FINAL

Paso Basin Cooperative Committee
and the Groundwater Sustainability Agencies

Paso Robles Subbasin
Water Year 2020 Annual Report

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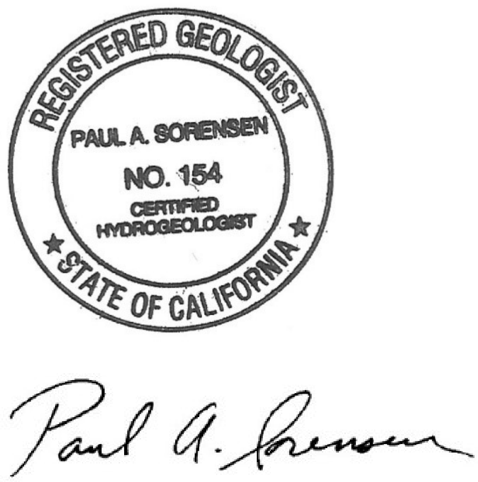
Paso Robles Subbasin
Water Year 2020 Annual Report

This report was prepared by the staff of GSI Water Solutions, Inc. under the supervision of professionals whose signatures appear below. The findings or professional opinion were prepared in accordance with generally accepted professional engineering and geologic practice.



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Abbreviations and Acronyms

AEM	airborne electromagnetic method
AF	acre-feet
AFY	acre-feet per year
AMSL	above mean sea level
BMP	Best Management Practice
CASGEM	California State Groundwater Elevation Monitoring Program
CCR	California Code of Regulations
CDEC	California Data Exchange Center
CDFFP	California Department of Forestry and Fire Protection
CIMIS	California Irrigation Management Information System
COC	constituent of concern
CSA	Community Service Area
CSD	Community Services District
CWWCP	Countywide Water Conservation Program
DSOD	Division of Safety of Dams
DWR	California State Department of Water Resources
EPCWD	Estrella-El Pomar-Creston Water District
ETo	reference evapotranspiration
GDE	groundwater dependent ecosystem
GMP	Groundwater Management Plan
gpd/ft	gallons per day per foot
gpm	gallons per minute
GSA	Groundwater Sustainability Agency
GSP	Groundwater Sustainability Plan
GSSI	Geoscience Support Services, Inc.
IDC	IWFM Independent Demand Calculator
ILRP	Irrigated Lands Regulatory Program
InSAR	interferometric synthetic-aperture radar
IWFM	Integrated Water Flow Model
LID	low-impact development
M&A	Montgomery & Associates, Inc.
MOA	memorandum of agreement
NPDES	National Pollutant Discharge Elimination System
NWP	Nacimiento Water Project
PBCC	Paso Basin Cooperative Committee
PRWSP	Paso Robles Watershed Plan
PWS	public water system
RDI	regulated deficit irrigation

RMS	representative monitoring site
RU	rural domestic unit
S	storage coefficient
SEP	Supplemental Environmental Project
SGMA	Sustainable Groundwater Management Act
SLO	San Luis Obispo
SLOFCWCD	San Luis Obispo County Flood Control and Water Conservation District
SPI	Standardized Precipitation Index
SSJGSA	Shandon-San Juan Groundwater Sustainability Agency
SSJWD	Shandon-San Juan Water District
Subbasin	Paso Robles Area Subbasin of the Salinas Valley Groundwater Basin
SWMP	Stormwater Management Plan
SWRCB	State Water Resources Control Board
SWRP	San Luis Obispo County Stormwater Resource Plan
SWP	State Water Project
TDS	total dissolved solids
USACE	United States Army Corps of Engineers
USGS	U.S. Geological Survey
WNND	Water Neutral New Development
WY	water year

Annual Report Elements Guide and Checklist

California Code of Regulations – GSP Regulation Sections	Annual Report Elements	Location in Annual Report
Article 7	Annual Reports and Periodic Evaluations by the Agency	
§ 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.	Executive Summary (§356.2[a])
	(b) A detailed description and graphical representation of the following conditions of the basin managed in the Plan:	Section 2.4 Monitoring Networks (§356.2[b])
	(1) Groundwater elevation data from monitoring wells identified in the monitoring network shall be analyzed and displayed as follows:	Section 3 Groundwater Elevations (§356.2[b][1])
	(A) Groundwater elevation contour maps for each principal aquifer in the basin illustrating, at a minimum, the seasonal high and seasonal low groundwater conditions.	Section 3.2 Seasonal High and Low (Spring and Fall) (§356.2[b][1][A])
	(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.	Section 3.3 Hydrographs (§356.2[b][1][B], and Appendix E)
	(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.	Section 4 Groundwater Extractions (§356.2[b][2])
	(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.	Section 5 Surface Water Use (§356.2[b][3])

California Code of Regulations – GSP Regulation Sections	Annual Report Elements	Location in Annual Report
Article 7	Annual Reports and Periodic Evaluations by the Agency	
§ 356.2	Annual Reports	
	(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.	Section 6 Total Water Use (§356.2[b][4])
	(5) Change in groundwater in storage shall include the following:	Section 7 Change in Groundwater in Storage (§356.2[b][5])
	(A) Change in groundwater in storage maps for each principal aquifer in the basin.	Section 7.1 Annual Changes in Groundwater Elevation (§356.2[b][5][A])
	(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.	Section 7.2 Annual and Cumulative Change in Groundwater in Storage Calculations (§356.2[b][5][B])
	(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.	Section 8 Progress towards Basin Sustainability (§356.2[c])

Executive Summary (§ 356.2[a])

Introduction

This Water Year 2020 Annual Report for the Paso Robles Area Subbasin of the Salinas Valley Groundwater Basin (Paso Robles Subbasin or Subbasin; see Figure 1) has been prepared in accordance with the Sustainable Groundwater Management Act (SGMA) and Groundwater Sustainability Plan (GSP) Regulations. Pursuant to the California Department of Water Resources (DWR) regulations, a GSP Annual Report must be submitted to DWR by April 1 of each year following the adoption of the GSP.

With the submittal of the adopted Paso Robles Subbasin GSP on January 31, 2020, the Groundwater Sustainability Agencies (GSAs) are required to submit an annual report for the preceding Water Year (October 1 through September 30) to DWR by April 1 of each subsequent year. These annual reports will convey monitoring and water use data to the DWR and to Subbasin stakeholders on an annual basis to gauge performance of the Subbasin relative to the sustainability goals set forth in the GSP.

Sections of the Water Year 2020 Annual Report include the following:

Section 1. Introduction – Paso Robles Subbasin Water Year 2020 Annual Report: a brief background of the formation and activities of the Paso Robles Subbasin GSAs and development and submittal of the GSP.

Section 2. Paso Robles Subbasin Setting and Monitoring Networks: a summary of the Subbasin setting, Subbasin monitoring networks, and ways in which data are used for groundwater management.

Section 3. Groundwater Elevations (§356.2[b][1]): a description of recent monitoring data with groundwater elevation contour maps for spring and fall monitoring events and representative hydrographs.

Section 4. Groundwater Extractions (§356.2[b][2]): compilation of metered and estimated groundwater extractions by land use sector and location of extractions.

Section 5. Surface Water Use (§356.2[b][3]): a summary of reported surface water use.

Section 6. Total Water Use (§356.2[b][4]): a presentation of total water use by source and sector.

Section 7. Change in Groundwater in Storage (§356.2[b][5]): a description of the methodology and presentation of changes in groundwater in storage based on fall to fall groundwater elevation differences.

Section 8. Progress towards Basin Sustainability (§356.2[c]): a summary of management actions taken throughout the Subbasin by GSAs and individual entities towards sustainability of the Subbasin.

Groundwater Elevations

In general, the groundwater elevations observed in the Subbasin during water year (WY) 2020 show a decline across portions of the Subbasin, likely due predominantly to below-average rainfall conditions in WY 2020. Positive and negative changes in groundwater elevations from year to year are observed in various parts of the Subbasin, as has been observed historically. Seasonal trends of slightly higher spring groundwater elevations compared with fall levels are observed annually.

Groundwater Extractions

Total groundwater extractions in the Subbasin for WY 2020 is estimated to be 67,300 acre-feet (AF). Table ES-1 summarizes the groundwater extractions by water use sector for each water year. The values for WYs 2017 – 2019 (grayed out) are included for reference purposes. This convention is carried throughout the report.

Table ES- 1. Groundwater Extractions by Water Use Sector

Water Year	Groundwater Extractions by Water Use Sector			Total (AF)
	Municipal (AF)	PWS and Rural Domestic (AF)	Agriculture (AF)	
2017	1,626	5,060	64,100	70,800
2018	1,677	5,060	75,500	82,200
2019	1,729	5,060	55,800	62,600
2020	1,509	5,060	60,700	67,300
Method of Measure:	Metered	2016 Groundwater Model	Soil-Water Balance Model	
Level of Accuracy:	high	low-medium	medium	

Notes:
AF = acre-feet
PWS = public water systems

Surface Water Use

The Subbasin currently benefits from surface water entitlements from the Nacimiento Water Project (NWP) and the State Water Project (SWP) to supplement municipal groundwater demands in the City of Paso Robles and the community of Shandon, respectively. The City of Paso Robles actually utilized 1,541 AF of their NWP entitlement, but 804 AF of their NWP deliveries were recharged and extracted in the Atascadero Subbasin, so those volumes do not show up in this accounting. Locations of communities dependent on groundwater and with access to surface water are shown on Figure 8. There is currently no surface water available for agricultural or recharge project use within the Subbasin. A summary of total actual surface water use by source is provided in Table ES-2.

Table ES- 2. Total Surface Water Use by Source

Water Year	Nacimiento Water Project[1] (AF)	State Water Project[2] (AF)	Total Surface Water Use (AF)
2017	1,650	42	1,691
2018	1,423	55	1,477
2019	1,142	43	1,184
2020	737	0	737

Notes:
[1] Contract annual entitlement to the City of Paso Robles = 6,488 AFY
[2] Contract annual entitlement to CSA 16 = 100 AFY
AF = acre-feet
AFY = acre-feet per year

Total Water Use

For WY 2020, quantification of total water use was completed through reporting of metered water production data from municipal wells, metered surface water use, and from models used to estimate agricultural crop water supply requirements. In addition, rural water use and small commercial public water system use was estimated. Table ES-3 summarizes the total annual water use in the Subbasin by source and water use sector.

Table ES- 3. Total Water Use in the Subbasin by Source and Water Use Sector

Water Year	Municipal (AF)		PWS and Rural Domestic (AF)	Agriculture (AF)	Total (AF)
Source:	Groundwater	Surface Water	Groundwater	Groundwater	
2017	1,626	1,691	5,060	64,100	72,500
2018	1,677	1,477	5,060	75,500	83,700
2019	1,729	1,184	5,060	55,800	63,800
2020	1,509	737	5,060	60,700	68,000
Method of Measure:	Metered	Metered	2016 Groundwater Model	Soil-Water Balance Model	
Level of Accuracy:	high	high	low-medium	medium	

Notes:
AF = acre-feet
PWS = public water systems

Change in Groundwater in Storage

The calculation of change in groundwater in storage in the Subbasin was derived from comparison of fall groundwater elevation contour maps from one year to the next as well as taking the difference between groundwater elevations throughout the Subbasin as the aquifer becomes saturated (storage gain) or dewatered (storage loss). For this analysis, fall 2019 groundwater elevations were subtracted from the fall 2020 groundwater elevations resulting in a map depicting the changes in groundwater elevations in the Paso Robles Formation Aquifer that occurred during WY 2020.

The groundwater elevation change map for WY 2020 shows that water levels declined over a majority of the eastern portion of the Subbasin, with a minor depression in the Shandon area and a more pronounced area of decline in the south (Figure 10). The 2020 map also shows that groundwater elevations generally increased in the western portion of the Subbasin, notably in the southeastern portion of the City of Paso Robles.

The annual change of groundwater in storage calculated for WY 2020 is presented in Table ES-4. Increases of groundwater in storage are presented as positive numbers and decreases of groundwater in storage are presented as negative numbers.

Table ES- 4. Annual Change of Groundwater in Storage

Water Year	Annual Change (AF)
2017	60,100
2018	6,400
2019	59,700
2020	-80,800

Note: AF = acre-feet

Progress towards Meeting Basin Sustainability

Several projects and management actions are in process or have been recently implemented in the Subbasin to attain sustainability. These projects and actions include capital projects as well as non-structural basin-wide policies intended to reduce or optimize local groundwater use. Some of these projects were described in concept in the GSP; some of the actions described herein are new initiatives designed to make new water supplies available to the Subbasin that may be implemented by project participants to reduce pumping and partially mitigate the degree to which the management actions would be needed. Some of the ongoing efforts include:

- Amendment #1 to the Memorandum of Agreement
- Water Neutral New Development
- Paso Basin Aerial Groundwater Mapping Pilot Study
- Installation of Monitoring Wells and Stream Gages (SEP)
- City of Paso Robles Recycled Water Program
- San Miguel Community Services District Recycled Water Project
- Blended Water Project
- Stormwater Capture and Recharge Projects
- Expansion of Monitoring Well Network
- Expansion of Salinas Dam and Ownership Transfer

Relative to the basin conditions at the end of the study period as reported in the GSP, the First Annual Report (WYs 2017–2019) (GSI, 2020) and this Water Year 2020 Annual Report indicate an improvement in groundwater conditions throughout the Subbasin and a modest increase of total groundwater in storage. It is clear that historical groundwater pumping in excess of the sustainable yield has created challenging conditions for sustainable management. However, actions are already underway to collect data, improve the monitoring and data collection networks, and coordinate with affected agencies and entities throughout the Subbasin to develop solutions that address the shared mutual interest in the Subbasin's overall sustainability goal.

The above-average rainfall water years of 2017 and 2019 improved groundwater conditions in the Subbasin. Of the 22 representative monitoring site (RMS) wells in the Subbasin groundwater monitoring network, only one well exhibits groundwater elevations at or below the minimum threshold established in the GSP (this well is discussed in more detail in Section 3.3). Although the groundwater elevations in some of the RMS wells are continuing to trend downward, several of the RMS wells exhibit recovering groundwater elevations in the past few years, apparently because of the return to normal rainfall conditions. Eight of the 22 RMS wells have current groundwater elevations greater than the measurable objective for that RMS well.

Groundwater in storage in the Subbasin increased more than 45,000 AF in total over the past four water years, despite the 80,800 AF decrease of groundwater in storage in WY 2020.

As of the date of this report, updated Interferometric Synthetic Aperture Radar (InSAR) data has been provided by DWR through September 2019. As discussed in the GSP, there is a potential error of 0.1 feet (or 1.2 inches) associated with the InSAR measurement and reporting methods. A land surface change of less than 0.1 feet is therefore within the noise of the data and is equivalent to no evidence of subsidence. Considering this range of potential error, examination of the June 2018 through September 2019 InSAR data show that zero land subsidence has occurred since June 2018. These data indicate that there is no indication of an undesirable result. The GSAs will continue to monitor and report annual subsidence as more data become available.

At this time, there are no more recent data available since publication of the GSP to assess the interconnectivity of surface water and groundwater and the potential depletion of interconnected surface water. The potential for impact to this sustainability indicator will be assessed in future annual reports as data are developed to fill data gaps.

Additional time will be necessary to judge the effectiveness and quantitative impacts of the projects and management actions either now underway or in the planning and implementation stage. However, it is clear that the actions in place and as described in this Water Year 2020 Annual Report are a good start towards reaching the sustainability goals laid out in the GSP. It is too soon to judge the observed changes in basin conditions against the interim goals outlined in the GSP, but the anticipated effects of the projects and management actions now underway are expected to positively affect the ability of the Subbasin to reach the necessary sustainability goals.

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SECTION 1: **Introduction – Paso Robles Subbasin Water Year 2020 Annual Report**

The Water Year 2020 Annual Report for the Paso Robles Area Subbasin of the Salinas Valley Groundwater Basin (Paso Robles Subbasin or Subbasin) has been prepared for the Paso Basin Cooperative Committee (PBCC) and the Groundwater Sustainability Agencies (GSAs) in accordance with the Sustainable Groundwater Management Act (SGMA) and Groundwater Sustainability Plan (GSP) Regulations (§ 356.2. Annual Reports) (see Appendix A, GSP Regulations for Annual Reports). Pursuant to the California Department of Water Resources (DWR) regulations, a GSP Annual Report must be submitted to DWR by April 1 of each year following the adoption of the GSP. Submittal of the adopted Paso Robles Subbasin GSP occurred on January 31, 2020. The GSAs are required to submit an annual report for the preceding water year (October 1 through September 30) to DWR by April 1 of each subsequent year. The First Annual Report (GSI, 2020) was submitted to DWR on March 25, 2020 and a modified version[1] was submitted to DWR on November 20, 2020. This Water Year 2020 Annual Report for the Paso Robles Subbasin documents groundwater production, water use data and water level data from October 1, 2019 through October 31, 2020 [2]. The numbers presented in this Water Year 2020 Annual Report include modified numbers for WYs 2017 through 2019. A revised First Annual Report, containing these modified numbers, will be submitted to DWR.

1.1 Setting and Background

The Paso Robles Subbasin GSP was prepared by Montgomery & Associates, Inc. (M&A, 2020), on behalf of and in cooperation with the Paso Basin Cooperative Committee and the Subbasin GSAs. The GSP, and subsequent annual reports including this Water Year 2020 Annual Report, covers the entire Paso Robles Subbasin (Figure 1). The Subbasin lies in the northern portion of San Luis Obispo County. The majority of the Subbasin comprises gentle flatlands near the Salinas River Valley, ranging in elevation from approximately 450 to 2,400 feet above mean sea level (AMSL). The Subbasin is drained by the Salinas River and its tributaries, including the Estrella River, Huer Huero Creek, and San Juan Creek. Communities in the Subbasin are the City of Paso Robles and the communities of San Miguel, Creston, and Shandon. Highway 101 is the most significant north-south highway in the Subbasin, with Highways 41 and 46 running east-west across the Subbasin.

The GSP was jointly developed by four GSAs:

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

The Paso Basin GSAs overlying the Subbasin entered into a Memorandum of Agreement (MOA) in September 2017. The purpose of the MOA was to establish a Paso Basin Cooperative Committee (PBCC) to develop a single GSP for the entire Subbasin to be considered for adoption by each GSA and subsequently submitted to DWR for approval. Under the framework of the original MOA, the GSAs engaged the public and

[1] Modifications were limited to language related to Section 8.3.2, Extension of Water Neutral New Development Program.
[2] The required timeframe of the annual reports, pursuant to the SGMA regulations, is by water year, which is October 1 through September 30 of any year. However, because the County of San Luis Obispo Groundwater Level Monitoring Program measures water levels in October, the October 2020 measurements, for instance, are utilized to reflect conditions at the end of water year 2020.

coordinated to jointly develop the Paso Robles Subbasin GSP. At its November 20, 2019 meeting, in accordance with the MOA, the PBCC voted unanimously to recommend that the GSAs adopt the GSP and submit it to DWR by the SGMA deadline. Subsequent actions by each GSA resulted in unanimous approval of the GSP and a joint submittal of the GSP to DWR.

The original MOA included provision for automatic termination upon approval of the GSP by DWR. Resolutions adopted by each GSA during the GSP approval process included an amendment to the MOA that removed automatic termination language because the GSAs will continue cooperating on the GSP and its implementation until such time as the long-term governance structure for implementation of the GSP is developed.

Each of the GSAs appointed a representative Member and Alternate to the PBCC to coordinate activities among the GSAs during the development of the GSP and the development and submittal of this Water Year 2020 Annual Report. The GSAs also agreed to designate the County of San Luis Obispo Director of Public Works as the Plan Manager with the authority to submit the GSP and annual reports and serve as the point of contact with DWR.

1.2 Organization of This Report

The required contents of an annual report are provided in the GSP Regulations (§ 356.2), included as Appendix A. Organization of the report is meant to follow the regulations where possible to assist in the review of the document. The sections are briefly described as follows:

Section 1. Introduction – Paso Robles Subbasin Water Year 2020 Annual Report: a brief background of the formation and activities of the Paso Robles Subbasin GSAs and development and submittal of the GSP.

Section 2. Paso Robles Subbasin Setting and Monitoring Networks: a summary of the Subbasin setting, Subbasin monitoring networks, and the ways in which data are used for groundwater management.

Section 3. Groundwater Elevations (§356.2[b][1]): a description of recent monitoring data with groundwater elevation contours for spring and fall monitoring events and representative hydrographs.

Section 4. Groundwater Extractions (§356.2[b][2]): compilation of metered and estimated groundwater extractions by land use sector and location of extractions.

Section 5. Surface Water Use (§356.2[b][3]): a summary of reported surface water use.

Section 6. Total Water Use (§356.2[b][4]): a presentation of total water use by source and sector.

Section 7. Change in Groundwater in Storage (§356.2[b][5]): a description of the methodology and presentation of changes in groundwater in storage based on fall to fall groundwater elevation differences.

Section 8. Progress towards Basin Sustainability (§356.2[c]): a summary of management actions taken throughout the Subbasin by GSAs and individual entities towards sustainability of the Subbasin.

SECTION 2: **Paso Robles Subbasin Setting and Monitoring Networks**

2.1 Introduction

This section provides a brief description of the basin setting and the groundwater management monitoring programs described in the GSP, as well as any notable events affecting monitoring activities or the quality of monitoring results in the reported WY 2020. Much of the background information reported on in this Water Year 2020 Annual Report was taken from the GSP prepared by Montgomery & Associates, Inc. (M&A, 2020).

2.2 Subbasin Setting

The Subbasin is a structural trough trending to the northwest filled with terrestrially derived sediments sourced from the surrounding mountains. The Subbasin is surrounded by relatively impermeable geologic formations, sediments with poor water quality, and structural faults. Land surface elevation ranges from approximately 2,000 feet AMSL in the southeast extent of the Subbasin to about 600 feet AMSL in the northwest extent, where the Salinas River exits the Subbasin. Agriculture is the dominant land use. The Subbasin includes the incorporated City of Paso Robles and unincorporated communities of San Miguel, Creston, and Shandon.

The Subbasin is the southernmost portion of the Salinas Valley Groundwater Basin. As originally defined by DWR (2003), the Subbasin was in both San Luis Obispo and Monterey counties. The 2019 DWR basin boundary modification process resulted in a revision of the northern boundary of the Paso Robles Subbasin to be coincident with the San Luis Obispo/Monterey county line, thereby placing the Subbasin entirely within San Luis Obispo County.

The top of the Subbasin is defined by land surface. The bottom of the Subbasin is defined by the base of the Paso Robles Formation. Sediments below the base of the Paso Robles Formation are typically much less permeable than the overlying sediments. Although the bedrock sediments often produce usable quantities of groundwater, the water is generally of poor quality, so they are not considered part of the Subbasin. As described in the GSP, the lateral boundaries of the Subbasin include the following:

- The western boundary is defined by the contact between the sediments in the Subbasin and the sediments of the Santa Lucia Range. A portion of the western boundary is defined by the Rinconada fault system which separates the Paso Robles Subbasin from the Atascadero Area Subbasin.
- The eastern boundary of the Subbasin is defined by the contact between the sediments in the Subbasin and the sediments of the Temblor Range. The San Andreas Fault generally forms the eastern Subbasin boundary.
- The southern boundary of the Subbasin is defined by the contact between the sediments in the Subbasin and the sediments of the La Panza Range. To the southeast, a watershed and groundwater divide separates the Subbasin from the adjacent Carrizo Plain Basin; sedimentary layers are likely continuous across this divide.
- The northern boundary of the Subbasin is defined by the San Luis Obispo/Monterey county line.

Two principal aquifers exist in the Subbasin, including the Alluvial Aquifer and the Paso Robles Formation Aquifer. The Alluvial Aquifer is the youngest aquifer. It is unconfined and consists of predominantly coarse-grained sediments (sand and gravel) deposited along the Salinas River, Estrella River, Huer Huero Creek, and San Juan Creek. The Alluvial Aquifer varies in thickness but may be up to 100 feet thick along the channels. Much of the Alluvial Aquifer is characterized by relatively high transmissivity that may exceed

100,000 gallons per day per foot (gpd/ft). Wells screened in the Alluvial Aquifer can be very productive and may yield over 1,000 gallons per minute (gpm).

The Paso Robles Formation Aquifer underlies the Alluvial Aquifer and outcrops in the Subbasin everywhere outside of the Holocene stream channels. The Paso Robles Formation represents the largest volume of sediments in the Subbasin, with a total thickness up to 3,000 feet in the northern Estrella area and up to 2,000 feet in the Shandon area. The Paso Robles Formation has a thickness of 700 to 1,200 feet throughout most of the Subbasin. It is generally characterized by interbedded, discontinuous lenses of sand and gravel that comprise the most productive strata within the aquifer, separated vertically by comparatively thick zones of fine-grained sediments (silts and clays). Well depths generally range from approximately 200 feet to 1,000 feet or more. As described in the GSP, reported aquifer transmissivity estimates in the Paso Robles Formation range from approximately 1,000 to 9,000 gpd/ft, and well yields range from approximately 150 gpm to 850 gpm.

The primary components of recharge to the Subbasin aquifers are percolation of precipitation and infiltration of surface water from rivers and streams. Natural discharge from the Subbasin aquifers occurs through springs and seeps, evapotranspiration, and discharge to surface water bodies. The most significant component of discharge is pumping of groundwater from wells. The regional direction of groundwater flow is from the southeast to the northwest. As there is no hydrogeologic barrier to flow along the northern boundary of the Subbasin, groundwater exits the Subbasin along that boundary to the adjacent Salinas Valley Basin to the north.

2.3 Precipitation and Climatic Periods

Annual precipitation recorded at the Paso Robles weather station (National Oceanic and Atmospheric Administration [NOAA] station 46730) is presented by water year in Figure 2. The total annual precipitation recorded at the Paso Robles weather station for WY 2020 is 12.5 inches. The long-term average annual precipitation for the period 1925 through 2020 is 14.6 inches per water year, as recorded at the Paso Robles weather station. Climatic periods in the Subbasin have been determined based on analysis of data from the Paso Robles weather station using the Standardized Precipitation Index (SPI), which quantifies deviations from normal precipitation patterns, using a 60-month period for analysis to maintain consistency with previous analyses in the GSP. These climatic periods are categorized according to the following designations: wet, dry, and average/alternating wet and dry (Figure 2). The spatial distribution of long-term average annual precipitation in the Paso Robles Subbasin is presented in Figure 3. Historical precipitation records for the NOAA station 46730 and the nearby City of Paso Robles Public Works station are provided in Appendix B.

2.4 Monitoring Networks

This section provides a brief description of the monitoring programs currently in place and any notable events affecting monitoring activities or the quality of monitoring results. Monitoring networks are developed for each of the five sustainability indicators relevant to the Paso Robles Subbasin:

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

Monitoring for the first two sustainability indicators (chronic lowering of water levels and reduction of groundwater in storage) is implemented using the representative monitoring sites (RMS), discussed in

Section 2.4.1. Monitoring for the remaining three sustainability indicators (degraded water quality, land subsidence, and depletion of interconnected surface water) is discussed below in Section 2.4.2.

2.4.1 Groundwater Elevation Monitoring Network (§ 356.2[b])

The GSP provided a summary of existing groundwater monitoring efforts currently promulgated under various existing local, state, and federal programs. SGMA requires that monitoring networks be developed in the Subbasin to provide sufficient data quality, frequency, and spatial distribution to evaluate changing aquifer conditions in response to GSP implementation.

The GSP identifies an existing network of 23 RMS wells for water level monitoring. Of these 23 wells, 22 are wells that screen the Paso Robles Formation[3], and one is an Alluvial Aquifer well. These RMS have been monitored biannually, in April and October, for various periods of record. The RMS groundwater monitoring network developed in the GSP is intended to support efforts to do the following:

- Monitor changes in groundwater conditions and demonstrate progress toward achieving measurable objectives and minimum thresholds documented in the GSP
- Quantify annual changes in water use
- Monitor impacts to the beneficial uses and users of groundwater

The RMS are displayed in Figure 4, and a summary of information for each of the wells is included in Appendix C.

2.4.1.1 Monitoring Data Gaps

The GSP noted numerous data gaps in the current RMS network. It should be noted that efforts are continuing during the implementation phase of the GSP to identify existing wells that can be added to the network, or to construct new wells for the network. As a start to this effort, the GSP identified nine additional wells that may be incorporated into the RMS network once the depth and screened aquifer are established. These wells are displayed in Figure 4, and a summary of available well information is included in Appendix D.

2.4.2 Additional Monitoring Networks

Evaluation of the water quality sustainability indicator is achieved through monitoring of an existing network of supply wells in the Subbasin. Constituents of concern (COCs) identified in the GSP that have the potential to impact suitability of water for public supply or agricultural use include salinity (as indicated by electrical conductivity), total dissolved solids (TDS), sodium, chloride, nitrate, sulfate, boron, and gross alpha..

COCs for drinking water are monitored at public water supply wells (PWS). There are 41 PWSs in the Subbasin. PWSs constitute part of the monitoring network for water quality in the Subbasin. In addition, the GSP identified 28 agricultural supply wells that are monitored for COCs under the Irrigated Lands Regulatory Program (ILRP).

Land subsidence in the Subbasin is monitored using interferometric synthetic-aperture radar (InSAR) data collected using microwave satellite imagery provided by DWR. Available data to date indicate no significant subsidence in the Subbasin that impacts infrastructure. The GSAs will annually assess subsidence using the InSAR data provided by DWR.

A monitoring network to assess the sustainability indicator of groundwater/surface water interconnection is a current data gap that will be addressed during GSP implementation. There is at present only a single

[3] Since initial establishment of the monitoring well network, two of the 22 Paso Robles Formation Aquifer RMS wells (27S/13E-30N01 and 26S/12E-2607) have become either inactive or inaccessible.

Alluvial Aquifer well in the water level monitoring network. This is identified in the GSP as a significant data gap. Additional Alluvial Aquifer wells will need to be established in the monitoring network before groundwater/surface water interaction can be more robustly analyzed.

SECTION 3: Groundwater Elevations (§ 356.2[b][1])

3.1 Introduction

This section provides a detailed report on groundwater elevations in the Subbasin measured during spring and fall of 2020. These maps present the most up-to-date seasonal conditions in the Basin. Most of the data presented characterizes conditions in the Paso Robles Formation Aquifer. Data for the Alluvial Aquifer are too sparse for regional analysis. Monitoring data is reviewed for quality and an appropriate time frame is chosen to provide the highest consistency in the wells used for each reporting period. Data quality is often difficult to ascertain when measurements are taken by other agencies or private well owners, and well construction information may be incomplete or unavailable. This means that a careful review of the data is required prior to uploading to DWR's Monitoring Network Module[4] to verify whether measurements are trending consistent with trends of previous years and with the current year's hydrology and level of extractions.

3.1.1 Principal Aquifers

As discussed in Section 2, there are two principal aquifers in the Subbasin. The Paso Robles Formation Aquifer is several hundreds of feet thick, represents the greatest volume of saturated sediments in the Subbasin, and is the aquifer that is most utilized for supply. The Alluvial Aquifer is limited in extent to the active channels of the streams in the Subbasin and is generally less than 100 feet thick.

3.2 Seasonal High and Low Groundwater Elevations (Spring and Fall) (§ 356.2[b][1][A])

The assessment of groundwater elevation conditions in the Subbasin as described in the GSP is largely based on data from the San Luis Obispo County Flood Control and Water Conservation District (SLOFCWCD) groundwater monitoring program. Groundwater levels are measured by the SLOFCWCD through a network of public and private wells in the Subbasin. Data from many of the wells in the monitoring program are collected subject to confidentiality agreements between the SLOFCWCD and well owners. Consistent with the terms of such agreements, the well owner information and specific locations for these wells are not published in the GSP and that convention is continued in this Water Year 2020 Annual Report. To maintain consistency with the GSP and represent conditions that can be easily compared from year to year, this Water Year 2020 Annual Report used the same set of wells as was used in the GSP. Groundwater level data from 39 wells were used to create the spring 2020 groundwater elevation contour map and data from 37 wells were used for the fall 2020 contour map. The well locations and data points are not shown on the maps to preserve confidentiality. Of these wells, owners of 23 of the wells have agreed to allow public use of the well data and are therefore used as RMS wells for the purpose of monitoring sustainability indicators. As implementation of the GSP progresses, it is anticipated that additional wells will be added to the data set and that many of the wells with current confidentiality agreements will be modified to allow for public use of the data.

