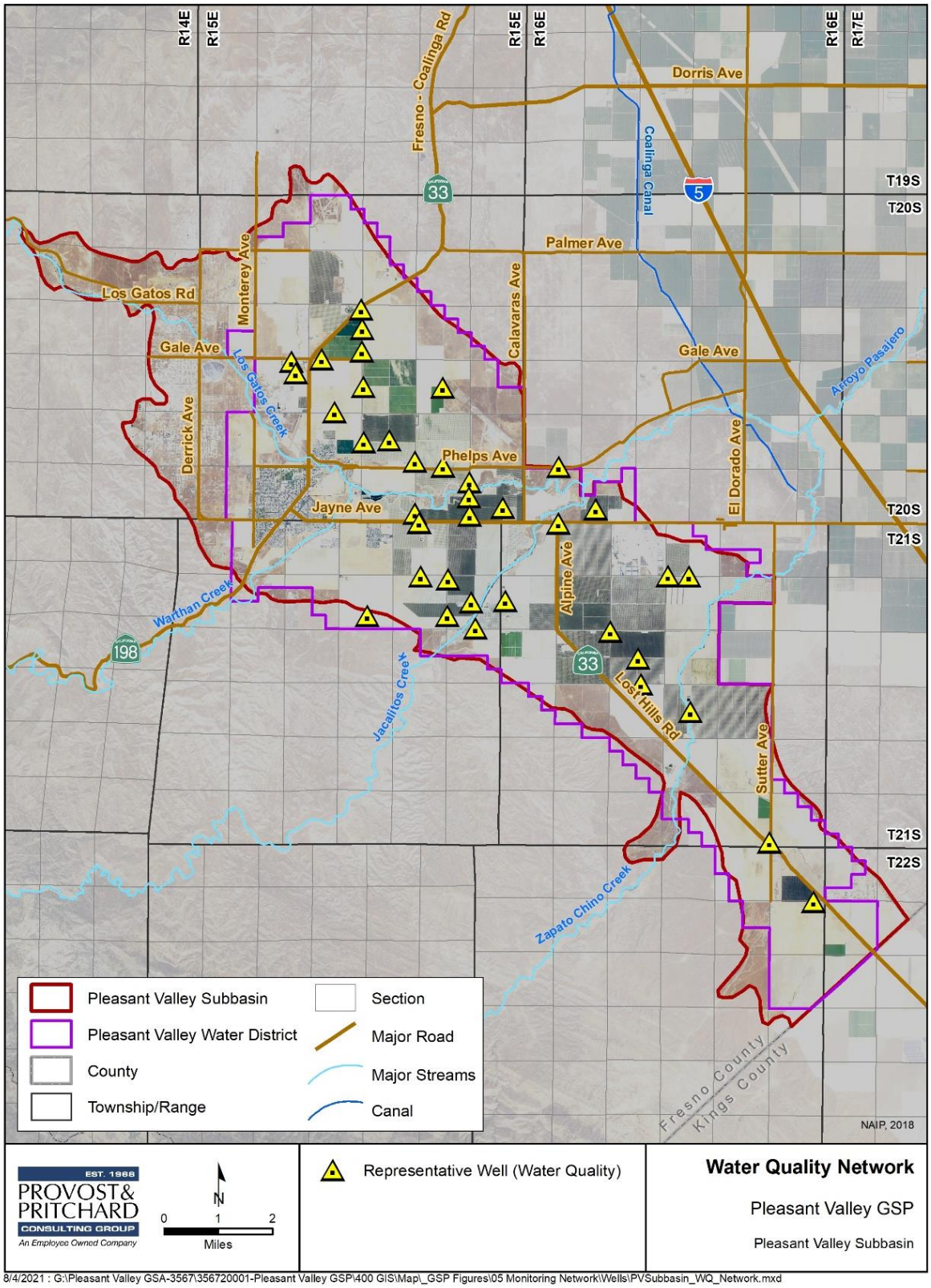


Figure 5-3 Groundwater Quality Network

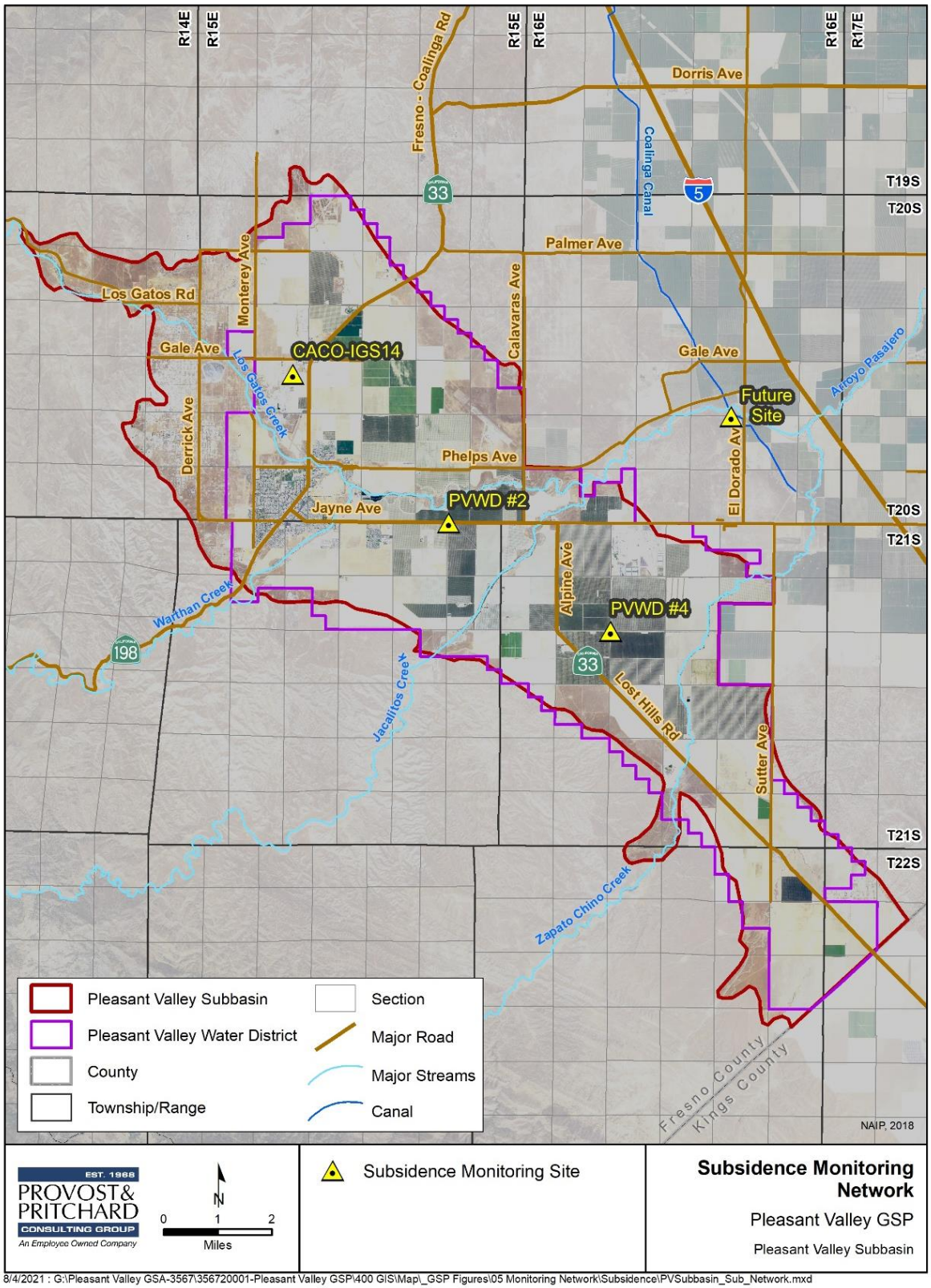


Figure 5-4 Subsidence Monitoring Network

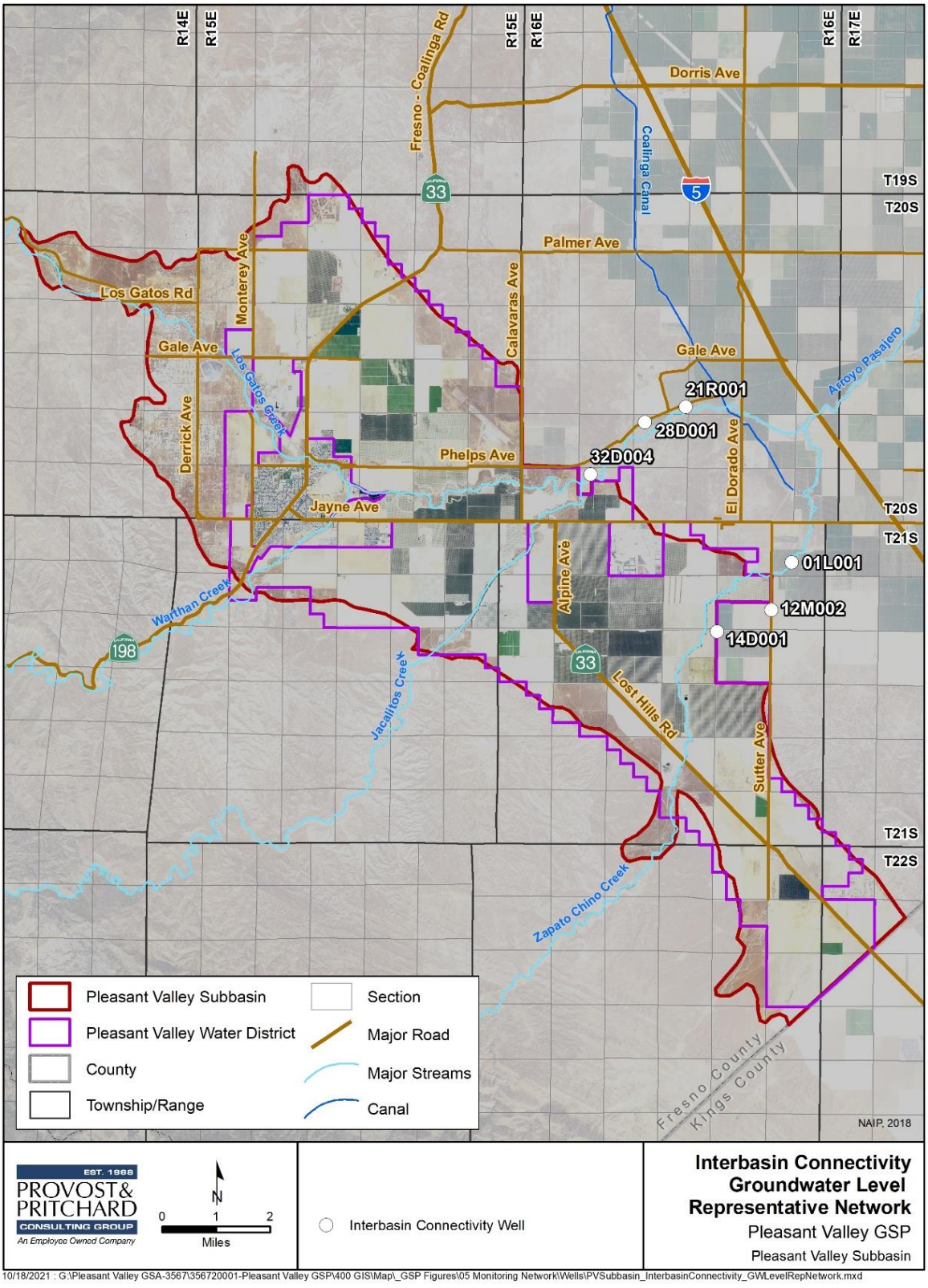


Figure 5-5 Interbasin Connectivity Groundwater Level Representative Network

5.2 Overview

Regulation Requirements:
§354.32 This Subarticle describes the monitoring network that shall be developed for each basin, including monitoring objectives, monitoring protocols, and data reporting requirements. The monitoring network shall promote the collection of data of sufficient quality, frequency, and distribution to characterize groundwater and related surface water conditions in the basin and evaluate changing conditions that occur through implementation of the Plan.

A comprehensive monitoring network is a fundamental component of groundwater management and is needed to measure progress towards groundwater sustainability. Monitoring programs needed to comply with SGMA monitoring and reporting requirements include the following:

- **Groundwater Levels**: Measuring of static groundwater levels each spring and fall
- **Groundwater Storage**: Calculations of the annual change in groundwater storage, and the use of the water balance method
- **Groundwater Quality**: Monitoring for water quality degradation that could impact available groundwater supplies
- **Land Subsidence**: Land subsidence caused by groundwater extraction
- **Depletion of Interconnected Surface Water**: Permanent connections between surface water and groundwater, which is not applicable to the GSAs
- **Seawater Intrusion**: Intrusion of seawater into local aquifers, which is not applicable to the GSAs

Additional requirements needed for GSP:

- **Groundwater Pumpage:** The amount and location of pumpage needs to be determined and quantified.
- **Crop Consumptive Use:** Crop consumptive use needs to be identified and quantified.
- **Stream Flow Measurement:** The amount and timing of streamflow both entering and leaving the basin will be documented.

Data Gaps in Monitoring Program

Pumpage

The GSAs in the Subbasin do not own any operating wells. Approximately 98 percent of the irrigation wells have flow meters, and the pumping volume is recorded by the GSA, twice a year. For some wells the pumpage is estimated by other means, such as typical per crop water demands per acre. . More details on proposed monitoring can be found in **Chapter 5 and Chapter 6**.

Water Levels

Two types of water-level measurements are available. The first is spring and fall static water levels, and records for a number of wells extend back to at least the 1960s. **Figure 5-6** shows the locations of wells with long-term water-level hydrographs. A data gap is water-level measurements in the southeast part of the Subbasin and near the County line. Another type of water-level measurement is continuous measurements provided by transducers. These are believed to have been installed in at least 30 wells in the valley**. Figure 5-7** shows the locations of about 20 wells known to have transducers. Continuous measurements provide an indication of the shallowest water level each year, from which annual changes in groundwater storage can be determined. Transducer hydrographs also show drawdowns due to pumping of the well. A data gap is that

pumping rates have not been plotted on these hydrographs. Where flowmeters are present, the pumping rates and specific capacities can be determined. Another data gap is that more transducer installations are needed in part of the valley.

In general, semi-annual water-level measurements for wells in Pleasant Valley have been reported by the DWR or by Provost & Pritchard, whereas transducer water-level hydrographs have usually not been reported.

Since the first submittal of the GSP, the PVGSA has implemented a water quality monitoring plan. Data for the 2023 year is reported in the Annual Report and is included in this report as well. Historic data is available and will be used as well to set the MOs and MTs for water quality. For irrigation wells, electrical conductivity is measured annually in the summer, and irrigation suitability analyses are obtained on one-third of the irrigation wells each year. Coordination between the PVGSA and the domestic well users in the Lost Hills Community and others has begun and a monitoring program is being developed. The domestic well owners in the Lost Hills Community do not treat and use the groundwater for drinking water. The monitoring plan will be used to gather data for future groundwater use and to inform the well owners of fluctuating water levels. The GSA will provide technical assistance with new well construction.

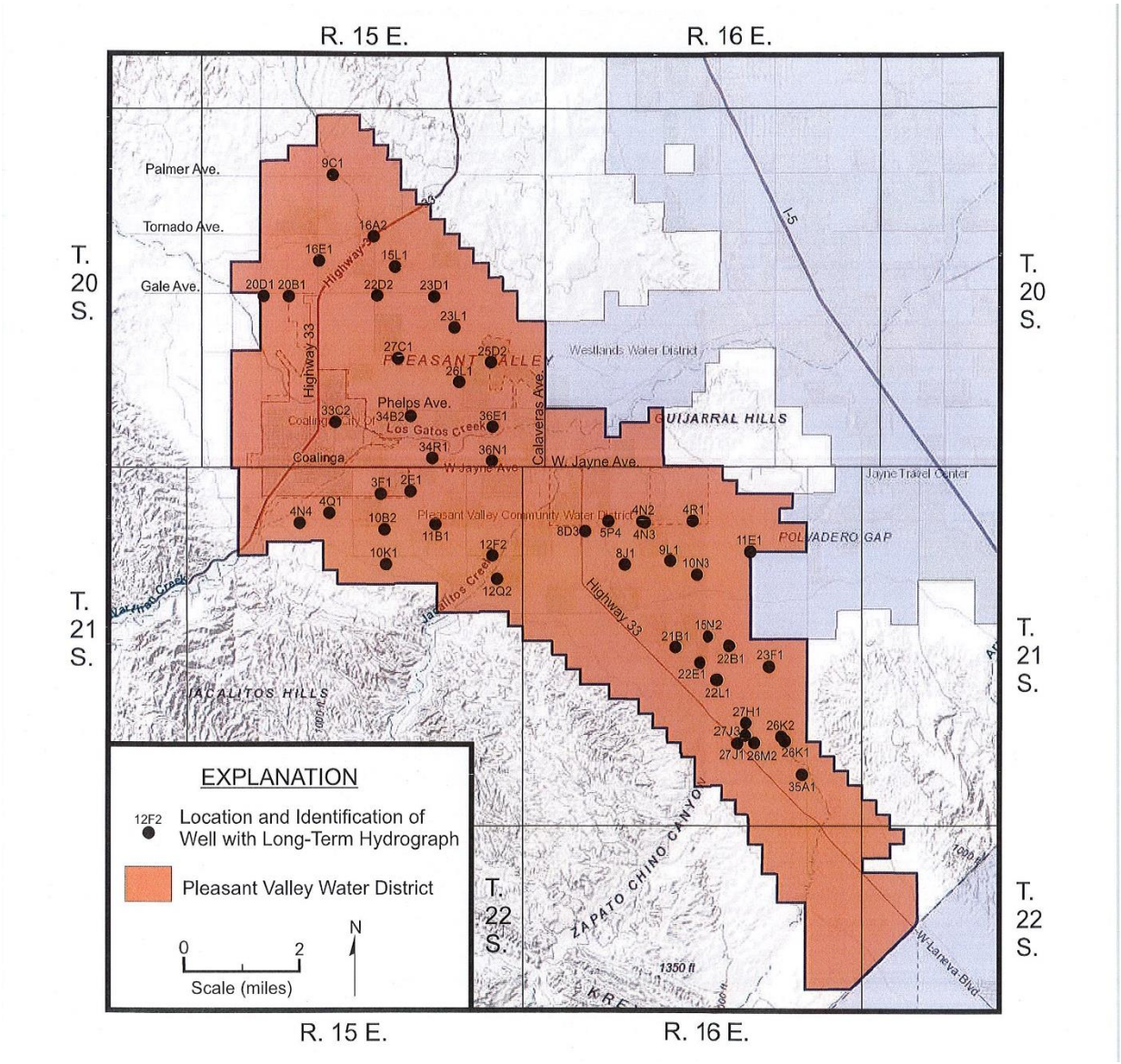


Figure 5-6 Locations of Wells with Long-Term Water-Level Hydrographs from Semi-Annual Measurements

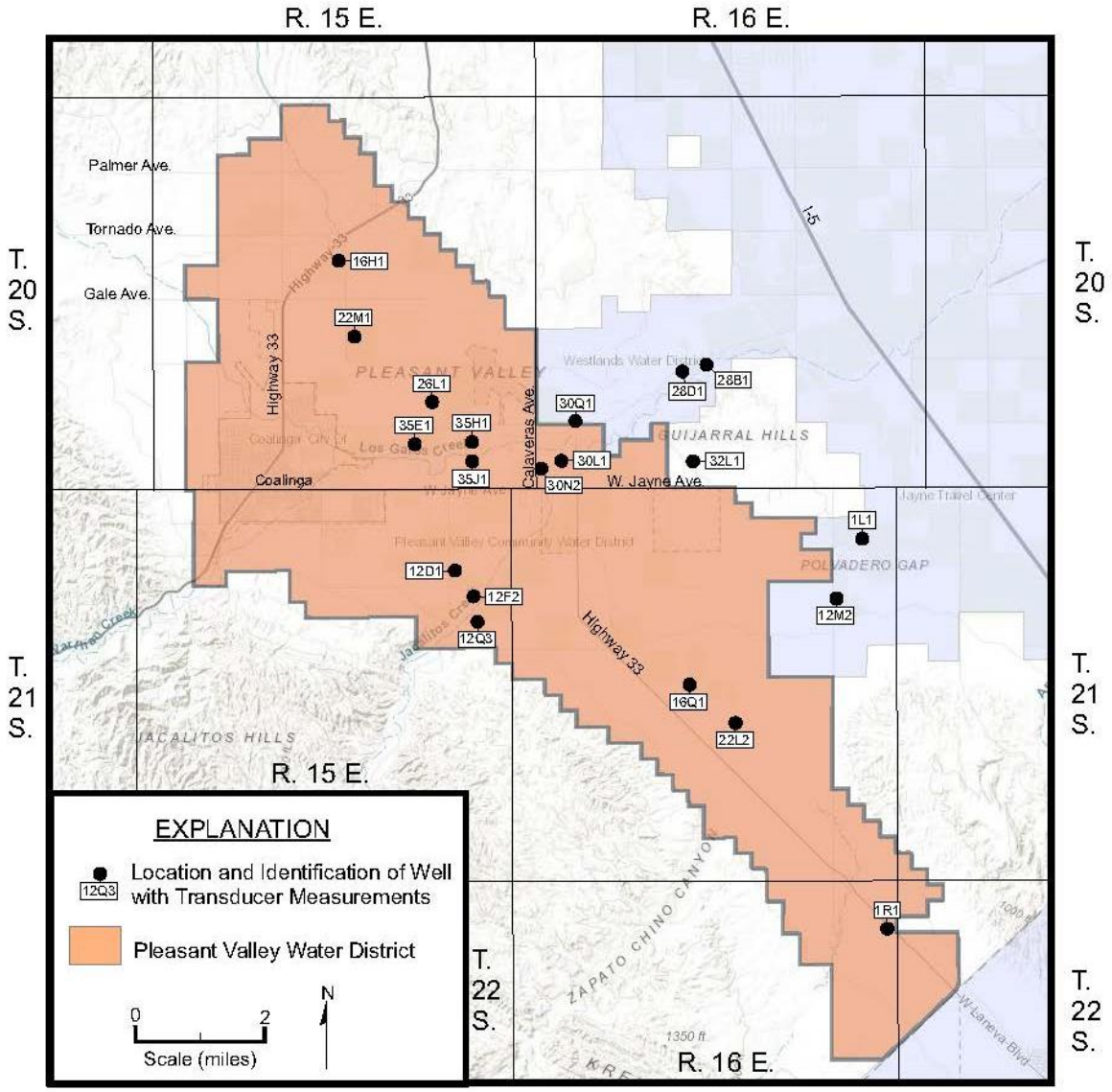


Figure 5-7 Locations of Known Wells with Transducer Water-Level Measurements

Consumptive Use

Historically, crop surveys have not been performed in the valley or recorded on an annual basis. Annual crop surveys are essential in order to determine consumptive use or evapotranspiration of water applied for irrigation. This is straight-forward in cases where permanent crops are present. Because trees use more water as they mature, records should be maintained of how old the trees are. Information from sources such as the Cal Poly Irrigation Training and Research Center can be used to determine crop consumptive use, which is an important part of the water budget.