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[4] The Paso Robles Subbasin is no longer in the CASGEM program since implementation of the GSP. The GSAs are now responsible for monitoring and reporting of groundwater elevation data.

In accordance with the SGMA regulations, the following information is presented based on available data:

- Groundwater elevation contour maps for the seasonal high and seasonal low groundwater conditions for the previous water year. Groundwater elevation contour maps are presented for spring 2020 and fall 2020.
- A map depicting the change in groundwater elevation for the preceding water year. A change in groundwater elevation map is shown here for the period fall 2019 to fall 2020 (Section 7.1).
- Hydrographs for wells with publicly available data (Appendix E).

3.2.1 Alluvial Aquifer Groundwater Elevation Contours

Groundwater elevation data for the Alluvial Aquifer are too limited to prepare representative contour maps of the seasonal high and seasonal low groundwater elevations. Figure 5 shows the current (as of 2017) groundwater elevation contours for the Alluvial Aquifer, as shown in the GSP. This map, however, was developed using 2017 data (when available) as well as the most recent data prior to 2017. A reasonable data set of Alluvial Aquifer groundwater elevations specific to 2020 is not available, so the map as presented in the GSP is the most recent map available. This same map was also presented in the First Annual Report (GSI, 2020).

Groundwater elevations range from approximately 1,400 feet AMSL in the southeastern portion of the Subbasin to approximately 600 feet AMSL near San Miguel. Groundwater flow direction in the Alluvial Aquifer generally follows the alignment of the creeks and rivers. Overall, groundwater in the Alluvial Aquifer flows from southeast to northwest across the Subbasin. On a basin-wide scale, the average horizontal hydraulic gradient in the alluvium is about 0.004 feet per foot (ft/ft) from the southeastern portion of the Subbasin to San Miguel.

3.2.2 Paso Robles Formation Aquifer Groundwater Elevation Contours

Spring and fall 2020 (high and low) groundwater elevation data for the Paso Robles Formation Aquifer in the Subbasin were contoured to assess spatial variations, yearly fluctuations, trends in groundwater conditions, groundwater flow directions, and horizontal groundwater gradients. Contour maps were prepared for the seasonal high groundwater levels, which typically occur in the spring, and the seasonal low groundwater levels, which typically occur in the fall. In general, the spring groundwater data are for April and the fall groundwater data are for October. For consistency with the GSP, the same well data sets were used for contouring; information identifying the owner or detailed location of private wells is not shown on the maps to preserve confidentiality.

Figures 6 and 7 show contours of groundwater elevations in the Paso Robles Formation Aquifer for spring 2020 and fall 2020, respectively. Overall, groundwater conditions in the Subbasin in the spring and fall of 2020 were similar, with groundwater elevations in the fall generally lower than in the spring, a typical seasonal trend for the Subbasin. Groundwater flow direction is generally to the northwest and west over most of the Subbasin. In general, groundwater flow in the western portion of the Subbasin tends to converge toward areas of low groundwater elevations. These areas of low groundwater elevation are in the area between the City of Paso Robles and the communities of San Miguel and Whitley Gardens. Horizontal groundwater gradients range from approximately 0.002 ft/ft in the southeast portion of the Subbasin to approximately 0.02 ft/ft in the area southeast of Paso Robles.

In general, the groundwater elevations observed in the Subbasin during WY 2020 show a decline across portions of the Subbasin, likely due predominantly to below-average rainfall conditions in WY 2020. Positive and negative changes in groundwater elevations from year to year are observed in various parts of the

Subbasin, as has been observed historically. Seasonal trends of slightly higher spring groundwater elevations compared with fall levels are observed annually.

3.3 Hydrographs (§ 356.2[b][1][B])

Groundwater elevation hydrographs are used to evaluate aquifer behavior over time. Changes in groundwater elevation at a given point in the Subbasin can result from many influencing factors, with all or some occurring at any given time. Factors can include changing hydrologic trends, seasonal variations in precipitation, varying Subbasin extractions, changing inflows and outflows along boundaries, availability of recharge from surface water sources, and influence from localized pumping conditions. Climatic variation can be one of the most significant factors affecting groundwater elevations over time. For this reason, the hydrographs also display periods of climatic variation categorized as wet, dry, or average/alternating wet and dry (see Figure 2).

3.3.1 Hydrographs

Groundwater elevation hydrographs and associated location maps for the 22 wells in the Subbasin monitoring network that are constructed in and extract groundwater from the Paso Robles Formation Aquifer are presented in Appendix E. The groundwater elevation data for the single Alluvial Aquifer RMS is not shown. These hydrographs also include information on well screen interval (if available), reference point elevation, as well as measurable objectives and minimum thresholds for each well that were developed during the preparation of the GSP. Many of the hydrographs illustrate a condition of declining water levels since the late 1990s, although some indicate relative water level stability over the same period.

As described in the GSP, an average of the 2017 non-pumping groundwater levels was selected as the measurable objectives and minimum thresholds are set below those levels. Going forward from 2017, the average of the spring and fall measurements in any one water year will be the benchmark against which trends will be assessed.

Of the 22 RMS hydrographs presented in Appendix E, only 27S/13E-28F01 exhibits groundwater elevations at or below the minimum threshold[5]. Although the groundwater elevations in some of the RMS wells are continuing to trend downward, several of the RMS wells exhibit recovering groundwater elevations in the past few years, apparently as a result of the return to normal rainfall conditions. Eight of the 22 RMS wells have current groundwater elevations greater than the measurable objective for that RMS well.

[5] Well 27S/13E-28F01 has a total depth of 230 feet below ground surface, which is only 22 feet below the minimum threshold set for this well. Considering the two-decade long downward trend in water levels in this well and the well having been measured as dry during fall 2020 this well does not appear to be suitable for continued use as an RMS well. The owner of well 27S/13E-28F01 has indicated that another well on the property with a deeper completion may be available for future use as an alternative RMS well.

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SECTION 4: **Groundwater Extractions (§ 356.2[b][2])**

4.1 Introduction

This section presents the metered and estimated groundwater extractions from the Subbasin for WY 2020. The types of groundwater extraction described in this section include municipal (Table 1), agricultural (Table 2), rural domestic (Table 3), and small public water systems (Table 4). Each following subsection includes a description of the method of measurement and a qualitative level of accuracy for each estimate. The level of accuracy is rated on a qualitative scale of low, medium, and high. The annual groundwater extraction volumes for all water use sectors are shown in Table 5.

4.2 Municipal Metered Well Production Data

The municipal groundwater extractions documented in this report are metered data. Metered groundwater pumping extraction data are from the City of Paso Robles, San Miguel CSD, and the County of San Luis Obispo for Community Service Area 16 (CSA 16), providing service to the community of Shandon. The data shown in Table 1 reflect metered data reported by the respective agencies. The accuracy level rating of these metered data is high.

Table 1. Municipal Groundwater Extractions

Water Year	Metered Groundwater Extractions			Total (AF)
	City of Paso Robles[1] (AF)	San Miguel CSD (AF)	CSA 16 (AF)	
2017	1,261	295	70	1,626
2018	1,302	325	50	1,677
2019	1,392	289	48	1,729
2020	1,121	297	91	1,509

Notes:
1 – The City of Paso Robles produces groundwater from wells located in both the Paso Robles Subbasin and the Atascadero Subbasin. Only the portion produced from within the Paso Robles Subbasin is included here.
AF = acre-feet
CSA = community service area (County of San Luis Obispo)
CSD = community services district

4.3 Estimate of Agricultural Extraction

Agricultural water use constituted 90 percent of the total anthropogenic groundwater use in the Subbasin in WY 2020. To estimate agricultural water demand, land use data along with climate and soil data were analyzed and processed using the soil-water balance model that was developed for the Paso Robles Groundwater Basin Model Update (GSSI, 2014). Annual land use spatial data sets from San Luis Obispo County were used to determine the appropriate crop categories, distribution, and acreages. Land use types were grouped within seven crop categories, including alfalfa, citrus, deciduous, nursery, pasture, vegetable, and vineyard, each with a respective set of crop water demand coefficients from the San Luis Obispo County Master Water Report[6] (Carollo, 2012). Climate data inputs include precipitation from the Paso Robles Station (NOAA station 46730) and reference evapotranspiration (ETo) data from several private stations in the Subbasin operated by Western Weather Group. Soil water holding capacity data from National Resources

[6] Vineyard crop coefficients were modified based on discussions with Mark Battany, University of California Extension (GSSI, 2014).

Conservation Service soil surveys of San Luis Obispo County were used. The soil-water balance model includes consideration for regulated deficit irrigation (RDI), cover crop, and frost protection water demands for vineyards as well as irrigation system efficiencies (GSSI, 2014).

The soil-water balance model was utilized to estimate agricultural water demands through WY 2016 during completion of the GSP (M&A, 2020) and for WYs 2017, 2018, and 2019 in the First Annual Report (GSI, 2020). Agricultural water demand for this Water Year 2020 Annual Report was estimated for WY 2020 also using the soil-water balance model. The resulting estimated groundwater extractions for agricultural demands are summarized in Table 2. The accuracy level rating of this estimated volume is medium.

Table 2. Estimated Agricultural Irrigation Groundwater Extractions

Water Year	Agricultural Demand (AF)
2017	64,100
2018	75,500
2019	55,800
2020	60,700

Note: AF = acre-feet

4.4 Rural Domestic and Small Public Water System Extraction

Rural domestic and small PWS groundwater extractions in the Subbasin were estimated using the methods described here.

4.4.1 Rural Domestic Demand

As documented in the Paso Robles Groundwater Basin Model Update (GSSI, 2014), the rural domestic water demand was originally estimated as the product of County estimates of rural domestic units (DUs) and a water demand factor of 1.7 AFY per DU, which included small PWS water demand (Fugro, 2002). This factor was subsequently modified to 1.0 AFY/DU in the San Luis Obispo County Master Water Report, not including small PWS demand (Carollo, 2012). Based on further investigation completed for the 2014 groundwater model update, the rural domestic water use factor was refined to 0.75 AFY/DU (GSSI, 2014). To simulate rural water demand over time in the groundwater model, an annual growth rate of 2.25 percent for the rural population was assumed, based on recommendation from the San Luis Obispo County Planning Department (GSSI, 2014). The groundwater model update completed for the GSP (M&A, 2020) used a linear regression projection based on the 2014 model update to estimate rural domestic demand through WY 2016. The projected future water budget presented in the GSP (M&A, 2020) assumes water neutral growth in rural domestic water demand from WY 2016 going forward. Therefore, the rural domestic demand has been held constant at the estimated WY 2016 volume for this Water Year 2020 Annual Report. The resulting groundwater extractions for rural domestic demands are summarized in Table 3. The accuracy level rating of these estimated volumes is low-medium.

Table 3. Estimated Rural Domestic Groundwater Extractions

Water Year	Rural Domestic (AF)
2017	3,530
2018	3,530
2019	3,530
2020	3,530

Note: AF = acre-feet

4.4.2 Small Public Water System Extractions

The category of small PWSs includes a wide variety of establishments and facilities including small mutual water companies, golf courses, wineries, rural schools, and rural businesses. Various studies over the years used a mix of pumping data and estimates for type-specific water demand rates to estimate small PWS groundwater demand (Fugro, 2002; Todd Engineers, 2009). The 2012 San Luis Obispo County Master Water Report used the County of San Luis Obispo geographic information services mapping to define the distribution and number of commercial systems at the time and applied a single annual factor of 1.5 AFY per system (Carollo, 2012).

For the 2014 model update, actual pumping data were used as available to provide a monthly record over the study period (GSSI, 2014). Groundwater demand for four major golf courses (at the time) in the Subbasin (The Links, Hunter Ranch, Paso Robles, and River Oaks) was estimated using the following factors: ETo data measured in Paso Robles, the crop coefficient for turf grass, monthly rainfall data, and golf course acreage (GSSI, 2014). Water use for wineries was estimated by identifying each winery and its permitted capacity and applying a water use rate of 5 gallons of water per gallon of wine produced. Minor landscaping, wine tasting/restaurant functions, and return flows were also accounted for (GSSI, 2014). Water use for several small commercial/institutional water systems was estimated using water duty factors specific to the water system type (i.e., camp, school, restaurant, and other uses) (GSSI, 2014).

The groundwater model update completed for the GSP (M&A, 2020) used a linear regression projection for the 2014 model update to estimate small PWS demand through WY 2016. The projected future water budget presented in the GSP (M&A, 2020) assumes water neutral growth in small PWS water demand from WY 2016 going forward. Therefore, the small PWS demand has been held constant at the estimated WY 2016 volume for this Water Year 2020 Annual Report. The resulting groundwater extractions for small PWS demands are summarized in Table 4. The accuracy level rating of these estimated volumes is low-medium.

Table 4. Estimated Small Public Water System Groundwater Extractions

Water Year	Small PWS (AF)
2017	1,530
2018	1,530
2019	1,530
2020	1,530

Note: AF = acre-feet

4.5 Total Groundwater Extraction Summary

Total groundwater extractions in the Subbasin for WY 2020 is estimated to be 67,300 AF. Table 5 summarizes the total groundwater use by sector and indicates the method of measure and associated level of accuracy. Approximate points of extraction were spatially distributed and colored according to a grid system to represent the relative pumping across the basin in terms of AF per acre (see Figure 8).

Table 5. Total Groundwater Extractions

Water Year	Groundwater Extractions by Water Use Sector			Total (AF)
	Municipal (AF)	PWS and Rural Domestic (AF)	Agriculture (AF)	
2017	1,626	5,060	64,100	70,800
2018	1,677	5,060	75,500	82,200
2019	1,729	5,060	55,800	62,600
2020	1,509	5,060	60,700	67,300
Method of Measure:	Metered	2016 Groundwater Model	Soil-Water Balance Model	
Level of Accuracy:	high	low-medium	medium	

Notes:
AF = acre-feet
PWS = public water systems

SECTION 5: **Surface Water Use (§ 356.2[b][3])**

5.1 Introduction

This section addresses the reporting requirement of providing surface water supplies used, or available for use, and describes the annual volume and sources for WY 2020. The method of measurement and level of accuracy is rated on a qualitative scale. The Subbasin currently benefits from surface water entitlements from the Nacimiento Water Project (NWP) and the State Water Project (SWP) to supplement municipal groundwater demands in the City of Paso Robles and the community of Shandon, respectively. Locations of communities dependent on groundwater and with access to surface water are shown on Figure 9.

5.2 Surface Water Available for Use

Table 6 provides a breakdown of surface water available for municipal use in the Subbasin. There is currently no surface water available for agricultural or recharge project use within the Subbasin.

Table 6. Surface Water Available for Use

Water Year	Nacimiento Water Project[1] (AF)	State Water Project[2] (AF)	Total Available Surface Water (AF)
2017	6,488	100	6,588
2018	6,488	100	6,588
2019	6,488	100	6,588
2020	6,488	100	6,588

Notes:
[1] Contract annual entitlement to the City of Paso Robles
[2] Contract annual entitlement to CSA 16
AF = acre-feet

5.3 Total Surface Water Use

A summary of total actual surface water use by source is provided in Table 7. The accuracy level rating of these metered data is high.

Environmental uses of surface water is also recognized but not estimated due to insufficient data to make an estimate of surface water use. It is expected that environmental uses will be quantified in future annual reports as more data become available.

Table 7. Surface Water Use

Water Year	Nacimiento Water Project[1] (AF)	State Water Project[2] (AF)	Total Surface Water Use (AF)
2017	1,650	42	1,691
2018	1,423	55	1,477
2019	1,142	43	1,184
2020	737	0	737

Notes:
[1] Contract annual entitlement to the City of Paso Robles = 6,488 AFY
[2] Contract annual entitlement to CSA 16 = 100 AFY
AF = acre-feet
AFY = acre-feet per year

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SECTION 6: Total Water Use (§ 356.2[b][4])

This section summarizes the total annual groundwater and surface water used to meet municipal, agricultural, and rural demands within the Subbasin. For WY 2020, the quantification of total water use was completed from reported metered municipal water production and metered surface water delivery, and from models used to estimate agricultural and rural water demand. Table 8 summarizes the total water use in the Subbasin by source and water use sector for WY 2020. The method of measurement and a qualitative level of accuracy for each estimate is rated on a qualitative scale of low, medium, and high.

Table 8. Total Water Use by Source and Water Use Sector, Water Year 2020

Water Year	Municipal (AF)		PWS and Rural Domestic (AF)	Agriculture (AF)	Total (AF)
Source:	Groundwater	Surface Water	Groundwater	Groundwater	
2017	1,626	1,691	5,060	64,100	72,500
2018	1,677	1,477	5,060	75,500	83,700
2019	1,729	1,184	5,060	55,800	63,800
2020	1,509	737	5,060	60,700	68,000
Method of Measure:	Metered	Metered	2016 Groundwater Model	Soil-Water Balance Model	
Level of Accuracy:	high	high	low-medium	medium	

Notes:
AF = acre-feet
PWS = public water systems

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SECTION 7: Change in Groundwater in Storage (§ 356.2[b][5])

7.1 Annual Changes in Groundwater Elevation (§ 356.2[b][5][A])

Annual changes in groundwater elevation in the Paso Robles Formation Aquifer for WY 2020 are derived from comparison of fall groundwater elevation contour maps from one year to the next. For this analysis, fall 2019 groundwater elevations were subtracted from the fall 2020 groundwater elevations resulting in a map depicting the changes in groundwater elevations in the Paso Robles Formation Aquifer that occurred during WY 2020 (see Figure 10). This groundwater elevation change map is based on a reasonable and thorough analysis of the currently available data. As stated in Section 3, groundwater elevation data for the Alluvial Aquifer are too limited to prepare annual groundwater elevation contour maps. Therefore, the change in groundwater in storage analysis is limited to the Paso Robles Formation Aquifer for this Water Year 2020 Annual Report. As discussed in the GSP, the monitoring network needs to be expanded to more completely assess Subbasin conditions.

The groundwater elevation change map for WY 2020 (Figure 10) shows that water levels declined over a majority of the eastern portion of the Subbasin, with a minor depression in the Shandon area and a more pronounced area of decline in the south. The 2020 map also shows that groundwater elevations generally increased in the western portion of the Subbasin, notably in the southeastern portion of the City of Paso Robles.

7.2 Annual and Cumulative Change in Groundwater in Storage Calculation (§ 356.2[b][5][B])

The groundwater elevation change map presented above represents a volume change within the Paso Robles Formation Aquifer for WY 2020. The volume change depicted on Figure 10 represents a total volume, including the volume displaced by the aquifer material and the volume of groundwater stored within the void space of the aquifer. The portion of void space in the aquifer that can be utilized for groundwater storage is represented by the aquifer storage coefficient (S), a unitless factor, which is multiplied by the total volume change to derive the change in groundwater in storage. Based on work completed for the GSP, S is estimated to be 7 percent.[7] The annual change of groundwater in storage calculated for WY 2020 is presented in Table 9 and the annual and cumulative change in groundwater in storage since 1981 are presented on Figure 11.

Table 9. Annual Change in Groundwater in Storage - Paso Robles Formation Aquifer

Water Year	Annual Change (AF)
2017	60,100
2018	6,400
2019	59,700
2020	-80,800

Note: AF = acre-feet

The 80,800 AF decrease of groundwater in storage in WY 2020 shown in Table 9 is coincident with below average precipitation in 2020 (12.5 inches). Historical comparison of annually tabulated precipitation, total groundwater extractions, and annual change in groundwater in storage reveals a close correlation between

[7] Appendix F includes derivation of the storage coefficient from the GSP groundwater model files and a sensitivity analysis.

annual total precipitation and change in groundwater in storage (see Figure 12). Specifically, years with well above average precipitation (i.e. 1983, 1993, 1995, 1998, 2005, and 2017) are all associated with years of large increases in groundwater in storage. Conversely, nearly all[8] below average precipitation years are associated with years of decline in groundwater in storage. The influence of total annual groundwater extractions on annual change in groundwater in storage is also apparent, although to a lesser degree. The influence of groundwater extractions on annual changes in groundwater in storage is most apparent during the drought of the mid-1980's through the early 1990's, when below average precipitation prevailed, but a trend of decreasing groundwater extractions resulted in a slight upward trend in annual changes of groundwater in storage.

[8] The exception to this is water year 2018, which was a below average precipitation year associated with a minor increase in groundwater in storage. It should be noted that this change in groundwater in storage was calculated independently from the groundwater model using the groundwater elevation change map method described above.

SECTION 8: Progress toward Basin Sustainability (§ 356.2[c])

8.1 Introduction

This section describes several projects and management actions that are in process or have been recently implemented in the Subbasin as a means to improve groundwater conditions, avoid potential undesirable results, attain subbasin sustainability, and improve understanding of the implications of GSP implementation. These projects and actions include capital projects and non-structural policies intended to reduce or optimize local groundwater use. Some of these projects were described in concept in the GSP; some of the actions described herein are new initiatives designed to make new water supplies available to the Subbasin that may be implemented by the GSAs to reduce pumping and partially mitigate the degree to which the management actions would be needed.

As described in the GSP, the need for projects and management actions is based on emerging Subbasin conditions, including the following:

- Groundwater levels are declining in some parts of the Subbasin, indicating that the amount of groundwater pumping is more than the natural recharge.
- The calculated water budget of the Paso Robles Formation aquifer indicates that the amount of groundwater in storage is in decline and will continue to decline in the near future if there is no net decrease in groundwater demand on the aquifer.

To mitigate declines in groundwater levels in some parts of the Subbasin, achieve the Subbasin sustainability goal by 2040, and avoid undesirable results as required by SMGA regulations, new water supplies must be imported into the Subbasin [i.e. project(s)] and/or groundwater pumping must be reduced through management action(s).

In addition to project and management actions that address chronic declines in groundwater levels and depletion of groundwater in storage, this section also provides a brief discussion of land subsidence, potential depletion of interconnected surface waters, and groundwater quality trends that occurred during WY 2020.

The projects and management actions described in this section are all intended to help achieve groundwater sustainability in the Subbasin and avoid undesirable results.

8.2 Implementation Approach

As described in the GSP, the volume of groundwater pumping in the Subbasin is more than the estimated sustainable yield and, as a result, groundwater levels are persistently declining in some parts of the Subbasin. In response, the GSAs have initiated several projects and management actions designed to address the impacts of the decline in groundwater levels and reductions of groundwater in storage. It is anticipated that additional new projects and management actions, some of which are described herein, will be implemented in the near future to continue progress towards avoiding or mitigating undesirable results.

Some of the projects and management actions described in this section are Subbasin-wide initiatives and some are area-specific. Generally, the basin-wide management actions apply to all areas of the Subbasin and reflect relatively basic GSP implementation requirements. Area-specific projects have been designed to aid in mitigating persistent water level declines in certain parts of the Subbasin.

8.3 Basin-Wide Management Actions and Projects

8.3.1 Amendment #1 to the MOA

This management action is described in the First Annual Report (GSI, 2020) but is repeated here because the intent of the action and the results of its implementation are applicable and relevant to the reporting of WY 2020.

Originally, five GSAs, including the four current partners as well as Heritage Ranch Community Services District (CSD), entered into a Memorandum of Agreement (MOA) in September 2017. The purpose of the MOA was to establish a committee to develop a single GSP for the entire Subbasin. Furthermore, the GSAs intended to use the MOA as the framework for basin-wide cooperation to manage the Subbasin during the time between adoption of the GSP by the GSAs and approval of the GSP by DWR. As originally written, the MOA would automatically terminate upon DWR's approval of the GSP, which is expected sometime within a two-year window following GSP submittal.

Heritage Ranch CSD was an original party to the MOA but with basin boundary modification approval by DWR in 2019, the CSD is no longer in the Subbasin and has withdrawn from the MOA.

Prior to submittal of the GSP for DWR review and approval, each of the GSAs adopted the GSP pursuant to the terms of the MOA. Each GSA separately adopted resolutions amending the original MOA to remove the automatic termination language because the GSAs agree to continue cooperating on the GSP and its implementation pursuant to the framework established by the MOA until such time as a long-term governance structure is developed. The amendment (Amendment #1) allows for continued collaboration and cooperation among the GSAs to manage groundwater in the Subbasin and achieve sustainability. A copy of the amendment to the MOA is provided in Appendix G.

8.3.2 Water Neutral New Development

In October 2015, the County Board of Supervisors adopted the Water Neutral New Development (WNND) amendments to the County Land Use Ordinance (Title 22) and Building and Construction Ordinance (Title 19). The amendments require a 1:1 water offset for new non-agricultural development and new or expanded irrigated commercial crop production while providing a 5 AFY exemption for irrigated properties outside of an “area of severe decline” defined based on changes in groundwater elevation measurements from Spring 1997 to Spring 2013. The action to amend the ordinances was taken in response to declining groundwater levels to minimize further depletion of the groundwater resource. The 1:1 water offset requirement was originally intended to be a stopgap measure to avoid further depletion of the groundwater basin[9] until SGMA implementation and included a termination clause to expire upon the effective date of a final and adopted GSP. On November 5, 2019, the County Board of Supervisors extended the termination date of the WNND ordinances to January 1, 2022 and removed “off-site” agricultural water offsets.

The water offset requirement for planting new irrigated crops may affect properties in three ways:

- If there was existing irrigated crop production onsite within 5 years of application, the property can be replanted in the same crop type and acreage with an Ag Offset Exemption. Planting new or expanded crops would require an Onsite Offset Clearance showing the new crop would use the same amount of water as the existing crop, or less.

[9] The WNND programs apply to the Paso Robles Groundwater Basin, as defined by the 2002 Fugro study, which differs from the Bulletin 118 boundary of the Paso Robles Subbasin. There are about 103,000 acres within the Bulletin 118 Subbasin boundary that are not subject to the WNND programs, they are predominately dry farmed or grazing lands.

- If there was not existing irrigated crop production onsite within 5 years of application, and if the site is not within the area of severe decline, new irrigated crop production may be allowed with a one-time exemption to plant crops that use up to 5 AFY.
- If there was not existing irrigated crop production onsite within 5 years of application, and if the site is within the area of severe decline, then there are no options for new or expanded irrigated crop production.

Additional actions by the Board of Supervisors on August 18, 2020 amended the ordinances by clarifying that the requirements apply if the well(s) serving the proposed use are located within the groundwater basin or area of severe decline, as defined in the County land use ordinance.

The actions by the County Board of Supervisors described above, including extension of the WNND requirements, have been included in the Water Year 2020 Annual Report because they affect groundwater management in the Subbasin. However, WNND is a temporary management action enacted by the County pursuant to its police powers through land use authority, rather than GSA authority, and is set to expire on January 1, 2022, rather than a long-term management action identified in the GSP. Thus, its inclusion in the Water Year 2020 Annual Report shall not be construed as any sort of commitment on the part of the County to a further extension.

8.3.3 Paso Basin Aerial Groundwater Mapping Study

In November 2019, the County of San Luis Obispo joined in a pilot study through DWR and Stanford University to conduct aerial groundwater mapping of a large portion of the Subbasin utilizing Airborne Electromagnetic method (AEM). The goal of the study is to acquire survey data to characterize and map subsurface geologic structures as well as the presence and extent of clay, silt, sand, and gravel layers to a depth of approximately 1,000 to 1,400 feet below the ground surface.

The SkyTEM aerial survey was flown from November 5th to November 7th, 2019. Throughout 2020, the acquired data were compiled and analyzed. An initial data report was finalized and made public in October 2020 (SkyTEM, 2020) and a hydrogeologic conceptual model report summarizing the results and interpretations of the data is expected in early 2021. The results of the study will enhance understanding of groundwater flow within the Subbasin, the interconnectedness of different parts of the Subbasin, and the geologic framework that controls groundwater flow.

8.4 Area-Specific Projects

8.4.1 Installation of Monitoring Wells and Stream Gages (SEP)

The existing network of monitoring wells in the Alluvial Aquifer in areas where surface water and groundwater interaction may occur is insufficient for adequate assessment, and surface water flows in the Subbasin are ephemeral. Together, these two factors make it difficult to evaluate the interconnectivity of surface water and groundwater and to quantify whether any surface water depletion has occurred. There are no available data that establish whether the groundwater and surface water are connected through a continuous saturated zone in any aquifer, although water elevation contour maps of groundwater in the Paso Robles Formation Aquifer wells suggest that a continuous saturated zone between the surface water and the Paso Robles Formation Aquifer does not exist. The lack of publicly available groundwater level data for the Alluvial Aquifer is a significant data gap.

The inability to assess the interconnectivity of the surface water with the underlying aquifers also affects the understanding of the potential impacts of pumping on groundwater dependent ecosystems (GDEs), which are plant and animal communities that require groundwater to meet some or all of their water needs. GDEs can be associated with areas where there is a direct connection between shallow alluvial water-bearing formations and deeper aquifers. The existing groundwater monitoring program in the Subbasin does not include any nested monitoring wells that can be used to assess the interaction between the surface stream flows, associated Alluvial Aquifer, and the underlying Paso Robles Formation Aquifer.

Per the recommendations set forth in the GSP, *"Definitive data delineating any interconnections between surface water and groundwater or a lack of interconnected surface waters is a data gap that will be addressed during implementation of this GSP."* To address this significant data gap and assess the potential for interconnectivity of the surface water with the principal aquifers of the Subbasin, the City of Paso Robles GSA submitted a proposal to the SWRCB for the use of Supplemental Environmental Project (SEP) funds that are available as a result of a settlement agreement between the SWRCB and the City of Paso Robles for violations of the City's National Pollutant Discharge Elimination System (NPDES) permit related to wastewater treatment releases.

Through the assistance of the SEP funds, the potential for interconnected surface water within the Alluvial Aquifer will be assessed after data from this expanded network of monitoring wells and stream gages are developed and analyzed. Currently, two stream gages exist within the Subbasin. The initial phase of work utilizing the SEP funds will expand that network by coupling stream gages with monitoring wells.

The GSAs recognize that installing the proposed network of monitoring wells and stream gages throughout the Subbasin will require a significant initial capital investment as well as a commitment of resources and funding for annual operation and maintenance of the sites. Thus, the GSAs intend to implement the proposed monitoring network over time. The initial work effort for monitoring well installation, therefore, is planned for two sites, including the Salinas River at the 13th Street Bridge in the city of Paso Robles, and the Estrella River at Airport Road (Cleath-Harris Geologists, 2020a; a copy of the summary report is provided in Appendix H). Construction of two monitoring wells at each site (four total) is planned for 2021. If budget permits, a third well at the Estrella River/Airport Road site is planned.

The SEP project will install stream gages that record stream stage; rating curve development is not part of the project. Stage data without a rating curve is useful for identifying flow/no flow conditions and the timing of stormwater runoff when analyzed with rain gages and other stream gages in the watershed. The stage data may also be used to evaluate the interconnectivity of surface water and groundwater. The SEP project funds were sufficient for performing the feasibility analysis of stream gage installation, identifying potential sites, developing a work plan, and installing up to three gages (Cleath-Harris Geologists, 2020b; a copy of the summary report is provided in Appendix H). The three new stream gage sites, which will be installed in 2021, are:

- Salinas River at the River Road Bridge in San Miguel
- Estrella River at the River Grove Drive Bridge in Whitley Gardens
- Huer Huero Creek at the Geneseo Road Bridge near Eagle Oak Ranch Way

8.4.2 City of Paso Robles Recycled Water Program

In 2016, the City completed a major upgrade of its Wastewater Treatment Plant to remove all harmful pollutants efficiently and effectively from the wastewater. The City's master plan is to produce tertiary-quality recycled water and distribute it to various locations within the City as well as east Paso Robles, where it may be used for irrigation of city parks, golf courses, and vineyards. This will reduce the need to pump groundwater from the Subbasin and will further improve the sustainability of the City's water supply. In 2019, the City began operating the recycled water system. Some sections of the distribution system are currently in construction in anticipation of eventually building the full system, pending development of funding mechanisms.

The project will have the capacity to use up to 2,200 AFY of disinfected tertiary effluent for in-lieu recharge inside the City of Paso Robles and in the central portion of the Subbasin (see Section 8.4.4) Water that is not used for recycled water purposes can potentially be discharged to surface infiltration facilities, such as Huer Huero Creek, with the possibility for additional recharge benefits.

The primary benefit from the City's Recycled Water Program is higher groundwater elevations in the central portion of the Subbasin due to in-lieu recharge from the direct use of the recycled water and potential surface recharge opportunities.

8.4.3 San Miguel CSD Recycled Water Project

The San Miguel CSD Recycled Water project is currently in the final design phase. This planned project will upgrade the CSD wastewater treatment plant to meet California Code of Regulations (CCR) Title 22 criteria for disinfected secondary recycled water for irrigation use by vineyards. Potential customers include a group of agricultural irrigators on the east side of the Salinas River, and a group of agricultural customers northwest of the wastewater treatment plant. The project could provide between 200 AFY and 450 AFY of additional water supplies. The primary benefit from the CSD's Recycled Water project is higher groundwater elevations in the vicinity of the community of San Miguel due to in-lieu recharge from the direct use of the recycled water.

8.4.4 Blended Water Project

Private entities and individuals are working actively with the City of Paso Robles and numerous agricultural irrigators to develop a project that can bring recycled water to the central portion of the Subbasin. As described above, the City estimates that as much as 2,200 AFY of recycled water will be available, and the volume will likely increase in the future as the City grows. The wastewater treatment plant is designed to process and deliver up to 4,000 AFY.

The goal of the Blended Water Project is to design and construct a pipeline system to connect to the City's Recycled Water Program and convey recycled water into the agricultural areas east of the City. Although there are many ways to utilize the Recycled Water Program water directly, certain challenges exist to make the water quality of the recycled water attractive to some agricultural users. Blending the recycled water with surplus Nacimiento Water Project water, when available, may mitigate these challenges. Additional challenges with the use of NWP water include acreage limitations on the place of use for irrigated agricultural lands within SLO County – a constraint in the existing water right held by the Monterey County Water Resources Agency.

Numerous challenges exist to develop the project, but considerable time and effort has been expended by several private entities as well as City and County staff to develop this conceptual project. The primary benefit from the Blended Water Project is higher groundwater elevations in the central portion of the Subbasin east of the City of Paso Robles due to reductions in groundwater pumping for irrigation and in-lieu recharge from the direct use of the blended water. Associated benefits may include improved groundwater quality from the use and recharge of high-quality irrigation water.

8.4.5 Stormwater Capture and Recharge Projects

As described in the GSP, stormwater runoff capture projects, including low-impact development (LID) standards for new or retrofitted construction, will be promoted throughout the Subbasin as priority projects to be implemented as described in the San Luis Obispo County Stormwater Resource Plan (SWRP). The SWRP outlines an implementation strategy to ensure valuable, high-priority projects with multiple benefits.

This management action covers two types of stormwater capture activities. The first stormwater management activity is the effort to reduce runoff of rainwater in the urban environment into streets, storm drains, and other sites that discharge water as well as pollutants directly into waterways and the underlying aquifer through infiltration of streamflow recharge. In this way, groundwater quality is protected and improved. Examples of this effort include LID and on-farm recharge of local runoff.

The second stormwater capture effort involves direct recharge of storm flows through the capture and diversion of water to recharge locations to help maintain base flows in streams and to replenish aquifer storage.

Two stormwater capture programs are underway in the Subbasin, including the City of Paso Robles's Municipal Stormwater Program and joint efforts by the Shandon-San Juan Water District (SSJWD) and Estrella-El Pomar-Creston Water District (EPCWD) to assess the feasibility of developing stormwater capture and recharge projects in their respective districts and Subbasin-wide.

8.4.5.1 City of Paso Robles Municipal Stormwater Program

The City of Paso Robles (City) implements a municipal stormwater program pursuant to the State's General Permit for the Discharge of Storm Water from Small Municipalities (Order 2003-0005-DWQ). As such, the stormwater program implements six major program elements to not only address improvements and protection of water quality but encourage groundwater recharge. The City implements its post-construction program, which is one of the six major program elements, where both private and public development projects are conditioned to design, construct and maintain specific stormwater features. These stormwater features, such as retention basins or bioretention swales, improve stormwater runoff generated from the new development project as well as encourage groundwater infiltration. By law, these stormwater features are proposed as part of the greater development project through the City's application process then evaluated and approved by City staff. Once constructed, the City conducts annual assessments of these post-construction stormwater features to determine their effectiveness and evaluate the need for maintenance ensuring their intended design efficiency.

In addition, the City is currently developing the Paso Robles Watershed Plan (PRWSP) for the purpose of providing the City flexibility in identifying optimal locations for the design and installation of stormwater features. Stormwater features are evaluated, scored, and ranked depending on their location, design, and intended purpose. Stormwater feature types and locations provide multi-beneficial uses such as stormwater capture, trash capture, and groundwater infiltration. The PRWSP also provides a roadmap for a crediting system where the City designs and installs a stormwater feature and creates water quality credits. Subsequently, developers proposing to construct projects within the City limits have flexibility to pay for water quality credits or install a stormwater feature on-site. This crediting system inherently provides greater flexibility to both the City as well as local developers. As a result, the City will have greater ability to install stormwater capture and groundwater recharge facilities in optimal locations throughout the City.

8.4.5.2 SSJWD/EPCWD Stormwater Capture and Recharge Feasibility Study

The SSJWD and EPCWD jointly funded a study to assess the feasibility of capturing stormwater runoff and recharging aquifers in the Subbasin. The summary report of the initial feasibility study was finalized in 2020 (GSI, 2020). The districts are now evaluating possible next step efforts.

Stormwater capture and recharge is a concept for augmenting natural recharge to a groundwater basin, thereby improving groundwater levels. The concept involves building diversion structures to divert storm flows from a stream above a certain allowed volume, capture those flows by diverting to nearby fields or undeveloped areas, and inundating the fields to allow for passive infiltration. The SSJWD/EPCWD study is a screening level feasibility study to locate sites where stormwater (flood) flow can be captured and used to recharge aquifers within the Subbasin. The study identifies areas with favorable soil, topography, and aquifer characteristics and estimates the stormwater amount from the tributary watersheds contributing to the surface flows in the Salinas and Estrella rivers and San Juan and Huer Huero creeks. Of particular focus are areas where the recharge water would migrate directly into the underlying Paso Robles Formation aquifer, the principal aquifer serving most irrigation demands in the basin. The study scope consisted of two main tasks, including (1) identification of optimum target areas for stormwater recharge, and (2) quantification of availability of stormwater for capture and potential recharge.

The key aspects of spatially distributed information and considerations used to delineate recharge target areas included:

- Topography
- Surficial soil hydraulic properties
- Aquifer hydraulic properties
- Surficial geology
- Groundwater occurrence and depth
- Proximity to a 100-year flood zone area
- Proximity to water treatment plants
- Proximity to septic tanks
- Proximity to wells

The State Water Resources Control Board (SWRCB) will permit diversions of stormflows that are 20 percent of the 90 percent exceedance flows, which occur, on average, 10 percent of the time. Thus, the long-term potential benefit of stormwater capture projects in the Subbasin are somewhat limited. The study assessed the potential for capturing stormwater at five separate locations in the Subbasin, including two sites on the Estrella River, two sites on San Juan Creek, and one site on Huer Huero Creek. The results showed that the potential volumes of available recharge ranged from highs of 280 AFY, 20,500 AFY, and 0 AFY in average, wet, and dry hydrologic years, respectively, to as little as 0 AFY, 630 AFY, and 0 AFY in average, wet, and dry hydrologic years, respectively. A copy of the GSI (2020) summary report is provided in Appendix I.

The districts are currently assessing possible next steps, including identification of alternative recharge locations, site specific project investigations, and permitting and regulatory requirements.

8.4.6 Expansion of Monitoring Well Network

As described in the GSP, SGMA regulations require a sufficient density of monitoring wells to characterize the groundwater elevation in each principal aquifer. The GSP concluded that a significant data gap existed in the number of monitoring wells in both the Alluvial Aquifer and Paso Robles Formation Aquifer within the Subbasin. The City of Paso Robles GSA project (using SEP funds) will partially address this data gap by drilling new monitoring wells, as described in Section 8.4.1.

The 22 wells in the Paso Robles Formation Aquifer monitoring network are insufficient to develop representative and sufficiently detailed groundwater contour maps. The lack of publicly available data for the aquifer is identified as a data gap that must be addressed in GSP implementation. This section describes new projects and initiatives undertaken by SLOFCWCD, Shandon-San Juan GSA (SSJGSA), and EPCWD to expand the collection of water level data in the Paso Robles Formation Aquifer and develop potential new monitoring wells in their respective districts.

8.4.6.1 SLOFCWCD Initiative to Expand the Monitoring Well Network on Public Properties

On July 7, 2020, the County Board of Supervisors directed staff to evaluate groundwater wells that are located on public properties and include them into the SLOFCWCD's existing monitoring network. County staff is evaluating approximately 6 groundwater wells in the Paso Robles Subbasin and has identified 2-3 wells on public properties that are suitable to be added to the semiannual groundwater level measuring program.

8.4.6.2 SSJGSA Program to Expand the Monitoring Well Network

The SSJGSA initiated a program in WY 2020 to enlist many well owners that are members of the SSJWD to join a pilot study to measure water levels in wells throughout the District. The initial effort is to measure water levels in as many as 60 wells on a weekly basis throughout the spring and fall of WY 2021 to gain a better understanding of the time of year of the seasonal high and low water levels. During the summer and winter seasons, water levels will be measured monthly.

After about a year of this extensive monitoring and recording program, the data will be analyzed with the intent to reduce the number of measuring points as well as frequency of measurements. The eventual goal of the program is to develop a network of 20 to 30 new wells to incorporate into the GSP RMS monitoring network.

8.4.6.3 EPCWD Program to Expand the Monitoring Well Network

The EPCWD initiated a program in WY 2020 similar to the SSJWD program. The District is enlisting as many as 20 to 40 property owners that are members of the District to allow a District subcontractor to measure water levels in their wells on a monthly to quarterly basis. Like the SSJGSA program, the eventual goal of the EPCWD initiative is to develop a network of 20 to 30 new wells to incorporate into the GSP RMS monitoring network.

8.4.7 Expansion of Salinas Dam and Ownership Transfer

One of the conceptual projects discussed in the GSP (Section 9.5.2.7 of the GSP) is expansion of the Salinas Dam. The dam is owned by the United States Army Corps of Engineers (USACE), which jointly holds Santa Margarita Reservoir water rights permits with the City of San Luis Obispo (City of SLO). The USACE leases the dam to the SLOFCWCD, who oversees its operation and maintenance, including water delivery to the City of SLO.

The original dam design included the installation of spillway gates that would raise the reservoir elevation, however they were not installed due to seismic safety concerns. The storage capacity of Santa Margarita Reservoir could be expanded by installing the spillway gates, potentially increasing the maximum volume in the reservoir from 23,843 AF to 41,792 AF.

As described in the GSP, expanded reservoir storage might benefit the Subbasin by scheduling summer releases from reservoir storage to the Salinas River, which would benefit the Subbasin by increasing streamflow recharge through augmented flows in the Salinas River. Another way the project might indirectly benefit the Subbasin is if the City of SLO could increase their Santa Margarita Reservoir deliveries, thereby freeing up a portion of their NWP water allocation for purchase by the GSAs.

In 2018, the USACE initiated a Disposition Study to evaluate options to dispose of the Salinas Dam, including transferring ownership to a local agency. An option under investigation is to transfer the dam to a local agency such as the SLOFCWCD, thus the USACE has requested that the County Board of Supervisors, acting in their role as the SLOFCWCD, submit a letter expressing interest in potentially moving forward with the ownership transfer process. Such an ownership transfer would help facilitate the dam expansion, should it prove to be a cost-effective and worthwhile project.

Some of the known issues with transferring ownership of the dam include:

- The USACE has indicated that the Salinas Dam has some deficiencies but is considered low risk. As such, the USACE has indicated that the dam would need to be transferred “as-is”, with the USACE only willing to consider providing minimal funding to support retrofit.
- The State, as the California DWR Division of Safety of Dams (DSOD), has indicated that seismic rehabilitation of Salinas Dam would be required. Any retrofit or structural improvements, including expanding the dam’s capacity, will require coordination with and approval by the DSOD following acquisition of the dam by the SLOFCWCD.
- Since the USACE has indicated they are unlikely to install the gates, ownership of the dam would need to be transferred from the federal government to a local agency to pursue the opportunity. This transfer would result in the Salinas Dam oversight responsibilities transferring from federal to state jurisdiction and require the dam retrofit and expansion to meet any additional requirements from the State.

On September 22, 2020, the County Board of Supervisors approved sending a letter to the USACE expressing interest in moving forward with the ownership transfer process. These actions by the County will require considerable time and expense to eventually bring this potential project to fruition and increase the local water supply resiliency, including potential benefits to the Subbasin and other public or private entities downstream of the dam along or near the Salinas River.

8.5 Summary of Progress toward Meeting Subbasin Sustainability

Relative to the basin conditions at the end of the study period as reported in the GSP, the First Annual Report (WYs 2017–2019) (GSI, 2020) and this Water Year 2020 Annual Report together indicate an improvement in groundwater conditions throughout the Subbasin and a modest increase of total groundwater in storage. It is clear that historical groundwater pumping in excess of the sustainable yield has created challenging conditions for sustainable management. However, actions are already underway to collect data, improve the monitoring and data collection networks, and coordinate with affected agencies and entities throughout the Subbasin to develop solutions that address the shared mutual interest in the Subbasin’s overall sustainability goal.

8.5.1 Subsidence

Land subsidence is the lowering of the land surface. As described in the GSP, several human-induced and natural causes of subsidence exist, but the only process applicable to SGMA are those due to permanently lowered ground surface elevations caused by groundwater pumping (M&A, 2020). Historical subsidence can be estimated using Interferometric Synthetic Aperture Radar (InSAR) data provided by DWR. InSAR measures ground elevation using microwave satellite imagery data. The GSP documents minor subsidence in the Subbasin using data provided by DWR depicting the difference in InSAR measured ground surface elevations between June 2015 and June 2018. These data show that subsidence of up to 0.025 feet may have occurred over this three-year period in a few small, isolated areas of the Subbasin (M&A, 2020). As of the date of this report, updated InSAR data has been provided by DWR through September 2019. As discussed in the GSP, there is a potential error of 0.1 feet (or 1.2 inches) associated with the InSAR measurement and reporting methods. A land surface change of less than 0.1 feet is therefore within the noise of the data, and is equivalent to no subsidence. Considering this range of potential error, examination of the June 2018 through September 2019 InSAR data show that zero land subsidence has occurred since June 2018 (Figure 13). Therefore, subsidence of up to 0.025 feet may have occurred in a few small, isolated areas over the four-year period between June 2015 and September 2019. The GSA's will continue to monitor and report annual subsidence as more data become available.

8.5.2 Interconnected Surface Water

Ephemeral surface water flows in the Subbasin make it difficult to assess the interconnectivity of surface water and groundwater and to quantify the degree to which surface water depletion has occurred. Currently, there are no available data that establish connectivity between groundwater and surface water through a continuous saturated zone in any aquifer. As stated in the GSP, water elevation contour maps of the Paso Robles Formation wells may suggest that a continuous saturated zone between the surface water and the Paso Robles Formation aquifer does not exist (M&A, 2020). As of the date of this report, there are no more recent data available since publication of the GSP to assess the interconnectivity of surface water and groundwater or to quantify potential surface water depletion. The potential for interconnected surface water with the Alluvial Aquifer will be assessed as data are developed and analyzed as discussed in Section 8.4.1.

8.5.3 Groundwater Quality

Although groundwater quality is not a primary focus of SGMA, actions or projects undertaken by GSAs to achieve sustainability cannot degrade water quality to the extent that they would cause undesirable results. As stated in the GSP, groundwater quality in the Subbasin is generally suitable for both drinking water and agricultural purposes (M&A, 2020). Eight constituents of concern (COC's) were identified and discussed in the GSP that have the potential to be impacted by groundwater management activities. These COC's identified in the GSP are salinity (as indicated by electrical conductivity), total dissolved solids (TDS), sodium, chloride, nitrate, sulfate, boron, and gross alpha. For this Water Year 2020 Annual Report, trends of concentrations of these eight COC's were analyzed through WY 2020 using data from the GeoTracker GAMA database (GAMA, 2021). All but one of the COC's reviewed show a steady concentration trend since 2016. Gross alpha, the exception, exhibits a slight downward trend since 2016, driven mostly by sampling results from the City of Paso Robles area.

Overall, there are no significant changes to groundwater quality since 2016, as documented in the GSP, the First Annual Report, and this Water Year 2020 Annual Report. Implementation of sustainability projects and/or management actions, as presented in the GSP, in this Water Year 2020 Annual Report, or in future reports or GSP updates, are not anticipated to result in degraded groundwater quality in the Subbasin. Any potential changes in groundwater quality will be documented in future annual reports and GSP updates.

8.5.4 Summary of Changes in Basin Conditions

Despite below-average precipitation in 2018 and 2020, the above-average precipitation water years of 2017 and 2019 improved groundwater conditions in the Subbasin. Groundwater in storage in the Subbasin increased more than 45,000 AF in total over the past four water years. Although groundwater in storage has increased, groundwater pumping continues to exceed the estimated future sustainable yield and the projects and management actions described in the GSP and in this Water Year 2020 Annual Report will be necessary in order to bring the Subbasin into sustainability.

8.5.5 Summary of Impacts of Projects and Management Actions

Additional time will be necessary to judge the effectiveness and quantitative impacts of the projects and management actions either now underway or in the planning and implementation stage. However, it is clear that the actions in place and as described in this Water Year 2020 Annual Report are a good start towards reaching the sustainability goals laid out in the GSP. It is too soon to judge the observed changes in basin conditions against the interim goals outlined in the GSP, but the anticipated effects of the projects and management actions now underway are expected to significantly affect the ability of the Subbasin to reach the necessary sustainability goals.

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Todd Groundwater, RMC Woodard & Curran (Todd). 2017. Paso Robles Basin Recharge Siting Feasibility Study for the Huer Huero Creek: unpublished consultant report prepared for the San Luis Obispo County Flood Control and Water Conservation District.

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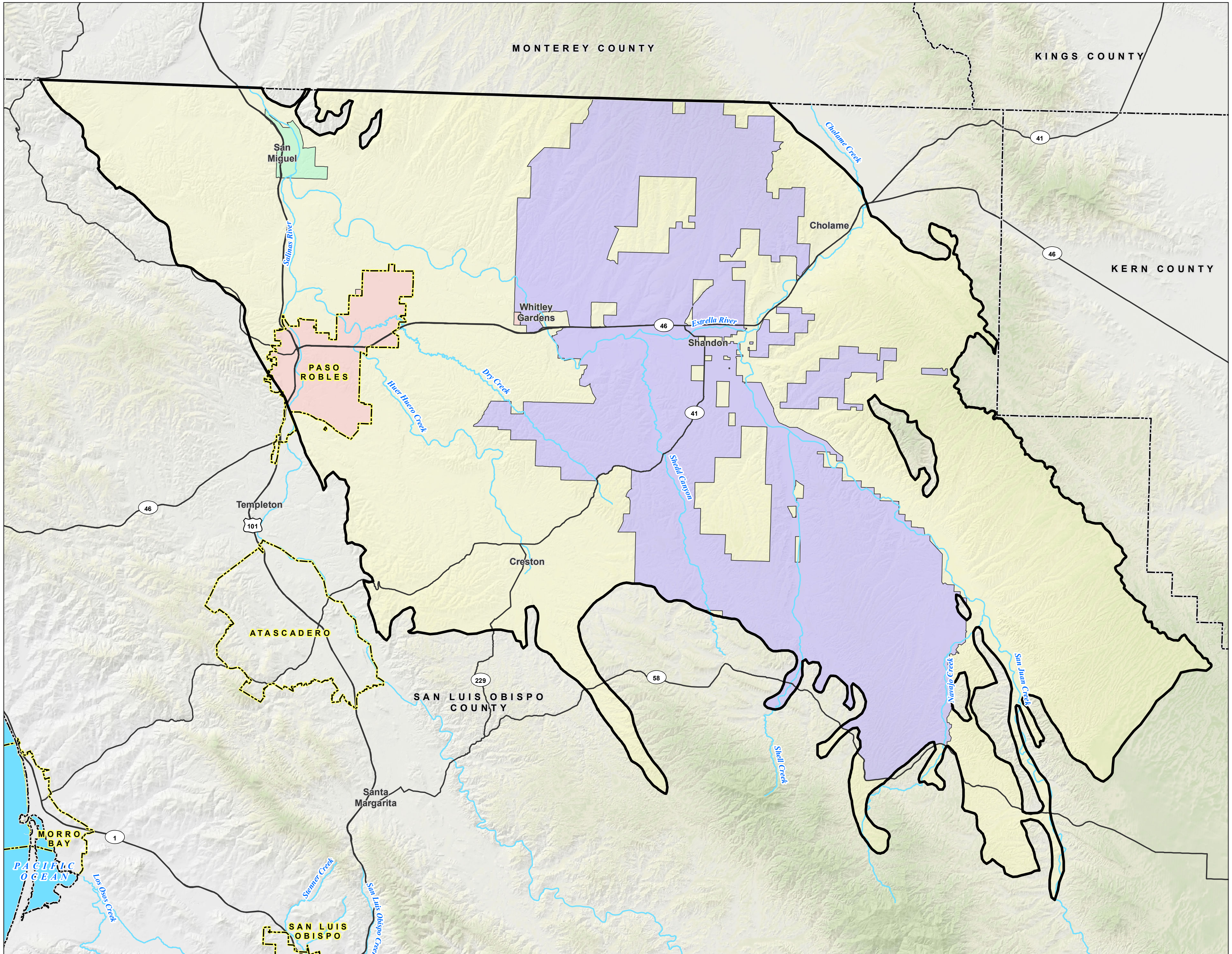
FIGURES

FIGURE 1

Extent of the Paso Robles Subbasin and Exclusive Groundwater Sustainability Agencies

Paso Robles Subbasin
Water Year 2020 Annual Report



LEGEND

- Paso Robles Subbasin

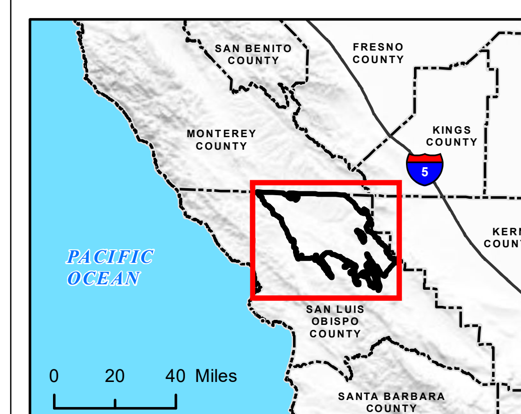
Exclusive Groundwater Sustainability Agencies

- San Miguel Community Services District
- City of Paso Robles
- Shandon- San Juan Water District
- Paso Basin - County of San Luis Obispo

All Other Features

- County Boundary
- City Boundary
- Major Road
- Watercourse
- Waterbody

LOCATOR MAP:



N

0 10,000 20,000 30,000
Feet

Date: February 16, 2021
Data Sources: CA DWR, SLO Co., USGS

GSI Water Solutions, Inc.

Document Path: Y:\0824_PasoRobles\Source_Figures\002_Annual_Report_2020\Figure1_Paso_Robles_Subbasin_and_Exclusive_GW_Sust_Agencies.mxd

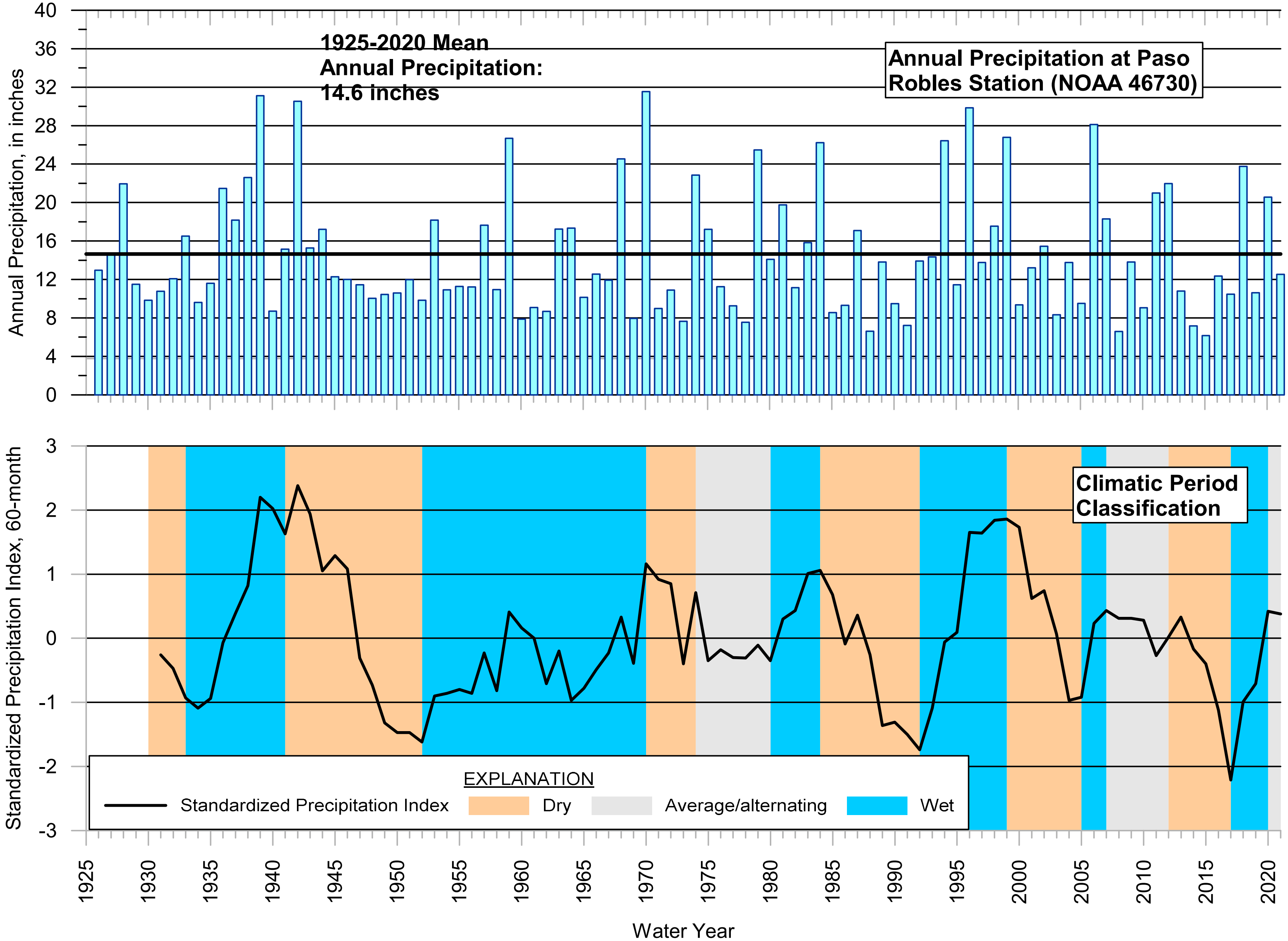


FIGURE 2

Annual Precipitation and Climatic Periods in the Paso Robles Subbasin

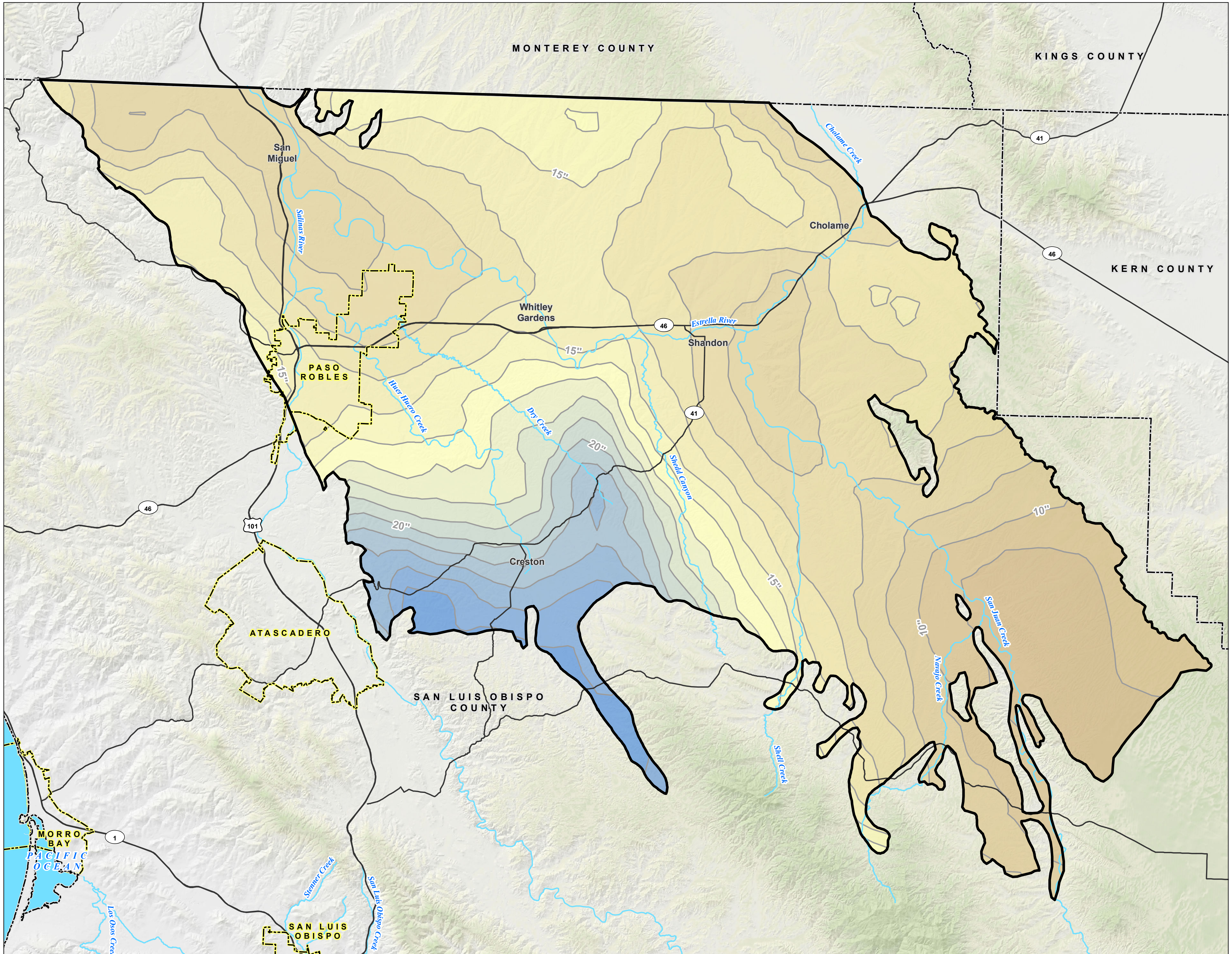
Paso Robles Subbasin Water Year 2020 Annual Report

P:\Portland\824-Paso Robles\001-GSP Annual Report\Analysis\ClimatePeriods\Grapher\AnnualRpt_SPI_1925_2019_60month_wTitle.grf

FIGURE 3

Average Distribution of Annual Precipitation in the Paso Robles Subbasin

Paso Robles Subbasin
Water Year 2020 Annual Report



LEGEND

- Paso Robles Subbasin
- 1 in. Precipitation Contour

Annual Precipitation (in.)