Land Subsidence

Two types of information have been used to evaluate land subsidence. The first is from periodic remote INSAR data provided by the Jet Propulsion Laboratory. The second is from continuous recorders that continuously measure the land surface elevations. At West Hills College, there is a station with such a recorder (CACO-IGS 14). For the most part, information on land subsidence in the valley has not been interpreted in detail. Additional information will be gathered at the groundwater wells. For example, the West Hills College station's records from 2017-20 indicate two periods of subsidence and two other periods of little or no subsidence. The periods of varying subsidence should be related to pumpage patterns and possibly streamflow patterns to the extent possible. Also, the geographic distribution of land subsidence should be related to the distribution of pumpage. See **Figure 5-4**. In addition to this information, three additional sites will be established. Two of these additional sites will be established in the vicinity of the greatest potential subsidence for groundwater pumpage. These sites will be measured annually.

Groundwater Quality

Groundwater quality data will be collected annually for all irrigation wells in the valley. Once every three years water samples are collected for irrigation suitability.

Deep Percolation

Deep percolation is the amount of water applied for irrigation that is not consumed by evapotranspiration and percolates downward. This downward percolating water eventually reaches the groundwater level. A data gap is that the travel time for the downward percolating water is not well known. This travel time for deep percolation is important for developing water budgets. In order to help determine this, two types of information can be used. The first is to collect samples of the cascading water from supply wells. In a number of cases this represents deep percolation. The second source of information is to install shallow monitor wells tapping the uppermost fifty feet or so of saturated deposits. Three new wells have been installed since the first submittal of this report. These wells will track the downward movement of the deep percolation water.

PROPOSED MONITORING & REPORTING PROGRAM

Stream Gauges

Historically, stream gauge records were available for Los Gatos Creek at the Los Gatos Creek Road crossing and at the Arroyo Pasajero at El Dorado Avenue. These stations were installed by the DWR to measure flood events originating in the watersheds upstream. Interstate 5 and the California Aqueduct are downstream of the station at El Dorado Avenue, and both the Interstate and Aqueduct have suffered damage from significant flood events. Several years ago, the District recognized that information on stream runoff and infiltration of the runoff within the basin was lacking. In an effort to determine and quantify recharge within the basin, six additional stream gauge locations were established in addition to the historic two locations to make eight sites that now record stream flows as shown in **Figure 5-8**.

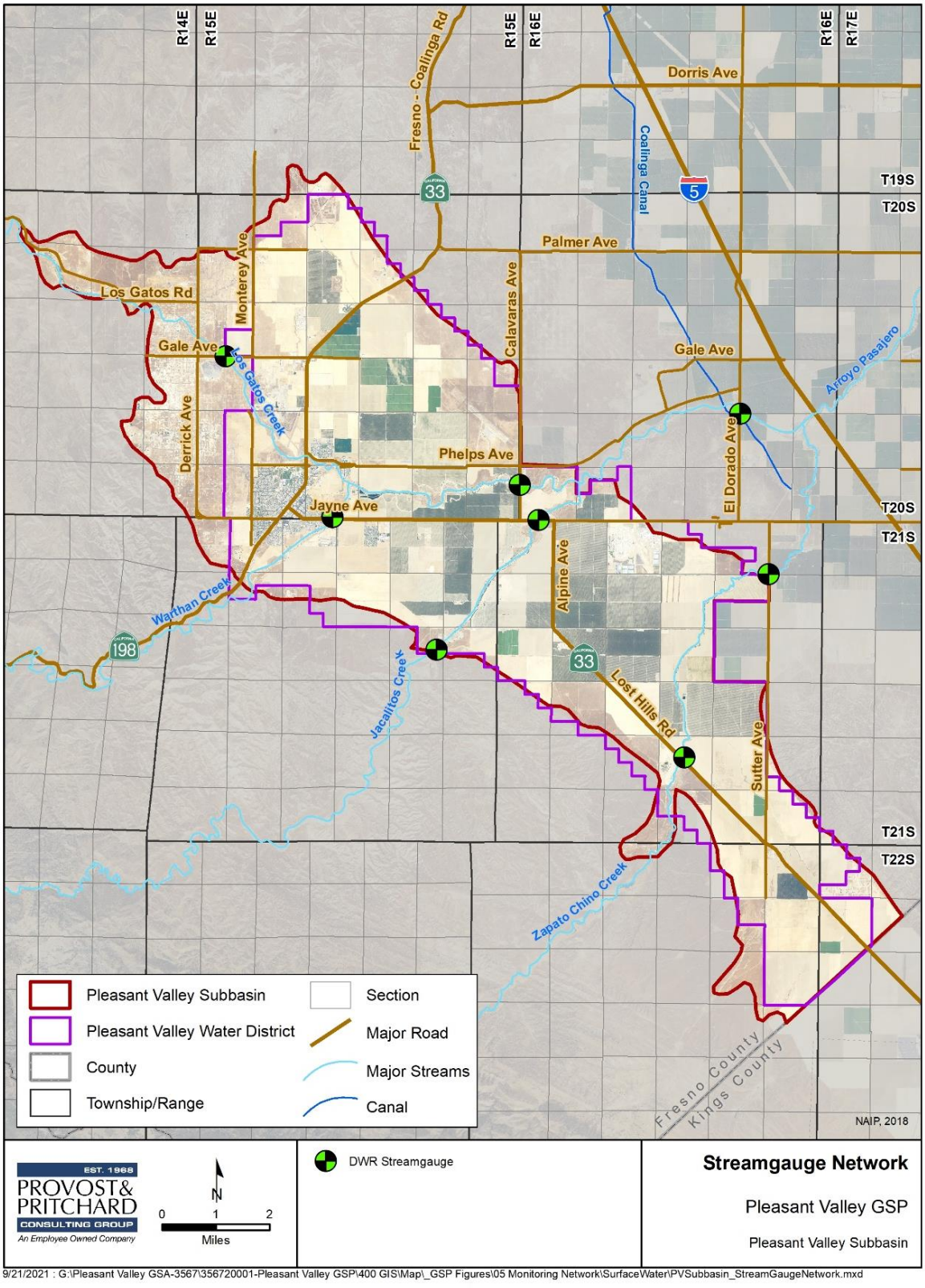


Figure 5-8 Streamgages

Data for the last several years have been quantified and suggest that an average of about 8,000 AF/yr of streamflow has infiltrated. The District will continue to evaluate the data for these sites and make adjustments to this system as needed.

Groundwater Pumpage

Totalizing flowmeters have been installed for many large capacity wells . The total pumpage would be read twice a year. It would be useful to have a photographic record of the totalizer readings for each well. On an annual basis, pumpage would be reported by well, and the total pumpage would be calculated for the GSA.

Water Levels

Semi-Annual Measurements
Continuing this program is recommended. However, the time for the "spring" measurements should be revised to coincide better with the annual shallowest static water levels, as determined from transducer measurements. To date, most of the transducer measurements indicate that the shallowest water levels have been in December, not in the spring. Thus the "spring" water-level measurements would indicate a truer indication of the shallowest annual water levels if the measurements were made in December. On an annual basis, water-level elevation and direction of groundwater flow maps should be prepared for the period of shallowest water levels. Also, water-level hydrographs (showing depth to water) should be updated.

Transducer Hydrographs

These should be updated on an annual basis to cover the entire period of record. Both the last annual hydrograph and the long-term hydrograph would be shown. Also, where flowmeters are tied into the transducers, pumping rates should be shown on the hydrographs to coincide with pumping water levels.

Land Subsidence

The JPL maps should be obtained every two years, and the land subsidence map compared to a map showing irrigation well pumpage by section. Records for the land surface elevation station at West Hills College should be obtained as well as data from survey of filed monuments and trends related to pumpage and/or streamflow records and water-level trends, if possible.

Groundwater Quality

In general, irrigation wells are to be sampled during heavy pumping periods in July or August, and after the well has been pumping for several days, if possible. The water sample needs to be collected near the well head, if possible, and prior to the addition of any chemicals.

Collection of samples of irrigation suitability is recommended every three years on each well. It is proposed that one third of the wells be sampled each year (resulting in data from a single well every three years) so that data is collected every year. If adequate chemical analyses can be obtained from the well owners, these could be used as opposed to new sampling. Electrical conductivity (EC) would be measured in water samples collected during heavy summer pumping from each large capacity agricultural well on an annual basis. The results would be plotted on a suitable map and EC hydrographs maintained for about a quarter of these wells over the long term.

Small capacity wells are to be pumped for about 20 minutes prior to collecting the water samples. Landowners should collect samples as close to the well as possible and prior to any addition of chemicals.

These samples would be collected once every three years. The chemical analyses would include TDS, EC, pH, nitrate-nitrogen, sulfate, iron, manganese, arsenic, hexavalent chromium, and alpha activity.

Deep Percolation

Samples of cascading water would be collected from active wells when the pump is pulled out of the well or from unused wells without pumps. The depth where the water enters the well would be measured and recorded. A bucket would be lowered down the well on a rope or wire and the sample collected. The samples would be analyzed for irrigation suitability parameters and stable isotopes oxygen-18 and deuterium of water. In addition, some age dating tests may be done, such as tritium.

Shallow monitor wells are being constructed at three sites. The general location is shown on **Figure 5-9**_.The casing hammer method would be used to drill a hole close to an existing irrigation well to a depth about 30 feet below the static water level in the well. Soil samples are to be collected about every 30 feet in depth to determine electroconductivity and nitrates-nitrogen concentrations in the saturated extents or until groundwater is reached. Once water is reached the casing would be extended up to an additional 30 feet. After the wells are completed and developed, they would be equipped with 4-inch diameter submersible pumps for periodic water sampling.

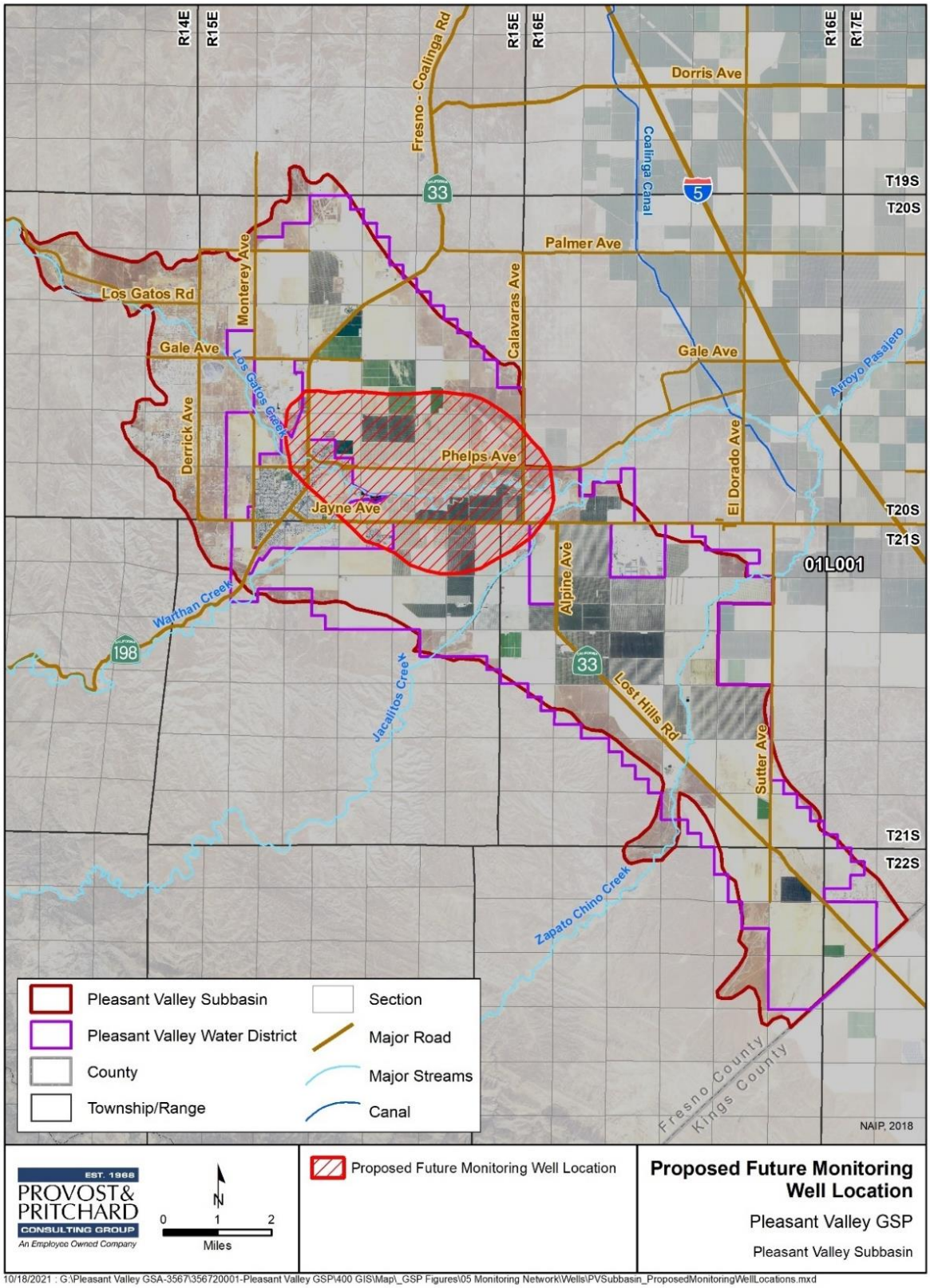


Figure 5-9 Area of Installation for Proposed Shallow Monitor Wells

Table5-1 Proposed Monitoring Network Summary

Subject	Description	Figure
Stream flows	Measure flow at each site and calculate infiltration of each storm event.	**Figure 5-8**
Groundwater Pumpage	Record pumpage at each well monthly.	
Water Levels	Take spring and fall depth-to-water measurements in all production wells. Install transducers in 25 wells.	**Figure 5-6, Figure 5-7**
Consumptive Use	Perform crop survey annually.	N/A
Land Subsidence	Perform survey of sites annually. Gain CACO site info yearly.	**Figure 5-4**
Groundwater Quality	Take irrigation suitability analysis samples from a third of the wells every year. Ec samples will be gathered annually for irrigation wells, wells will be sampled during the summer months.	**Figure 5-3**
Deep Percolation	Take WQ samples of falling water or shallow water from wells that have pumps removed for repair.	N/A

5.2.1 Monitoring Network Objectives

Regulation Requirements:
§354.34(b) Each Plan shall include a description of the monitoring network objectives for the basin, including an explanation of how the network will be developed and implemented to monitor groundwater and related surface conditions, and the interconnection of surface water and groundwater, with sufficient temporal frequency and spatial density to evaluate the affects and effectiveness of Plan implementation. The monitoring network objectives shall be implemented to accomplish the following:

1) Demonstrate progress toward achieving measurable objectives described in the Plan.
2) Monitor impacts to the beneficial uses or users of groundwater.
3) Monitor changes in groundwater conditions relative to measurable objectives and minimum thresholds.
4) Quantify annual changes in water budget components.

The objectives of the various monitoring programs include the following:

1. Establish a baseline for future monitoring.
2. Provide warning of potential future problems.
3. Use data gathered to generate information for water resources evaluation.
4. Help to quantify annual changes in water budget components.
5. Develop meaningful long-term trends in groundwater characteristics.
6. Provide data comparable from place to place in the Plan Area.
7. Demonstrate progress toward achieving measurable objectives described in the Plan.
8. Monitor changes in groundwater conditions relative to minimum thresholds.
9. Monitor impacts to the beneficial uses or users of groundwater.

5.2.2 Network Development Process

Regulation Requirements:
§354.34(c) Each monitoring network shall be designed to accomplish the following for each sustainability indicator:
[§354.34**(c)(1)** through §354.34**(c)(6)** are individually listed below]

Sections 5.3 through **5.10** describe existing networks within the Subbasin's boundary which track groundwater levels, groundwater storage, water quality, land subsidence, and depletion of interconnected surface water. For each sustainability indicator, the adequacy of the monitoring network is discussed. The sections also include a review of each monitoring network for monitoring frequency and density, identification of data gaps, plans to fill data gaps, and future site selection. This information will be reviewed and evaluated during each five-year assessment.

Groundwater monitoring has been performed in the Subbasin for many decades by the DWR and the Pleasant Valley Water District. Much less routine groundwater monitoring has been conducted in the some of the areas outside the PVGSA boundaries, and there is a general lack of water wells in the southern and northwestern portions of the Subbasin. The monitoring program within the Subbasin will continue and be expanded to comply with SGMA monitoring requirements. Future monitoring will occur with data sharing between neighboring agencies to better understand groundwater boundary conditions such as depth to water and flow. These partnerships will also be maintained and enhanced to provide useful agency and region-wide information.

5.3 Description of Monitoring Network

5.3.1 Groundwater Levels

Regulation Requirements:
§354.34(c)(1) Chronic Lowering of Groundwater Levels. Demonstrate groundwater occurrence, flow directions, and hydraulic gradients between principal aquifers and surface water features by the following methods:
A) A sufficient density of monitor wells to collect representative measurements through depth-discrete perforated intervals to characterize the groundwater table or potentiometric surface for each principal aquifer.
B) Static groundwater elevation measurements shall be collected at least two times per year, to represent seasonal low and seasonal high groundwater conditions.

Pleasant Valley GSA will utilize existing wells that are currently measured for groundwater level including but not limited to CASGEM, Pleasant Valley Water District, municipal, DWR, agency, and private wells. Data gap areas may have new monitor wells installed in the future. Groundwater level measurements will be collected every winter and fall to provide data on the seasonal low and seasonal high groundwater conditions. Based upon recent transducer measurements, the shallowest levels appear to occur in December – and the "spring" readings required for SGMA would be proposed to occur in this month (the winter). Fall measurements may be collected in October. Monitoring data will be included in the Data Management System and annual reports.

Groundwater levels have historically been measured by the Pleasant Valley Water District, the DWR, and by landowners in the GSA. Since approximately 2017, the DWR no longer routinely measures groundwater levels in the GSA. Groundwater level measurements in seven wells are now routinely collected and reported to the CASGEM program. The CASGEM program was created by SBx7-6, Groundwater Monitoring, a part of the 2009 Comprehensive Water Package. The locations of wells in the groundwater level monitoring network are shown in **Figure 5-2**. The network includes wells outside the Subbasin eastern boundary to monitor and better understand groundwater flow across the Pasajero and Polvadero Gaps, as shown in **Figure 5-5**. The current water level monitoring network is largely comprised of active and inactive production wells.

5.3.2 Groundwater Storage

Regulation Requirements:
§354.34(c)(2) Reduction of Groundwater Storage. Provide an estimate of the change in annual groundwater in storage.

Groundwater storage change will be estimated by multiplying local specific yield values by the change in groundwater levels, which are to be determined on an annual basis from water-level hydrographs.

A multi-year average of the storage change will be evaluated and compared to long-term trends to understand the impact of the implementation of the Plan. A second method of estimating the storage change that was utilized is the water budget analytical model or the checkbook balance method. It uses inputs from sources of recharge and outputs. The general methodology used in those efforts will continue to be used by the GSA; however, the water level method will be the main method employed to determine the change in storage, with the water budget used to help validate the results.

The alluvium in the PV Subbasin are not conducive of storage loss, meaning the soils will be able to be rewetted to store water above the MOs and MTs that are set.

Please refer to **Section 3.1.8** for more information on specific yield values.

The monitoring network for storage change will include the wells in the groundwater water level monitoring network since water level change is an integral part of storage change. In general, as many wells as possible within the subbasin will be measured annually for the storage change calculation.