- 8 - 9
- 9 - 10
- 10 - 11
- 11 - 12
- 12 - 13
- 13 - 14
- 14 - 15
- 15 - 16
- 16 - 17
- 17 - 18
- 18 - 19
- 19 - 20
- 20 - 21
- 21 - 22
- 22 - 23
- 23 - 24
- 24 - 25

All Other Features

- County Boundary
- City Boundary
- Major Road
- Watercourse
- Waterbody

NOTE

Average distribution of annual precipitation based on 30-year normal PRISM data calibrated to the Paso Robles Station (NOAA 46730).

N

0 10,000 20,000 30,000
Feet

Date: February 16, 2021
Data Sources: CA DWR, SLO Co., USGS, PRISM (OregonState).

GSI Water Solutions, Inc.

Document Path: Y:\0824_PasoRobles\Source_Figures\002_Annual_Report_2020\Figure3_Avg_Dist_Annual_Precip.mxd

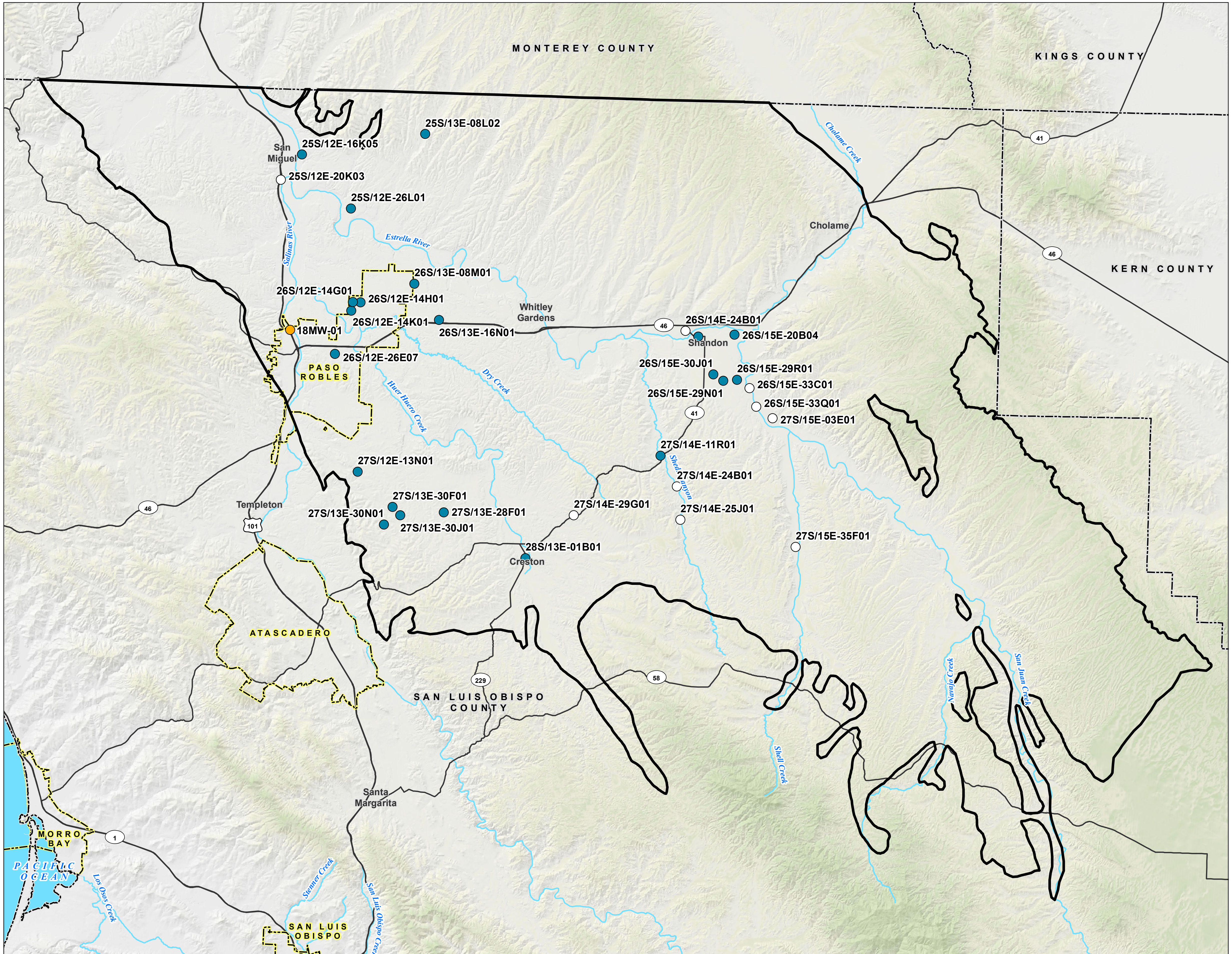


FIGURE 4

Groundwater Elevation Monitoring Well Network in the Paso Robles Subbasin

Paso Robles Subbasin
Water Year 2020 Annual Report

LEGEND

Wells

- Paso Robles Formation
- Alluvial Aquifer
- Potential Future Monitoring Well

All Other Features

- Paso Robles Subbasin
- County Boundary
- City Boundary
- Major Road
- Watercourse
- Waterbody

N

0 10,000 20,000 30,000
Feet

Date: February 16, 2021
Data Sources: CA DWR, SLO Co., City of Paso Robles, USGS

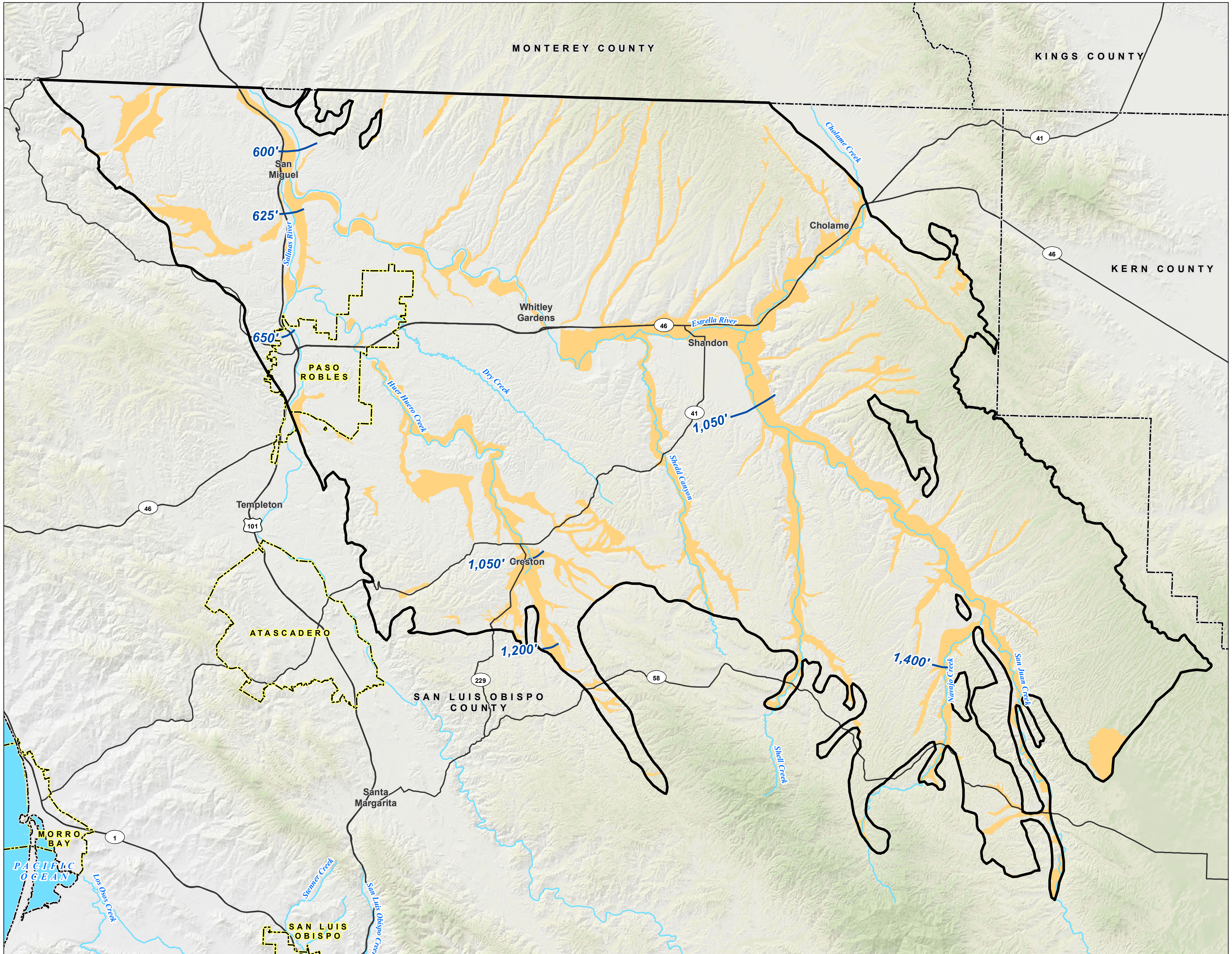
GSI Water Solutions, Inc.

Document Path: Y:\0824_PasoRobles\Source_Figures\002_Annual_Report_2020\Figure4_GW_Elev_Monitoring_Well_Network.mxd

FIGURE 5

Alluvial Aquifer Groundwater Elevation Contours

Paso Robles Subbasin
Water Year 2020 Annual Report



LEGEND

- Alluvial Groundwater Elevation Contour, in feet above mean sea level
- Paso Robles Subbasin

Geologic Alluvial Units

- Qal: Alluvial Deposits

All Other Features

- County Boundary
- City Boundary
- Major Road
- Watercourse
- Waterbody

N

0 10,000 20,000 30,000
Feet

Date: February 16, 2021
Data Sources: CA DWR, SLO Co., Montgomery, USGS

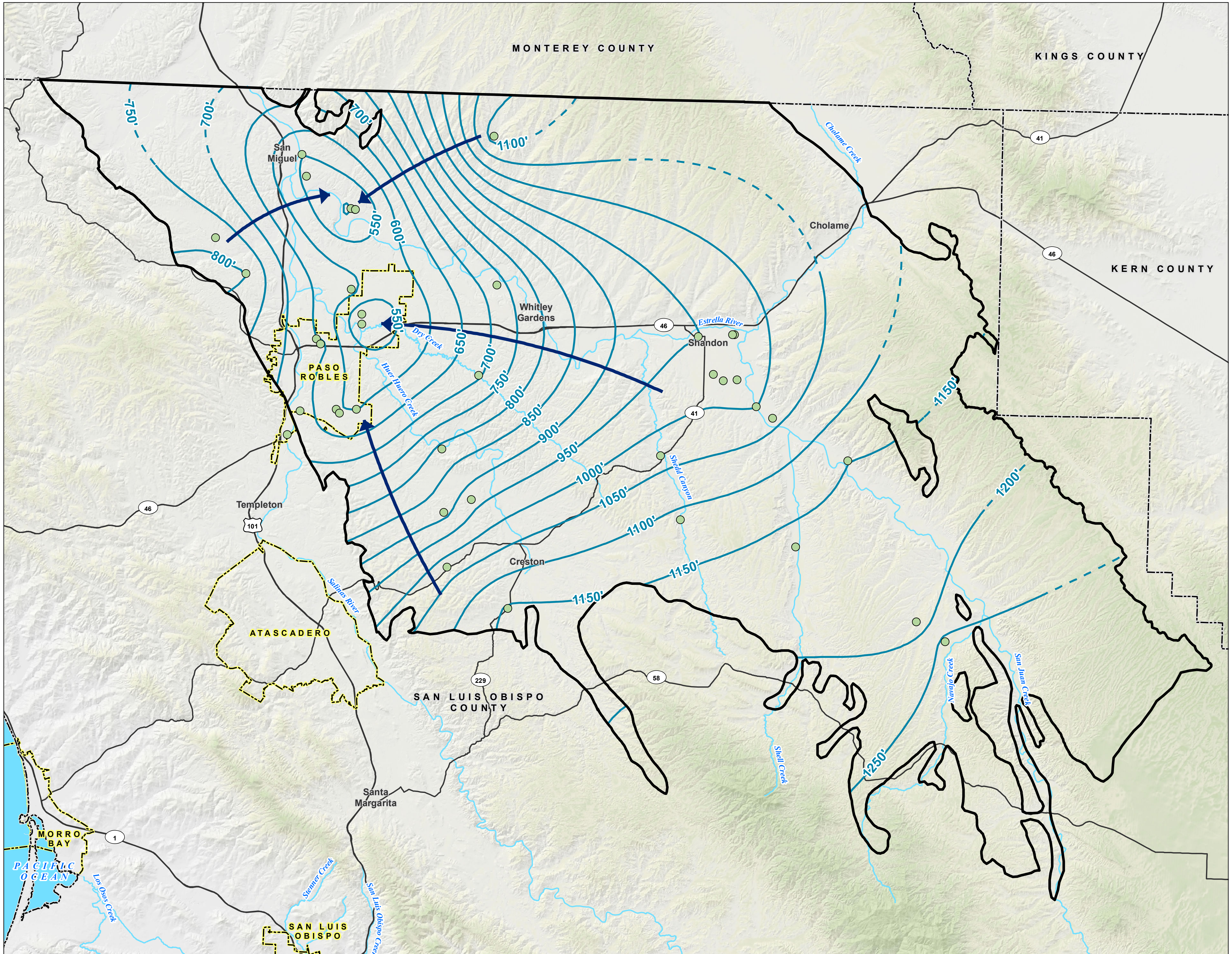
GSI Water Solutions, Inc.

Document Path: Y:\0824_PasoRobles\Source_Figures\002_Annual_Report_2020\Figure5_Alluvial_Aquifer_GW_Elev_Contours.mxd

FIGURE 6

Paso Robles Formation Aquifer Spring 2020 Groundwater Elevation Contours

Paso Robles Subbasin
Water Year 2020 Annual Report



Document Path: Y:\0824_PasoRobles\Source_Figures\002_Annual_Report_2020\Figure6_Spring_2020_GW_Contours.mxd

LEGEND

- Well providing data for Paso Robles Formation Aquifer
- Spring 2020 Groundwater Elevation Contour in feet above mean sea level; dashed where inferred
- Inferred Groundwater Flow Direction
- Paso Robles Subbasin

All Other Features

- County Boundary
- City Boundary
- Major Road
- Watercourse
- Waterbody

N

0 10,000 20,000 30,000
Feet

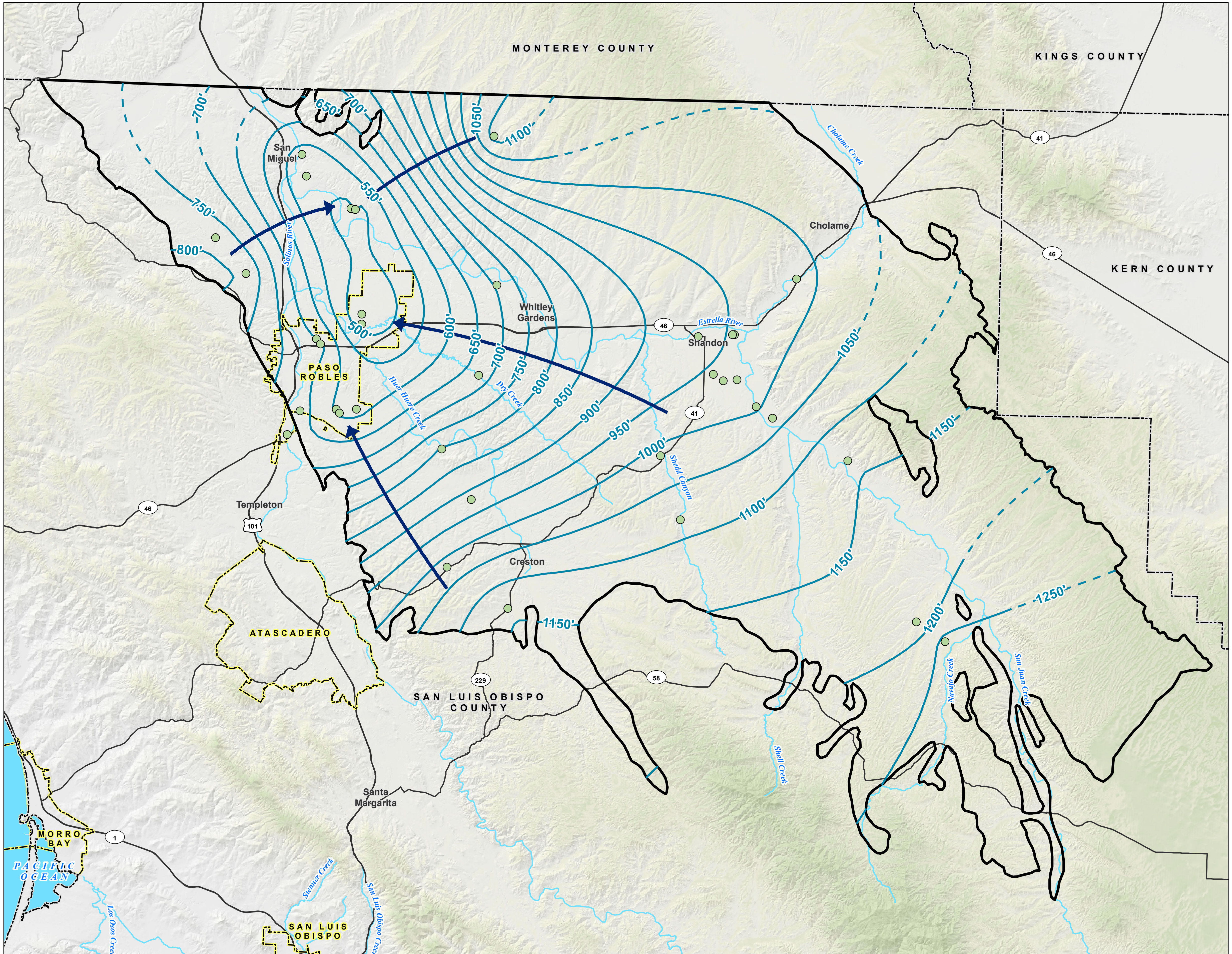
Date: February 16, 2021
Data Sources: CA DWR, SLO Co., USGS

GSI Water Solutions, Inc.

FIGURE 7

Paso Robles Formation Aquifer Fall 2020 Groundwater Elevation Contours

Paso Robles Subbasin
Water Year 2020 Annual Report



LEGEND

- Well providing data for Paso Robles Formation Aquifer
- Fall 2020 Groundwater Elevation Contour in feet above mean sea level; dashed where inferred
- Inferred Groundwater Flow Direction
- Paso Robles Subbasin

All Other Features

- County Boundary
- City Boundary
- Major Road
- Watercourse
- Waterbody

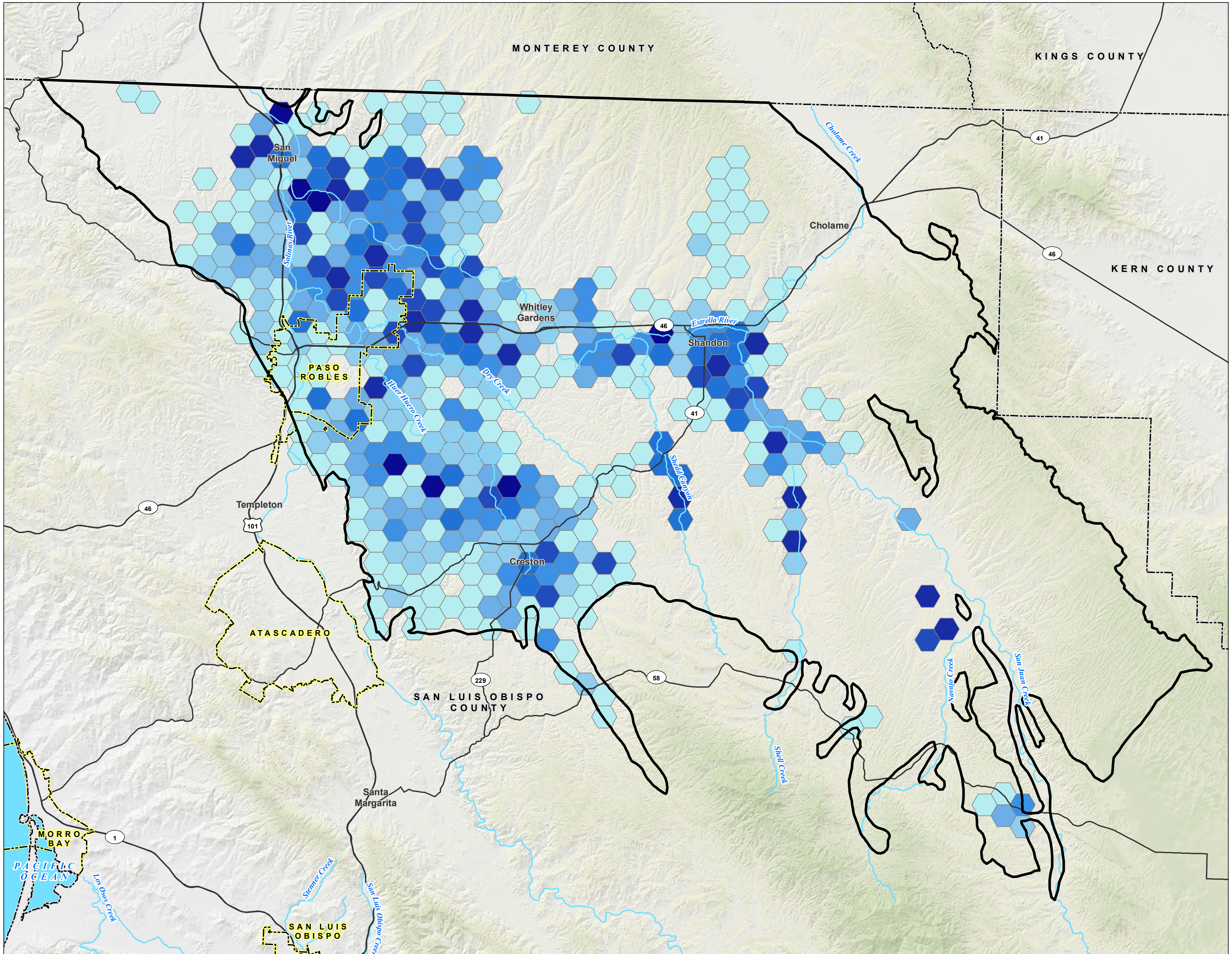
N

0 10,000 20,000 30,000
Feet

GSI Water Solutions, Inc.

Date: February 16, 2021
Data Sources: CA DWR, SLO Co., USGS

Document Path: Y:\0824_PasoRobles\Source_Figures\002_Annual_Report_2020\Figure7_Fall_2020_GW_Contours.mxd



Document Path: Y:\0824_PasoRobles\Source_Figures\002_Annual_Report_2020\Figure8_General_Locs_and_Volumes_of_GW_Extractions.mxd

FIGURE 8

General Locations and Volumes of Groundwater Extraction

Paso Robles Subbasin
Water Year 2020 Annual Report

LEGEND

Paso Robles Subbasin

Water Year 2020 Groundwater Extraction (AFY)

- 1 - 30
- 31 - 91
- 92 - 173
- 174 - 264
- 265 - 394
- 395 - 608
- 609 - 887
- 888 - 1476

All Other Features

- County Boundary
- City Boundary
- Major Road
- Watercourse
- Waterbody

NOTE

AFY: Acre-Feet per Year

N

0 10,000 20,000 30,000
Feet

Date: February 16, 2021
Data Sources: CA DWR, SLO Co., Soil Water Balance Model, USGS

GSI Water Solutions, Inc.

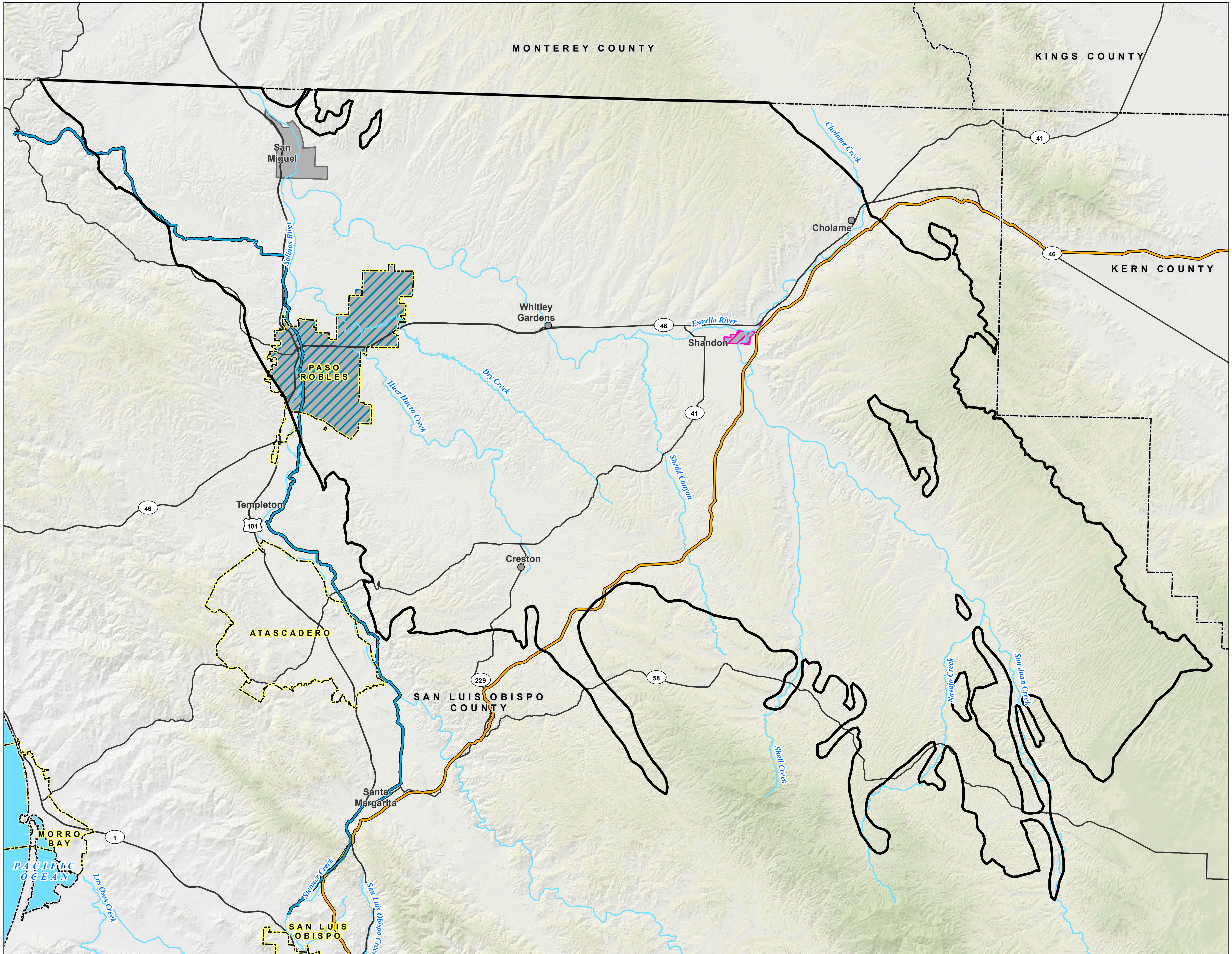


FIGURE 9

Communities Dependent on Groundwater and with Access to Surface Water

Paso Robles Subbasin
Water Year 2020 Annual Report

LEGEND

- Nacimiento Water Project Pipeline
- State Water Project Pipeline
- Community Dependent Solely on Groundwater
- Community Served by Groundwater and Nacimiento Water Project
- Community Served by Groundwater and State Water Project
- Paso Robles Subbasin

All Other Features

- County Boundary
- City Boundary
- Major Road
- Watercourse
- Waterbody

N

0 10,000 20,000 30,000
Feet

Date: February 16, 2021
Data Sources: CA DWR, SLO Co., USGS

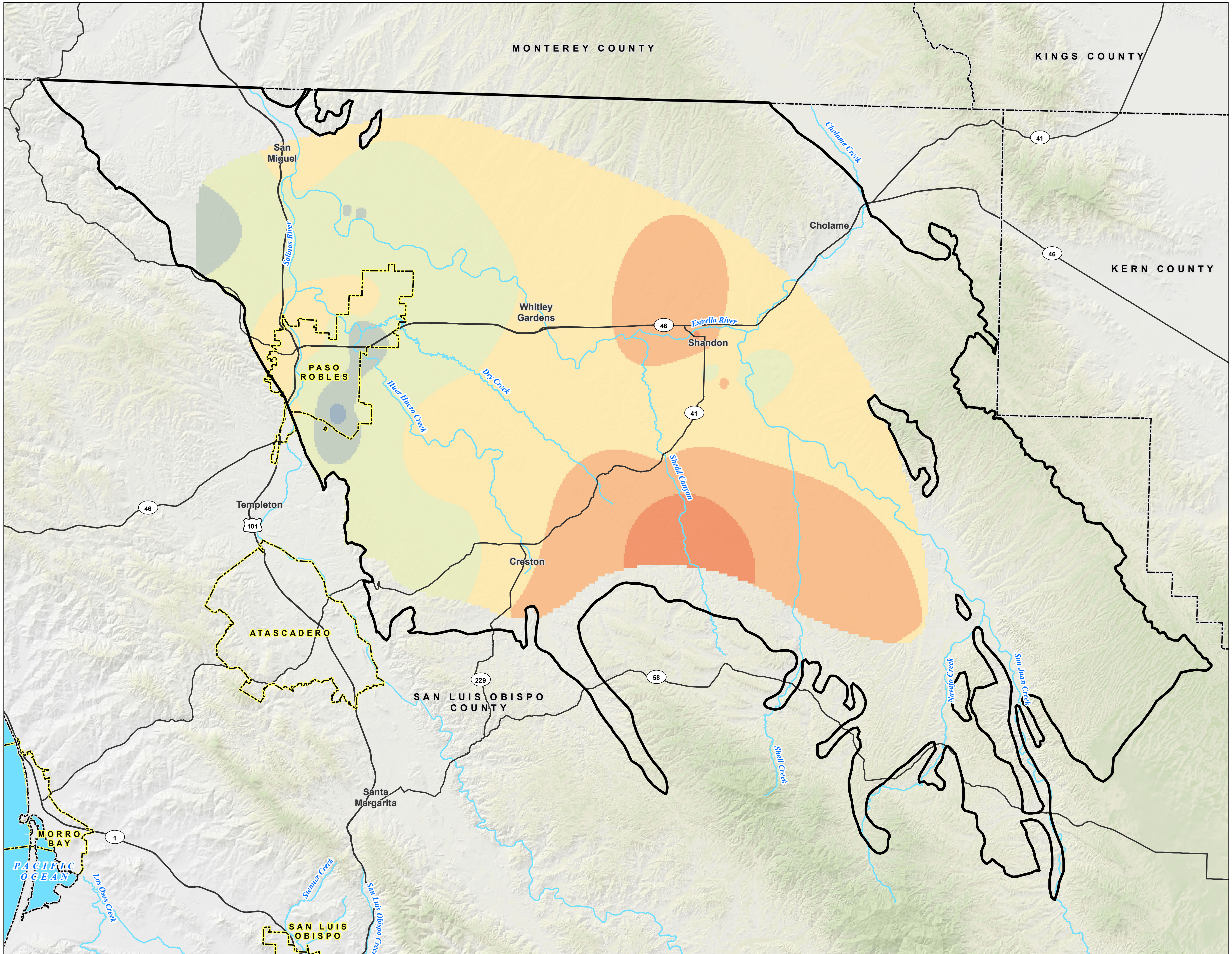
GSI Water Solutions, Inc.

Document Path: Y:\0824_PasoRobles\Source_Figures\002_Annual_Report_2020\Figure9_Comms_Dependent_on_GW.mxd

FIGURE 10

Paso Robles Formation Aquifer Change in Groundwater Elevation Fall 2019 to Fall 2020

Paso Robles Subbasin
Water Year 2020 Annual Report



LEGEND

Paso Robles Subbasin

Water Level Change, in feet

Fall 2019 to Fall 2020

- < -40 feet
- -40 to -30 feet
- -30 to -20 feet
- -20 to -10 feet
- -10 to 0 feet
- 0 to 10 feet
- 10 to 20 feet
- 20 to 30 feet
- 30 to 40 feet
- > 40 feet

All Other Features

- County Boundary
- City Boundary
- Major Road
- Watercourse
- Waterbody

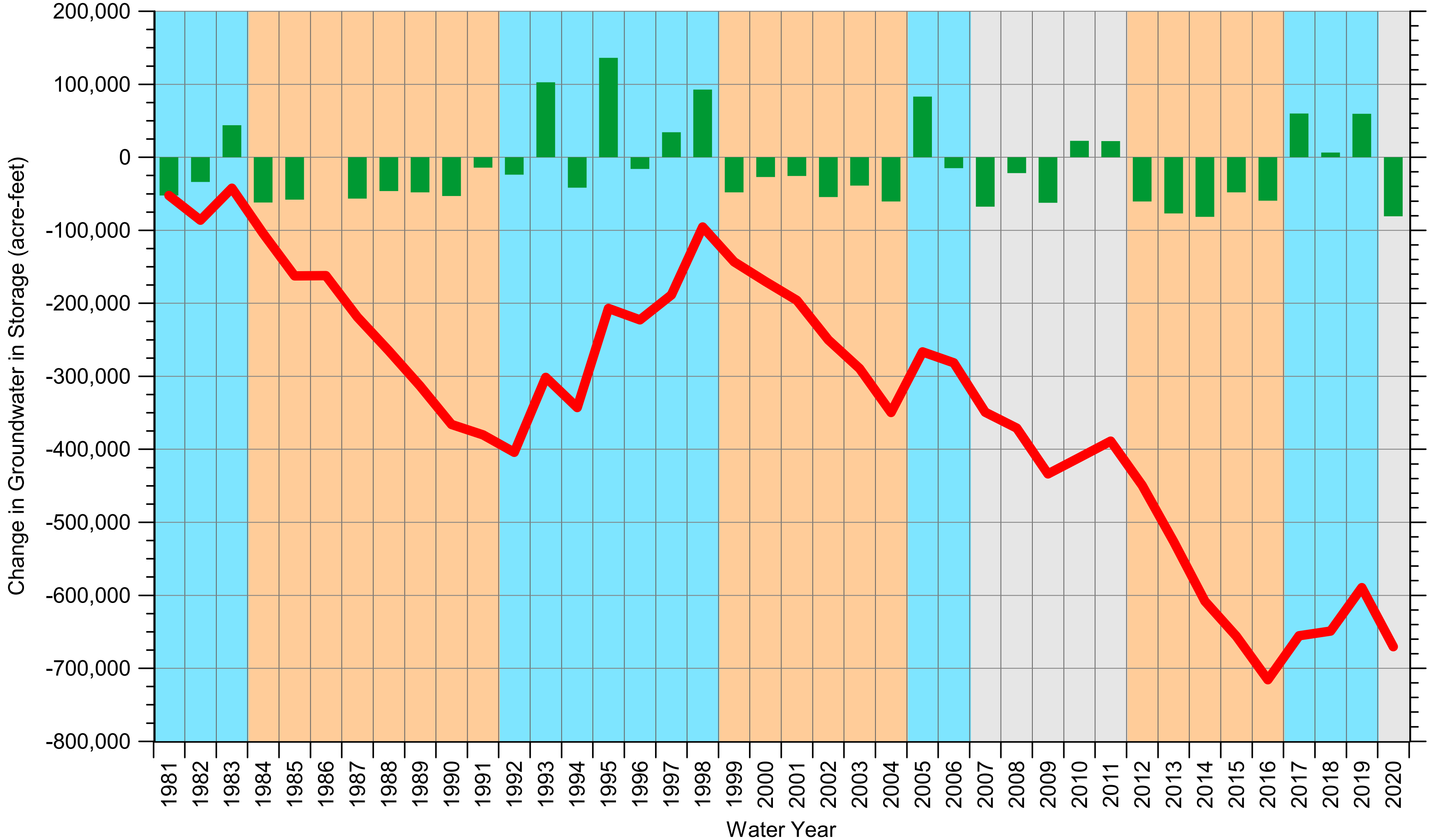
N

0 10,000 20,000 30,000
Feet

Date: February 16, 2021
Data Sources: CA DWR, SLO Co., USGS

GSI Water Solutions, Inc.

Document Path: Y:\0824_PasoRobles\Source_Figures\002_Annual_Report_2020\Figure10_Change_in_GW_Elev_Fall2019_2020.mxd



EXPLANATION

Cumulative Change in Groundwater Storage   Annual Change in Groundwater Storage

CLIMATIC PERIOD CLASSIFICATION

Dry   Average/Alternating   Wet

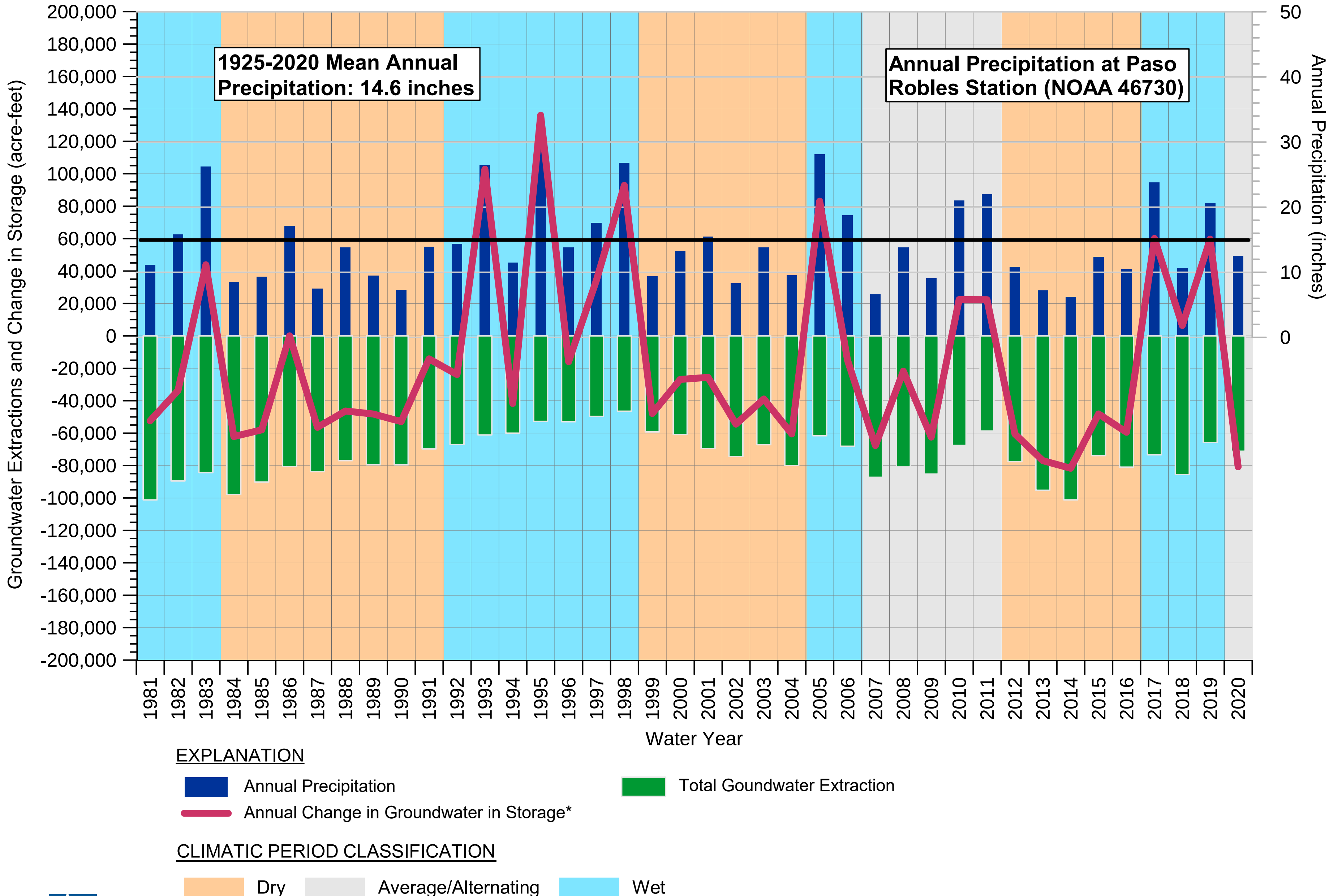
GSI Water Solutions, Inc.

FIGURE 11

Estimated Annual and Cumulative Change in Groundwater in Storage in the Paso Robles Subbasin

Paso Robles Subbasin Water Year 2020 Annual Report

P:\Portland\824-Paso Robles\002-GSP Second Annual Report\Analysis\ChangeInStorage\GW_CumulativeChangeGWStoragePRannual_wTitle.grf



*Annual Change in Groundwater in Storage is calculated using the groundwater model (1981-2016) and by water level change maps (2017-2020)

FIGURE 12

Annual Precipitation and Groundwater Extraction vs Annual Change in Groundwater in Storage

Paso Robles Subbasin Water Year 2020 Annual Report

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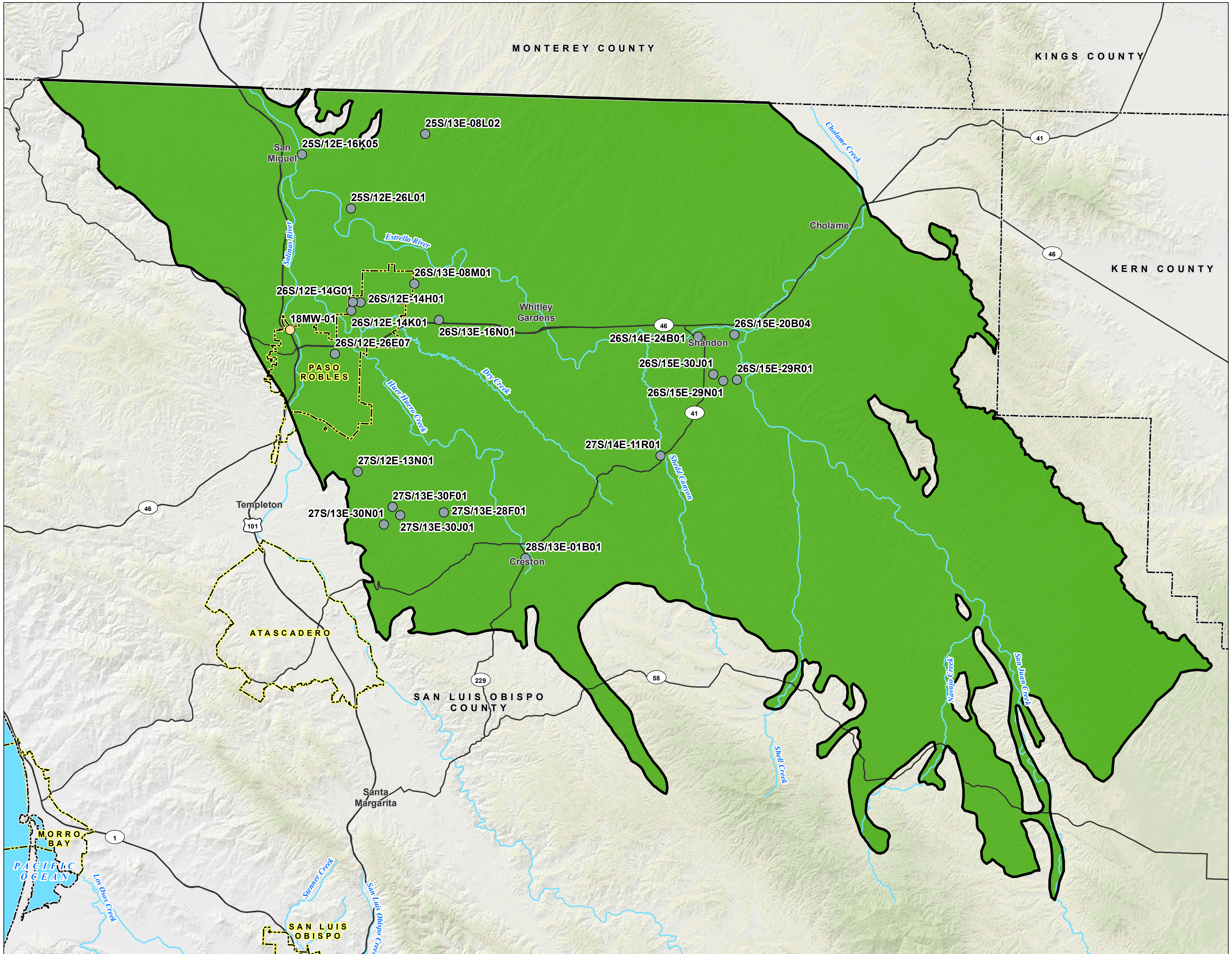
P:\Portland\824-Paso Robles\002-GSP Second Annual Report\Analysis\ChangeInStorage\GW_CumulativeChangeGWStoragePRannual_wTitle.grf



Document Path: Y:\0824_PasoRobles\Source_Figures\002_Annual_Report_2020\Figure13_Land_Subsidence_InSAR.mxd

FIGURE 13

Land Subsidence Measured by InSAR (June 2018 – September 2019)

Paso Robles Subbasin
Water Year 2020 Annual Report

LEGEND

Wells

- Paso Robles Formation
- Alluvial Aquifer

Estimated Subsidence (decimal ft)

June 2018 - September 2019

- -0.1 - 0.1

All Other Features

- Paso Robles Subbasin
- County Boundary
- City Boundary
- Major Road
- Watercourse
- Waterbody

NOTE

InSAR: Interferometric Synthetic Aperture Radar

N

0 10,000 20,000 30,000
Feet

Date: February 16, 2021
Data Sources: CA DWR, SLO Co., City of Paso Robles, USGS, TRE Altamira InSAR dataset

GSI Water Solutions, Inc.

APPENDICES

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APPENDIX A

GSP Regulations for Annual Reports

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§ 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.

Note: Authority cited: Section 10733.2, Water Code.

Reference: Sections 10727.2, 10728, and 10733.2, Water Code.

APPENDIX B
Precipitation Data

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Monthly Precipitation at the Paso Robles Station (NOAA 46730)

(inches)

Source: https://wrcc.dri.edu/cgi-bin/cliMAIN.pl?ca6730

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	WY Total
1925	0.34	2.44	2.57	2.01	2.41	0.08	0.09	0.12	0.02	0.17	0.21	1.98	12.95
1926	2.13	6.26	0.27	3.52	0.00	0.02	0.00	0.00	0.00	0.25	7.14	0.90	14.56
1927	1.84	9.04	1.45	1.27	0.00	0.02	0.00	0.00	0.00	1.33	2.02	1.63	21.91
1928	0.23	2.87	2.76	0.37	0.29	0.00	0.00	0.00	0.00	0.01	1.82	2.87	11.50
1929	1.27	1.65	1.22	0.49	0.00	0.49	0.00	0.00	-----	0.00	0.00	0.24	9.82
1930	4.32	1.80	3.00	0.54	1.01	0.04	0.00	0.00	0.04	0.00	1.64	0.16	10.99
1931	4.58	1.87	0.39	0.56	2.01	0.93	0.00	0.09	0.00	0.01	1.89	7.04	12.23
1932	2.74	3.89	0.50	0.30	0.13	0.00	0.00	0.00	0.00	0.04	0.11	1.28	16.50
1933	6.05	0.08	0.84	0.22	0.32	0.68	0.00	0.00	0.00	0.64	0.00	4.26	9.62
1934	2.06	3.75	0.04	0.00	0.12	0.75	0.00	0.00	0.00	1.56	2.61	2.66	11.62
1935	6.23	0.65	4.08	3.41	0.02	0.00	0.00	0.16	0.07	0.18	1.58	1.66	21.45
1936	0.61	11.07	1.24	1.52	0.01	0.04	0.25	0.00	0.00	1.93	0.00	6.10	18.16
1937	4.59	4.54	5.25	0.16	0.00	0.00	0.00	0.00	0.00	0.16	0.66	7.40	22.57
1938	1.73	12.74	6.77	0.93	0.30	0.00	0.00	0.00	0.41	0.23	0.33	1.45	31.10
1939	3.11	1.45	1.58	0.05	0.09	0.00	0.00	0.00	0.43	0.55	0.78	1.29	8.72
1940	5.28	5.57	1.13	0.54	0.00	0.00	0.00	0.00	0.00	0.19	0.13	8.18	15.14
1941	4.73	8.16	6.14	2.76	0.19	0.00	0.00	0.02	0.00	1.34	0.70	5.15	30.50
1942	2.40	0.76	1.77	3.01	0.15	0.00	0.00	0.00	0.00	0.53	1.01	1.64	15.28
1943	8.00	1.68	3.63	0.72	0.00	0.00	0.00	0.00	0.00	0.39	0.12	3.38	17.21
1944	1.03	5.96	0.64	0.65	0.13	0.00	0.00	0.00	0.00	0.26	2.64	1.09	12.30
1945	0.80	4.17	2.76	0.26	0.02	0.00	0.00	0.00	0.00	1.09	0.49	3.89	12.00
1946	0.31	1.64	3.01	0.05	0.72	0.00	0.26	0.00	0.00	0.19	4.57	2.17	11.46
1947	0.56	0.97	1.14	0.13	0.28	0.00	0.00	0.00	0.04	0.32	0.18	0.62	10.05
1948	0.00	1.85	3.51	3.50	0.45	0.00	0.00	0.00	0.00	0.06	0.00	3.04	10.43
1949	1.09	1.95	3.73	0.36	0.38	0.00	0.00	0.00	0.00	0.00	0.78	2.33	10.61
1950	3.05	2.43	1.65	1.00	0.05	0.00	0.68	0.00	0.00	1.24	1.18	2.50	11.97
1951	2.50	0.68	0.58	1.11	0.00	0.00	0.00	0.00	0.03	0.33	1.91	4.64	9.82
1952	5.54	0.20	3.92	1.49	0.03	0.00	0.07	0.00	0.02	0.02	1.76	4.78	18.15
1953	1.71	0.00	0.66	1.90	0.06	0.01	0.00	0.00	0.00	0.00	2.46	0.00	10.90
1954	3.06	1.89	3.12	0.64	0.10	0.00	0.00	0.00	0.00	0.00	1.29	1.51	11.27
1955	3.57	1.85	0.37	1.16	1.31	0.00	0.00	0.13	0.00	0.00	1.36	8.14	11.19
1956	3.82	0.99	0.01	1.87	1.45	0.00	0.00	0.00	0.00	1.07	0.00	0.17	17.64
1957	4.77	1.90	0.31	1.63	0.70	0.37	0.00	0.00	0.02	0.60	0.30	3.30	10.94
1958	2.93	6.02	6.35	5.22	0.37	0.00	0.00	0.38	1.20	0.00	0.13	0.48	26.67
1959	1.69	4.53	0.03	0.44	0.05	0.00	0.00	0.00	0.52	0.00	0.00	0.31	7.87
1960	2.42	4.20	0.70	1.40	0.04	0.00	0.00	0.00	0.00	0.10	3.63	1.17	9.07
1961	1.72	0.20	0.88	0.22	0.74	0.00	0.00	0.00	0.00	0.01	1.99	2.59	8.66
1962	2.05	8.49	1.98	0.00	0.12	0.00	0.00	0.00	0.00	0.79	0.01	2.49	17.23
1963	4.41	3.79	2.10	3.32	0.17	0.01	0.00	0.00	0.24	1.00	4.25	0.01	17.33
1964	1.87	0.15	1.46	0.68	0.55	0.06	0.00	0.08	0.03	1.05	2.27	2.37	10.14
1965	2.50	0.51	1.16	2.48	0.00	0.00	0.04	0.03	0.15	0.00	6.43	3.24	12.56
1966	1.17	0.68	0.08	0.00	0.01	0.14	0.08	0.00	0.11	0.00	2.43	8.60	11.94
1967	3.93	0.35	3.99	4.41	0.03	0.02	0.00	0.00	0.79	0.14	1.74	1.70	24.55
1968	1.19	0.68	1.76	0.70	0.04	0.00	0.00	0.00	0.00	1.83	1.14	3.13	7.95
1969	13.93	9.12	0.35	1.68	0.06	0.01	0.25	0.00	0.00	0.24	0.44	0.68	31.50
1970	3.71	1.66	1.83	0.37	0.00	0.04	0.00	0.00	0.00	0.08	3.14	4.56	8.97
1971	1.08	0.24	0.85	0.69	0.21	0.00	0.00	0.00	0.05	0.29	0.88	4.27	10.90
1972	1.35	0.30	0.00	0.53	0.00	0.00	0.00	0.00	0.03	1.68	4.14	0.85	7.65
1973	6.54	6.95	2.60	0.01	0.06	0.00	0.00	0.00	0.00	0.61	3.09	1.61	22.83
1974	6.39	0.05	4.56	0.91	0.00	0.00	0.00	0.00	0.00	0.64	0.43	2.33	17.22

Monthly Precipitation at the Paso Robles Station (NOAA 46730)

(inches)

Source: https://wrcc.dri.edu/cgi-bin/cliMAIN.pl?ca6730

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	WY Total
1975	0.01	4.12	2.81	0.89	0.00	0.00	0.00	0.01	0.00	0.77	0.03	0.10	**11.24**
1976	0.00	2.61	1.09	0.66	0.00	0.08	0.00	1.02	2.90	0.58	0.55	1.80	**9.26**
1977	1.47	0.03	1.41	0.00	1.71	0.00	0.00	0.00	0.00	0.08	0.25	5.25	**7.55**
1978	5.77	7.31	3.10	2.77	0.00	0.00	0.00	0.00	0.92	0.00	2.47	1.04	**25.45**
1979	4.70	3.52	2.30	0.00	0.00	0.00	0.00	0.00	0.06	0.93	0.85	2.31	**14.09**
1980	4.47	8.05	1.88	0.65	0.24	0.00	0.35	0.00	0.00	0.00	0.02	0.44	**19.73**
1981	4.00	1.60	4.52	0.56	0.00	0.00	0.00	0.00	0.00	1.01	1.44	0.62	**11.14**
1982	2.65	0.88	5.10	3.05	0.00	0.02	0.00	0.00	1.04	0.90	3.98	1.98	**15.81**
1983	5.84	4.53	4.69	3.35	0.05	0.00	0.00	0.52	0.37	1.34	2.07	3.68	**26.21**
1984	0.20	0.24	0.66	0.35	0.00	0.00	0.00	0.00	0.00	0.38	2.10	3.01	**8.54**
1985	0.52	0.92	2.11	0.19	0.00	0.00	0.02	0.00	0.04	0.40	1.07	0.97	**9.29**
1986	2.11	6.93	4.64	0.32	0.00	0.00	0.03	0.00	0.63	0.02	0.15	0.75	**17.10**
1987	0.88	2.01	3.40	0.14	0.06	0.07	0.00	0.00	0.00	1.50	2.63	2.73	**7.48**
1988	1.94	2.54	0.10	2.02	0.21	0.14	0.00	0.00	0.00	0.00	1.29	2.87	**13.81**
1989	0.98	1.59	0.71	0.37	0.07	0.00	0.00	0.00	1.59	0.97	0.22	0.00	**9.47**
1990	3.02	1.48	0.24	0.12	0.66	0.00	0.00	0.00	0.51	0.00	0.14	0.20	**7.22**
1991	0.63	2.17	10.25	0.08	0.03	0.20	0.00	0.10	0.10	0.50	0.16	3.00	**13.90**
1992	1.44	6.09	2.99	0.10	0.00	0.03	0.03	0.00	0.01	0.79	0.00	3.59	**14.35**
1993	9.63	8.31	3.89	0.07	0.01	0.14	0.00	0.00	0.00	0.17	0.86	1.28	**26.43**
1994	1.90	3.37	1.16	0.49	1.05	0.00	0.00	0.00	1.17	0.70	2.32	0.93	**11.45**
1995	11.51	1.42	12.31	0.09	0.44	0.14	0.00	0.00	0.00	0.00	0.12	1.92	**29.86**
1996	1.84	6.52	2.03	0.78	0.55	0.00	0.00	0.00	0.00	1.78	1.85	5.83	**13.76**
1997	7.93	0.00	0.00	0.00	0.00	0.00	0.01	0.05	0.10	0.07	4.05	3.93	**17.55**
1998	2.99	9.06	2.71	1.90	1.87	0.11	0.00	0.00	0.08	0.21	0.99	0.73	**26.77**
1999	1.84	1.26	2.68	1.19	0.00	0.00	0.00	0.00	0.47	0.00	0.71	0.22	**9.37**
2000	3.16	5.89	1.55	1.56	0.05	0.04	0.00	0.00	0.03	1.34	0.05	0.16	**13.21**
2001	4.43	5.14	3.59	0.68	0.00	0.00	0.04	0.00	0.00	0.24	2.81	2.19	**15.43**
2002	0.87	0.33	1.40	0.23	0.25	0.00	0.00	0.00	0.00	0.00	2.54	4.36	**8.32**
2003	0.00	2.10	1.85	1.70	1.18	0.00	-----	0.03	0.00	0.00	1.36	2.31	**13.76**
2004	0.91	4.31	0.30	0.32	0.00	0.00	0.00	0.00	0.00	5.11	1.39	6.75	**9.51**
2005	4.81	5.02	3.07	0.76	1.10	0.01	0.00	0.08	0.00	0.02	0.44	2.54	**28.10**
2006	5.78	1.23	4.50	2.74	1.48	0.00	0.00	0.00	0.00	0.61	0.28	1.13	**18.73**
2007	0.74	2.98	0.13	0.37	0.00	0.00	0.00	0.31	0.04	0.96	0.00	2.23	**6.59**
2008	8.44	1.83	0.00	0.33	0.01	0.00	0.00	0.00	0.00	0.14	1.26	1.13	**13.80**
2009	0.91	3.89	1.37	0.17	0.12	0.02	0.00	0.00	0.05	4.04	0.02	3.96	**9.06**
2010	6.09	3.38	0.64	2.71	0.12	0.00	0.03	0.00	0.00	1.06	1.57	7.14	**20.99**
2011	2.07	3.05	5.29	0.28	0.95	0.53	0.00	0.00	0.03	0.90	1.93	0.12	**21.97**
2012	2.38	0.25	2.44	2.60	0.18	0.00	0.00	0.00	0.00	0.28	0.75	3.94	**10.80**
2013	1.02	0.28	0.69	0.07	0.15	0.00	0.00	0.00	0.00	0.01	0.26	0.30	**7.18**
2014	0.00	2.75	1.96	0.85	0.00	0.00	0.03	0.00	0.00	0.00	1.00	5.48	**6.16**
2015	0.32	2.16	0.10	0.37	0.05	0.00	2.82	0.00	0.05	0.07	1.45	0.89	**12.35**
2016	4.13	0.85	2.92	0.15	0.00	0.00	0.00	0.00	0.00	1.61	1.46	1.98	**10.46**
2017	9.50	6.44	0.92	1.46	0.24	0.00	0.00	0.00	0.16	0.08	0.22	0.04	**23.77**
2018	2.08	0.25	7.74	0.21	0.00	0.00	0.00	0.00	0.00	0.28	3.23	1.12	**10.62**
2019	5.30	6.72	3.01	0.08	0.82	0.00	0.00	0.00	0.00	0.00	1.40	5.22	**20.56**
2020	0.65	0.00	3.53	1.59	0.03	0.00	0.00	0.11	0.00	0.00	0.29	0.89	**12.53**
												Water Year Average (1925 - 2020):	**14.63**

Monthly Precipitation at City of Paso Robles Water Yard

(inches) Source: https://www.prcity.com/DocumentCenter/View/14953/Paso-Robles-Rainfall-1942---Present-PDF

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	WY Total
1942	---	---	---	---	---	---	0.00	0.00	0.00	0.58	1.01	1.64	**---**
1943	8.00	1.68	3.63	0.72	0.00	0.00	0.00	0.00	0.00	0.34	0.12	3.38	**17.26**
1944	0.94	5.96	0.64	0.65	0.13	0.00	0.00	0.00	0.00	0.26	2.64	1.38	**12.16**
1945	0.80	4.17	2.76	0.26	0.04	0.00	0.00	0.00	0.00	1.09	0.49	1.72	**12.31**
1946	0.31	1.64	3.01	0.05	0.72	0.00	0.26	0.00	0.10	0.00	4.57	2.17	**9.39**
1947	0.56	0.97	1.14	0.13	0.28	0.00	0.00	0.00	0.04	0.32	0.18	0.62	**9.86**
1948	0.00	1.85	3.51	3.50	0.45	0.00	0.00	0.00	0.00	0.06	0.00	3.04	**10.43**
1949	1.09	1.95	3.73	0.36	0.38	0.00	0.00	0.00	0.00	0.78	0.78	2.33	**10.61**
1950	2.39	2.43	1.65	0.89	0.05	0.00	0.68	0.00	0.00	1.24	1.18	2.50	**11.98**
1951	2.50	0.68	0.58	1.11	0.00	0.00	0.00	0.00	0.03	0.33	1.94	4.64	**9.82**
1952	5.54	0.20	3.92	1.50	0.03	0.00	0.07	0.00	0.02	0.02	1.76	4.78	**18.19**
1953	1.71	0.00	0.66	1.90	0.06	0.01	0.00	0.00	0.00	0.00	2.46	0.00	**10.90**
1954	3.06	1.89	3.12	0.64	0.10	0.00	0.00	0.00	0.00	0.00	1.29	1.51	**11.27**
1955	3.57	1.85	0.37	1.16	1.31	0.00	0.00	0.13	0.00	0.00	1.36	8.14	**11.19**
1956	3.82	1.00	0.01	1.87	1.45	0.00	0.00	0.00	0.00	1.07	0.00	0.17	**17.65**
1957	4.77	1.90	0.31	1.63	0.71	0.47	0.00	0.00	0.02	0.62	0.30	3.30	**11.05**
1958	2.93	6.02	6.35	5.22	0.37	0.00	0.00	0.38	1.20	0.00	0.13	0.48	**26.69**
1959	1.69	4.53	0.03	0.44	0.05	0.00	0.00	0.00	0.52	0.00	0.00	0.31	**7.87**
1960	2.42	4.20	0.70	1.40	0.04	0.00	0.00	0.00	0.00	0.10	3.63	1.17	**9.07**
1961	1.72	0.20	0.88	0.22	0.74	0.00	0.00	0.00	0.00	0.01	1.99	2.59	**8.66**
1962	2.05	8.49	1.98	0.00	0.12	0.00	0.00	0.00	0.00	0.79	0.01	2.52	**17.23**
1963	4.41	3.79	2.10	3.32	0.17	0.01	0.00	0.00	0.24	1.00	4.25	0.01	**17.36**
1964	1.87	0.15	1.46	0.68	0.55	0.06	0.00	0.08	0.03	1.05	2.27	2.37	**10.14**
1965	2.50	0.51	1.16	2.48	0.00	0.00	0.04	0.03	0.15	0.00	6.43	3.24	**12.56**
1966	1.17	0.68	0.08	0.00	0.01	0.14	0.08	0.00	0.11	0.00	2.43	8.60	**11.94**
1967	3.93	0.35	3.99	4.41	0.03	0.02	0.00	0.00	0.79	0.14	1.74	1.70	**24.55**
1968	1.19	0.68	1.76	0.70	0.04	0.00	0.00	0.00	0.00	1.83	1.14	3.13	**7.95**
1969	13.93	9.12	0.35	1.68	0.06	0.01	0.25	0.00	0.00	0.24	0.44	0.68	**31.50**
1970	3.71	1.66	1.83	0.37	0.00	0.04	0.00	0.00	0.00	0.08	3.14	4.56	**8.97**
1971	1.08	0.24	0.85	0.69	0.21	0.00	0.00	0.00	0.05	0.29	0.88	4.27	**10.90**
1972	1.35	0.30	0.00	0.53	0.00	0.00	0.00	0.00	0.03	1.68	4.14	0.85	**7.65**
1973	6.54	6.95	2.60	0.01	0.06	0.00	0.00	0.00	0.00	0.68	3.09	1.61	**22.83**
1974	6.39	0.05	4.56	0.91	0.00	0.00	0.00	0.00	0.00	0.64	0.43	2.33	**17.29**
1975	0.01	4.12	2.81	0.89	0.00	0.00	0.00	0.01	0.00	0.76	0.03	0.10	**11.24**
1976	0.00	2.61	1.09	0.66	0.00	0.08	0.00	1.02	2.90	0.58	0.55	1.80	**9.25**
1977	1.47	0.03	1.41	0.00	1.71	0.00	0.00	0.00	0.00	0.08	0.25	5.25	**7.55**
1978	5.77	7.31	3.10	2.77	0.00	0.00	0.00	0.00	0.92	0.00	2.47	1.04	**25.45**
1979	4.70	3.52	2.30	0.00	0.00	0.00	0.00	0.00	0.06	0.93	0.85	2.31	**14.09**
1980	4.47	8.05	1.88	0.65	0.24	0.00	0.35	0.00	0.00	0.00	0.02	0.44	**19.73**
1981	4.00	1.60	4.52	0.56	0.00	0.00	0.00	0.00	0.00	1.01	1.44	0.62	**11.14**
1982	2.65	0.88	5.10	3.05	0.00	0.02	0.00	0.00	1.04	0.90	3.98	1.96	**15.81**
1983	5.86	4.53	4.69	3.35	0.05	0.00	0.00	0.52	0.37	1.34	2.07	3.68	**26.21**
1984	0.20	0.24	0.66	0.35	0.00	0.00	0.00	0.00	0.00	0.38	2.10	3.01	**8.54**
1985	0.52	0.92	2.11	0.19	0.00	0.00	0.02	0.00	0.04	0.40	1.07	0.97	**9.29**
1986	2.11	6.73	4.64	0.32	0.00	0.00	0.03	0.00	0.62	0.02	0.15	0.64	**16.89**
1987	0.88	2.01	3.40	0.14	0.06	0.07	0.00	0.00	0.00	1.50	2.63	2.73	**7.37**
1988	1.94	2.54	0.10	2.02	0.21	0.14	0.00	0.00	0.00	0.00	1.16	2.87	**13.81**
1989	0.98	1.59	0.71	0.37	0.07	0.00	0.00	0.00	1.59	0.97	0.22	0.00	**9.34**
1990	3.02	1.48	0.24	0.12	0.66	0.00	0.00	0.00	0.51	0.00	0.14	0.20	**7.22**