5.3.3 Seawater Intrusion

Regulation Requirements:

§354.34(c)(3) Seawater Intrusion. Monitor seawater intrusion using chloride concentrations, or other measurements convertible to chloride concentrations, so that the current and projected rate and extent of seawater intrusion for each applicable principal aquifer may be calculated.

§354.34(j) An Agency that has demonstrated that undesirable results related to one or more sustainability indicators are not present and are not likely to occur in a basin, as described in Section 354.26, shall not be required to establish a monitoring network related to those sustainability indicators.

By definition, seawater intrusion occurs when saline water from the ocean infiltrates the groundwater system and begins to flow into areas of freshwater due to pressure differentials, in many cases caused by groundwater pumping. The Coastal Range lies between the Central Valley and the Pacific Ocean. The Subbasin is over 100 miles from the Sacramento-San Joaquin Delta, which would be the only means for seawater to enter the Central Valley. Due to the great distance and the current groundwater elevations, the Subbasin does not need to account for seawater intrusion.

5.3.4 Water Quality

Regulation Requirements:

§354.34(c)(4) Degraded Water Quality. Collect sufficient spatial and temporal data from each applicable principal aquifer to determine groundwater quality trends for water quality indicators, as determined by the Agency, to address known water quality issues.

Water quality monitoring is an important aspect of groundwater management and can provide many benefits, including:

1. Determining the suitability of groundwater quality for irrigation or drinking water
2. Spatially characterizing groundwater water quality
3. Comparing constituent levels at specific wells over time (i.e., years and decades)
4. Determining if groundwater quality problems exist in specific areas
5. Determining water treatment needs

The data used for the groundwater quality evaluation is primarily from test results from water samples taken from growers' wells. A secondary source is from the California Groundwater Ambient Monitoring and Assessment (GAMA) Program database, which includes water quality information collected by the DWR, SWRCB, Division of Drinking Water (DDW), and the USGS. The network of wells used for assessing groundwater quality in the Subbasin was selected to provide representative data for the basin.

As stated earlier, the data and information to be gathered is to first establish a baseline and then over time to test for degradation of quality in the agricultural production area and in the area of the Lost Hills Community for possible degradation of water supply for domestic purposes.

5.3.5 Land Subsidence

Regulation Requirements:
§354.34(c)(5) Land Subsidence. Identify the rate and extent of land subsidence, which may be measured by extensometers, surveying, remote sensing technology, or other appropriate method.

Limited land subsidence is occurring within the Subbasin due to groundwater overdraft. Land subsidence monitoring will be performed using three different methods:

1. Survey of Ground Control Points
2. Continuous Acting GPS station
3. Remote Sensing

The Land Subsidence Monitoring Network is shown on **Figure 5-4.** The monitoring network will consist of three Ground Control Points with two to be installed in 2021 selected based on the InSAR data showing areas of decline as described in **Section 3.2.6** and a fourth Ground Control Point to be installed near the proposed north pipeline outside the Subbasin. These points will be measured annually and compared to the corresponding data from the Continuous Acting GPS station at West Hills College. Available remote sensing data will also be used to help verify direct measurements and show estimated subsidence in other areas of the basin.

5.3.6 Depletion of Interconnected Surface Water

Regulation Requirements:
§354.34(c)(6) Depletions of Interconnected Surface Water. Monitor surface water and groundwater, where interconnected surface water conditions exist, to characterize the spatial and temporal exchanges between surface water and groundwater, and to calibrate and apply the tools and methods necessary to calculate depletions of surface water caused by groundwater extractions. The monitoring network shall be able to characterize the following:
A) Flow conditions including surface water discharge, surface water head, and baseflow contribution.
B) Identifying the approximate date and location where ephemeral or intermittent flowing streams and rivers cease to flow, if applicable.
C) Temporal change in conditions due to variations in stream discharge and regional groundwater extraction.
D) Other factors that may be necessary to identify adverse impacts on beneficial uses of the surface water.

Regulation Requirements:
§354.34(j) An Agency that has demonstrated that undesirable results related to one or more sustainability indicators are not present and are not likely to occur in a basin, as described in Section 354.26, shall not be required to establish a monitoring network related to those sustainability indicators.

Interconnected surface water systems are surface waters that are hydraulically connected by a continuous saturated zone to an underlying aquifer. The Subbasin must monitor if depletions of surface water are caused by groundwater extractions. There are no known interconnected surface water systems within the Subbasin, although there are areas where they may exist on the western border. No information is available to assess potential surface water-groundwater interconnection in these areas since there are no wells, and hence no groundwater pumping. These areas may have thin alluvium and have slopes that could be problematic for cultivation. Currently, these areas are mostly used for rangeland. No active wells are within 2 to 3 miles of these areas, so there is no potential for interference or wells to monitor.

5.4 Adequacy of Monitoring Network

Regulation Requirements:
§354.34(d) The monitoring network shall be designed to ensure adequate coverage of sustainability indicators. If management areas are established, the quantity and density of monitoring sites in those areas shall be sufficient to evaluate conditions of the basin setting and sustainable management criteria specific to that area.
§354.34(e) A Plan may utilize site information and monitoring data from existing sources as part of the monitoring network

Regulation Requirements:
§354.34(c)(3) Seawater Intrusion. Monitor seawater intrusion using chloride concentrations, or other measurements convertible to chloride concentrations, so that the current and projected rate and extent of seawater intrusion for each applicable principal aquifer may be calculated.

§354.34(j) An Agency that has demonstrated that undesirable results related to one or more sustainability indicators are not present and are not likely to occur in a basin, as described in Section 354.26, shall not be required to establish a monitoring network related to those sustainability indicators.

5.4.1 Groundwater Levels

The Subbasin has a reasonable water-level monitoring density. The monitoring network will rely on existing wells. The GSAs may include additional wells in the future to monitor areas where water level information has historically been lacking, such as near the boundary with the Kettlemen Plains Subbasin, in the northwest of the Pleasant Valley Subbasin, and near the Pasajero and Polvadero Gaps.

The existing network of wells has provided data to prepare historic water level and direction of groundwater flow contour maps and identify groundwater level trends over the years in much of the Subbasin.

5.4.2 Groundwater Storage

Groundwater storage capacity will be calculated using local groundwater levels and specific yield values. This methodology has proved adequate in estimating annual change in groundwater storage in regions of the Subbasin. Groundwater storage calculations are based on the shallowest groundwater level measurements collected throughout the Subbasin each year.

5.4.3 Seawater Intrusion

See **Section 5.3.3**.

5.4.4 Groundwater Quality

As stated in **Section 0**, it is expected that the proposed network provides adequate coverage.

5.4.5 Land Subsidence

Past monitoring has shown that there has been a small amount of land subsidence due to pumping of groundwater in the area. Using the proposed monitoring network, the entire Subbasin will be monitored with possibly more detailed monitoring in potential problem areas.

5.4.6 Depletion of Interconnected Surface Water

Currently, it is believed that there are no interconnected surface water systems within the Subbasin. Should the status of interconnected surface waters within the Subbasin change, a monitoring network for this sustainability indicator will be set in future GSP updates.

5.5 Density of Monitoring Sites and Frequency of Measurements

Regulation Requirements:
§354.34(f) The Agency shall determine the density of monitoring sites and frequency of measurements required to demonstrate short-term, seasonal, and long-term trends based upon the following factors:
1) Amount of current and projected groundwater use.
2) Aquifer characteristics, including confined or unconfined aquifer conditions, or other physical characteristics that affect groundwater flow.
3) Impacts to beneficial uses and users of groundwater and land uses and property interests affected by groundwater production, and adjacent basins that could affect the ability of that basin to meet the sustainability goal.
4) Whether the Agency has adequate long-term existing monitoring results or other technical information to demonstrate an understanding of aquifer response.

Regulation Requirements:
§354.34(c)(3) Seawater Intrusion. Monitor seawater intrusion using chloride concentrations, or other measurements convertible to chloride concentrations, so that the current and projected rate and extent of seawater intrusion for each applicable principal aquifer may be calculated.

§354.34(j) An Agency that has demonstrated that undesirable results related to one or more sustainability indicators are not present and are not likely to occur in a basin, as described in Section 354.26, shall not be required to establish a monitoring network related to those sustainability indicators.

5.5.1 Groundwater Levels

Semi Annual Measurements
From **Figure 5-6**, it can be seen that there are a number of locations that will offer the data and information to continue and expand upon the historical long-term trends of water level in the basin. Groundwater levels will be measured manually in the winter (December) and fall (October) of each year. This could differ slightly from historical measurements. Winter measurements are designed to capture the shallowest levels each year. The fall measurement would capture a period after peak irrigation and summertime urban demands have ceased.

Continuous Measurements
From **Figure 5-7**, it is apparent that many continuous water-level measurements via the use of pressure transducers are now occurring. Though there is not a long-term trend for these sites, the data will be useful to identify seasonal variations in water levels over time, in particular the shallowest and deepest levels each year.

5.5.2 Groundwater Storage

Groundwater storage change will be estimated annually, based on the shallowest annual water levels from as many wells as possible. Only wells with reasonable and reliable data will be used.

5.5.3 Seawater Intrusion

See **Section 5.3.3**.

5.5.4 Groundwater Quality

See **Section 5.3.4** and **Figure 5-3**.

5.5.5 Land Subsidence

See **Section 5.3.5.**

5.5.6 Depletion of Interconnected Surface Water

Currently, it is believed that there are no interconnected surface water systems within the Subbasin. Therefore, the density of the interconnected surface water monitoring network is currently undetermined. Should the status of interconnected surface waters within the Subbasin change, a monitoring network for this sustainability indicator will be set in future GSP updates.

5.6 Monitoring Network Information

Regulation Requirements:
§**354.34(g)** Each Plan shall describe the following information about the monitoring network:
(1) Scientific rationale for the monitoring site selection process.
(2) Consistency with data and reporting standards described in Section 352.4. If a site is not consistent with those standards, the Plan shall explain the necessity of the site to the monitoring network, and how any variation from the standards will not affect the usefulness of the results obtained.
(3) For each sustainability indicator, the quantitative values for the minimum threshold, measurable objective, and interim milestones that will be measured at each monitoring site or representative monitoring sites established pursuant to Section 354.36.

5.6.1 Groundwater Levels

5.6.1.1 Scientific Rationale for Site Selection

The following sections describe the monitoring network, including scientific rationale for the selection; consistency with data and reporting standards; corresponding sustainability indicator, minimum threshold, measurable objective, and interim milestone; and the locations of the monitoring sites.

The rationale for selecting monitoring points in the current groundwater-level monitoring network includes:

- The monitoring points are anticipated to be available for future measurements;
- The monitoring point has historic measurement data available and has had a measurable objective determined, if the well has existed for some time; and
- The monitoring points have well construction information available.

The following scientific rationale will be used to add new wells to the groundwater level monitoring network:

- Add wells where necessary to fill spatial data gaps laterally and vertically;
- Select wells with available construction information; and
- Select wells that will be available for monitoring in the future.

5.6.1.2 Consistency with Data and Reporting Standards

The data gathered through the monitoring networks are and will continue to be consistent with the standards identified in Section 352.4 of the California Code of Regulations related to Groundwater Sustainability Plans. The main topics of Section 352.4 are outlined below, and the full section is included as **Appendix H**.

- Data reporting units and accuracy;
- Monitoring site information;
- Well attribute reporting;
- Map standards;
- Hydrograph requirements;
- Groundwater and surface water models; and
- Availability of input and output files to DWR.

5.6.1.3 Quantitative Values

The quantitative values for minimum threshold, measurable objective, and interim milestones will be set for representative monitored wells (RMW) in the monitoring network. Refer to **Section 4.2.3.1** for the table with the criteria set for each well.

5.6.2 Groundwater Storage

The following sections describe the monitoring network, including scientific rationale for the selection; consistency with data and reporting standards; corresponding sustainability indicator, minimum threshold, measurable objective, and interim milestone; and the locations of the monitoring sites.

5.6.2.1 Scientific Rationale for Site Selection

Change in groundwater storage is based on a calculation involving the specific yield and change in groundwater levels from year to year. Levels in the semiannual water-level program will be measured each winter. Information from transducers will also be used. This approach is considered the most reliable method to estimate storage change since it is based largely on measured data. Storage change can also be estimated with a water balance exercise, but that is subject to more uncertainty.

5.6.2.2 Consistency with Data and Reporting Standards

The data gathered through the monitoring networks are and will continue to be consistent with the standards identified in Section 352.4 of the California Code of Regulations related to Groundwater Sustainability Plans. The main topics of Section 352.4 are outlined below, and the full section is included as **Appendix H**.

- Data reporting units (e.g., Water volumes shall be reported in acre-feet, etc.)
- Monitoring site information (e.g., Site identification number, description of site location, etc.)
- Streamflow measurements
- Well attribute reporting (e.g., State well numbers, CASGEM well identification number, casing perforations, etc.)
- Map standards (e.g., Data layers, shapefiles, geodatabases shall be local numbers submitted in accordance with the procedures described in Article 4, etc.)
- Depth to water level measurements
- Pumpage measurements
- Crop acreages and consumptive use

5.6.2.3 Quantitative Values

The quantitative values for minimum threshold, measurable objective, and interim milestones have been set for the Subbasin. Refer to **Section 4.3.2.1** for the set criteria.

5.6.3 Seawater Intrusion

See **Section 5.3.3**.

5.6.4 Groundwater Quality

5.6.4.1 Scientific Rationale for Site Selection

The scientific rationale for selecting water quality monitoring sites includes:

- Wells are selected that have available construction information (i.e., depth, perforated interval);
- Spatial distribution is such that groundwater quality can be characterized across the Subbasin;

5.6.4.2 Consistency with Data and Reporting Standards

The data gathered through the monitoring networks are and will continue to be consistent with the standards identified in Section 352.4 of the California Code of Regulations related to Groundwater Sustainability Plans.

5.6.4.3 Quantitative Values

Wells in the groundwater quality network will be sampled as described previously in **Section 4.5**, and the collected groundwater quality data will be evaluated for groundwater quality trends

5.6.5 Land Subsidence

The following sections describe the monitoring network, including scientific rationale for the selection; consistency with data and reporting standards; corresponding sustainability indicator, minimum threshold, measurable objective, and interim milestone; and the locations of the monitoring sites.

5.6.5.1 Scientific Rationale for Site Selection

InSAR data provided by DWR has complete coverage of the Subbasin; however, it is understood that direct measurements are generally considered more accurate than remote sensing. The monitoring points to be installed in 2021 (see **Figure 5-4**) were selected due to the corresponding locations in the area of the Subbasin that InSAR data has indicated limited subsidence has occurred (**Section 3.2.6**). The West Hills College GPS station and the location near the north pipeline outside the Subbasin will be used for comparison to data collected from other sites. InSar data will still be reviewed as a supplementary source and compared to direct measurements.

5.6.5.2 Consistency with Data and Reporting Standards

The data gathered through the monitoring networks are consistent with the standards identified in Section 352.4 of the California Code of Regulations related to Groundwater Sustainability Plans. The main topics of Section 352.4 are outlined below.

- Data reporting units (e.g., elevations shall be reported in feet relative to established datum)
- Monitoring site information (e.g., Site identification number, description of site location, etc.)
- Map standards (e.g., Data layers, shapefiles, geodatabases shall be submitted in accordance with the procedures described in Article 4, etc.)

5.6.5.3 Quantitative Values

The quantitative values for minimum threshold, measurable objective, and interim milestones will be set for the Subbasin. Refer to **Sections 4.2.4, 4.3.3, 4.5.3, 4.6.3,** and **4.7.3**.

5.6.6 Depletion of Interconnected Surface Water

5.6.6.1 Scientific Rationale for Site Selection

The following scientific rationale will be used to create and add monitoring sites to the interconnected surface water monitoring network should it become necessary in the future:

- Add monitoring sites within the vicinity of the surface water body;
- Install shallow monitor wells;
- Select monitoring sites that will be available for monitoring in the future
-

5.6.6.2 Consistency with Data and Reporting Standards

The data gathered through the Subbasin monitoring networks, either existing or yet to be established, will be consistent with the standards identified in Section 352.4 of the California Code of Regulations related to Groundwater Sustainability Plans. The main topics of Section 352.4 are outlined below, and the full section is included as **Appendix H**.

- Data reporting units and accuracy;
- Monitoring site information;
- Well attribute reporting;
- Map standards;
- Groundwater and surface water models; and
- Availability of input and output files to DWR.

5.6.6.3 Quantitative Values

5.7 Monitoring Locations

Regulation Requirements:
§354.34(h) The location and type of each monitoring site within the basin displayed on a map, and reported in tabular format, including information regarding the monitoring site type, frequency of measurement, and the purposes for which the monitoring site is being used.

5.7.1 Groundwater Levels

5.7.1.1 Map

Figure 5-2 shows the groundwater level RW locations for the Subbasin. Seasonal monitoring will be compared to the interim milestones, measurable objectives, and minimum thresholds established for these indicator wells. While the RW wells will be used as described above, it should be noted that as many wells as possible will be used to calculate change in storage as well as the RWs to assure that the RWs are reflecting the change across the basin.

5.7.1.2 Table

No table is necessary or available for monitoring sites. The network may be modified and/or enhanced if deemed necessary.

5.7.2 Groundwater Storage

See **Figure 5-2**. Storage will be determined based off of data collected from the Groundwater Level Monitoring Network.

5.7.3 Seawater Intrusion

See **Section 5.3.3**.

5.7.4 Water Quality

5.7.4.1 Map

See **Section 5.3.4**.

5.7.4.2 Table

No table is necessary or available for monitoring sites. A map of the water quality monitoring network is included as **Figure 5-3.**

5.7.5 Land Subsidence

5.7.5.1 Map

Figure 5-4 is a map of the proposed land subsidence monitoring network sites.

5.7.5.2 Table

No table is necessary or available for monitoring sites.

5.7.6 Depletion of Interconnected Surface Water

Currently, it is believed that there are no interconnected surface water systems within the Subbasin. Should the status of interconnected surface waters within the Subbasin change, a monitoring network for this sustainability indicator will be set in future GSP updates.

5.8 Monitoring Protocols

Regulation Requirements:
§352.2 Each Plan shall include monitoring protocols adopted by the Agency for data collection and management, as follows:
(a) Monitoring protocols shall be developed according to best management practices.
(b) The Agency may rely on monitoring protocols included as part of the best management practices developed by the Department, or may adopt similar monitoring protocols that will yield comparable data.
(c) Monitoring protocols shall be reviewed at least every five years as part of the periodic evaluation of the Plan, and modified as necessary.
§354.34(i) The monitoring protocols developed by each Agency shall include a description of technical standards, data collection methods, and other procedures or protocols pursuant to Water Code Section 10727.2**(f)** for monitoring sites or other data collection facilities to ensure that the monitoring network utilizes comparable data and methodologies.

5.8.1 Groundwater Levels

The Data Quality Objectives (DQO) process will be used to develop monitoring protocols that assist in meeting measurable objectives and sustainability goals of this GSP. The DQO process includes the following:

1. State the problem;
2. Identify the goal;
3. Identify the inputs;
4. Define the boundaries of the area/issue being studied;
5. Develop an analytical approach;
6. Specify performance or acceptance criteria; and
7. Develop a plan for obtaining data.

Groundwater level monitoring will generally follow the protocols identified in the *Monitoring Protocols, Standards, and Sites BMP* (DWR, December 2016b). The GSA may develop standard monitoring forms in the future if deemed necessary. Depth to water measurements may be collected utilizing either wireline or sonic depth to water meters depending on several factors including instrument accuracy, well accessibility, and groundwater water depth.

The following comments and exceptions to the BMP should be noted:

1. SGMA regulations require that groundwater levels be measured to the nearest 0.1 feet. The BMP suggests measurements to the nearest 0.01 foot; however, this is not practical for many measurement methods. In addition, this level of accuracy would have little value since groundwater contour maps typically have 10- or 20-foot intervals, and storage calculations are based on groundwater levels rounded to the nearest foot. The accuracy of groundwater level measurements will vary based on the well type and condition. For instance, if significant oil is found in an agricultural well, then readings to the nearest foot may be the best one can achieve.
2. Unique well identifiers will be labeled on all public wells and on private wells if permission is granted to monitor these.
3. The BMP states that measurements each spring and fall should be taken "preferably within a 1- to 2-week period – As discussed previously, the shallowest levels are in the winter, not the spring. So winter measurements will be used.
4. Water level measurements will be compared to previous records; if there is a significant difference, then the measurement will be verified.

5.8.2 Groundwater Storage

Water level monitoring, which is the same as the storage change monitoring, will generally follow the protocols identified in the *Monitoring Protocols, Standards, and Sites BMP* (DWR, 2016b).

5.8.3 Seawater Intrusion

See **Section 5.3.3**.

5.8.4 Groundwater Quality

Standard procedures have been developed for sample collection and preservation of water from irrigation wells. Of foremost importance is the time of pumping prior to water sample collection. In general, irrigation wells should be sampled during heavy pumping periods in July or August and after the well has been pumping for several days, if possible. The water sample needs to be collected near the well head, if possible, and prior to the addition of any chemicals.

Electrical conductivity (EC) is being measured in water samples collected during heavy summer pumping from each large capacity well. The results would be plotted on a suitable map and EC hydrographs maintained for about a quarter of these wells over the long term.

Also, once every three years, irrigation suitability analyses would be obtained from the wells.

Samples of cascading water would be collected from active wells when the pump is pulled out of the well or from unused wells without pumps. The depth where the water enters the well would be measured and recorded. A bucket would be lowered down the well on a rope or wire and the sample collected. The samples would be analyzed for irrigation suitability parameters and stable isotopes of water. Water samples will be collected twice a year for the newly installed monitor wells.