Monthly Precipitation at City of Paso Robles Water Yard

(inches) Source: https://www.prcity.com/DocumentCenter/View/14953/Paso-Robles-Rainfall-1942---Present-PDF

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	WY Total
1991	0.63	2.17	10.25	0.08	0.03	0.20	0.00	0.10	0.10	0.50	0.16	3.00	**13.90**
1992	1.44	6.09	2.99	0.10	0.00	0.03	0.03	0.00	0.01	0.79	0.00	3.59	**14.35**
1993	9.63	6.96	3.43	0.06	0.01	0.14	0.00	0.00	0.00	0.17	0.86	1.28	**24.61**
1994	1.90	3.37	1.16	0.49	1.05	0.00	0.00	0.00	1.17	0.70	2.32	0.93	**11.45**
1995	11.51	1.42	12.31	0.09	0.44	0.14	0.00	0.00	0.00	0.00	0.12	1.92	**29.86**
1996	1.84	6.52	2.03	0.72	0.55	0.00	0.00	0.00	0.00	1.78	1.52	5.78	**13.70**
1997	7.93	0.00	0.00	0.00	0.00	0.00	0.01	0.05	0.10	0.07	4.05	3.93	**17.17**
1998	2.99	9.06	2.71	1.96	2.05	0.11	0.00	0.00	0.08	0.21	0.99	0.73	**27.01**
1999	1.84	1.26	2.68	1.19	0.00	0.00	0.00	0.00	0.47	0.00	0.71	0.22	**9.37**
2000	3.16	5.89	1.55	1.56	0.05	0.04	0.00	0.00	0.03	1.34	0.05	0.16	**13.21**
2001	4.43	5.14	3.59	1.08	0.00	0.00	0.04	0.00	0.00	0.24	2.81	2.19	**15.83**
2002	0.87	0.33	1.40	0.23	0.25	0.00	0.00	0.00	0.00	0.00	2.54	4.52	**8.32**
2003	0.13	2.10	1.86	1.70	1.18	0.00	0.16	0.03	0.00	0.00	1.36	2.31	**14.22**
2004	0.91	4.31	0.30	0.32	0.00	0.00	0.00	0.00	0.00	5.11	1.39	6.75	**9.51**
2005	4.81	5.02	3.07	0.76	1.10	0.01	0.00	0.08	0.00	0.02	0.46	2.54	**28.10**
2006	5.78	1.23	4.50	2.92	1.48	0.00	0.00	0.00	0.00	0.61	0.28	1.13	**18.93**
2007	0.74	2.98	0.13	0.37	0.00	0.00	0.00	0.31	0.04	0.96	0.00	2.23	**6.59**
2008	8.44	1.83	0.00	0.33	0.01	0.00	0.00	0.00	0.00	0.14	1.26	1.13	**13.80**
2009	0.91	3.89	1.37	0.17	0.12	0.02	0.00	0.00	0.05	4.04	0.02	3.96	**9.06**
2010	6.09	3.38	0.64	2.75	0.12	0.00	0.03	0.00	0.00	1.06	1.57	7.14	**21.03**
2011	2.07	3.05	5.29	0.28	0.95	0.53	0.00	0.00	0.03	0.90	1.93	0.12	**21.97**
2012	2.38	0.25	2.44	2.60	0.18	0.00	0.00	0.00	0.00	0.28	0.75	3.94	**10.80**
2013	1.02	0.28	0.69	0.07	0.15	0.00	0.00	0.00	0.00	0.01	0.26	0.30	**7.18**
2014	0.00	2.75	1.96	0.85	0.00	0.00	0.03	0.00	0.00	0.00	1.00	5.48	**6.16**
2015	0.32	2.16	0.10	0.37	0.05	0.00	2.82	0.00	0.05	0.07	1.45	0.89	**12.35**
2016	4.13	0.85	2.92	0.15	0.00	0.00	0.00	0.00	0.00	1.61	1.46	1.80	**10.46**
2017	9.50	6.44	0.92	1.45	0.24	0.00	0.00	0.00	0.16	0.08	0.22	0.04	**23.58**
2018	2.08	0.25	7.74	0.21	0.00	0.00	0.00	0.00	0.00	0.28	3.23	1.12	**10.62**
2019	5.30	6.72	3.01	0.08	0.82	0.00	0.00	0.00	0.00	0.00	1.40	5.22	**20.56**
2020	0.65	0.00	3.53	1.59	0.03	0.00	0.00	0.11	0.00	0.00	0.29	0.89	**12.53**
												Water Year Average (1943 - 2020):	**14.18**

APPENDIX C

Groundwater Level and Groundwater Storage Monitoring Well Network

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Table C-1 – Groundwater Level and Groundwater Storage Monitoring Well Network

Well ID (alt ID)	Well Depth (feet)	Screen Interval(s) (feet bls)	Reference Point Elevation (feet AMSL)	First Year of Data	Last Year of Data	Years Measured	Number of Measurement	Aquifer
18MW-0191[1]	50	10-50	672 (LSE)	2018	2018	<1	1	Qa
25S/12E-16K05 (PASO-0345)	350	300-310, 330-340	669.8	1992	2019	27	56	PR
25S/12E-26L01 (PASO-0205)	400	200-400	719.72	1970	2019	49	107	PR
25S/13E-08L02 (PASO-0195)	270	110-270	1,033.81	2012	2019	7	15	PR
26S/12E-14G01 (PASO-0048)	740	---	789.3	1969	2019	50	121	PR
26S/12E-14G02 (PASO-0017)	840	640-840	787	1993	2019	26	28	PR
26S/12E-14H01 (PASO-0184)	1230	180-?	790	1969	2019	50	48	PR
26S/12E-14K01 (PASO-0238)	1100	---	786	1979	2019	40	84	PR
26S/12E-26E07 (PASO-0124)	400	---	835	1958	2018	60	131	PR
26S/13E-08M01 (PASO-0164)	400	260-400	827.92	2013	2019	6	16	PR
26S/13E-16N01 (PASO-0282)	400	200-400	890.17	2012	2019	7	16	PR
26S/15E-19E01 (PASO-0073)	512	223-512	1,020	1987	2019	32	56	PR
26S/15E-20B04 (PASO-0401)	461	297-461	1,036.36	1984	2019	35	71	PR
26S/15E-29N01 (PASO-0226)	350	---	1,135	1958	2019	61	127	PR
26S/15E-29R01 (PASO-0406)	600	180-600	1,109.5	2012	2019	7	12	PR
26S/15E-30J01 (PASO-0393)	605	195-605	1,123.3	1970	2019	49	83	PR
27S/12E-13N01 (PASO-0223)	295	195-295	972.42	2012	2019	7	15	PR
27S/13E-28F01 (PASO-0243)	230	118-212	1,072	1969	2019	50	108	PR
27S/13E-30F01 (PASO-0355)	310	200-310	1,043.2	2012	2019	7	14	PR
27S/13E-30J01 (PASO-0423)	685	225-685	1,095	2012	2019	7	10	PR
27S/13E-30N01 (PASO-0086)	355	215-235, 275-355	1,086.73	2012	2016	4	6	PR
27S/14E-11R01 (PASO-0392)	630	180-630	1,160.5	1974	2019	45	75	PR
28S/13E-01B01 (PASO-0066)	254	154-254	1,099.93	2012	2019	7	17	PR

NOTES: New alluvial monitoring well information provided by City of Paso Robles; well not included in County database.
"—" = unknown; AMSL – above mean sea level; PR Paso Robles Formation Aquifer; Qa Alluvial Aquifer

APPENDIX D

Potential Future Groundwater Monitoring Wells

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Table D-1 – Potential Future Groundwater Monitoring Wells

Well ID (alt ID)	Well Depth (feet)	Screen Interval(s) (feet bls)	Reference Point Elevation (feet AMSL)	First Year of Data	Last Year of Data	Years Measured (years)	Number of Measurements	Aquifer
25S/12E-20K03 (PASO-0304)	---	---	625	1974	2019	45	86	---
26S/14E-24B01 (PASO-0302)	---	---	1001	1962	2019	57	99	---
26S/15E-33C01 (PASO-0314)	---	---	1095	1973	2019	46	80	---
26S/15E-33Q01 (PASO-0381)	---	---	1102	1973	2019	46	82	---
27S/15E-03E01 (PASO-0277)	---	---	1120.8	1968	2019	51	109	---
27S/14E-24B01 (PASO-0391)	---	---	1180.5	1973	2019	46	74	---
27S/14E-25J01 (PASO-0074)	---	---	1,225.5	1972	2019	47	72	--
27S/14E-29G01 (PASO-0041)	---	---	1201.5	1974	2019	45	78	---
27S/15E-35F01 (PASO-0053)	---	---	1230	1965	2019	54	82	---

NOTES: “—“ = unknown

APPENDIX E
Hydrographs

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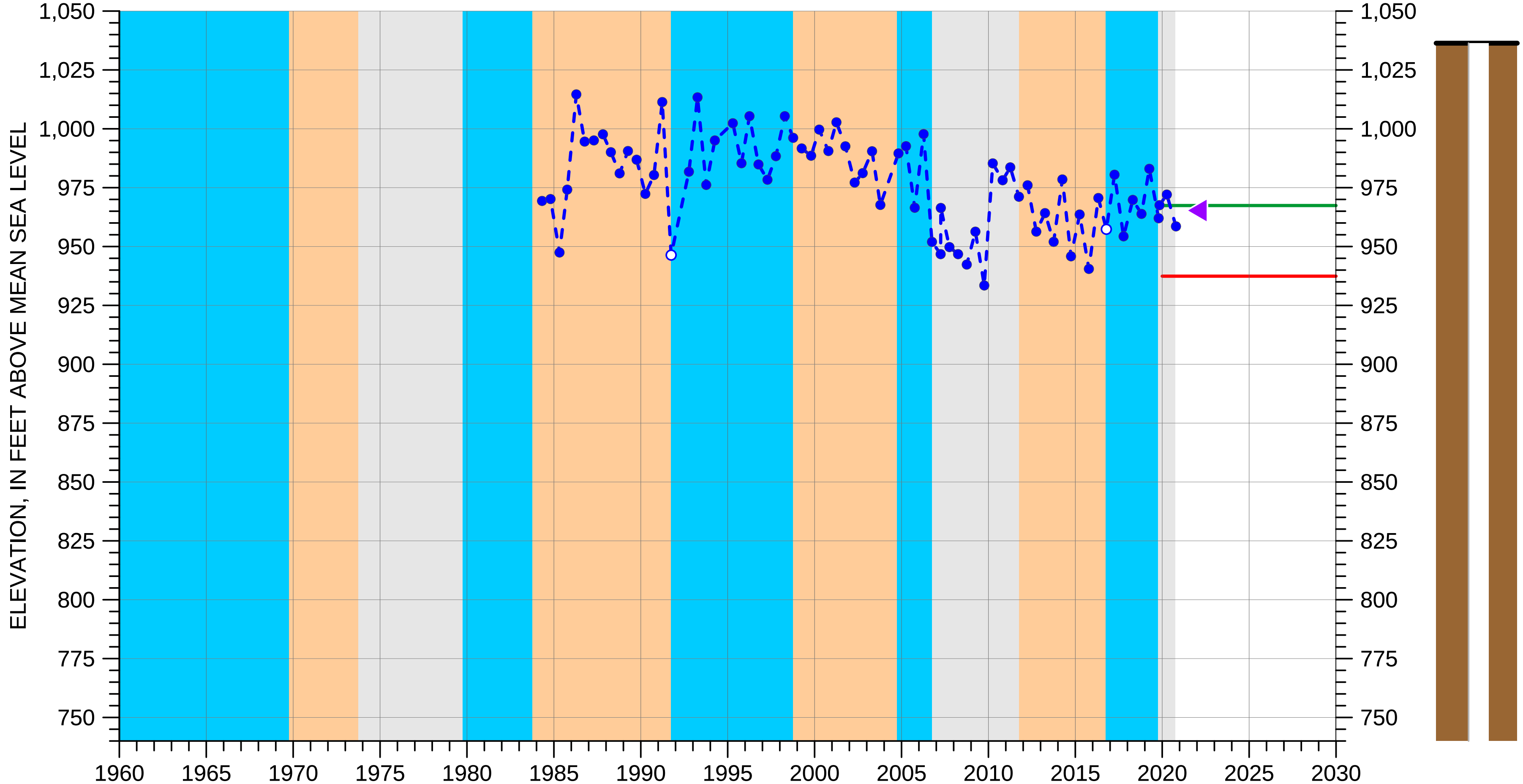


EXPLANATION

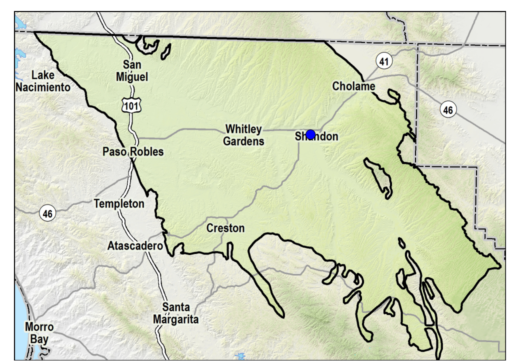
Groundwater Elevation

Measurable Objective

Average of spring and fall 2020 water elevations

Measurement Not Verified*

Minimum Threshold



CLIMATE PERIOD CLASSIFICATION

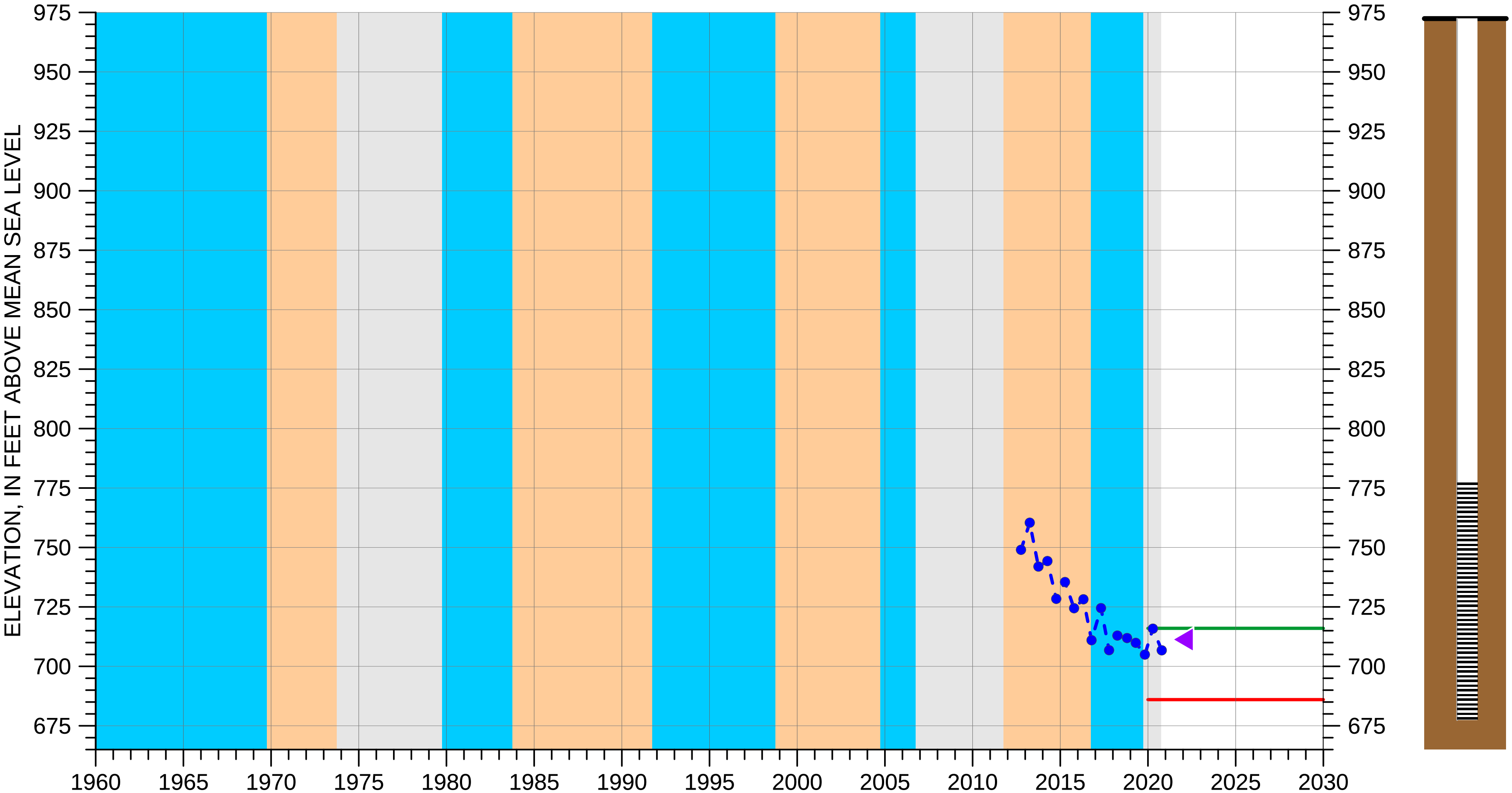
Dry Average/Alternating Wet

Well Depth: 461 feet
Screened Interval: 297-461 feet below ground surface
Reference Point Elevation: 1036.36 feet above mean sea level

* Measurement reported as not static

HYDROGRAPH OF MEASURED GROUNDWATER ELEVATION FOR 26S/15E-20B04

P:\Portland\824-Paso Robles\002-GSP Second Annual Report\Analysis\Hydrographs\Grapher\Annual Rpt\Hydr_26S_15E-20B04.grf



EXPLANATION

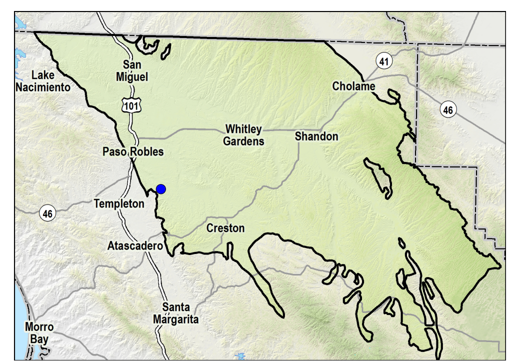
Groundwater Elevation

Measurable Objective

Average of spring and fall 2020 water elevations

Measurement Not Verified*

Minimum Threshold



CLIMATE PERIOD CLASSIFICATION

Dry | Average/Alternating | Wet

Well Depth: 295 feet
Screened Interval: 195-295 feet below ground surface
Reference Point Elevation: 972.4 feet above mean sea level

* Measurement reported as not static

HYDROGRAPH OF MEASURED GROUNDWATER ELEVATION FOR 27S/12E-13N01

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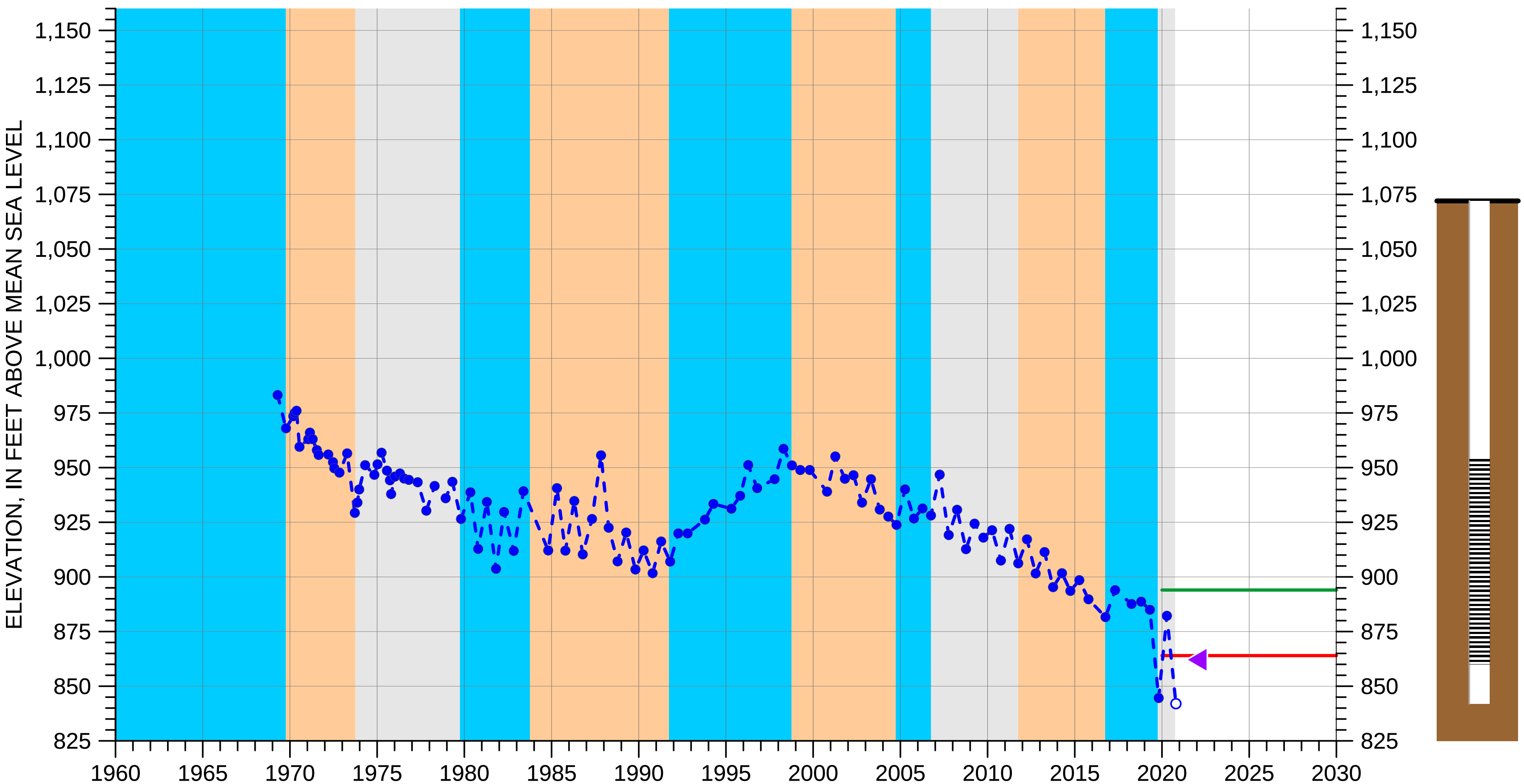


EXPLANATION

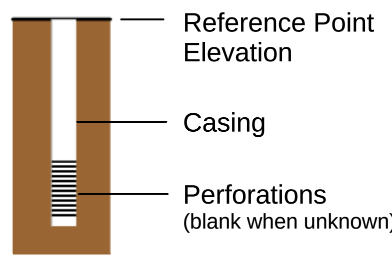
Groundwater Elevation

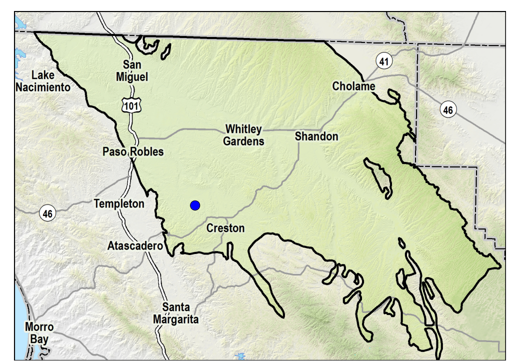
Measurement Not Verified*

Measurable Objective

Minimum Threshold

Average of spring and fall 2020 water elevations





CLIMATE PERIOD CLASSIFICATION

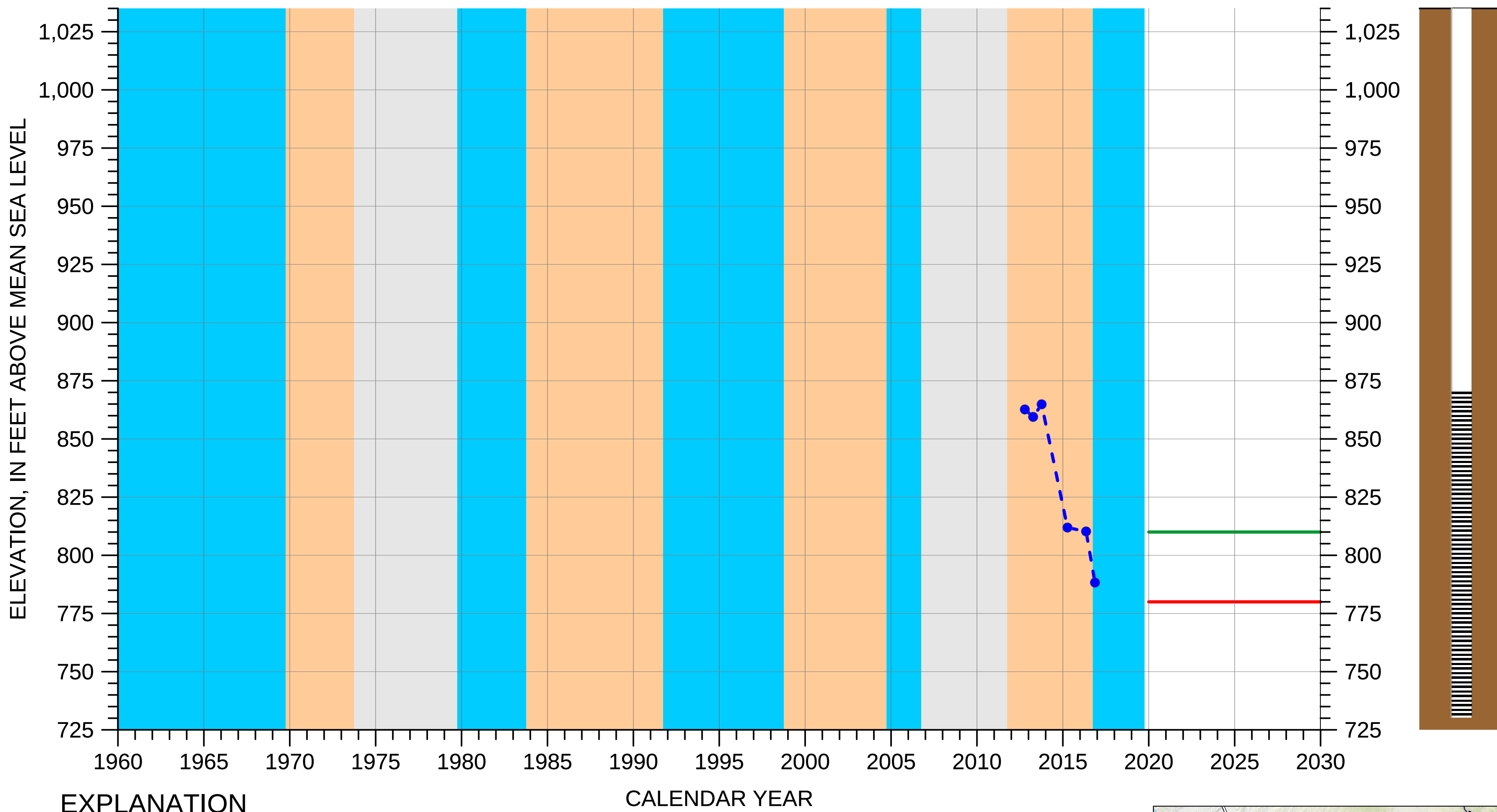
Dry
Average/Alternating
Wet

Well Depth: 230 feet
Screened Interval: 118-230 feet below ground surface
Reference Point Elevation: 1072 feet above mean sea level

* Measurement recorded at bottom of well (dry well). Actual elevation may be lower.