5.8.5 Land Subsidence

Land subsidence monitoring will generally follow the protocols identified in the Monitoring Protocols, Standards, and Sites BMP (DWR, 2016b). The GSAs may develop standard monitoring forms in the future if deemed necessary.

The following comments and exceptions to the BMP should be noted:

1. Identifying land subsidence conditions;
2. Monitoring regions of suspected subsidence where potential exists; and
3. Following surveying standards set out in the California Department of Transportation's Caltrans Surveys Manual for GPS surveys.

5.8.6 Depletion of Interconnected Surface Water

See **Section 5.3.6.**

5.9 Representative Monitoring

Regulation Requirements:
§354.36 Each Agency may designate a subset of monitoring sites as representative of conditions in the basin or an area of the basin, as follows:
a) Representative monitoring sites may be designated by the Agency as the point at which sustainability indicators are monitored, and for which quantitative values for minimum thresholds, measurable objectives, and interim milestones are defined.
b) Groundwater elevations may be used as a proxy for monitoring other sustainability indicators if the Agency demonstrates the following:
1) Significant correlation exists between groundwater elevations and the sustainability indicators for which groundwater elevation measurements serve as a proxy.
2) Measurable objectives established for groundwater elevation shall include a reasonable margin of operational flexibility taking into consideration the basin setting to avoid undesirable results for the sustainability indicators for which groundwater elevation measurements serve as a proxy.
c) The designation of a representative monitoring site shall be supported by adequate evidence demonstrating that the site reflects general conditions in the area.

5.9.1 Groundwater Levels

5.9.1.1 Description of Representative Sites

See **Figure 5-2**.

5.9.1.2 Use of Groundwater Elevations as Proxy for Other Sustainability Indicators

The Subbasin plans to use change in shallowest water levels each year as a proxy for groundwater storage sustainability indicators.

5.9.2 Groundwater Storage

5.9.2.1 Description of Representative Sites

See **Figure 5-2**.

5.9.2.2 Use of Water-Level Trends as Proxy for other Sustainability Indicators

The Subbasin plans to use water-level trends as a proxy for storage change. The shallowest annual water levels will be used as a critical component of groundwater storage estimation.

5.9.3 Seawater Intrusion

See **Section 5.3.3**.

5.9.4 Water Quality

5.9.4.1 Description of Representative Sites

See **Figure 5-3.**

5.9.4.2 Use of Groundwater Elevations as Proxy for other Sustainability Indicators

The Subbasin does not plan to use water level elevations as a proxy for monitoring groundwater degradation.

5.9.5 Land Subsidence

5.9.5.1 Description of Representative Sites

The sites shown on **Figure 5-4** will be the monitoring sites.

5.9.5.2 Use of Water-Level Trends as Proxy for other Sustainability Indicators

The Subbasin does not plan to use groundwater elevations as a proxy for monitoring land subsidence.

5.9.6 Depletion of Interconnected Surface Water

5.9.6.1 Description of Representative Sites

Representative monitoring sites will not be utilized in the Subbasin.

5.9.6.2 Use of Water-Level Trends as Proxy for other Sustainability Indicators

The Subbasin does not plan to use groundwater elevations as a proxy for monitoring depletion of interconnected surface water.

5.10 Assessment and Improvement of Monitoring Network

5.10.1 Groundwater Levels

5.10.1.1 Review and Evaluation of Monitoring Network

Regulation Requirements:
§354.38(a) Each Agency shall review the monitoring network and include an evaluation in the Plan and each five-year assessment, including a determination of uncertainty and whether there are data gaps that could affect the ability of the Plan to achieve the sustainability goal for the basin.

The following includes a description of the different types of data gaps, a summary of existing data gaps, and plans to fill the data gaps. These items will be reevaluated in each 5-year update to this Plan.

5.10.1.2 Identification of Groundwater Level Data Gaps

Regulation Requirements:
§354.38(b) Each Agency shall identify data gaps wherever the basin does not contain a sufficient number of monitoring sites, does not monitor sites at a sufficient frequency, or utilizes monitoring sites that are unreliable, including those that do not satisfy minimum standards of the monitoring network adopted by the Agency.
.

There are three general types of data gaps to consider for monitoring networks:

1. **Temporal**: Insufficient frequency of monitoring. For instance, data may be available from a well only in the fall since it is rarely idle in the spring.
2. **Spatial**: Insufficient number or density of monitoring sites in a specific area.
3. **Insufficient quality of data**: Data may be available but be of poor or questionable accuracy. Poor data may at times be worse than no data, since it could lead to incorrection assumptions or biases. The data may not appear consistent with other data in the area or with past readings at the monitoring site. The monitoring site may not meet all the desired criteria to provide reliable data, such as having information on perforation depth, etc. For further details, see **Section 5.2**.

Wells in the monitoring network have been measured regularly in the spring and fall of each year since monitoring began at each site. It has been found that the shallowest levels occus in the winter. The spring measurements will thus be replaced with winter measurements. It is anticipated that the measuring agencies will continue to measure the wells and report the data to the CASGEM program as well as the Pleasant Valley GSA. However, some wells in the monitoring network have not been measured in the last few years, or perhaps were measured but the data has not been uploaded to CASGEM yet. While data gaps are generally not present in the frequency of groundwater level monitoring, temporal gaps are present in some of the well data.

The existing groundwater-level monitoring network has provided adequate data to prepare groundwater contour maps and water-level hydrographs over the years. The average density of the monitoring network in the region is adequate; however, there are areas in the Subbasin that have sparse coverage. From more recent work, a large number of wells included in the monitoring network have known construction information.

5.10.1.3 Plans to Fill Groundwater Level Data Gaps

Regulation Requirements:
§354.38(c) If the monitoring network contains data gaps, the Plan shall include a description of the following:
1) The location and reason for data gaps in the monitoring network.
2) Local issues and circumstances that limit or prevent monitoring **.**
§354.38 (d) Each Agency shall describe steps that will be taken to fill data gaps before the next five-year assessment, including the location and purpose of newly added or installed monitoring sites.

See **Section 5.2**.

These data gaps can be filled using the four alternatives below:

- **Collect well completion reports and TV surveys.** Well Completion Reports can provide well construction information including perforated interval and total depth. These could be collected from the landowner or the DWR; however, several challenges exist.
- **Perform a video inspection of some wells to obtain construction information.** A video inspection can be performed on desired wells to determine the total depth and perforated interval, if a driller's log isn't available.
- **Replace well with another well.** Wells without construction information could be replaced with another private well that has well construction information. This may be simpler and less costly than a video inspection. However, replacing well locations is not always desirable, since it is preferred to continue measurements in wells that have a long period of record (i.e., long hydrograph).
- **Three New Monitor Wells-** filling data gaps for the first encountered water.

5.10.1.4 Adjustment to Density of Monitoring Sites and Frequency of Measurements

Regulation Requirements:
§354.38(e) Each Agency shall adjust the monitoring frequency and density of monitoring sites to provide an adequate level of detail about site-specific surface water and groundwater conditions and to assess the effectiveness of management actions under circumstances that include the following:
1) Minimum threshold exceedances.
2) Highly variable spatial or temporal conditions
3) Adverse impacts to beneficial uses and users of groundwater.
4) The potential to adversely affect the ability of an adjacent basin to implement its Plan or impede achievement of sustainability goals in an adjacent basin.

The frequency and density of the proposed monitoring programs are discussed in previous sections. The plans to fill data gaps above will address highly variable spatial or temporal conditions currently identified in the monitoring network. Beginning in 2022, when groundwater conditions are compared to sustainability goals, the monitoring network may be modified or enhanced if deemed necessary. **Figure 5-2** is a map of the Groundwater Level Monitoring Network. This map identifies the groundwater level indicator wells, actively monitored wells with known construction information, and data gap areas.

5.10.2 Groundwater Storage

5.10.2.1 Review and Evaluation of Monitoring Network

Regulation Requirements:
§354.38(a) Each Agency shall review the monitoring network and include an evaluation in the Plan and each five-year assessment, including a determination of uncertainty and whether there are data gaps that could affect the ability of the Plan to achieve the sustainability goal for the basin.

This section includes a description of the different types of data gaps, a summary of existing data gaps in each monitoring network, and plans to fill the data gaps.

5.10.2.2 Identification of Groundwater Storage Data Gaps

Regulation Requirements:
§354.38(b) Each Agency shall identify data gaps wherever the basin does not contain a sufficient number of monitoring sites, does not monitor sites at a sufficient frequency, or utilizes monitoring sites that are unreliable, including those that do not satisfy minimum standards of the monitoring network adopted by the Agency.
.

See **Section 5.2** and each of the main headings.

5.10.2.3 Plans to Fill Groundwater Storage Data Gaps

Regulation Requirements:
§354.38(c) If the monitoring network contains data gaps, the Plan shall include a description of the following:
1) The location and reason for data gaps in the monitoring network.
2) Local issues and circumstances that limit or prevent monitoring **.**
§354.38 (d) Each Agency shall describe steps that will be taken to fill data gaps before the next five-year assessment, including the location and purpose of newly added or installed monitoring sites.

The plan to fill data gaps in the monitoring network is established under Proposed Monitoring and Reporting Program described in **Section 5.2**.

5.10.2.4 Adjustment to Density of Monitoring Sites and Frequency of Measurements

Regulation Requirements:
§354.38(e) Each Agency shall adjust the monitoring frequency and density of monitoring sites to provide an adequate level of detail about site-specific surface water and groundwater conditions and to assess the effectiveness of management actions under circumstances that include the following:
1) Minimum threshold exceedances.
2) Highly variable spatial or temporal conditions
3) Adverse impacts to beneficial uses and users of groundwater.
4) The potential to adversely affect the ability of an adjacent basin to implement its Plan or impede achievement of sustainability goals in an adjacent basin.

The frequency and density of the proposed monitoring programs are discussed in previous sections. The criteria are considered adequate to provide sufficient monitoring data to satisfy SGMA requirements. Beginning in 2022, when groundwater conditions are compared to sustainability goals, the monitoring network may be modified or enhanced if deemed necessary.

5.10.3 Seawater Intrusion

Regulation Requirements:
§354.34(c)(3) Seawater Intrusion. Monitor seawater intrusion using chloride concentrations, or other measurements convertible to chloride concentrations, so that the current and projected rate and extent of seawater intrusion for each applicable principal aquifer may be calculated.

§354.34(j) An Agency that has demonstrated that undesirable results related to one or more sustainability indicators are not present and are not likely to occur in a basin, as described in Section 354.26, shall not be required to establish a monitoring network related to those sustainability indicators.

See **Section 5.3.3**.

5.10.4 Water Quality

5.10.4.1 Review and Evaluation of Monitoring Network

Regulation Requirements:
§354.38(a) Each Agency shall review the monitoring network and include an evaluation in the Plan and each five-year assessment, including a determination of uncertainty and whether there are data gaps that could affect the ability of the Plan to achieve the sustainability goal for the basin.

The following includes a summary of existing data gaps and plans to fill the data gaps. These items will be reevaluated in each 5-year update to this Plan.

5.10.4.2 Identification of Water Quality Data Gaps

Regulation Requirements:
§354.38(b) Each Agency shall identify data gaps wherever the basin does not contain a sufficient number of monitoring sites, does not monitor sites at a sufficient frequency, or utilizes monitoring sites that are unreliable, including those that do not satisfy minimum standards of the monitoring network adopted by the Agency.
.

Historically the data proposed to be acquired has not been acquired. The five-year update will review and identify if data gaps occur.

5.10.4.3 Plans to Fill Water Quality Data Gaps

Regulation Requirements:
§354.38(c) If the monitoring network contains data gaps, the Plan shall include a description of the following:
1) The location and reason for data gaps in the monitoring network.
2) Local issues and circumstances that limit or prevent monitoring **.**
§354.38 (d) Each Agency shall describe steps that will be taken to fill data gaps before the next five-year assessment, including the location and purpose of newly added or installed monitoring sites.

The five-year plan will identify if and how additional data gaps will be filled.

5.10.4.4 Adjustment to Density of Monitoring Sites and Frequency of Measurements

Regulation Requirements:
§354.38(e) Each Agency shall adjust the monitoring frequency and density of monitoring sites to provide an adequate level of detail about site-specific surface water and groundwater conditions and to assess the effectiveness of management actions under circumstances that include the following:
1) Minimum threshold exceedances.
2) Highly variable spatial or temporal conditions
3) Adverse impacts to beneficial uses and users of groundwater.
4) The potential to adversely affect the ability of an adjacent basin to implement its Plan or impede achievement of sustainability goals in an adjacent basin.

The frequency and density of the proposed monitoring programs are discussed in previous sections. The well network is considered adequate for water levels as well as for water quality. The criteria are considered adequate to provide the monitoring data to satisfy SGMA requirements. Beginning in 2022, when groundwater conditions are compared to sustainability goals, the monitoring network may be modified or enhanced if deemed necessary.

5.10.5 Land Subsidence

5.10.5.1 Review and Evaluation of Monitoring Network

Regulation Requirements:
§354.38(a) Each Agency shall review the monitoring network and include an evaluation in the Plan and each five-year assessment, including a determination of uncertainty and whether there are data gaps that could affect the ability of the Plan to achieve the sustainability goal for the basin.

This section includes a description of the different types of data gaps, a summary of existing data gaps in each monitoring network, and plans to fill the data gaps.

5.10.5.2 Identification of Land Subsidence Data Gaps

Regulation Requirements:
§354.38(b) Each Agency shall identify data gaps wherever the basin does not contain a sufficient number of monitoring sites, does not monitor sites at a sufficient frequency, or utilizes monitoring sites that are unreliable, including those that do not satisfy minimum standards of the monitoring network adopted by the Agency.
.

Land subsidence is often examined as an annual rate. As such, it is ideal to have survey data at monitoring points once per year at a minimum. The JPL remote sensing data is collected annually. Taking into consideration all the data, temporal data gaps are not anticipated to occur in the monitoring network in the future.

5.10.5.3 Plans to Fill Land Subsidence Data Gaps

Regulation Requirements:
§354.38(c) If the monitoring network contains data gaps, the Plan shall include a description of the following:
1) The location and reason for data gaps in the monitoring network.
2) Local issues and circumstances that limit or prevent monitoring **.**
§354.38 (d) Each Agency shall describe steps that will be taken to fill data gaps before the next five-year assessment, including the location and purpose of newly added or installed monitoring sites.

The Subbasin will rely on, as previously discussed, other agencies to continue to collect subsidence data.

5.10.5.4 Adjustment to Density of Monitoring Sites and Frequency of Measurements

Regulation Requirements:
§354.38(e) Each Agency shall adjust the monitoring frequency and density of monitoring sites to provide an adequate level of detail about site-specific surface water and groundwater conditions and to assess the effectiveness of management actions under circumstances that include the following:
1) Minimum threshold exceedances.
2) Highly variable spatial or temporal conditions
3) Adverse impacts to beneficial uses and users of groundwater.
4) The potential to adversely affect the ability of an adjacent basin to implement its Plan or impede achievement of sustainability goals in an adjacent basin.

The frequency and density of the proposed monitoring programs are discussed in previous sections. The criteria are considered adequate to provide the monitoring data to satisfy SGMA requirements. Beginning in 2022, when land subsidence is compared to sustainability goals, the monitoring network may be modified or enhanced if deemed necessary.

5.10.6 Depletion of Interconnected Surface Water

5.10.6.1 Review and Evaluation of Monitoring Network

Regulation Requirements:
§354.38(a) Each Agency shall review the monitoring network and include an evaluation in the Plan and each five-year assessment, including a determination of uncertainty and whether there are data gaps that could affect the ability of the Plan to achieve the sustainability goal for the basin.

The following includes a summary of existing data gaps and plans to fill the data gaps. These items will be reevaluated in each 5-year update to this Plan.

5.10.6.2 Identification of Interconnected Surface Water Data Gaps

Regulation Requirements:
§354.38(b) Each Agency shall identify data gaps wherever the basin does not contain a sufficient number of monitoring sites, does not monitor sites at a sufficient frequency, or utilizes monitoring sites that are unreliable, including those that do not satisfy minimum standards of the monitoring network adopted by the Agency.
.

The Subbasin does not recognize any data gaps at this time.

5.10.6.3 Plans to Fill Interconnected Surface Water Data Gaps

Regulation Requirements:
§354.38(c) If the monitoring network contains data gaps, the Plan shall include a description of the following:
1) The location and reason for data gaps in the monitoring network.
2) Local issues and circumstances that limit or prevent monitoring **.**
§354.38 (d) Each Agency shall describe steps that will be taken to fill data gaps before the next five-year assessment, including the location and purpose of newly added or installed monitoring sites.

Data gaps are not recognized at this time. This will be reevaluated in each 5-year update to this Plan.

5.10.6.4 Adjustment to Density of Monitoring Sites and Frequency of Measurements

Regulation Requirements:
§354.38(e) Each Agency shall adjust the monitoring frequency and density of monitoring sites to provide an adequate level of detail about site-specific surface water and groundwater conditions and to assess the effectiveness of management actions under circumstances that include the following:
1) Minimum threshold exceedances.
2) Highly variable spatial or temporal conditions
3) Adverse impacts to beneficial uses and users of groundwater.
4) The potential to adversely affect the ability of an adjacent basin to implement its Plan or impede achievement of sustainability goals in an adjacent basin.

Should the status of interconnected surface waters within the Subbasin change, a monitoring network for this sustainability indicator will be set in future GSP updates. Adjustments to monitoring networks within the Subbasin will be made as necessary in on-going GSP updates.

5.11 Reporting Monitoring Data to the Department

Regulation Requirements:
§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.

Monitoring programs data will be stored in a Data Management System described in Chapter 7. Well location, construction, and water level data and groundwater quality data will be shared as necessary. In addition, the monitoring programs described in this Chapter are generally consistent with the Subbasin's neighboring GSPs. Similarly, data reported to DWR will be collected and reported in a consistent format.

6 Projects and Management Actions to Achieve Sustainability

Regulation Requirements:

§354.42 Introduction to Projects and Management Actions. This Subarticle describes the criteria for projects and management actions to be included in a Plan to meet the sustainability goal for the basin in a manner that can be maintained over the planning and implementation horizon.

§354.44(a) Each Plan shall include a description of the projects and management actions the Agency has determined will achieve the sustainability goal for the basin, including projects and management actions to respond to changing conditions in the basin.

(b) Each Plan shall include a description of the projects and management actions that include the following:

(1) A list of projects and management actions proposed in the Plan with a description of the measurable objective that is expected to benefit from the project or management action. The list shall include projects and management actions that may be utilized to meet interim milestones, the exceedance of minimum thresholds, or where undesirable results have occurred or are imminent. The Plan shall include the following:

(a) A description of the circumstances under which projects or management actions shall be implemented, the criteria that would trigger implementation and termination of projects or management actions, and the process by which the Agency shall determine that conditions requiring the implementation of particular projects or management actions have occurred.

(b) The process by which the Agency shall provide notice to the public and other agencies that the implementation of projects or management actions is being considered or has been implemented, including a description of the actions to be taken.

(2) If overdraft conditions are identified through the analysis required by Section 354.18, the Plan shall describe projects or management actions, including a quantification of demand reduction or other methods, for the mitigation of overdraft.

(3) A summary of the permitting and regulatory process required for each project and management action.

(4) The status of each project and management action, including a time-table for expected initiation and completion, and the accrual of expected benefits.

(5) An explanation of the benefits that are expected to be realized from the project or management action, and how those benefits will be evaluated.

(6) An explanation of how the project or management action will be accomplished. If the projects or management actions rely on water from outside the jurisdiction of the Agency, an explanation of the source and reliability of that water shall be included.

(7) A description of the legal authority required for each project and management action, and the basis for that authority within the Agency.

(8) A description of the estimated cost for each project and management action and a description of how the Agency plans to meet those costs.

(9) A description of the management of groundwater extractions and recharge to ensure that chronic lowering of groundwater levels or depletion of supply during periods of drought is offset by increases in groundwater levels or storage during other periods.

(c) Projects and management actions shall be supported by best available information and best available science.

(d) An Agency shall take into account the level of uncertainty associated with the basin setting when developing projects or management actions.

6.1 Introduction

GSAs have a variety of tools that can be used to achieve sustainable groundwater management, which fall into two primary categories – 1) project development for water supply augmentation and 2) management actions for demand reduction. A combination of these actions will likely be needed to achieve sustainability. The projects described herein focus on the development, use, and recharge of available surface water supplies to reduce the lowering of the groundwater levels. Management actions have been developed that focus on reducing water demand and associated reduction of groundwater pumping, along with increased data collection and associated actions including education and outreach, regulatory policies, incentive-based programs, and enforcement actions. Projects that are currently envisioned for implementation are discussed in Section 6.2, and potential management actions that may be implemented are discussed in Section 6.3.

Some projects and management actions will benefit the entire Subbasin, while others will be implemented by individual GSAs and/or individual landowners and will benefit those GSAs and/or landowners. Some projects and management actions will be implemented sooner than others. The GSAs understand there are various levels of uncertainty with project and program implementation, and it is not unusual for project and program implementation to take longer than originally estimated. Some projects and management actions build upon others, and the accrual of expected benefits may take multiple years to be individually realized and vary

substantially from year to year due to fluctuating hydrologic cycles. Various implementation timelines may change over time and will be reevaluated each time this GSP is updated.

Implementation of this GSP over the planning horizon will require ongoing efforts to engage stakeholders and the general public in the sustainability process, communicating the statutory requirement, the objectives of the GSP, and progress toward each identified measurable objective. Ongoing public communication, announcements of upcoming environmental hearings, project presentations, bid openings, and project construction schedules will be made on a regular basis. Public forums will include opportunities for public comment and feedback. The GSAs will provide notice to the public and other agencies as the implementation of each project or management action is being considered through public meetings, newsletters, and the PVGSA website (http://sgma.pleasantvalleywaterdistrict.com/). The projects will be paid for by project participants. This may be by GSA, by water district or groups of landowners. The project participant will fund the development of the projects, construction and operation of the project and receive their proportionate benefit (based upon their proportionate share of costs) of the projects that are developed.

Table 6-1 identifies the different types of potential projects and management actions that may be considered by the GSA. They have not been prioritized because the GSAs have not selected specific projects and programs for implementation. If possible, the projects that would be constructed first would be in those areas where rates of groundwater level decline are the greatest.

Table 6-1 Projects and Programs for Mitigating Groundwater Overdraft

No.	Category	Description	Supply (S) or Demand (D) side action	Estimated Time to Potential Implementation (years)		
Projects						
1	Surface Water	Groundwater Recharge ○ Recharge basins ○ Dry wells ○ Injection wells ○ Intentional irrigation field flooding ○ Unlined canals ○ Reclaimed water	S		1 - 5	
2		Groundwater Banking	S		1 - 5	
3		Direct Use of Flood and Storm Water	S		1 - 5	
4		Import New Surface Water Supplies	S		1 - 5	
5		Increase Surface Water Storage	S			>5
6		Increase Conveyance Capacity	S		1 - 5	
Management Actions						
7	Land Management	Agricultural Land Conversion ○ Sell/lease land and reserve groundwater rights ○ Agency purchases and fallows land from willing landowners ○ Fallow land and flood fields/build recharge basins ○ Watershed management	D		1 - 5	
8		Deficit Irrigation	D	0 - 1		
9		Urban Land Use Regulations	D	0 - 1		
10	Groundwater Use Restrictions	Prohibit Groundwater Exports	S	0 - 1		
11		Groundwater Metering and Pumping Restrictions	D	0 - 1		
12		Groundwater Pumping Fees	D	0 - 1	1 - 5	
13		Wellhead Fees (annual or new wells)	D	0 - 1		
14		Additional Well Permit Requirements	D	0 - 1		
15	Water Conservation	Water Use Restrictions in Droughts	D	0 - 1		
16		Urban Water Conservation	D	0 - 1		
17		Urban Water Recycling	S			>5
18		Agricultural Water Recycling	S		1 - 5	
19		Tiered Pricing / Fines for Overuse	D	0 - 1		
20	Other	Blend Poor and Good Quality Waters	S		1 - 5	
21		Groundwater Credits	N/A	0 - 1		
22		Rainwater Harvesting	S		1 - 5	
23		Public Education	D	0 - 1		

Description of the circumstance and criteria for initiating projects or management actions:

From historical information documented in Chapter 3, it can be shown that presently there has been a lowering of groundwater levels. Thus, overdraft is occurring, and the GSAs are in the process of developing projects to correct the overdraft. PVGSA plans to add a new surface delivery pipeline (Northern Canal Pipeline Project) into the District which will allow the importation of additional surface supplies. The PVGSA as well as the other GSAs will continue to monitor groundwater level changes as the northern pipeline project is constructed and operated. Groundwater level change will be averaged over a five-year period to evaluate effectiveness of the project(s).

Process to notify the public and local agencies:

The PVGSA has initiated a website as well as outreach to its constituency through mailers and workshops. The website will be the main instrument to keep the public aware of current conditions and success in managing the groundwater resources.

What if Overdraft Continues to Occur:

With the planned approach, it is envisioned that 1) the GSAs will be successful in developing the projects needed to offset the overdraft and that 2) the landowners will be able to purchase and import additional surface water supplies. Should this not be realized, then the addition of other projects and management actions would be implemented, including reductions in irrigated land.

Permitting:

The project(s) will each need to be permitted. Generally, the permitting process involves review of the project site for environmental and cultural concerns, and preparation of environmental documents to comply with California Environmental Quality Act and with the Air Resources' and Regional Water Quality Control Board's requirements and approvals. Since most of the areas planned for this development are currently cultivated to farming, it is thought that this process should be relatively straightforward. The District is presently approximately half-way through this process on the North Pipeline project.

Status of each Action:

The Action currently planned is the addition of the North Pipeline project. The District is currently initiating acquisition of right of way.

Explanation of Benefits:

The projects will allow greater ability to import surface water supplies. With the acquisition of recharge sites, there is the potential that some land is removed from agricultural production, which might yield a reduction in demand. The ponds allows surface water to be diverted and recharged for later use in the spring and summer months. If the rain/snowmelt patterns change and more surface water is available outside the normal crop irrigation demand season, these facilities will allow the District to take advantage of the timing of the surface water availability and may make even more surface water available for recharge. Accomplishment of the Projects:

District staff have relationships with its growers, as well as local real estate operatives, and it is through this network that the District will continue to pursue acquisition of property.

Legal Authority:

The PVWD has the legal authority to buy, sell, and enter into contracts for purchase of property as well as construction contracts.

Cost:

See the explanation in chapter 7.

Management:

The activities of the PVGSA and other GSAs will be handled by their staff. The PVGSA is expected to hire a manager and normal field activities are expected to be the responsibility of the individual landowners.

As stated, the District plans to develop a significant project known as the North Pipeline project. The maintenance and operation procedures of this facility have yet to be determined, but would be expected to be a mixture of contract operations along with landowner participation.

The main revenue objectives for the District involve the collection of funds to 1) fully fund the operations of the GSA, 2) fund the Pleasant Valley Water District's portion of the cost to prepare and implement a GSP, and 3) expand the ability to intentionally recharge groundwater. Ultimately, it is estimated that the cost of over $20 million will need to be generated from either assessments and or toll charges or a mixture of both.

Each potential project presented herein has a surface water supply that was identified as being the most likely to be available. Each of the current projects summarized in Section 6.2 identifies the water supplies that could be available to the project. The Priority 1 projects have been included in this chapter. Due to the location of the projects, only certain surface water supplies might be available for a particular project. As discussed in Section 3.4, a system of permits, licenses, and registrations give the right to beneficially use reasonable amounts of surface water within a specific area or Place of Use. The Place of Use for the USBR Central Valley Project (CVP), represented as the Place of Use for the City of Coalinga CVP contract, is shown in **Figure** 6-1 When there is a willing seller, the GSAs could purchase surface water supplies from the CVP and use it for beneficial purposes within the Subbasin after completing various regulatory and environmental processes for a water transfer. Included in **Appendix J** is a contract for water supplies executed by the PVWD in 2021.

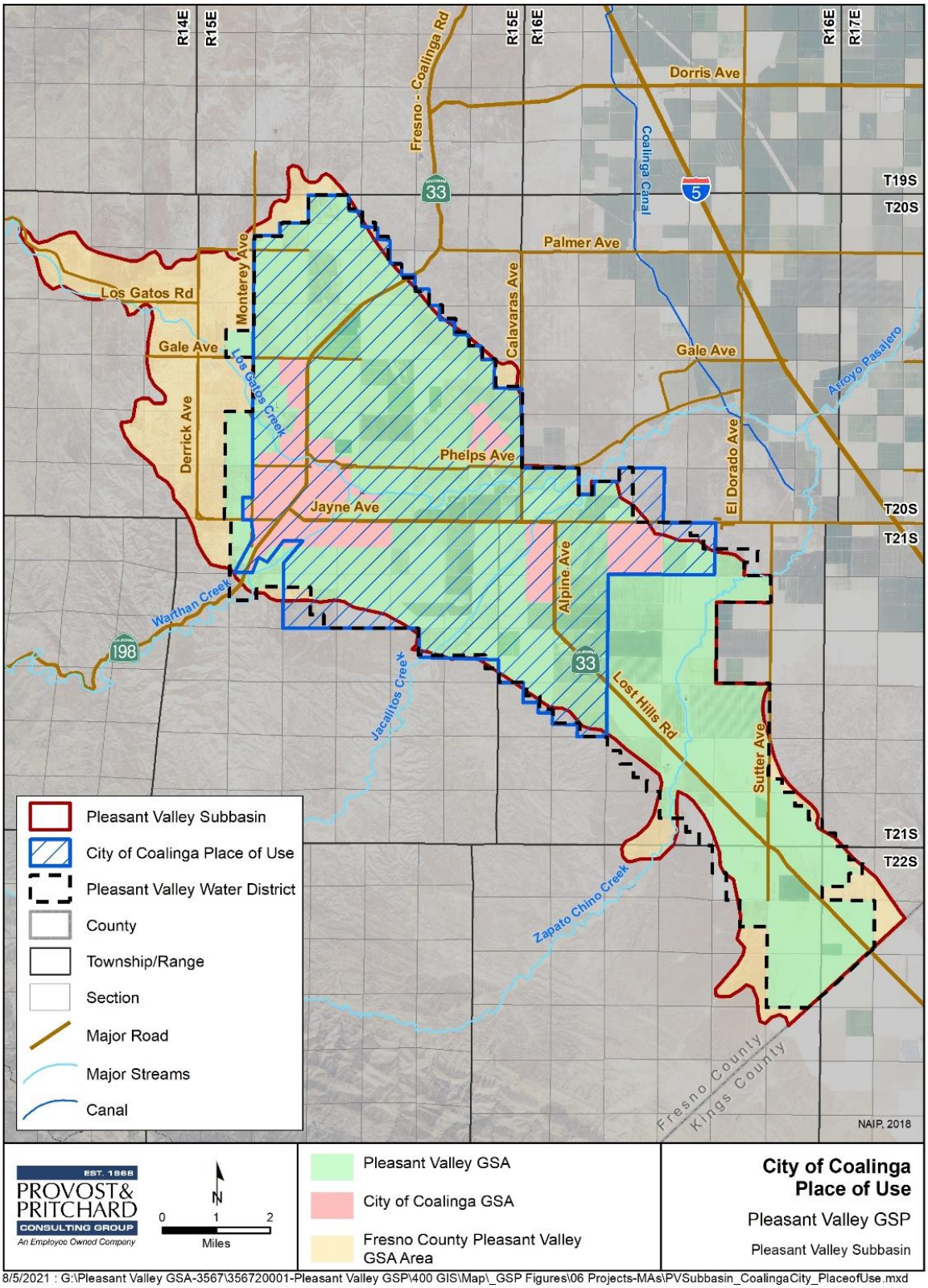


Figure 6-1 City of Coalinga CVP Place of Use in Pleasant Valley Subbasin

6.2 Projects

The GSAs have identified a number of potential projects to help achieve groundwater sustainability, and additional projects may be added or developed as GSP implementation proceeds. The existing City of Coalinga Wastewater Treatment Facility has been contributing to aquifer recharge, since it treats and percolates effluent originating from imported surface water, but additional larger projects are required to augment the water supply to help overcome the Subbasin groundwater overdraft. Some of the individual projects discussed below have been included in the Westside San Joaquin Integrated Regional Water Management Plan (IRWMP) to pursue project funding, while other projects are more Subbasin-wide projects. It is envisioned that projects will be implemented as joint GSA efforts, by individual GSAs, or implemented by individual landowners or stakeholders.

The following projects are being planned to supplement existing recharge efforts, and the projects are in various stages of development, ranging from a conceptual level to projects that are under design. A different level of investigation has been completed for each project, ranging from preliminary conceptual projects with limited information to projects with a feasibility level design completed, to projects that are "shovel ready," which is defined as having complete environmental documentation and complete design plans and specifications. Those that have had more investigation are identified as priority 1 and the others are identified as priority 2. A summary listing the projects and the associated measurable objectives is included in the report.

Table 6-2 List of Potential Projects

Project	Title	Estimated Yearly Recharge (AF)	Estimated Capital Cost ($)	Estimated Cost ($/AF)[1]
Priority 1	Description			
1	North Canal Pipeline (facility cost)	12,000	$14,000,000	$100
2	South Canal Pipeline Expansion (facility cost)	4,000	$2,500,000	$54
3	Los Gatos Creek Gravel Pits	720	$2,100,000	$254
4	Zapato Creek Instream	75	$1,600,000	$9280
	Annual Operations Costs			
5	Import surface water supplies	20,000	$5-$10,000,000[3]	$250-$500/yr
	Subtotal			
Priority 2				
6	City of Coalinga Surface Water	2-3,000	Unknown	
7	City of Coalinga WWTP Recharge	?	Unknown	
8	Los Gatos Creek Surface Water Diversion	?	Unknown	
9	Los Gatos in-Creek Recharge	?	Unknown	
10	Jacalitos Creek Surface Water Diversion	?	Unknown	
11	Jacalitos Creek in-Creek Recharge	?	Unknown	
12	Zapato Chino Surface Water Diversion	?	Unknown	
13	Zapato Chino in-Creek Recharge	?	Unknown	
14	Flood Mar	?	Unknown	
15	Intentional Recharge Basins	?	Unknown	
16	Dry Well Recharge	?	Unknown	
17	Cloud Seeding	?	Unknown	

Notes – 1 – Costs capitalized at 6% for 20 years. Cost does not include water supply.
2 – Costs are 2016 based dollars
3 – Importation of surface water costs are an annual cost and are not a one-time expenditure as shown for the other entries in the table.

The GSAs will maintain a list of proposed projects and their characteristics, along with their development status, and will use this list to prioritize and secure funding as opportunities become available. The GSAs will seek and encourage projects that provide multi-benefits if feasible. All projects will be supported by the best available information and the best available science.

Projects discussed in this GSP will remain a part of the potential projects that the GSAs may choose to implement; however, as additional information is gathered other projects may be identified and considered in the future.

Categories of the project types are listed below:

- Groundwater Recharge/Groundwater Banking
    - Infiltration Ponds
    - On-Farm Recharge
    - In-stream Recharge
    - Canals
    - Dry Wells
    - Tile Lines (Subsurface)
- Conveyance Systems
    - Pipelines
    - Canal Systems
    - In Stream Diversion Points
    - Coalinga Canal Diversion Points
- Surface Storage Ponds
- Stormwater Capture and Recharge Project
    - Watershed Management
        - Removal of non-native vegetation and overgrowth
    - Upper Watershed
    - Lower Watershed
    - Cloud seeding
- Use of recycled water
    - Use of Surface Water Treatment Facility
    - Wastewater Treatment Facility
- Demand Reduction

The projects currently being considered would yield an estimated average-annual volume needed to become sustainable. The projects listed in this document will not all be utilized during the same time. Many of the identified projects are scalable, meaning they could be expanded beyond the identified benefits by expanding acreage or having more landowners participate. The potential projects are summarized in **Table 6-2** indicating the average annual estimated benefits, the generalized priority for implementation, the estimated capital cost (current dollars) to the GSAs, and the estimated cost per acre foot of project yield. **Figure 6-2** shows the location of the main projects being considered. It is possible that the implementing entity for some projects may change in the future and that the GSAs may choose to implement more projects. Subsequently, this project list will need to be evaluated and revised each year. It will also be updated in the GSP Annual Report and/or 5-year GSP update.

The steps below can be used as a guide for a process to be used for project implementation:

1. Identify potential projects.
2. Gather required information and field data.
3. Prepare conceptual level feasibility studies and cost estimates.
4. Prioritize potential projects.
5. Obtain agreements with project partner(s).

6. Secure funding.
7. Prepare environmental documents and obtain permit and regulatory approvals.
8. Design and prepare construction documents.
9. Implement project construction.
10. Operate and maintain project for sustainability.
11. Periodically evaluate estimated benefits vs. actual benefits.

Projects constructed or under design as of 2024:

- North Canal Pipeline-Design is approximately 95% complete
- South Canal Pipeline Expansion-Current delivery is approximately 20 cfs and can be expanded to 40 cfs total, in 2023 4,250 AF of surface water was imported, 1,919 AF to Firestone Recharge Project, 2,331 AF to On Farm Recharge.
- Los Gatos Creek Gravel Pits-Preliminary Design stage,
- Zapato Creek Instream-Conceptual Stage
- Import Surface Water Supplies-Continued efforts, individual landowners have imported water through private purchases.
- Firestone Recharge Facility-In operation and has recharged over 1,919 AF in 2023..
- Installation of three new wells to fill data gaps-Wells are operational and will provide water level data, sample water for water quality and stable isotope identification to better understand the downward movement of water through the soil.
- Also, the PVWD is a member of the San Luis Delta Mendota Water Authority and may participate in the Dry Year Program.
- The City of Coalinga has a contract agreement to sell excess surface water to local landowners.

Management Actions as of 2024:

Farmland: The following policies are implemented or under development:

- Metering policy - in place since January 2023
- Semi Annual static water level measurements - in place since January 2023
- Well registration policy - in place since January 2023
- Per acre foot extraction fee policy - in place since January 2023
- Annual water quality sampling policy - in place since July 2023
- Construction of (3) 500’ foot deep monitor wells
- Groundwater recharge policy - in development
- Groundwater pumping curtailment policy – in development.
- Surface water in lieu groundwater pumping policy-in development
- Demand reduction when surface water is not available - in development.
- Restriction of further permanent crop planting - in development.
- The following projects are in development or in place to deliver surface water to the subbasin:
- South Pipeline – in operation
- North Pipeline – 90% completion of permitting and design. Construction schedule for the 3rd quarter of 2024
- Outreach to educate landowners on the DWR Dry well reporting System, and/or Contacts at the Subbasin where they can voice their concerns or provide feedback of effects on their well due to groundwater management in the Subbasin.

Domestic Users: The following policies are under development:

- Domestic Well Monitoring Policy: Outreach with the property owners every six months by flyers or direct communication.
- Set up a monitoring program in the Lost Hills Community for data collection of water levels and water quality to assist with technical services for the development of new wells and continued operation. At the time of this resubmittal there were no known wells used for drinking water. A landowner with a domestic well was contacted, see Appendix O for notes on the conversation.

Outreach to educate landowners on the DWR Dry well reporting System, and/or Contacts at the Subbasin where they can voice their concerns or provide feedback of effects on their well due to groundwater management in the Subbasin.

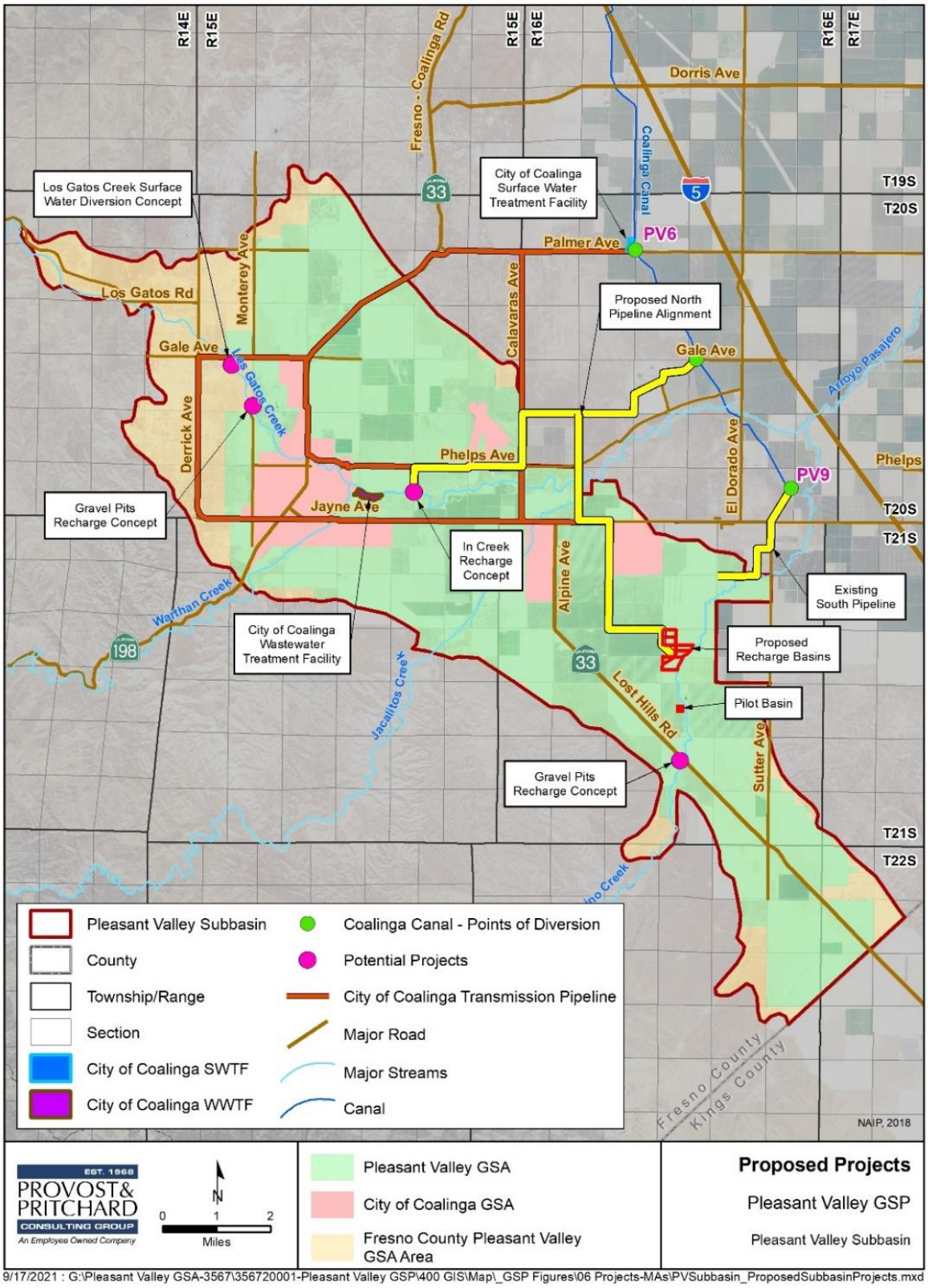


Figure 6-2 Proposed Projects

6.2.1 Project #PV 01 North Pipeline Project

Title:	**Name**	**ID: Name**

Project Type

Surface Water Recharge

Project Location

Pumps Station: Latitude: 36° 10' 51.73", Longitude: 120° 13' 33.49", Recharge Area Latitude: 36° 8' 25.59", Longitude: 120° 18' 35.57"

Implementing Agency

Pleasant Valley Water District-Funded by local Landowners

Description - 354.44**(a)**

The proposed project is for construction of a 60 cfs pump station and water pipeline and an ecological restoration for groundwater recharge near the city of Coalinga. The project has two parts: 1) Pumpstation and main pipeline from the Coalinga Canal to Los Gatos Creek, including diversion pipelines into the creek and 2) the construction of a recharge and restoration (R&R) area in and around Los Gatos Creek. Construction for the pump station and the pipeline is planned for the months of October to March, when the Coalinga Canal has minimal use, actual construction year will be based on coordination with the Bureau. The entire area of potential effect (APE) is 264 acres (90 for the main pipeline and 174 acres for the Los Gatos Creek area).