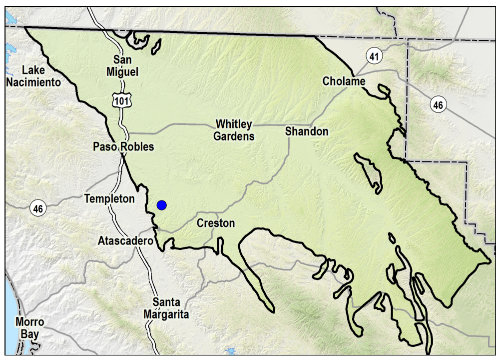
HYDROGRAPH OF MEASURED GROUNDWATER ELEVATION FOR 27S/13E-28F01

P:\Portland\824-Paso Robles\002-GSP Second Annual Report\Analysis\Hydrographs\Grapher\Annual Rpt\Hydr_27S_13E-28F01.grf



EXPLANATION

- Groundwater Elevation
- Measurement Not Verified*
- Measurable Objective
- Minimum Threshold



CLIMATE PERIOD CLASSIFICATION

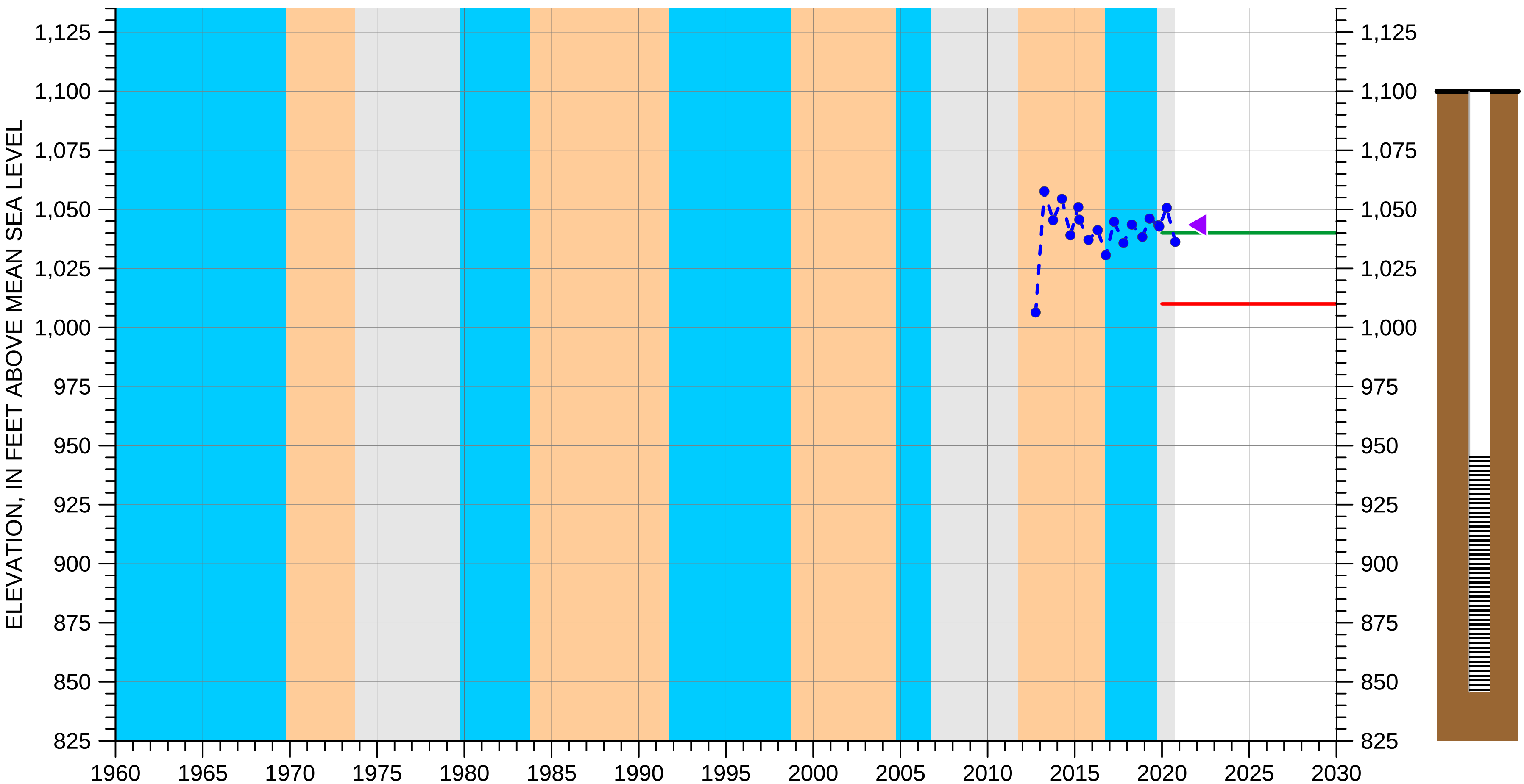
Dry | Average/Alternating | Wet

Well Depth: 355 feet
Screened Interval: 215-235, 275-355 feet below ground surface
Reference Point Elevation: 1086.7 feet above mean sea level

* Measurement reported as not static

HYDROGRAPH OF MEASURED GROUNDWATER ELEVATION FOR 27S/13E-30N01

P:\Portland\824-Paso Robles\002-GSP Second Annual Report\Analysis\Hydrographs\Grapher\Annual Rpt\Hydr_27S_13E-30N01.grf



EXPLANATION

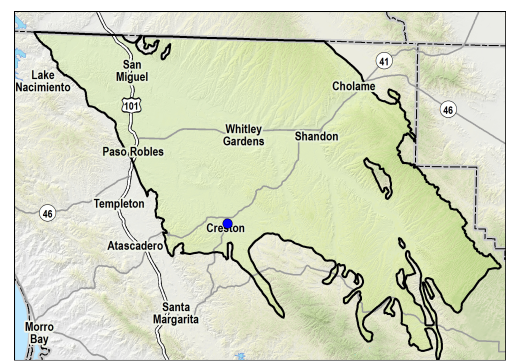
Groundwater Elevation

Measurement Not Verified*

Measurable Objective

Minimum Threshold

Average of spring and fall 2020 water elevations



CLIMATE PERIOD CLASSIFICATION

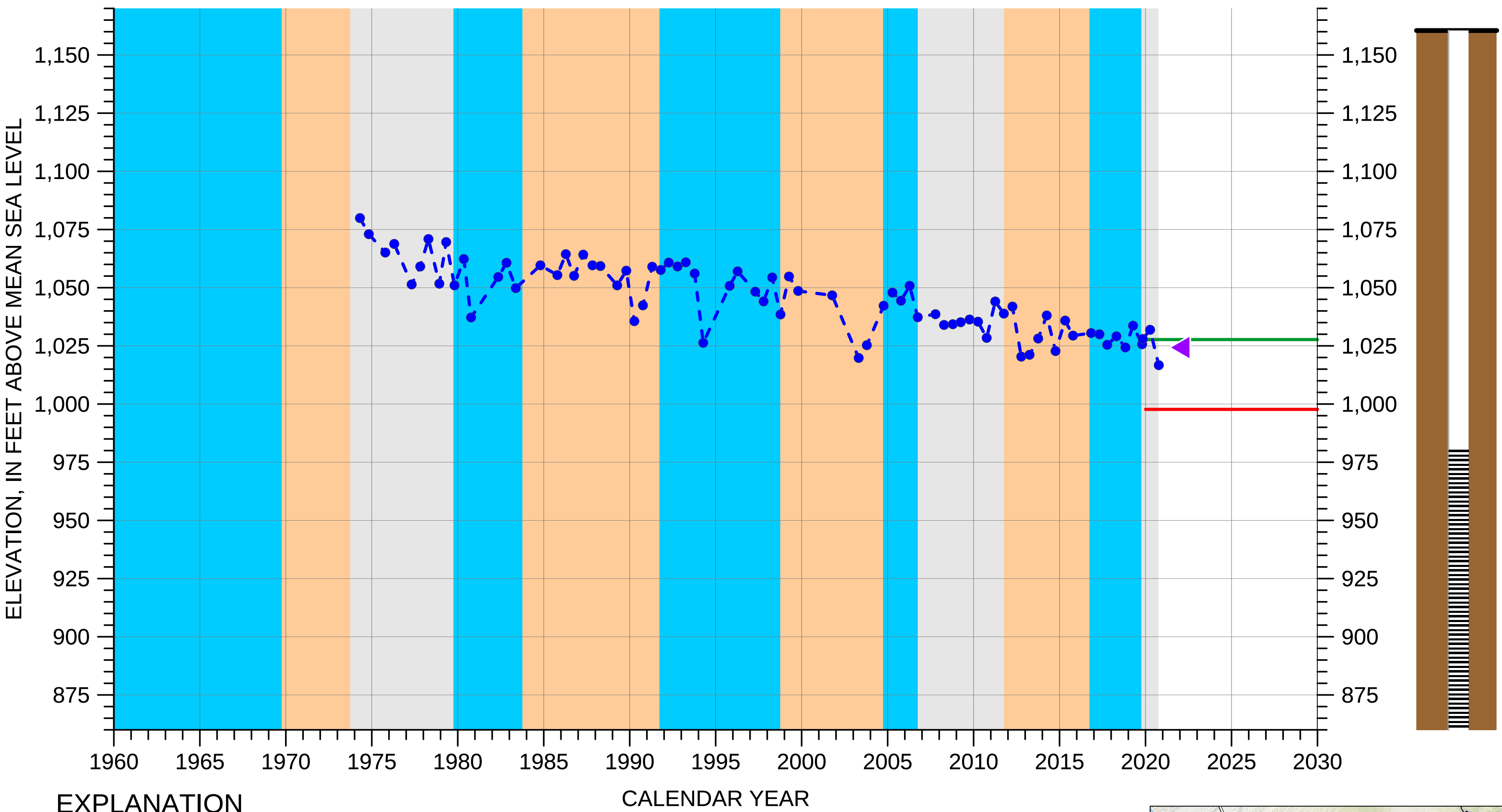
Dry | Average/Alternating | Wet

Well Depth: 254 feet
Screened Interval: 154-254 feet below ground surface Reference Point
Elevation: 1099.9 feet above mean sea level

* Measurement reported as not static

HYDROGRAPH OF MEASURED GROUNDWATER ELEVATION FOR 28S/13E-01B01

P:\Portland\824-Paso Robles\002-GSP Second Annual Report\Analysis\Hydrographs\Grapher\Annual Rpt\Hydr_28S_13E-01B01.grf



EXPLANATION

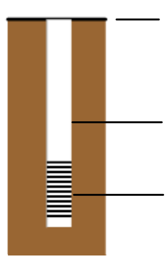
Groundwater Elevation

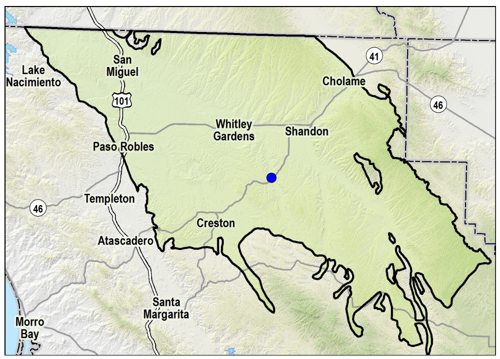
Measurable Objective

Average of spring and fall 2020 water elevations

Measurement Not Verified*

Minimum Threshold





CLIMATE PERIOD CLASSIFICATION

Dry | Average/Alternating | Wet

Well Depth: 630 feet
Screened Interval: 180-630 feet below ground surface
Reference Point Elevation: 1160.5 feet above mean sea level

* Measurement reported as not static

HYDROGRAPH OF MEASURED GROUNDWATER ELEVATION FOR 27S/14E-11R01

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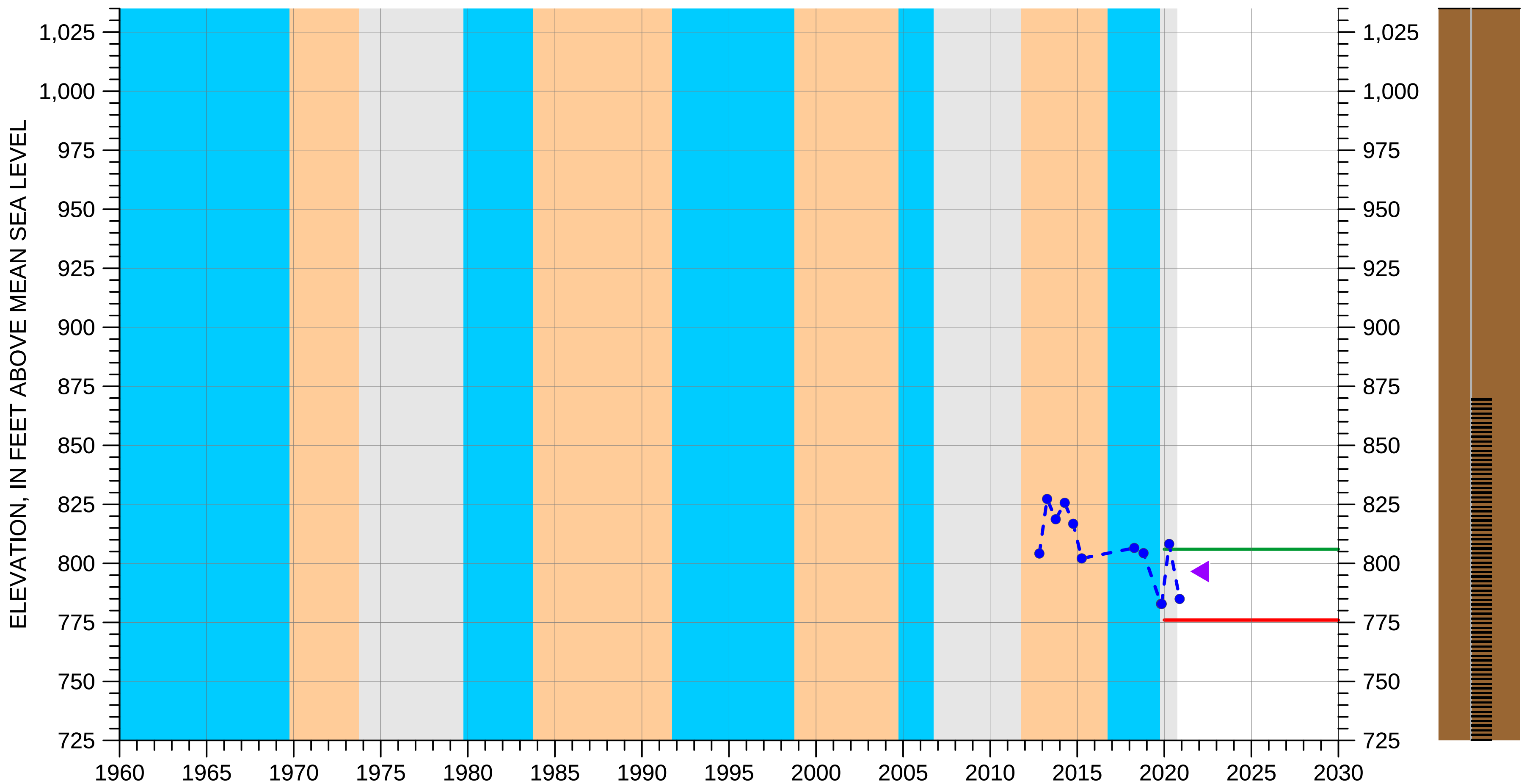


EXPLANATION

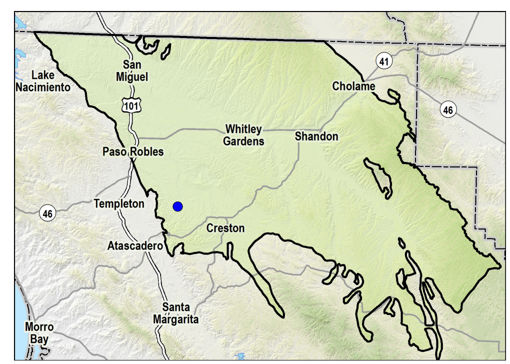
Groundwater Elevation

Measurable Objective

Average of spring and fall 2020 water elevations

Measurement Not Verified*

Minimum Threshold



CLIMATE PERIOD CLASSIFICATION

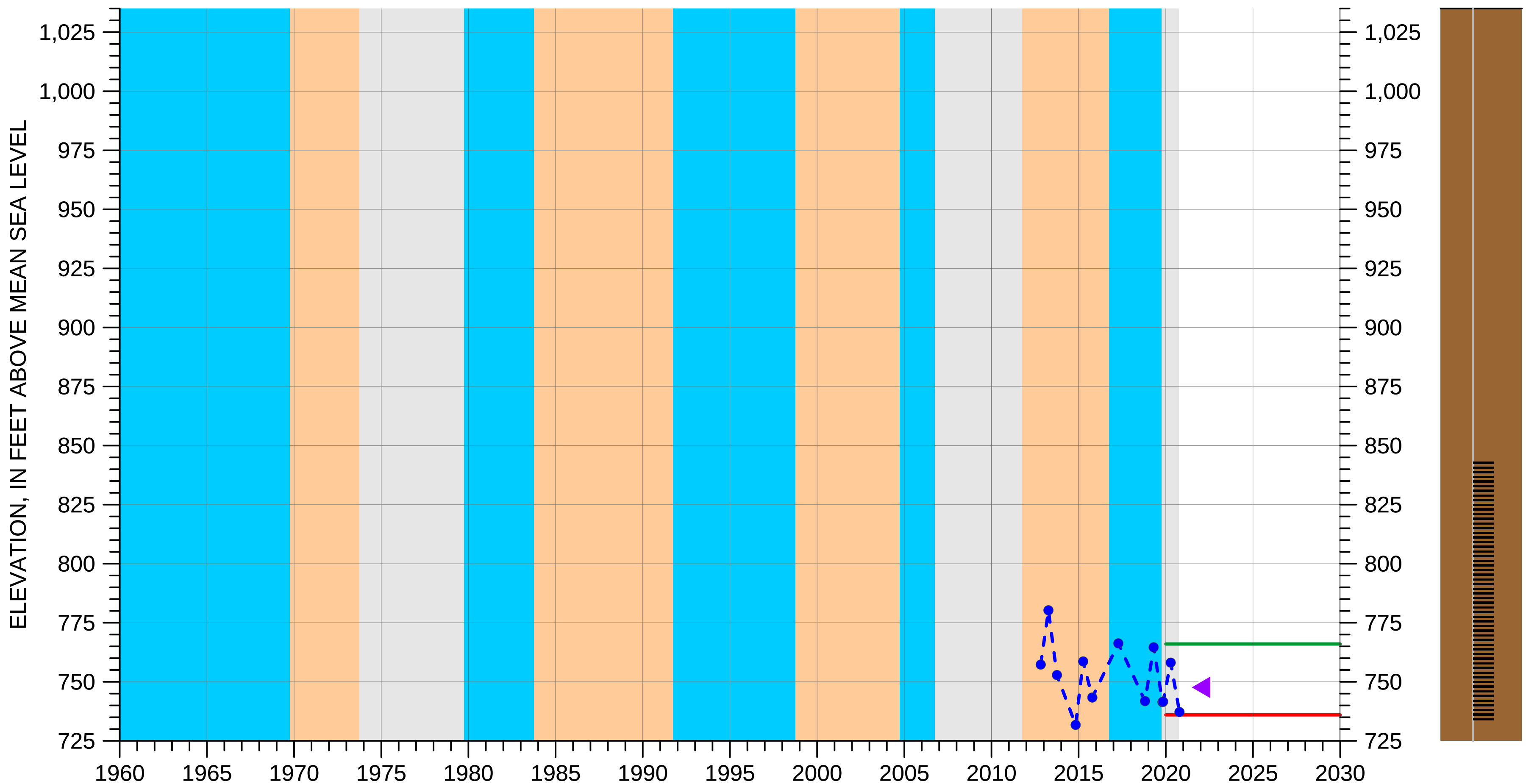
Dry Average/Alternating Wet

Well Depth: 685 feet
Screened Interval: 225-685 feet below ground surface
Reference Point Elevation: 1095 feet above mean sea level

* Measurement reported as not static

HYDROGRAPH OF MEASURED GROUNDWATER ELEVATION FOR 27S/13E-30J01

P:\Portland\824-Paso Robles\002-GSP Second Annual Report\Analysis\Hydrographs\Grapher\Annual Rpt\Hydr_27S_13E-30J01.grf



EXPLANATION

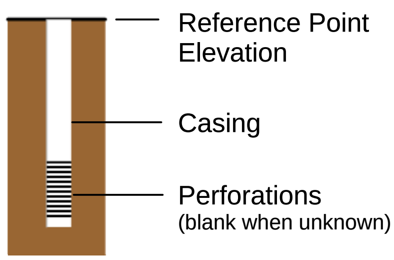
Groundwater Elevation

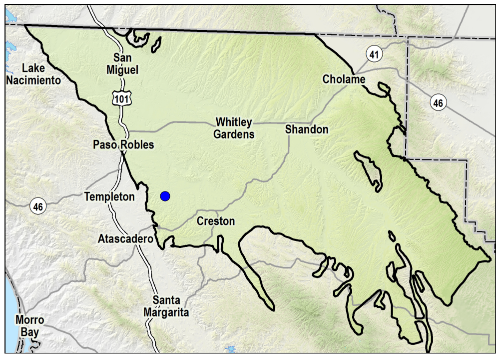
Measurable Objective

Average of spring and fall 2020 water elevations

Measurement Not Verified*

Minimum Threshold





CLIMATE PERIOD CLASSIFICATION

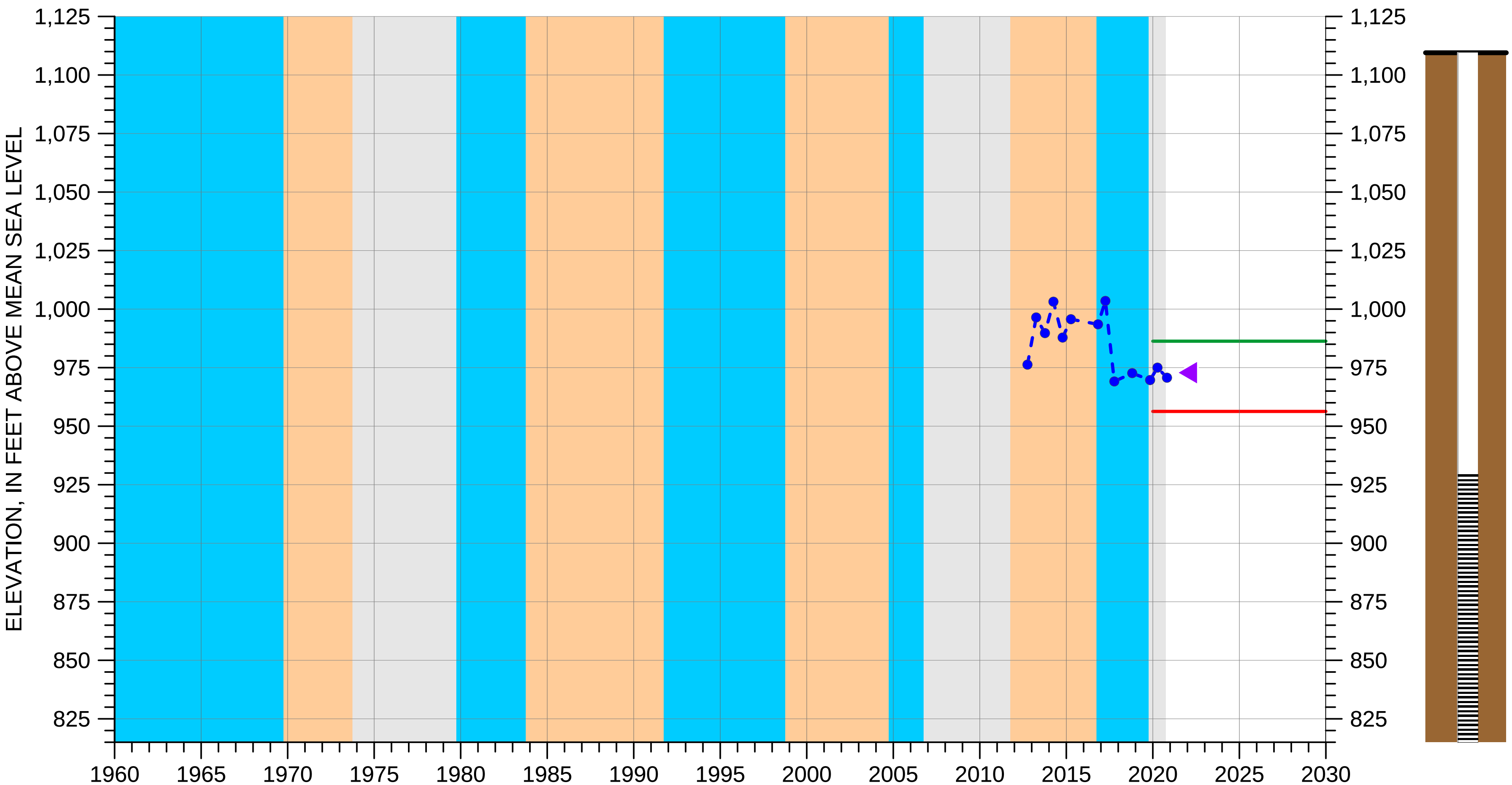
Dry | Average/Alternating | Wet

Well Depth: 310 feet
Screened Interval: 200-310 feet below ground surface
Reference Point Elevation: 1043.2 feet above mean sea level

* Measurement reported as not static

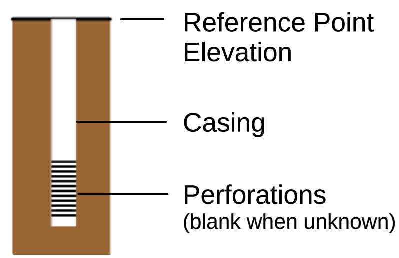
HYDROGRAPH OF MEASURED GROUNDWATER ELEVATION FOR 27S/13E-30F01

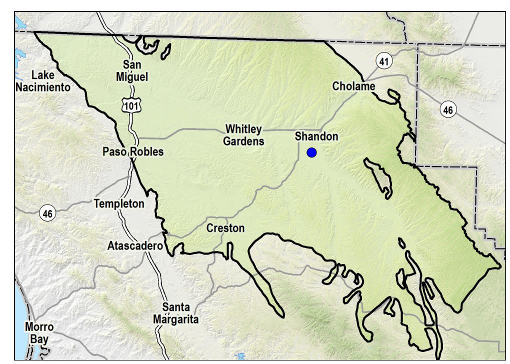
P:\Portland\824-Paso Robles\002-GSP Second Annual Report\Analysis\Hydrographs\Grapher\Annual Rpt\Hydr_27S_13E-30F01.grf



EXPLANATION

- Groundwater Elevation
- Measurable Objective
- Average of spring and fall 2020 water elevations
- Measurement Not Verified*
- Minimum Threshold





CLIMATE PERIOD CLASSIFICATION

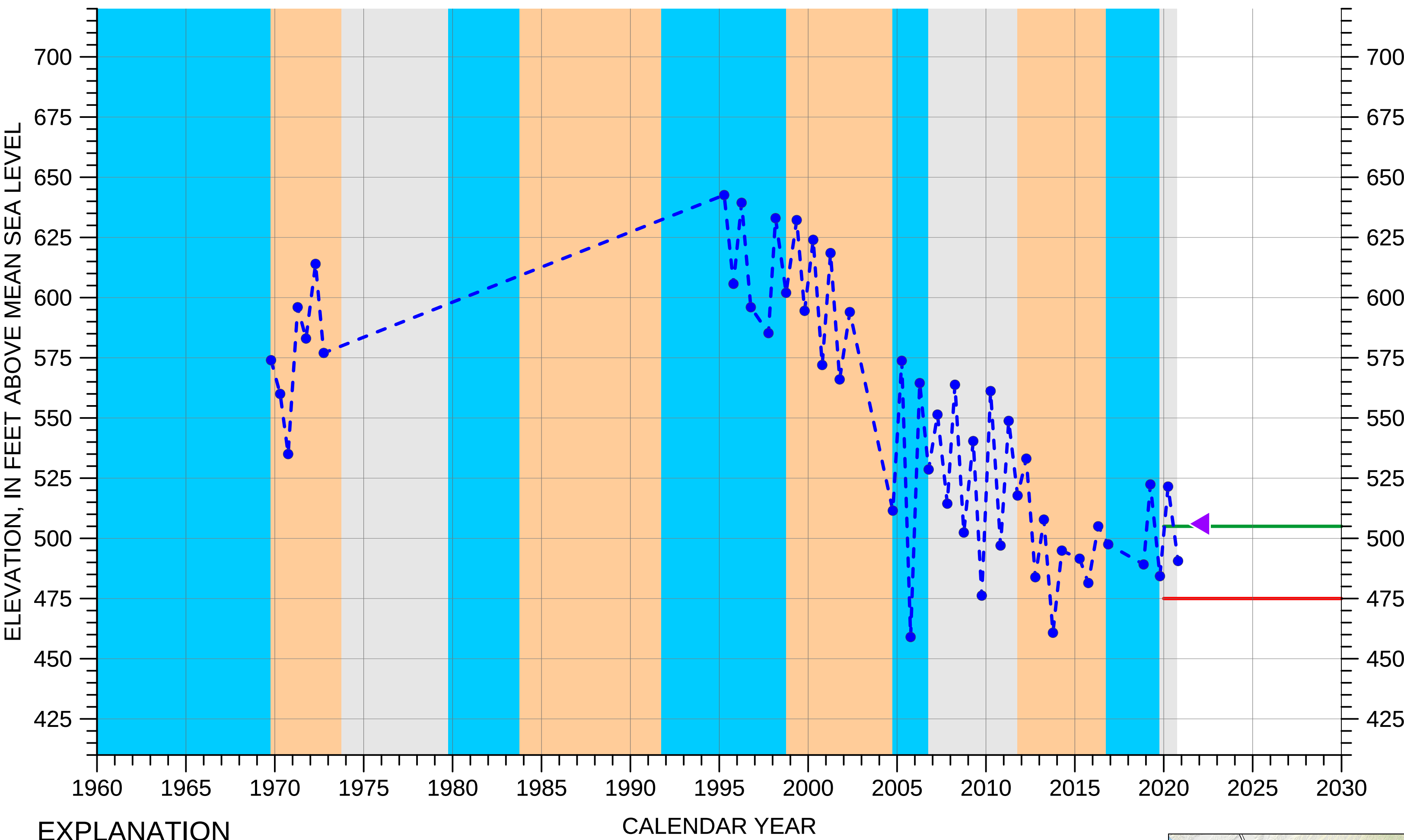
Dry Average/Alternating Wet

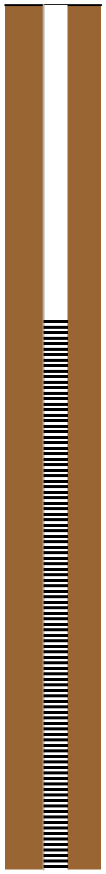
Well Depth: 600 feet
Screened Interval: 180-600 feet below ground surface
Reference Point Elevation: 1109.5 feet above mean sea level

* Measurement reported as not static

HYDROGRAPH OF MEASURED GROUNDWATER ELEVATION FOR 26S/15E-29R01

P:\Portland\824-Paso Robles\002-GSP Second Annual Report\Analysis\Hydrographs\Grapher\Annual Rpt\Hydr_26S_15E-29R01.grf