Measurable Objective(s) Addressed - 354.44**(b)(1)**

- ☒ Chronic Lowering of Groundwater Levels
- ☐ Seawater Intrusion – *not applicable*
- ☐ Land Subsidence
- ☒ Reduction of Groundwater Storage
- ☐ Degraded Water Quality
- ☐ Depletion of Interconnected Surface Water

Circumstances and Criteria for Implementation - 354.44**(b)(1)(a)**

The local landowners are in the process of funding this project. The project design and field investigation started in December of 2019.

Process to Provide Notice of Implementation - 354.44**(b)(1)(b)**

The project has been noticed at the GSA Board meetings.

Estimated Annual Project Benefits (AF/yr) - 354.44**(b)(2)**

It is estimated that the projects estimated average annual benefit is 12,000 AF/yr. Based on 100 diversion days. The project can be used throughout the year when water is available.

Permitting and Regulatory Requirements - 354.44**(b)(3)**

Army Corps (404), Stream Bed Alteration Agreement (1600), State Water Resources Control Board (401), USBR Licensing Agreement, Westlands Water District Conveyance Agreement. All these permits are estimated to be submitted by August of 2021.

Schedule - 354.44**(b)(4)** Anticipated Start & Completion, Timeframe to accrue benefits

Title:	**Name**	**ID: Name**

The project started in December of 2019 and is currently in process.

Evaluation of Benefits - 354.44**(b)(5)**

Monitoring of Groundwater levels and pumpage; measurement of surface water impacted.

How will this be accomplished, and what is the water source? - 354.44**(b)(6)**

Each landowner will purchase water on the open market and be delivered when available.

Legal Authority - 354.44**(b)(7)**

Pleasant Valley Water District

Cost - 354.44**(b)(8)** Estimated Capital Cost

$14,000,000

Funding Source - 354.44**(b)(8)**

Local Landowners and Grant Funding when available

Management of Groundwater Extractions and Recharge - 354.44**(b)(9)**

This project will contribute to the replenishment of extracted groundwater, for later recovery. Policy for recovery will be set by the GSA Board.

Level of Uncertainty - 354.44**(d)**

To assess benefit to the Subbasin, the GSA will review groundwater level data.

6.2.2 Project #PV 02 South Pipeline Expansion and Extension Project

Title:	**Name**	**ID: Name**

Project Type

Surface Water Recharge

Project Location

Pumps Station: Latitude: 36° 8' 46.95", Longitude: 120° 11' 39.20",

Implementing Agency

Pleasant Valley Water District

Description - 354.44**(a)**

This project proposes to expand the current pumping capacity out of the Coalinga canal, with an increase of 20 cfs and to connect to the existing 40 cfs booster pump station. The local landowners have been proactive and have funded and permitted the existing project. The project participants have permitted the physical improvements and it is anticipated that no additional permits will be required. This project also proposes to extend the pipeline an additional 2 miles as a lateral off one of the main lines to deliver water to areas in need.

Measurable Objective(s) Addressed - 354.44**(b)(1)**

- ☒ Chronic Lowering of Groundwater Levels
- ☐ Seawater Intrusion – *not applicable*
- ☐ Land Subsidence
- ☒ Reduction of Groundwater Storage
- ☐ Degraded Water Quality
- ☐ Depletion of Interconnected Surface Water

Circumstances and Criteria for Implementation - 354.44**(b)(1)(a)**

A board decision and compliance with the owners. When Grant funds become available.

Process to Provide Notice of Implementation - 354.44**(b)(1)(b)**

The project will be noticed at the GSA Board meetings, and on the website.

Estimated Annual Project Benefits (AF/yr) - 354.44**(b)(2)**

It is estimated that the projects estimated annual benefit is 4,000 AF/yr. Based on 100 diversion days. The project can be used throughout the year when water is available.

Permitting and Regulatory Requirements - 354.44**(b)(3)**

All these permits are in place under the previous project. No permits are anticipated. Coordination with Westlands Water District will be needed.

Schedule - 354.44**(b)(4)** Anticipated Start & Completion, Timeframe to accrue benefits

When Grant Funds become available. It is anticipated benefits will accrue in the year the project becomes online.

Evaluation of Benefits - 354.44**(b)(5)**

Monitoring of Groundwater levels and pumpage.

Title:	**Name**	**ID: Name**

How will this be accomplished, and what is the water source? - 354.44**(b)(6)**

Each landowner will purchase water on the open market and deliver it to the area in need.

Legal Authority - 354.44**(b)(7)**

Pleasant Valley Water District

Cost - 354.44**(b)(8)** Estimated Capital Cost

$2,500,000

Funding Source - 354.44**(b)(8)**

Grant Funding when available and/or Land Based Assessments

Management of Groundwater Extractions and Recharge - 354.44**(b)(9)**

This project will contribute to the replenishment of groundwater.

Level of Uncertainty - 354.44**(d)**

There is a level of uncertainty associated with the effects of groundwater replenishment and fluctuations in groundwater elevations. The GSA will take this into account when developing the benefit to the Subbasin, through monitoring of the groundwater.

6.2.3 Project #PV 03 Los Gatos Creek Gravel Pits Recharge Project

Title:	**Name**	**ID: Name**

Project Type

Surface Recharge

Project Location

Latitude: 36° 9' 27.17", Longitude: 120° 21' 55.6"

Implementing Agency

Pleasant Valley GSA

Description - 354.44**(a)**

The following groundwater recharge project is to capture seasonal surface water flows in Los Gatos Creek as it flows past Granite's Coalinga, California operations. The overall project would divert surface water flows from Los Gatos Creek into an existing gravel pit that is not currently being used just west of the airport runway. Evaluation of the potential for groundwater recharge via existing gravel pits at the Granite Construction Company Site in the City of Coalinga was evaluated in 2003 by Provost & Pritchard in the report, "Pleasant Valley Water District Groundwater Storage Pilot Project and Feasibility Study". In that report a groundwater recharge project at Granite was found to be a potentially viable project to provide water storage in the aquifer below Pleasant Valley for subsequent extraction. It includes a concrete turnout structure and a pipeline that feeds into the gravel pit. An estimated volume of 960 AF can be stored in the pit at any given time. The infiltration rate is predicted to be in the range between 2 and 4 feet per day.

Measurable Objective(s) Addressed - 354.44**(b)(1)**

- ☒ Chronic Lowering of Groundwater Levels
- ☐ Seawater Intrusion – *not applicable*
- ☐ Land Subsidence
- ☒ Reduction of Groundwater Storage
- ☐ Degraded Water Quality
- ☐ Depletion of Interconnected Surface Water

Circumstances and Criteria for Implementation - 354.44**(b)(1)(a)**

Implementation will begin when funds are available.

Process to Provide Notice of Implementation - 354.44**(b)(1)(b)**

Notice will be given at the GAS board meeting as well as posted on the website.

Estimated Annual Project Benefits (AF/yr) - 354.44**(b)(2)**

It is anticipated that during the wet part of the year that the volume can be refilled twice in a wet year and once in a normal year. A cycle of a wet, normal and two dry years are used for this analysis. Average estimated benefit is 720 AF/year.

Permitting and Regulatory Requirements - 354.44**(b)(3)**

Army Corps (404), Stream Bed Alteration Agreement (1600), State Water Resources Control Board (401), State Board Water Resource-Water Right Division

Schedule - 354.44**(b)(4)** Anticipated Start & Completion, Timeframe to accrue benefits

The project is anticipated to take 3 years to complete.

Evaluation of Benefits - 354.44**(b)(5)**

Title:	**Name**	**ID: Name**

Groundwater monitoring will be used to evaluate the benefits.

How will this be accomplished, and what is the water source? - 354.44**(b)(6)**

Runoff water from Arroyo Pasajero Water Shed will be used. Once the project is constructed monitoring of storm events will be done to schedule the diversion.

Legal Authority - 354.44**(b)(7)**

Pleasant Valley GSA

Cost - 354.44**(b)(8)** Estimated Capital Cost

$2,100,000

Funding Source - 354.44**(b)(8)**

Grant Funding

Management of Groundwater Extractions and Recharge - 354.44**(b)(9)**

This project will contribute to the replenishment of extracted groundwater, for later recovery. Policy for recovery will be set by the GSA Board.

Level of Uncertainty - 354.44**(d)**

There is a level of uncertainty associated with the effects of groundwater replenishment and fluctuations in groundwater elevations. The GSA will take this into account when evaluating the benefit to the Subbasin, through monitoring of the groundwater.

6.2.4 Project #PV 04 Zapato Chino Creek Instream Recharge Project

Title:	**Name**	**ID: Name**

Project Type

Groundwater Recharge

Project Location

Latitude: 36° 7' 7.01", Longitude: 120° 12' 55.20", Center of Zapato Chino Creek Stream within Subbasin

Implementing Agency

Pleasant Valley GSA

Description - 354.44**(a)**

This project will utilize various techniques to slow the instream flow and allow water ponding within the stream to increase the duration of water contact with the soil to increase infiltration amount within the stream. The flow in the channel is typically at a depth of 2-5 feet deep, while the channel is in places 10 15 feet deep. The goal would be to design swales within the channel to increase the depth of water but not impact or restrict the channel capacity during a high flow.

Measurable Objective(s) Addressed - 354.44**(b)(1)**

- ☒ Chronic Lowering of Groundwater Levels
- ☐ Seawater Intrusion – *not applicable*
- ☐ Land Subsidence
- ☒ Reduction of Groundwater Storage
- ☐ Degraded Water Quality
- ☐ Depletion of Interconnected Surface Water

Circumstances and Criteria for Implementation - 354.44**(b)(1)(a)**

Project will be implemented when Grant funds become available, and the GSA board make the decision to move forward.

Process to Provide Notice of Implementation - 354.44**(b)(1)(b)**

Notice will be given at the GAS board meeting as well as posted on the website.

Estimated Annual Project Benefits (AF/yr) - 354.44**(b)(2)**

The estimate annual project benefit is based on the stream running in three out of five years. The increased area expected to be 5 acres. The infiltration rate in the stream is in the range of 9 cubic feet per second to 15 cubic feet per second per mile and is expected to increase the duration of the flow to 12 hours for a total average yearly benefit in the range of 50 AF/yr to 75 AF/yr.

Permitting and Regulatory Requirements - 354.44**(b)(3)**

Army Corps (404), Stream Bed Alteration Agreement (1600), State Water Resources Control Board (401), State Board Water Resource-Water Right Division

Schedule - 354.44**(b)(4)** Anticipated Start & Completion, Timeframe to accrue benefits

The project is anticipated to take 3 years to complete.

Evaluation of Benefits - 354.44**(b)(5)**

Groundwater monitoring will be used to evaluate the benefits.

How will this be accomplished, and what is the water source? - 354.44**(b)(6)**

Title:	**Name**	**ID: Name**

The source of water will be run-of from the Arroyo Pasajero Watershed. Monitoring of storm events will be done. Once the project is constructed minimal preparation will be needed to implement the project.

Legal Authority - 354.44**(b)(7)**

Pleasant Valley GSA

Cost - 354.44**(b)(8)** Estimated Capital Cost

$1,600,000

Funding Source - 354.44**(b)(8)**

Grant Funding and Assessments

Management of Groundwater Extractions and Recharge - 354.44**(b)(9)**

This project will contribute to the replenishment of extracted groundwater, for later recovery. Policy for recovery will be set by the GSA Board.

Level of Uncertainty - 354.44**(d)**

There is a level of uncertainty associated with the effects of groundwater replenishment and fluctuations in groundwater elevations. The GSA will take this into account when developing the benefit to the Subbasin, through monitoring of the groundwater.

6.2.5 Project #PV 05 PV Water Banking Project – Section 31

Title:	**Name**	**ID: Name**

Project Type

Groundwater Recharge/Groundwater Banking Project

Project Location

Latitude: 36° 8' 35.21", Longitude 120° 16' 29.80", Center of Section 31, 20S, 16E.

Implementing Agency

Pleasant Valley Water District

Description - 354.44**(a)**

Project is to construct 130 acres of infiltration basins on section 31 to recharge ground water to recover it in dry years. The infiltration rate in this area is estimated to range from 0.5 to 1.0 ft per day. Utilizing the North Pipeline to supply water to this project. The basins will be shallow in nature with 1 to 2 feet of cut material.

Measurable Objective(s) Addressed - 354.44**(b)(1)**

- ☒ Chronic Lowering of Groundwater Levels
- ☐ Seawater Intrusion – *not applicable*
- ☐ Land Subsidence
- ☒ Reduction of Groundwater Storage
- ☐ Degraded Water Quality
- ☐ Depletion of Interconnected Surface Water

Circumstances and Criteria for Implementation - 354.44**(b)(1)(a)**

Project will be implemented when Grant funds become available or through assessments from the board. The GSA board make the decision to move forward.

Process to Provide Notice of Implementation - 354.44**(b)(1)(b)**

Notice will be given at the GAS board meeting as well as posted on the website

Estimated Annual Project Benefits (AF/yr) - 354.44**(b)(2)**

The estimate annual project benefit is based on the water being available from an outside source 3 out 5 years and the project can be utilized for a minimum of 30 days in a normal water year. The average yearly benefit can range from 4,700 to 9,400 AF/yr.

Permitting and Regulatory Requirements - 354.44**(b)(3)**

Permits are underway for diversion from the Coalinga Canal. There are no permits required for this project.

Schedule - 354.44**(b)(4)** Anticipated Start & Completion, Timeframe to accrue benefits

This project is dependent on the construction of the North Pipeline Project. This project can be completed in 8 months.

Evaluation of Benefits - 354.44**(b)(5)**

Groundwater Monitoring

How will this be accomplished, and what is the water source? - 354.44**(b)(6)**

Open Market purchase of water.

Legal Authority - 354.44**(b)(7)**

Title:	**Name**	**ID: Name**

Pleasant Valley Water District

Cost - 354.44**(b)(8)** Estimated Capital Cost

$4,100,000

Funding Source - 354.44**(b)(8)**

Grant or Assessments

Management of Groundwater Extractions and Recharge - 354.44**(b)(9)**

This project will contribute to the replenishment of extracted groundwater, for later recovery. Policy for recovery will be set by the GSA Board.

Level of Uncertainty - 354.44**(d)**

There is a level of uncertainty associated with the effects of groundwater replenishment and fluctuations in groundwater elevations. The GSA will take this into account when evaluating the benefit to the Subbasin, through monitoring of the groundwater.

6.3 Management Actions

Management actions, such as education and outreach, as well as initiating the development of rules and regulations and metering requirements may be initiated during the first year of implementation or may also be added to this GSP prior to adoption. Discussed herein is a suite of management actions the GSAs may consider during implementation of the GSP to achieve sustainability. Management actions identified below should be implemented before others can be achieved. The GSAs could implement some management actions Subbasin-wide, while the policies and programs for other management actions may be developed by a single GSA and be implemented by individual landowners. It is expected the GSAs will further develop and craft management actions in response to stakeholder input on parallel timelines and adapt to the estimated schedules according to the best available information and best available science at any given time used to support the management actions.

The legal authority and basis for the management actions described in this GSP are outlined in the SGMA and related provisions. GSA authorities include but are not limited to adopting policies, regulating groundwater extractions, imposing fees, monitoring, enforcing programs, and more. Though SGMA grants the GSAs these powers, the pursuit and implementation of the projects and management actions are the GSAs' responsibility. The GSAs must enforce their legal authority to the extent necessary to achieve sustainable groundwater management for all beneficial users within the Subbasin. In the development of the management actions, the GSAs intend to embody the lessons learned from other groundwater managed basins and strive to accomplish the following:

- Be transparent.
- Use a portfolio of approaches to achieve sustainability.
- Continued data collection.
- Devise a groundwater pumping limitation.
- Address concerns of funding GSP projects, programs, and management actions.
- Assure performance by penalties and enforcement.

The Management Actions that may be considered by the GSA are discussed below and grouped into the following general topics. These categories are referenced in the Management Action IDs.

A summary of conceptual potential management actions is included as **Table 6-3.**

Management Actions since 2024:
Farmland: The following policies are implemented or under development:

- Metering policy - in place since January 2023
- Semi Annual static water level measurements - in place since January 2023
- Well registration policy - in place since January 2023
- Per acre foot extraction fee policy - in place since January 2023
- Annual water quality sampling policy - in place since July 2023
- Construction of (3) 500' foot deep monitor wells
- Groundwater recharge policy - in development
- Groundwater pumping curtailment policy – in development.
- Surface water in lieu groundwater pumping policy-in development
- Demand reduction when surface water is not available - in development.
- Restriction of further permanent crop planting - in development.

- The following projects are in development or in place to deliver surface water to the subbasin:
- South Pipeline – in operation
- North Pipeline – 90% completion of permitting and design. Construction schedule for the 3rd quarter of 2024
- Outreach to educate landowners on the DWR Dry well reporting System, and/or Contacts at the Subbasin where they can voice their concerns or provide feedback of effects on their well due to groundwater management in the Subbasin.

Domestic Users: The following policies are under development:

- Domestic Well Monitoring Policy: Outreach with the property owners every six months by flyers or direct communication.
- Set up a monitoring program in the Lost Hills Community for data collection of water levels and water quality to assist with technical services for the development of new wells and continued operation. At the time of this resubmittal there were no known wells used for drinking water.

Outreach to educate landowners on the DWR Dry well reporting System, and/or Contacts at the Subbasin where they can voice their concerns or provide feedback of effects on their well due to groundwater management in the Subbasin

Table 6-3 Conceptual Potential Management Actions

Management Action (b)(1)	Description (b)(1)	Measurable Objective (b)(1)	Circumstances of Implementation (b)(1)(A)	Quantification of Demand Reduction (b)(2)	Permitting & Regulatory Process (b)(3)	Status, Start, End, & Accrual of Benefits (b)(4)	Explanation of Benefits & Method of Evaluation (b)(5)	Explanation of Water Source & Reliability (b)(6)	Cost & Funding Options (b)(8)	Management of Groundwater Extraction & Recharge (b)(9)	Level of Uncertainty, 1=certain 5=uncertain (d)
Education of groundwater use per acre	The GSA may adopt a policy which provides groundwater extractors their approximate groundwater extraction on a per acre basis for multiple years as an education tool prior to any enforcement action.	The goal is to provide education and promote awareness of the GSA overdraft condition particularly for those groundwater extractors who do not have meters. The measurable objective is annual statements of groundwater extraction in acre-feet.	The GSA may consider multiple quantification methods for determination of groundwater extraction per acre. The policy may be implemented shortly after the adoption of the GSP and remain until GSA overdraft has ended or other programs are enacted.	This management action alone may not generate a quantifiable demand reduction. However, it is an educational tool which may change individual practices.	No permits or regulatory process is required for the GSA to adopt the policy.	The policy has not been drafted. It is expected to commence shortly after the adoption of the GSP and be completed within 1 year.	The expected benefits may mitigate overdraft by educating the public about the use of groundwater supplies. The method of evaluation may be achieved through multiple approaches.	The management action may be accomplished by GSA policy adoption. No external water source is used.	Estimated $_____ cost to draft and adopt policy.	Not applicable.	2
Pumping fees for groundwater allocation exceedances	The GSA may adopt a policy to levy tiered fees for pumping beyond the current groundwater pumping limits. The GSA may consider cease and desist orders for excessive abuse.	The goal is incentivize groundwater extractors to pump only up to their groundwater pumping limit per year. The measurable objective is the volume of groundwater extraction in acre-feet.	Prerequisites of levying fees may include the installation of a flowmeter or other quantification method for groundwater extractors (excluding de minimis extractors). The policy may be implemented within 5 years of GSP adoption and remain indefinitely. The policy fees and penalties may be reviewed by the GSA annually.	Estimated 0 - ? acre-feet per year. It may vary significantly depending upon levied fees, water year, and available transfers/banked credits.	No permits or regulatory process is required for the GSA to adopt the policy. The GSA has the power as outlined in the SGMA, and related provisions to adopt ordinances, levy financial penalties, and enforce policies.	The policy has not been drafted. It is expected to commence after the adoption of quantification method and be completed within 3 years. Refer to the (b)(2) for accrual of expected benefits.	The expected benefits may mitigate local overdraft by incentivizing groundwater extractors to pump groundwater supplies in a sustainable fashion. The ancillary benefits include additional funds for the GSA to invest in other projects and management actions. The method of evaluation may be reviewing the effective fee structures and number of fees levied.	The management action may be accomplished by GSA policy adoption and enforcement. No external water source is used.	Estimated $_____ cost to draft and adopt policy. Once adopted, the levied fees may fund other projects and management actions.	Chronic lowering of groundwater levels in cones of depression or depletion of supply during periods of drought may be offset by temporary increases in fee structure or groundwater pumping restrictions.	3
Agricultural land fallowing subsidies	The GSA may adopt a policy to incentive farmers to permanently fallow land.	The goal is to reduce irrigated acreage. The measurable objective is the acreage of fallowed land.	The policy could be considered at anytime, but recommended within 5 years of GSP adoption. The policy would remain indefinitely.	Estimated 0 - ? acre-feet per year.	No permits or regulatory process is required for the GSA to adopt the policy. The GSA has the power as outlined in the SGMA, and related provisions to adopt ordinances.	The policy has not been drafted. It is expected to commence shortly after the adoption of the GSP and be completed within 2 years. Refer to the (b)(2) for accrual of expected benefits.	The expected benefits of on-farm water conservation may reduce the overall groundwater pumping. The method of evaluation may consider the type of subsidy and number of participants.	The management action may be accomplished by GSA policy adoption. No external water source is used.	Estimated $_____ cost to draft and adopt policy. Ongoing subsidies may range from $_____ - _____annually.	Chronic lowering of groundwater levels or depletion of supply during periods of drought may be offset by a temporary increase in subsidies.	3
Require new developments (non-de minimis extractors) to prove sustainable water supplies.	The GSA may adopt a policy to require new developments or land development (non-de minimis extractors) to prove sustainable water supplies based upon the current GSA groundwater allocation. The GSA may review and comment on all new development environmental documents to ensure water balance and corresponding mitigation measures are implemented. Requires County support.	The goal is to ensure all new developments (non-de minimis extractors) do not exceed the current GSA groundwater allocation and groundwater supplies are consumed or retained within the GSA boundary. The measurable objective is proven new development water balance with the goal of 0.0 acre-feet groundwater overdraft /year.	The policy may be implemented shortly after the adoption of the GSP and remain until GSA overdraft has ended or indefinitely. The County must also support the policy.	Estimated 0 - ? acre-feet per year may be retained within the GSA boundary.	The regulatory process may require cooperation from the County/City to ensure the GSA reviewed and commented on the environmental documents prior to County/City approval. The GSA has the power as outlined in the SGMA, and related provisions to adopt ordinances.	The policy has not been drafted. It is expected to commence shortly after the adoption of the GSP and be completed within 3 years. Refer to the (b)(2) for accrual of expected benefits.	The expected benefits may mitigate overdraft by ensuring new developments utilize groundwater supplies in accordance with current GSA groundwater allocations and groundwater supplies are consumed or retained within the GSA boundary. The method of evaluation may be quantifying the number of new developments that are approved without GSA comment/approval.	The management action may be accomplished by GSA policy adoption and coordination with the County/City. The GSA may request County/City development procedures to include the circulation of environmental documents and approval from GSA prior to County/City approval. No external water source is used.	Estimated $_____ cost to draft and adopt policy, plus an estimated $_____ cost to coordinate development approval changes at the County/City.	Not applicable.	2

Note: The following sections were noted below because they apply to all management actions with very little variance.

Public Notice (b)(1)(B): The GSA may provide public notice in multiple formats and platforms. Adopted policies may reside in GSA Board Meeting minutes and GSA Policy Manual available on the GSA website. Electronic notice may be provided to any person who requests email notifications. The GSA Board may hold regular monthly meetings and annual education workshops.

Legal Authority (b)(7): The GSA has the power as outlined in the SGMA, and related provisions to adopt ordinances, levy financial penalties, and enforce programs.

Cost & Funding Options (b)(8): GSA administrative and operating costs may be funded through various financial avenues discussed further in GSP Chapter 7.2.

Table 6-4 List of Potential Management Actions

Project	Title	Est Recharge (af)	Est Reduction (af)	Estimated Cost ($)	Estimated Cost ($/af)[1]
Priority 1					
5	Install Flowmeters		-	$50,000[3]	NA
6	Rules and Regulations		-	$20,000	NA
7	Water Recharge and Banking Policy		-	$20,000	NA
8	Transfer Policy		-	$20,000	NA
9	Pumping limits Policy		20,000	$50,000	NA
10	Fill Data Gaps			$100,000	NA
	SubTotal				
Priority 2					

Notes – 1 – costs capitalized at 6% for 30 years. Cost does not include water supply.
2 – Costs are 2016 based dollars
3- Assumes 5 wells at $10,000 per well

From discussions with local landowners the following management actions are being considered:

1. Flow measurement
    a. Surface water diversions
    b. Groundwater production wells
2. Rules and Regulations
3. Establishment of pumping limits by year
4. Surface water Recharge and Banking
5. Water transfers
6. Groundwater Transfers outside of basin
7. Limitation on future development without supply.

These policy or management actions are listed as **Table 6-4**. Other management actions that could be considered are:

8. Registration of Extraction Facilities
9. Installation of Sounding Tubes and Water Quality Sample Ports
10. Groundwater Carryover Structure
11. Incentives
12. Pumping Restrictions During Droughts

7 Plan Implementation

Plan implementation will officially commence with the adoption of this GSP and will continue until January 2042. The GSAs within the Subbasin will continue to build upon existing efforts regarding public engagement and securing additional funding to support actions necessary for sustainably managing groundwater in the Plan Area. During a five-year period between the inaugural GSP submission and the next interim milestone, and while DWR has up to two years to review the GSP, the GSAs anticipate a focus on project implementation, data collection, and coordinating with stakeholders and other beneficial users. Since most of the groundwater pumping occurs within the PVGSA, it is expected that most of the actions will be taken by this GSA. With this understanding, the following sections relate specifically to the PVGSA.

7.1 Estimate of GSP Implementation Costs

PVGSA and the Pleasant Valley Water District will experience two types of implementation costs – ongoing administrative expenses and project costs. Ongoing administrative expenses are anticipated to initially include fiscal agent and legal counsel expenses, audits, annual data collection and reporting, outreach, consultant expenses for preparing funding reports and updating the GSP. Although project implementation costs are likely to be excluded from PVGSA-related expenses to landowners and possibly negligible during the first interim GSP milestone period, a future scenario may require PVGSA to support capital costs for improvement of the monitoring network or another type of project with a collective benefit to local landowners. Total costs for this initial interim five-year period are estimated to vary from $150,000 to $373,000 per annum and will be presented to PVGSA's Board of Directors for consideration and approval annually. Costs associated with implementing the GSP will require PVGSA to pursue funding mechanisms such as Proposition 26 or Proposition 218 as well as water use charges, in order to provide a steady stream of revenue for a specific period. PVGSA has not determined which funding mechanism will be utilized to provide future revenue, at a minimum for the first interim milestone period (five years).

Regulation Requirements:
§ 354.6. Agency Information
When submitting an adopted Plan to the Department, the Agency shall include a copy of the information provided pursuant to Water Code Section 10723.8, with any updates, if necessary, along with the following information:
(e) An estimate of the cost of implementing the Plan and a general description of how the Agency plans to meet those costs.

7.2 Identify Funding Alternatives

Administrative Expenses. PVGSA must consider other funding mechanisms, such as through Propositions 26 or Proposition 218, to secure funds for the next five years leading up to the first interim milestone. Individual projects are currently being funded by the landowners, such as the Firestone Recharge Facility, and the North Canal Pipeline Projects. Projected costs and expenses include such items as administrative support, GSP update and implementation, annual SGMA reporting, stakeholder outreach and engagement, consulting firms and legal counsel for SGMA compliance, etc., and estimated costs can be found in **Table 7-1** below. Given that project costs are not the current responsibility of PVGSA, the proposed budget included herein will be the basis for anticipated costs incurred during this first five-year interim milestone period. Annually, PVGSA Board of Directors will consider budget needs to ensure fiscal solvency with the understanding that adjustments may be required if budget assumptions do not hold true.

Table 7-1 Administrative Expenses

Item	2022	2023	2024	2025	2026
Administration	$5,000	$10,000	$10,000	$10,000	$10,000
Groundwater Monitoring and Measurement	$10,000	$25,000	$25,000	$25,000	$25,000
Legal	$2,000	$10,000	$10,000	$10,000	$10,000
Annual Reporting	$75,000	$75,000	$75,000	$75,000	$75,000
Coordination with adjacent Basins	$2,000	$4,000	$4,000	$3,000	$3,000
Plan Update				$150,000	$150,000
Totals	$94,000	$124,000	$124,000	$273,000	$273,000

Project Costs. At this time, project costs are not the responsibility of PVGSA and will be borne solely by a project proponent. Such projects may be funded by existing capital improvement budgets, grant funding, propositions (26 or 218), low interest loans, or other methods. Each project will be required to develop and secure funding needed to ensure their sustainability by 2042. Member agencies will re-evaluate their respective SGMA efforts periodically to determine whether an adjustment is necessary in their project implementation plan.

At this time, project costs are not the responsibility of PVGSA and will be borne solely by a project proponent. Such projects may be funded by existing capital improvement budgets, grant funding, propositions (26 or 218), low interest loans, or other methods. Each project will be required to develop and secure funding needed to ensure their sustainability by 2042. Member agencies will re-evaluate their respective SGMA efforts periodically to determine whether an adjustment is necessary in their project implementation plan.

Table 7-2 Project Costs

Item	2022	2023	2024	2025	2026
North Canal Pipeline		$1,000,000	$10,000,000	$10,000,000	
South Canal Pipeline Exp					$2,500,000
Los Gatos Gravel Pits					$2,100,000
Meter Policy	$50,000				
Rules and Regulations	$20,000				
Transfer Policy	$20,000				
Pumping limits Policy	$50,000				
Monitor Well Installation			$300,000		

[1]Surface water Purchase			$1,500,000	$1,500,000	$3,000,000
[2]Firestone Recharge Facility		$470,000			
Totals	$140,000	$1,470,000	$11,800,000	$11,500,000	$7,600,000

[1]Assumes a rate of $250-500/AF. [2]In Operation

Grant Funding. PVGSA recognizes that grants provide a key source of funding that can be utilized to offset fiscal burdens to stakeholders and beneficial users. While the foregoing is true, PVGSA also knows that such funds should not be factored into any budget projections because of the time lag between reimbursement and date expense is incurred. PVGSA also recognizes that grant funding is not guaranteed and will perform long-term financial planning accordingly.

Regulation Requirements:
§ 354.6. Agency Information
When submitting an adopted Plan to the Department, the Agency shall include a copy of the information provided pursuant to Water Code Section 10723.8, with any updates, if necessary, along with the following information:
(e) An estimate of the cost of implementing the Plan and a general description of how the Agency plans to meet those costs.

7.3 Schedule for Implementation

Projects were identified in **Section 6** and summarized in **Table 6-1**. The Priority 1 projects and management actions are planned to be completed during the first five-year period and there are hopes to complete a number of the management actions and the north pipeline within the first year of adoption of the plan as shown in table 7.2.

Regulation Requirements:
§ 350.4. General Principles
Consistent with the State's interest in groundwater sustainability through local management, the following general principles shall guide the Department in the implementation of these regulations.
(f) A Plan will be evaluated, and its implementation assessed, consistent with the objective that a basin be sustainably managed within 20 years of Plan implementation without adversely affecting the ability of an adjacent basin to implement its Plan or achieve and maintain its sustainability goal over the planning and implementation horizon.

7.3.1 Pleasant Valley GSA –

This GSA is expected to implement many of the projects and management actions of the plan. The GSA may take the initiative, work in coordination with the Pleasant Valley Water District and/or the other GSAs in the Subbasin, or work with individual landowners.

7.3.2 City of Coalinga GSA –

The City imports surface water for its customers as well as the prisons located in the Subbasin. Additionally, the City and prisons both treat wastewater. Through cooperative agreements some of this wastewater is reused for agricultural production and some is recharged back to the aquifer. There may be opportunity to increase the infiltration of the existing WWTP basins as well as use of storm basins within the City for intentional recharge activities when not in use to control storm water. These projects will be implemented, as needed, for groundwater sustainability.

7.3.3 County of Fresno GSA - Pleasant Valley –

The County GSA properties consist of a rural residential enclave in the southern margins of the Subbasin as well as the current oil production lands in the western most portion of the basin. There is little existing groundwater demand in these areas, and it is expected that the actions for this GSA will be minimal.

7.4 Data Management System

Regulation Requirements:
§ 352.6. Data Management System
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 Plan and monitoring of the basin.

The GSAs in the Subbasin are coordinating with respect to development of a data management system (DMS) capable of storing and aggregating information necessary for annual reporting to DWR through this effort of developing the GSP. Since the basin is relatively small, the DMS is planning to use a combination of spreadsheets as well as data logger data summarized in spreadsheets that will facilitate standardization of collection of basin-wide data and allow for data entry by PVGSA. Below is a list of basic elements included in the DMS:

- Well location and construction information (where applicable)
- Water level readings and hydrographs, including water year type
- Groundwater level elevation contours and direction of groundwater flow map
- Estimated groundwater extraction by category
- Total water use by source
- Estimate of groundwater storage change, including map and tables of estimation
- Graph showing annual groundwater use and cumulative storage change with each water year type

This DMS will also utilize GIS information with basic data layers for referencing typical information such as GSA boundaries, topography, land use, streets, aerial imagery, subsurface geology, etc.

Figure 7-1 Data Management System Screenshot

To be included upon system completion.

7.5 Annual Reporting

Regulation Requirements:

§ 356.2. Annual Reports

Each Agency shall submit an annual report to the Department by April 1 of each year following the adoption of the Plan. The annual report shall include the following components for the preceding water year:

(a) General information, including an executive summary and a location map depicting the basin covered by the report.

(b) A detailed description and graphical representation of the following conditions of the basin managed in the Plan:

(1) Groundwater elevation data from monitoring wells identified in the monitoring network shall be analyzed and displayed as follows:

(a) Groundwater elevation contour maps for each principal aquifer in the basin illustrating, at a minimum, the seasonal high and seasonal low groundwater conditions.

(b) Hydrographs of groundwater elevations and water year type using historical data to the greatest extent available, including from January 1, 2015, to current reporting year.

(2) Groundwater extraction for the preceding water year. Data shall be collected using the best available measurement methods and shall be presented in a table that summarizes groundwater extractions by water use sector, and identifies the method of measurement (direct or estimate) and accuracy of measurements, and a map that illustrates the general location and volume of groundwater extractions.

(3) Surface water supply used or available for use, for groundwater recharge or in-lieu use shall be reported based on quantitative data that describes the annual volume and sources for the preceding water year.

(4) Total water use shall be collected using the best available measurement methods and shall be reported in a table that summarizes total water use by water use sector, water source type, and identifies the method of measurement (direct or estimate) and accuracy of measurements. Existing water use data from the most recent Urban Water Management Plans or Agricultural Water Management Plans within the basin may be used, as long as the data are reported by water year.

(5) Change in groundwater in storage shall include the following:

(a) Change in groundwater in storage maps for each principal aquifer in the basin. **(b)** A graph depicting water year type, groundwater use, the annual change in groundwater in storage, and the cumulative change in groundwater in storage for the basin based on historical data to the greatest extent available, including from January 1, 2015, to the current reporting year.

(c) A description of progress towards implementing the Plan, including achieving interim milestones, and implementation of projects or management actions since the previous annual report.

PVGSA will be the Basin Coordinator and comply with required information pursuant to SGMA regulation 356.2. The type of information that will be included in these annual reports, due April 1st each year, is i) groundwater levels, ii) estimated extraction volumes, iii) surface and total water use, iv) groundwater storage change, and v) progress of GSP implementation within the Subbasin. **Table 7-3** presents an outline the Subbasin will follow for its inaugural annual report. The anticipated schedule for these annual reports is as follows:

- December 31 GSAs provide required GSA specific information.
- February 28 Draft annual report completed.
- March GSAs review and approve annual report.
- April 1 Basin Coordinator completes submittal of annual report to DWR.

Table 7-3 Potential Outline for Pleasant Valley Subbasin Annual Reports

Chapter/Subchapter	Title
Chapter 1	Introduction
Chapter 2	Land Use and Surface Water Supplies
Chapter 3	Groundwater Pumping
Chapter 4	Sustainable Management Criteria
4.1	Sustainability Goal
4.2	Groundwater Levels
4.3	Groundwater Storage
4.4	Groundwater Quality
4.5	Land Subsidence
4.6	Surface to Groundwater Interconnection
Chapter 5	Monitoring Network Changes
Chapter 6	Groundwater Projects and Management Action Status

7.6 Periodic Evaluations

Regulation Requirements:

§ 356.4. Periodic Evaluation by Agency

Each Agency shall evaluate its Plan at least every five years and whenever the Plan is amended, and provide a written assessment to the Department. The assessment shall describe whether the Plan implementation, including implementation of projects and management actions, are meeting the sustainability goal in the basin, and shall include the following:

(a) A description of current groundwater conditions for each applicable sustainability indicator relative to measurable objectives, interim milestones and minimum thresholds.

(b) A description of the implementation of any projects or management actions, and the effect on groundwater conditions resulting from those projects or management actions.

(c) Elements of the Plan, including the basin setting, management areas, or the identification of undesirable results and the setting of minimum thresholds and measurable objectives, shall be reconsidered and revisions proposed, if necessary.

(d) An evaluation of the basin setting in light of significant new information or changes in water use, and an explanation of any significant changes. If the Agency's evaluation shows that the basin is experiencing overdraft conditions, the Agency shall include an assessment of measures to mitigate that overdraft.

(e) A description of the monitoring network within the basin, including whether data gaps exist, or any areas within the basin are represented by data that does not satisfy the requirements of Sections 352.4 and 354.34**(c)**. The description shall include the following:

(1) An assessment of monitoring network function with an analysis of data collected to date, identification of data gaps, and the actions necessary to improve the monitoring network, consistent with the requirements of Section 354.38.

(2) If the Agency identifies data gaps, the Plan shall describe a program for the acquisition of additional data sources, including an estimate of the timing of that acquisition, and for incorporation of newly obtained information into the Plan.

(3) The Plan shall prioritize the installation of new data collection facilities and analysis of new data based on the needs of the basin.

(f) A description of significant new information that has been made available since Plan adoption or amendment, or the last five-year assessment. The description shall also include whether new information warrants changes to any aspect of the Plan, including the evaluation of the basin setting, measurable objectives, minimum thresholds, or the criteria defining undesirable results.

(g) A description of relevant actions taken by the Agency, including a summary of regulations or ordinances related to the Plan.

(h) Information describing any enforcement or legal actions taken by the Agency in furtherance of the sustainability goal for the basin.

(i) A description of completed or proposed Plan amendments.

(j) Where appropriate, a summary of coordination that occurred between multiple Agencies in a single basin, Agencies in hydrologically connected basins, and land use agencies.

(k) Other information the Agency deems appropriate, along with any information required by the Department to conduct a periodic review as required by Water Code Section 10733.

Sustainable management of groundwater, by its very nature, is a dynamic effort resulting in new information and data that requires periodic evaluations of actions relative to sustainability goals. PVGSA will periodically evaluate this GSP pursuant to SGMA §356.4. Results of these evaluations will be documented in assessments to DWR and are anticipated to occur concurrently with the five-year updates to the GSP. Assessments may be issued more frequently if PVGSA determines an action is necessary, because failure to modify the current course of action would result in not achieving a sustainability goal.

8 References and Technical Studies (Reg. § 354.4)

Regulation Requirements:
§ 354.4. General Information
Each Plan shall include the following general information:
(a) An executive summary written in plain language that provides an overview of the Plan and description of groundwater conditions in the basin.
(b) A list of references and technical studies relied upon by the Agency in developing the Plan. Each Agency shall provide to the Department electronic copies of reports and other documents and materials cited as references that are not generally available to the public. Note: Authority cited: Section 10733.2, Water Code.
Reference: Sections 10733.2 and 10733.4, Water Code.

8.1 References

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Appendices

Appendix A – Memorandums of Understanding Between GSAs

Appendix B – Stakeholder Communication and Engagement Plan

Appendix C – Stakeholder Comments and Responses

Appendix D – GSP Checklist—Elements of the Plan

Appendix E – KDSA Report 2020

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Appendix H – Reporting Standards Section 352.4

Appendix I – Public Comments and Response Summary

Appendix J – PVWD Contract for Water Supplies 2021

Appendix K – Water Quality vs. Ground Elevation Change

Appendix L – Policies since First Submittal

Appendix M – Urban Domestic Well Users – Well Completion Reports

Appendix N – Data Gap Memo

Appendix O – Outreach – Domestic Groundwater Well Owner

Appendix P – Subsidence Memo

Appendix A – Memorandums of Understanding Between GSAs

MEMORANDUM OF UNDERSTANDING BETWEEN THE CITY OF COALINGA GROUNDWATER SUSTAINABILITY AGENCY AND THE PLEASANT VALLEY GROUNDWATER SUSTAINABILITY AGENCY WITH RESPECT TO IMPLEMENTATION OF THE SUSTAINABLE GROUNDWATER MANAGEMENT ACT

THIS MEMORANDUM OF UNDERSTANDING ("MOU") is made and effective as of January 2, 2020, by and between the CITY OF COALINGA GROUNDWATER SUSTAINABILITY AGENCY ("City") and PLEASANT VALLEY GROUNDWATER SUSTAINABILITY AGENCY ("PVGSA"). The City and PVGSA may be collectively referred to herein as the "Parties," or singularly as a "Party."

RECITALS

A. On September 16, 2014, the Governor of the State of California signed into law Senate Bills 1168 and 1319, and Assembly Bill 1739 collectively, the Sustainable Groundwater Management Act ("SGMA"), which is codified at Water Code Sections 10720 *et seq.*; and

B. SGMA requires that California groundwater basins and subbasins be managed by a Groundwater Sustainability Agency ("GSA") or multiple GSAs, and that such management be implemented pursuant to an approved Groundwater Sustainability Plan ("GSP") or multiple coordinated GSPs; and

C. California Water Code Section 10723.8, subdivision (c), prohibits the recognition of any entity as an exclusive GSA if the entity's proposed GSA management area overlaps the proposed GSA management area of another entity, subject to certain procedural requirements; and

D. PVGSA and the City have elected to serve as exclusive GSAs for their respective areas within the Pleasant Valley Subbasin of the San Joaquin Valley Basin (Basin No. 5-022.10 in the Department of Water Resources' Bulletin No. 118).

The Parties therefore agree as follows:

1. **Objectives.** The objectives of the Parties in entering into this MOU are as follows:

(a) To achieve sustainable groundwater management pursuant to SGMA in the Pleasant Valley Subbasin that is identified in the attached **Exhibit "A"**.

(b) To work cooperatively with each other and with adjacent GSAs in the Pleasant Valley Subbasin to prepare a single GSP that covers the Pleasant Valley Subbasin.

(c) To work cooperatively with each other and with adjacent GSAs in the Pleasant Valley Subbasin and in adjacent subbasins to achieve sustainable groundwater management in the Pleasant Valley Subbasin.

2. **Precedence of City's Land Use Planning Authority.** PVGSA agrees that its operations as the PVGSA, and the GSP adopted by the PVGSA, the City and the other GSAs in the subbasin, will not abrogate the City's general plan or conflict with the City's exercise of its land use planning authority; provided, that the City's general plan and the City's exercise of its land use planning authority comply with all applicable laws, statutes, and regulations.

3. **Coordination Framework.** Each Party to this MOU agrees, in developing the GSP, and in its respective implementation of the GSP, to consider the interests of the other Party, including but not limited to the City's general plan. In order to prevent conflicts between the GSP and the City's general plan and between PVGSA's operations as the PVGSA and the City's exercise of its land use planning authority, the City shall have opportunities to provide, and PVGSA shall consider, advisory input in the development and implementation of the GSP. The Director of the City's Department of Public Works and Planning shall designate a contact person (Designated Contact Person) to whom PVGSA shall provide written notices of opportunities to participate in SGMA implementation.

No fewer than 90 days before adopting or modifying the GSP or policies or procedures for the exercise of GSA powers, PVGSA shall provide written notice to the Designated Contact Person. Within 30 days of receiving such notice, the Designated Contact Person may request consultation with PVGSA's representative. Prior to the adoption or modification of the GSP or policies or procedures for the exercise of GSA powers, PVGSA shall consider any comments or recommendations provided by the Designated Contact Person for the City, to achieve the goals of this MOU.

No fewer than 90 days prior to issuing, adopting, modifying, or approving any ordinance, policy, plan, or permit, or taking any other action related to groundwater resources within the Pleasant Valley basin, the City shall provide written notice to PVGSA. Within 30 days of receiving such notice, PVGSA may request a mandatory consultation with the City. Prior to taking any groundwater-related action, the City shall consider any comments or recommendations provided by PVGSA.

4. **Finances.** Each of the Parties to this MOU shall bear its own costs of implementing SGMA, except as follows:

(a) The City shall provide such assistance and support as it is able to provide at current staffing levels in applying for grant funding related to SGMA implementation when so requested by the PVGSA. The ability of the City to provide such assistance and support shall be determined exclusively by the City.

5. **Notices.** All notices required or permitted by this MOU or applicable law shall be in writing and may be delivered in person (by hand or by courier) or may be sent by regular, certified, or registered mail or U.S. Postal Service Express Mail, with postage prepaid, or by facsimile transmission, or by electronic transmission (email) and shall be deemed sufficiently given if served in a manner specified in this Section 5. The addresses and addressees noted below are that Party's designated address and addressee for delivery or mailing of notices.

To Pleasant Valley Water District:	Pleasant Valley Water District c/o District President Post Office Box 468 Coalinga, CA 93210-0468
To City of Coalinga GSA:	City of Coalinga Department of Public Works and Planning c/o Marissa Tejo, City Manager 155 W. Durian Ave. Coalinga, CA 93210 Telephone: (559) 935-1533

Either Party may, by written notice to the other, specify a different address for notice. Any notice sent by registered or certified mail, return receipt requested, shall be deemed given on the date of delivery shown on the receipt card, or if no delivery date is shown, three (3) days after the postmark date. If sent by regular mail, the notice shall be deemed given forty-eight (48) hours after it is addressed as required in this section and mailed with postage prepaid. Notices delivered by United States Express Mail or overnight courier that guarantee next day delivery shall be deemed given twenty-four (24) hours after delivery to the Postal Service or courier. Notices transmitted by facsimile transmission or similar means (including email) shall be deemed delivered upon telephone or similar confirmation of delivery (conformation report from fax machine is sufficient), provided a copy is also delivered via personal delivery or mail. If notice is received after 4:00 p.m. or on a Saturday, Sunday or legal holiday, it shall be deemed received on the next business day.

6. **Indemnification.** As the City does not vote on the actions of the PVGSA, PVGSA shall hold harmless and indemnify the City from and against any liability, claims, actions, costs, damages or losses of any kind, including but not limited to death or injury to any person and/or damage to property, arising out of the implementation of the GSP by PVGSA. PVGSA shall not be obligated to indemnify the City where any loss, damage, injury, liability, or claim is a result of the sole negligence or willful misconduct of the City. Additionally, the City shall hold harmless and indemnify the PVGSA from and against any liability, claims, actions, costs, damages or losses of any kind, including but not limited to death or injury to any person and/or damage to property, arising out of the implementation of the GSP by the City. The City shall not be obligated to indemnify PVGSA where any loss, damage, injury, liability, or claim is a result of the sole negligence or willful misconduct of PVGSA.

The foregoing indemnification obligation shall continue beyond the term of this MOU as to any acts or omissions occurring before or under this MOU or any extension of this MOU.

7. **Compliance with Laws.** In any action taken pursuant to this MOU, PVGSA and the City shall comply with all applicable statutes, laws, and regulations, specifically including, but not limited to, SGMA and its implementing regulations, as they now exist or as they may be amended or promulgated from time to time.

To the extent that this MOU conflicts with or does not accurately reflect any applicable statutes, laws, or regulations now existing or as amended or promulgated from time to time, the laws, statutes, and regulations shall govern.

To the extent that any applicable statutes, laws, or regulations are amended or newly promulgated in such a manner that causes this MOU to conflict with or no longer accurately reflect such statutes, laws, or regulations, this MOU shall be modified, in writing, by all Parties, in order to comport with the newly amended or promulgated statutes, laws, or regulations.

8. **Entire Agreement.** This MOU and items incorporated herein contain all of the agreements of the Parties with respect to the matters contained herein, and no prior agreement or understanding pertaining to any such matter shall be effective for any purpose.

9. **Amendments.** No provisions of this MOU may be amended or modified in any manner whatsoever except by an agreement in writing duly authorized by representatives of all Parties.

10. **No Assignment.** The rights and obligations of the Parties to this MOU may not be assigned or delegated, and any attempt to assign or delegate such rights or duties in contravention of this section shall be null and void.

11. **Binding Effect.** This MOU shall apply to and bind successors, assignees, contractors, subcontractors, transferees, agents, employees, and representatives of the respective Parties hereto.

12. **Governing Law.** This MOU and all documents provided for herein and the rights and obligations of the Parties hereto shall be governed in all respects, including validity, interpretation and effect, by the laws of the State of California (without giving effect to any choice of law principles).

13. **Waiver.** The failure of any Party to insist on strict compliance with any provision of this MOU shall not be considered a waiver of any right to do so, whether for that breach or any subsequent breach. The acceptance by any Party of either performance or payment shall not be considered to be a waiver of any preceding breach of the MOU by any other Party.

14. **Severability.** If any term or provision of this MOU is, to any extent, held invalid or unenforceable, the remainder of this MOU shall not be affected.

15. **Headings.** The subject headings of the sections of this MOU are included for purposes of convenience only and shall not affect the construction or interpretation of any of the provisions herein.

16. **Counterparts.** This MOU may be executed in any number of counterparts, each of which shall be an original, but all of which shall constitute one and the same instrument.

IN WITNESS WHEREOF, the Parties have executed this MOU as of the day and year first above written.

PLEASANT VALLEY GROUNDWATER SUSTAINABILITY AGENCY

By: _____

Name: Bradford E. Gleason

Title: Board President

CITY OF COALINGA GROUNDWATER SUSTAINABILITY AGENCY

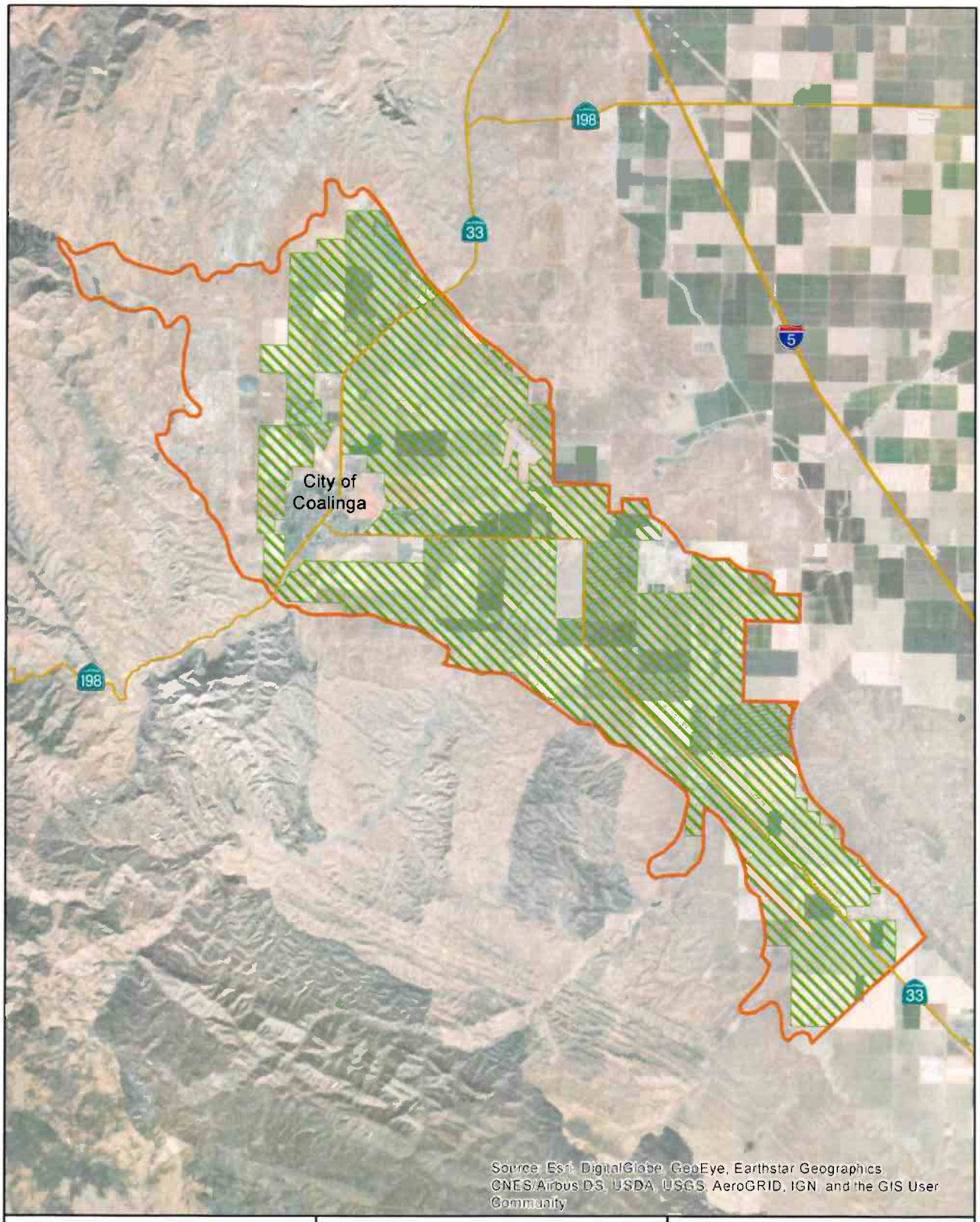
By: _____

Ron Lander, Mayor and Chairman, City of Coalinga Groundwater Sustainability Agency

ATTEST:
Shannon Jensen, City Clerk
City of Coalinga, State of California

By: _____

City Clerk



7/15/2019 : G:\Pleasant Valley WD - 1103\110319001-2019 On Going\GIS\Map\Pleasant Valley WD GSA.mxd

Hall of Records, Room 301
2281 Tulare Street
Fresno, California
93721-2198
Telephone: (559) 600-3529
Toll Free: 1-800-742-1011
www.co.fresno.ca.us

February 25, 2020

Present: 5 - Chairman Buddy Mendes, Vice Chairman Steve Brandau, Supervisor Nathan Magsig, Supervisor Brian Pacheco, and Supervisor Sal Quintero

Agenda No. 50. **Public Works & Planning** File ID: 19-1622

Re: Authorize the Chairman to execute a Memorandum of Understanding with the Pleasant Valley Groundwater Sustainability Agency for implementation of the Sustainable Groundwater Management Act in the Pleasant Valley Groundwater Subbasin

APPROVED AS RECOMMENDED

Ayes: 5 - Mendes, Brandau, Magsig, Pacheco, and Quintero

Agreement No. 20-081

MEMORANDUM OF UNDERSTANDING BETWEEN THE COUNTY OF FRESNO AND PLEASANT VALLEY GROUNDWATER SUSTAINABILITY AGENCY WITH RESPECT TO IMPLEMENTATION OF THE SUSTAINABLE GROUNDWATER MANAGEMENT ACT

THIS MEMORANDUM OF UNDERSTANDING ("MOU") is made and effective as of February 25, 2020, by and between the COUNTY OF FRESNO ("County") and PLEASANT VALLEY WATER DISTRICT (also known, for purposes of the Sustainable Groundwater Management Act, as PLEASANT VALLEY GROUNDWATER SUSTAINABILITY AGENCY) ("PVWD" or "PVGSA"). The County and PVGSA may be collectively referred to herein as the "Parties," or singularly as a "Party."

RECITALS

A. On September 16, 2014, the Governor of the State of California signed into law Senate Bills 1168 and 1319, and Assembly Bill 1739 collectively, the Sustainable Groundwater Management Act ("SGMA"), which is codified at Water Code Sections 10720 *et seq.*; and

B. SGMA requires that California groundwater basins and subbasins be managed by a Groundwater Sustainability Agency ("GSA") or multiple GSAs, and that such management be implemented pursuant to an approved Groundwater Sustainability Plan ("GSP") or multiple coordinated GSPs; and

C. California Water Code Section 10723.8, subdivision (c), prohibits the recognition of any entity as an exclusive GSA if the entity's proposed GSA management area overlaps the proposed GSA management area of another entity, subject to certain procedural requirements; and

D. PVGSA and the County have elected to serve as exclusive GSAs for their respective areas within the Pleasant Valley Subbasin of the San Joaquin Valley Basin (Basin No. 5-022.10 in the Department of Water Resources' Bulletin 118.

The Parties therefore agree as follows:

1. **Objectives.** The objectives of the Parties in entering into this MOU are as follows:

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(b) To work cooperatively with each other and with adjacent GSAs in the Pleasant Valley Subbasin to prepare a single GSP that covers the Pleasant Valley Subbasin.

(c) To work cooperatively with each other and with adjacent GSAs in the Pleasant Valley Subbasin and in adjacent subbasins to achieve sustainable groundwater management in the Pleasant Valley Subbasin.

2. **Precedence of County's Land Use Planning Authority.** PVGSA agrees that its operations as the PVGSA, and the GSP adopted by the PVGSA, the County and the other GSAs in the subbasin, will not abrogate the County's general plan or conflict with the County's exercise of its land use planning authority; provided, that the County's general plan and the County's exercise of its land use planning authority comply with all applicable laws, statutes, and regulations.

3. **Coordination Framework.** Each Party to this MOU agree, in developing the GSP, and in its respective implementation of the GSP, to consider the interests of the other Party, including but not limited to the County's general plan. In order to prevent conflicts between the GSP and the County's general plan and between PVGSA's operations as the PVGSA and the County's exercise of its land use planning authority, the County shall have opportunities to provide, and PVGSA shall consider, advisory input in the development and implementation of the GSP. The Director of the County's Department of Public Works and Planning shall designate a contact person (Designated Contact Person) to whom PVGSA shall provide written notices of opportunities to participate in SGMA implementation.

No fewer than 90 days before adopting or modifying the GSP or policies or procedures for the exercise of GSA powers, PVGSA shall provide written notice to the Designated Contact Person. Within 30 days of receiving such notice, the Designated Contact Person may request consultation with PVGSA's representative. Prior to the adoption or modification of the GSP or policies or procedures for the exercise of GSA powers, PVGSA shall consider any comments or recommendations provided by the Designated Contact Person for the County, to achieve the goals of this MOU.

No fewer than 90 days prior to issuing, adopting, modifying, or approving any ordinance, policy, plan, or permit, or taking any other action related to groundwater resources within the Pleasant Valley basin, the County shall provide written notice to PVGSA. Within 30 days of receiving such notice, PVGSA may request a mandatory consultation with the County. Prior to taking any groundwater-related action, the County shall consider any comments or recommendations provided by PVGSA.

4. **Finances.** Each of the Parties to this MOU shall bear its own costs of implementing SGMA, except as follows:

(a) The County shall provide such assistance and support as it is able to provide at current staffing levels in applying for grant funding related to SGMA implementation when so requested by the PVGSA. The ability of the County to provide such assistance and support shall be determined exclusively by the County.

5. **Notices.** All notices required or permitted by this MOU or applicable law shall be in writing and may be delivered in person (by hand or by courier) or may be sent by regular, certified, or registered mail or U.S. Postal Service Express Mail, with postage prepaid, or by facsimile transmission, or by electronic transmission (email) and shall be deemed sufficiently given if served in a manner specified in this Section 6. The addresses and addressees noted below are that Party's designated address and addressee for delivery or mailing of notices.

To Pleasant Valley Water District:	Pleasant Valley Water District c/o District President Post Office Box 468 Coalinga, CA 93210-0468
To County of Fresno:	County of Fresno Department of Public Works and Planning c/o Glenn Allen, Water and Natural Resources Division 2220 Tulare St. 6th Floor Fresno, CA 93721 Telephone: (559) 600-4500

Either Party may, by written notice to the other, specify a different address for notice. Any notice sent by registered or certified mail, return receipt requested, shall be deemed given on the date of delivery shown on the receipt card, or if no delivery date is shown, three (3) days after the postmark date. If sent by regular mail, the notice shall be deemed given forty-eight (48) hours after it is addressed as required in this section and mailed with postage prepaid. Notices delivered by United States Express Mail or overnight courier that guarantee next day delivery shall be deemed given twenty-four (24) hours after delivery to the Postal Service or courier. Notices transmitted by facsimile transmission or similar means (including email) shall be deemed delivered upon telephone or similar confirmation of delivery (conformation report from fax machine is sufficient), provided a copy is also delivered via personal delivery or mail. If notice is received after 4:00 p.m. or on a Saturday, Sunday or legal holiday, it shall be deemed received on the next business day.

6. **Indemnification.** As the County does not vote on the actions of the PVGSA, PVGSA shall hold harmless and indemnify the County from and against any liability, claims, actions, costs, damages or losses of any kind, including but not limited to death or injury to any person and/or damage to property, arising out of the implementation of the GSP by PVGSA. PVGSA shall not be obligated to indemnify the County where any loss, damage, injury, liability, or claim is a result of the sole negligence or willful misconduct of the County. Additionally, the County shall hold harmless and indemnify the PVGSA from and against any liability, claims, actions, costs, damages or losses of any kind, including but not limited to death or injury to any person and/or damage to property, arising out of the implementation of the GSP by the County. The County shall not be obligated to indemnify PVGSA where any loss, damage, injury, liability, or claim is a result of the sole negligence or willful misconduct of PVGSA.

The foregoing indemnification obligation shall continue beyond the term of this MOU as to any acts or omissions occurring before or under this MOU or any extension of this MOU.

7. **Compliance with Laws.** In any action taken pursuant to this MOU, PVGSA and the County shall comply with all applicable statutes, laws, and regulations, specifically including, but not limited to, SGMA and its implementing regulations, as they now exist or as they may be amended or promulgated from time to time.