EXPLANATION

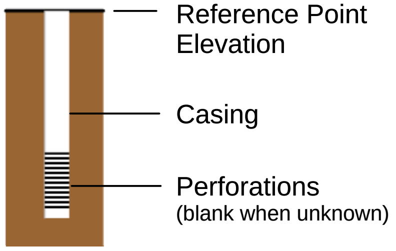
Groundwater Elevation

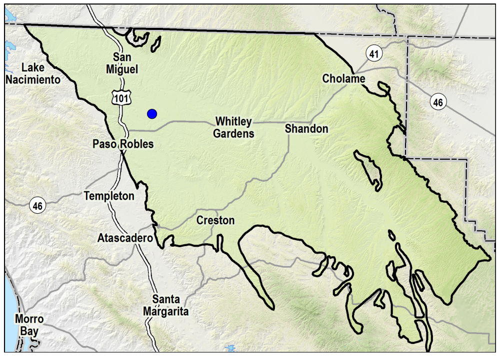
Measurable Objective

Average of spring and fall 2020 water elevations

Measurement Not Verified*

Minimum Threshold





CLIMATE PERIOD CLASSIFICATION

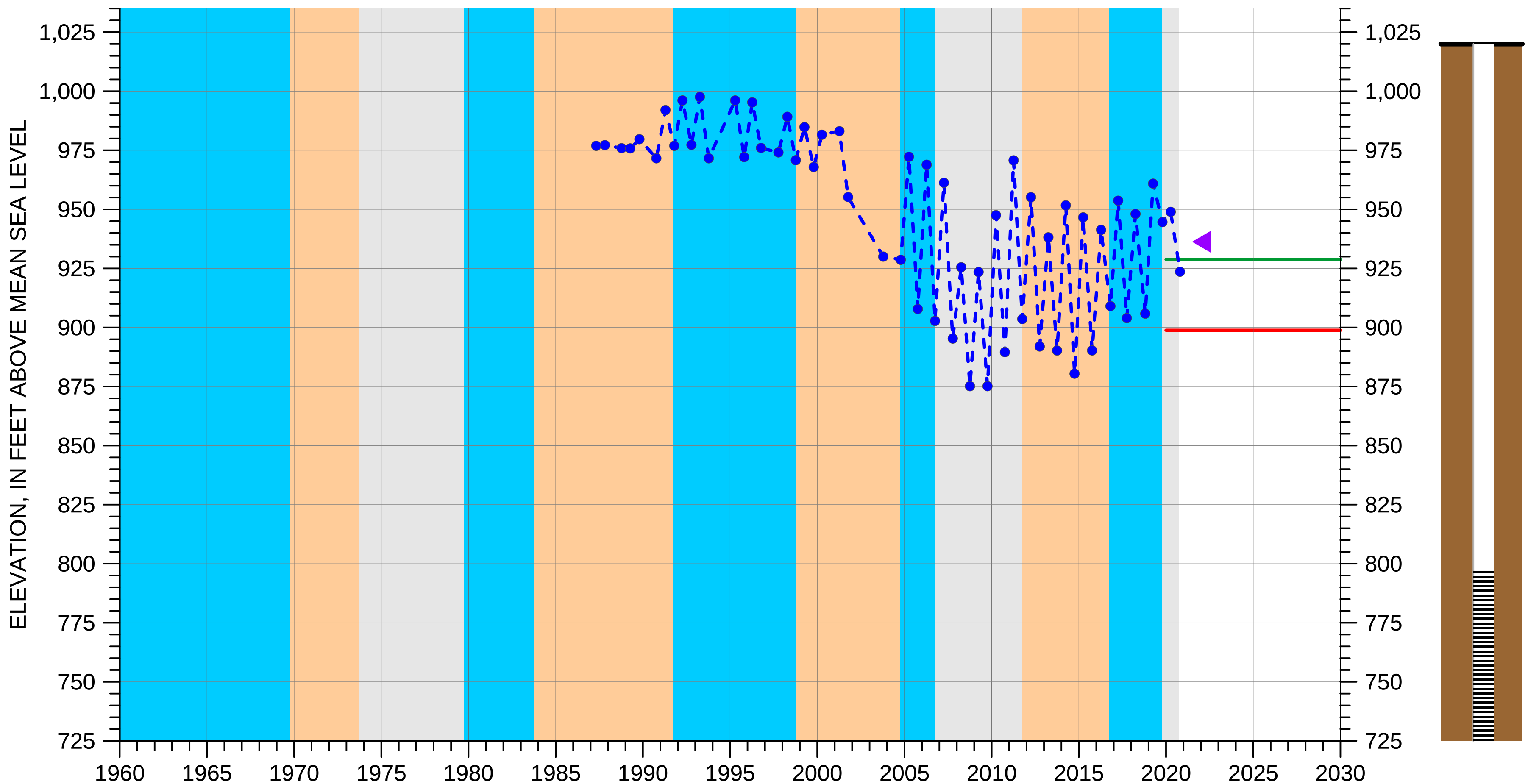
Dry Average/Alternating Wet

Well Depth: 1230 feet
Screened Interval: 180-1230 feet below ground surface
Reference Point Elevation: 790 feet above mean sea level

* Measurement reported as not static

HYDROGRAPH OF MEASURED GROUNDWATER ELEVATION FOR 26S/12E-14H01

P:\Portland\824-Paso Robles\002-GSP Second Annual Report\Analysis\Hydrographs\Grapher\Annual Rpt\Hydr_26S_12E-14H01.grf



EXPLANATION

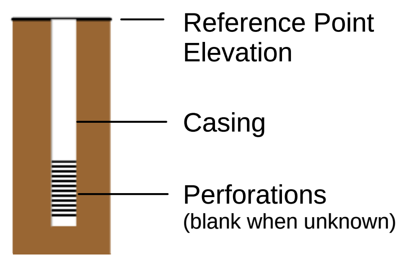
Groundwater Elevation

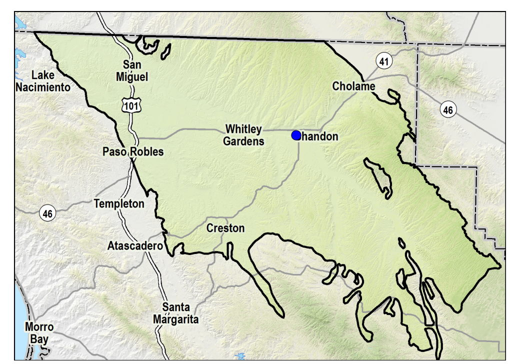
Measurable Objective

Average of spring and fall 2020 water elevations

Measurement Not Verified*

Minimum Threshold





CLIMATE PERIOD CLASSIFICATION

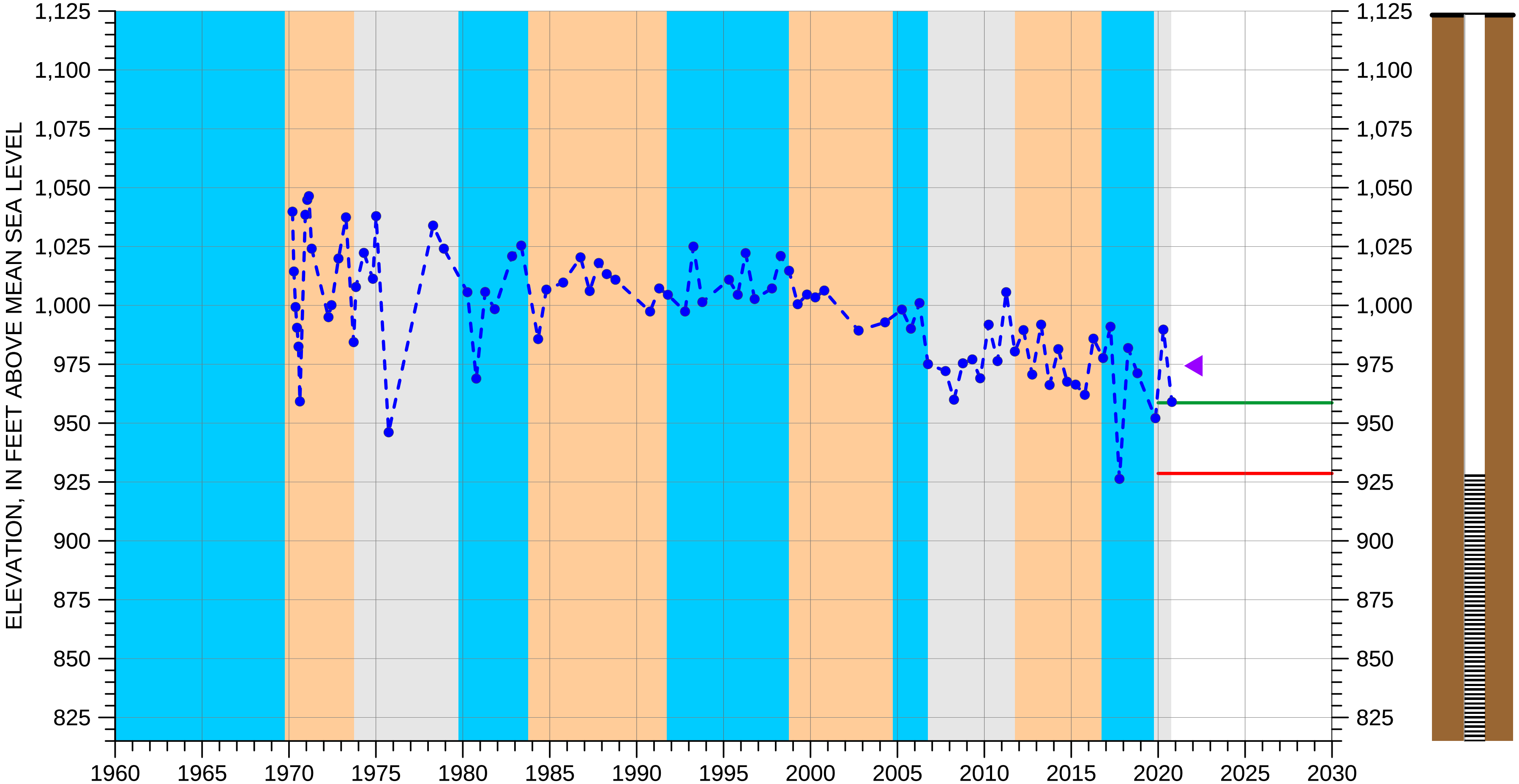
Dry Average/Alternating Wet

Well Depth: 512 feet
Screened Interval: 223-512 feet below ground surface
Reference Point Elevation: 1020 feet above mean sea level

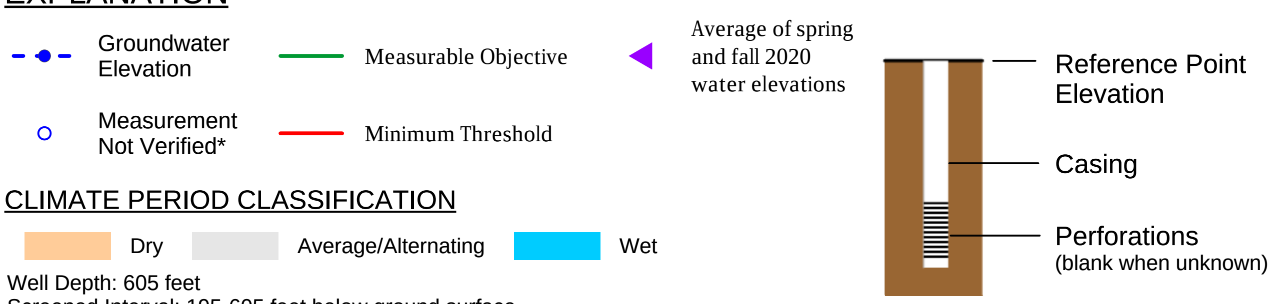
* Measurement reported as not static

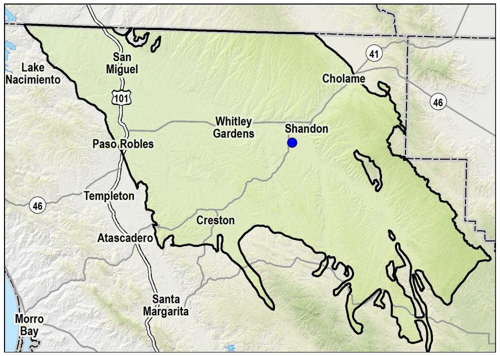
HYDROGRAPH OF MEASURED GROUNDWATER ELEVATION FOR 26S/15E-19E01

P:\Portland\824-Paso Robles\002-GSP Second Annual Report\Analysis\Hydrographs\Grapher\Annual Rpt\Hydr_26S_15E-19E01.grf



EXPLANATION





CLIMATE PERIOD CLASSIFICATION

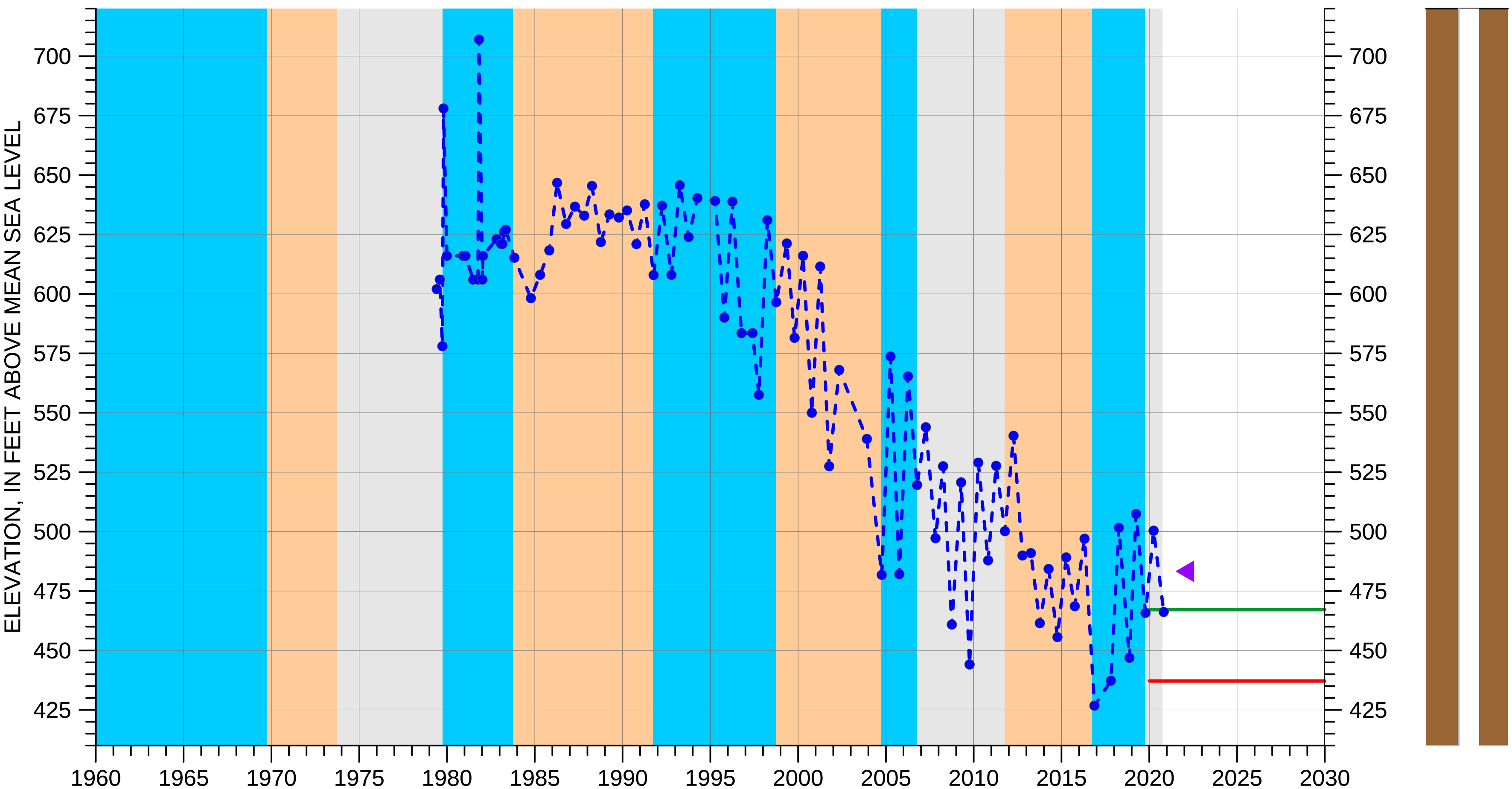
Dry Average/Alternating Wet

Well Depth: 605 feet
Screened Interval: 195-605 feet below ground surface
Reference Point Elevation: 1123.3 feet above mean sea level

* Measurement reported as not static

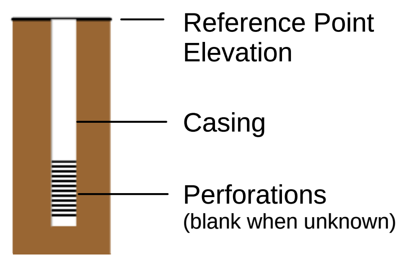
HYDROGRAPH OF MEASURED GROUNDWATER ELEVATION FOR 26S/15E-30J01

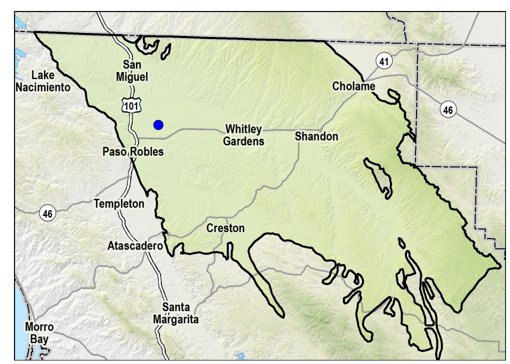
P:\Portland\824-Paso Robles\002-GSP Second Annual Report\Analysis\Hydrographs\Grapher\Annual Rpt\Hydr_26S_15E-30J01.grf



EXPLANATION

- Groundwater Elevation
- Measurement Not Verified*
- Measurable Objective
- Minimum Threshold
- Average of spring and fall 2020 water elevations





CLIMATE PERIOD CLASSIFICATION

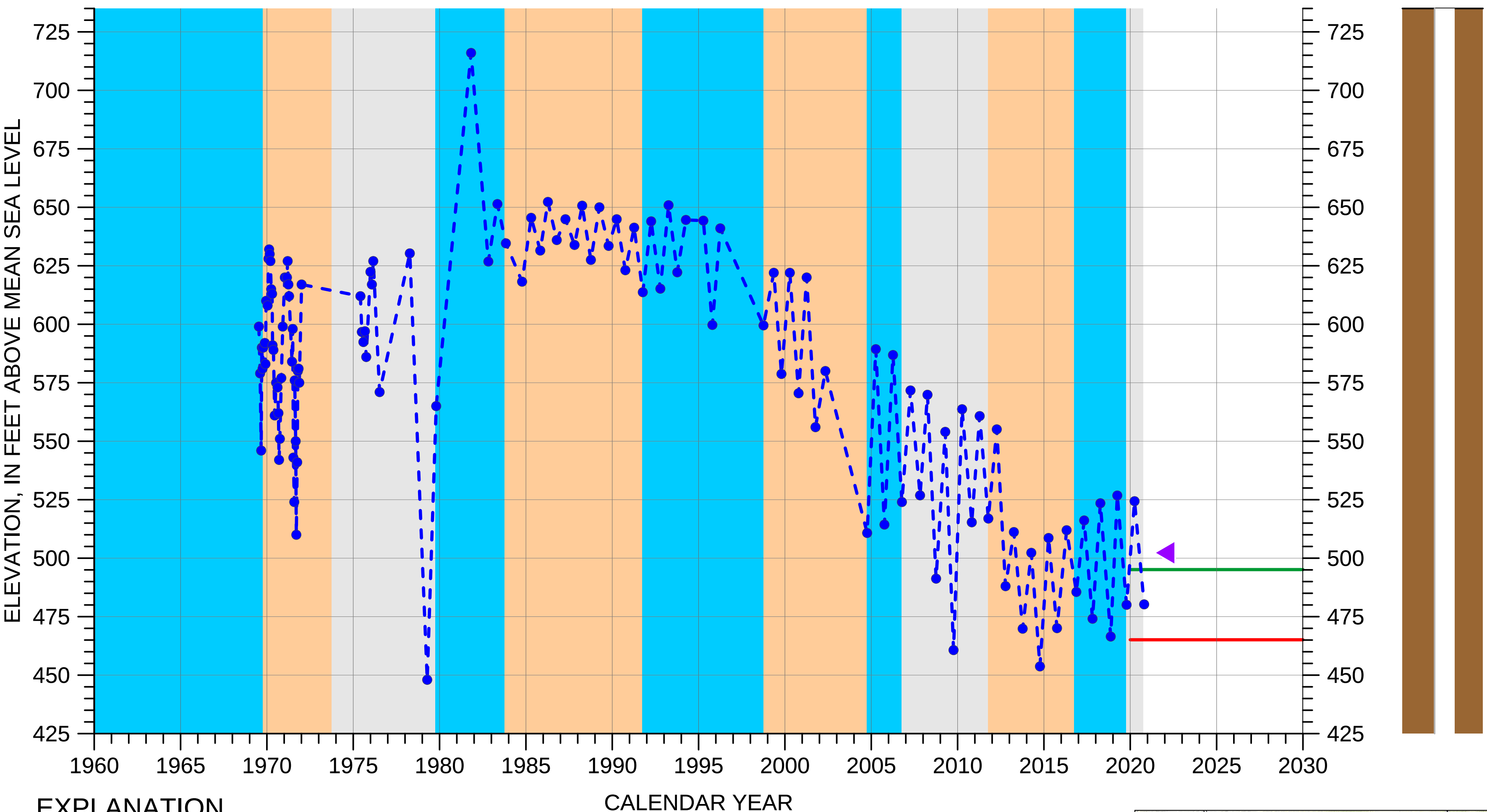
Dry Average/Alternating Wet

Well Depth: 1100 feet
Screened Interval: unknown
Reference Point Elevation: 786 feet above mean sea level

* Measurement reported as not static

HYDROGRAPH OF MEASURED GROUNDWATER ELEVATION FOR 26S/12E-14K01

P:\Portland\824-Paso Robles\002-GSP Second Annual Report\Analysis\Hydrographs\Grapher\Annual Rpt\Hydr_26S_12E-14K01.grf



EXPLANATION

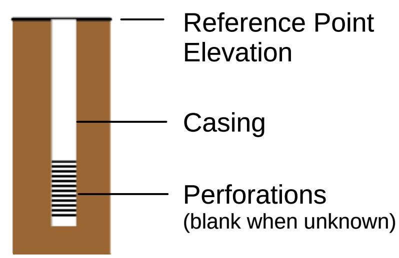
Groundwater Elevation

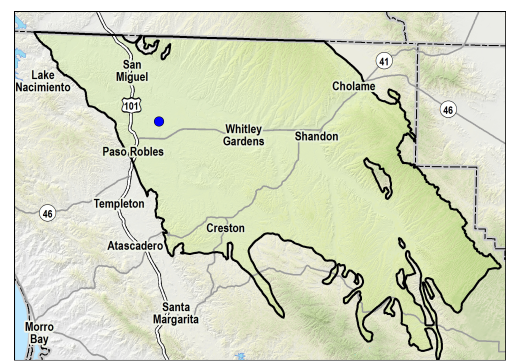
Measurable Objective

Average of spring and fall 2020 water elevations

Measurement Not Verified*

Minimum Threshold





CLIMATE PERIOD CLASSIFICATION

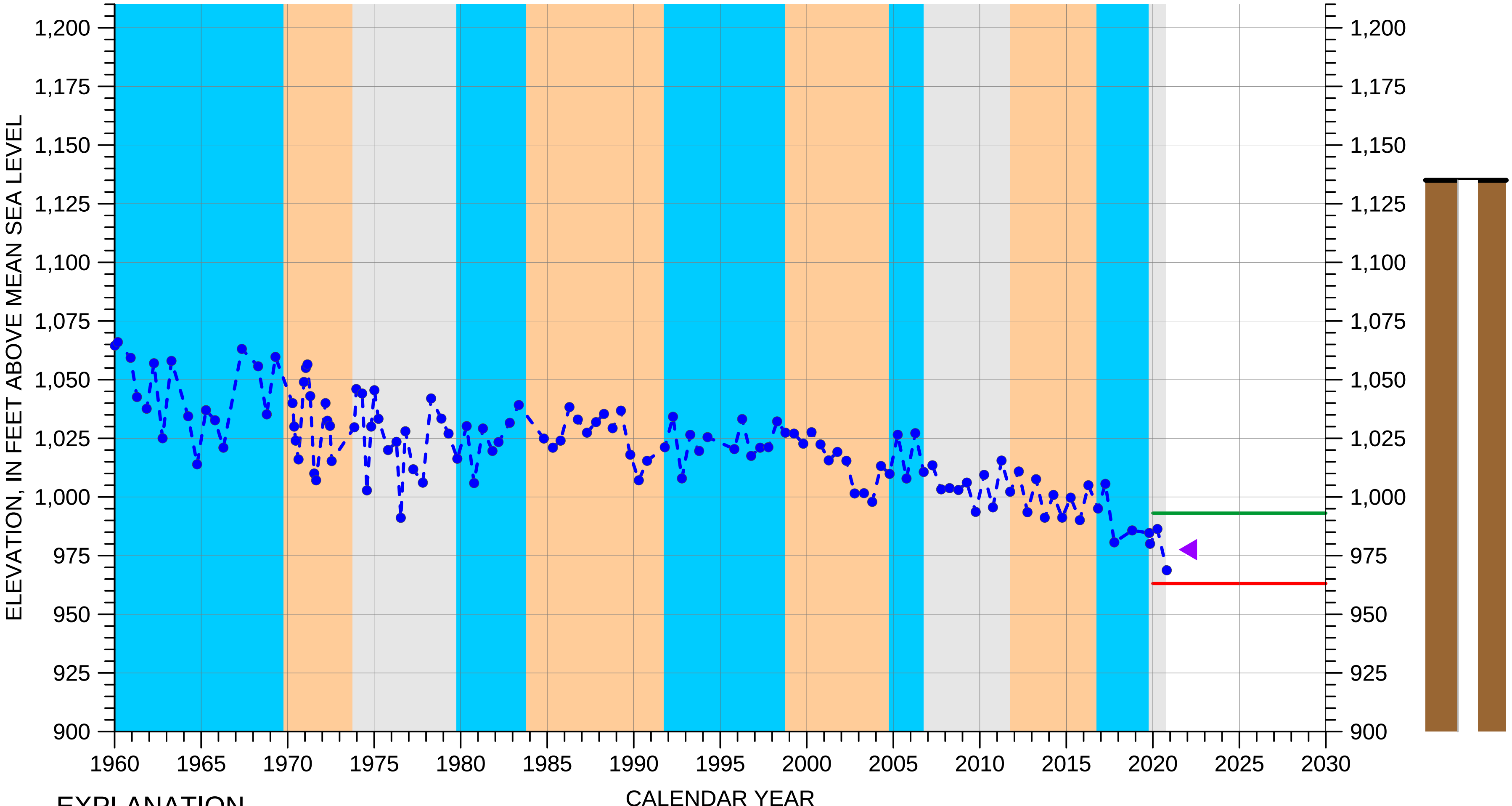
Dry | Average/Alternating | Wet

Well Depth: 740 feet
Screened Interval: unknown
Reference Point Elevation: 789.3 feet above mean sea level

* Measurement reported as not static

HYDROGRAPH OF MEASURED GROUNDWATER ELEVATION FOR 26S/12E-14G01

P:\Portland\824-Paso Robles\002-GSP Second Annual Report\Analysis\Hydrographs\Grapher\Annual Rpt\Hydr_26S_12E-14G01.grf



EXPLANATION

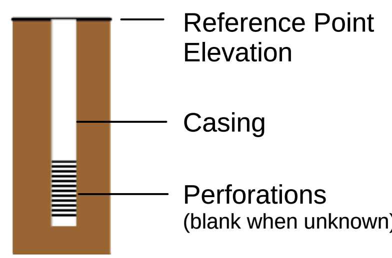
Groundwater Elevation

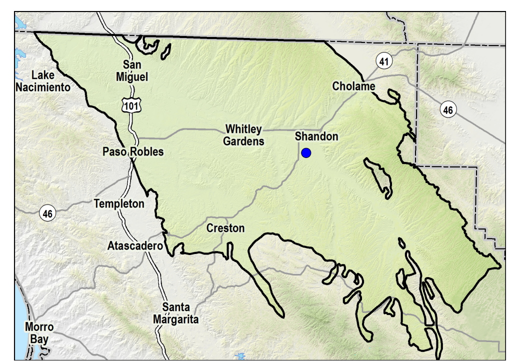
Measurable Objective

Average of spring and fall 2020 water elevations

Measurement Not Verified*

Minimum Threshold





CLIMATE PERIOD CLASSIFICATION

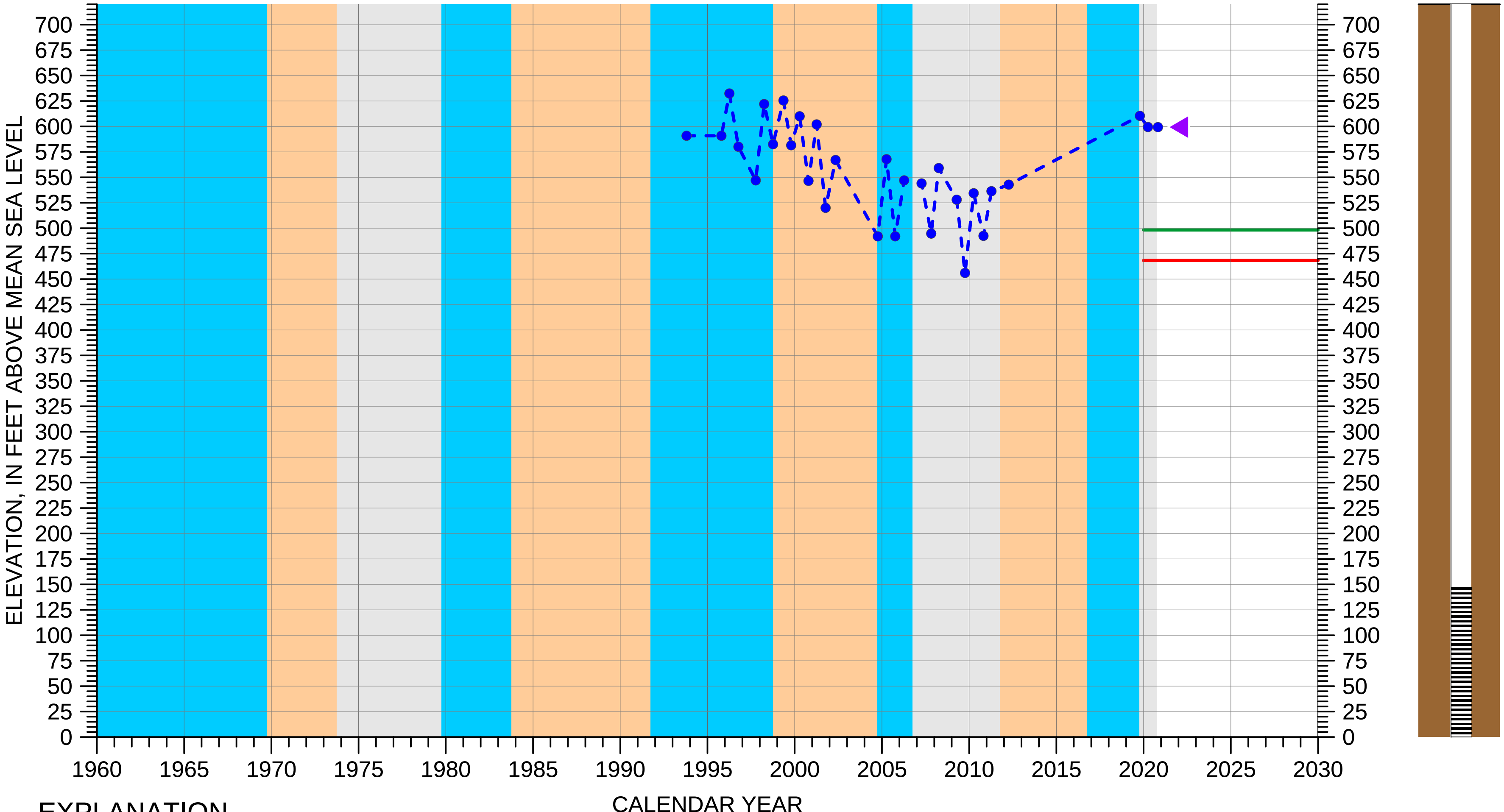
Dry | Average/Alternating | Wet

Well Depth: 350 feet
Screened Interval: unknown
Reference Point Elevation: 1135 feet above mean sea level

* Measurement reported as not static

HYDROGRAPH OF MEASURED GROUNDWATER ELEVATION FOR 26S/15E-29N01

P:\Portland\824-Paso Robles\002-GSP Second Annual Report\Analysis\Hydrographs\Grapher\Annual Rpt\Hydr_26S_15E-29N01.grf



EXPLANATION

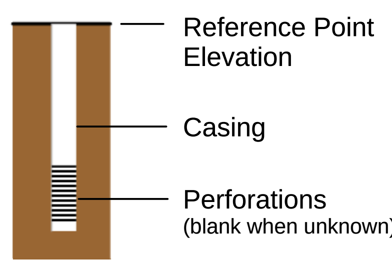
Groundwater Elevation

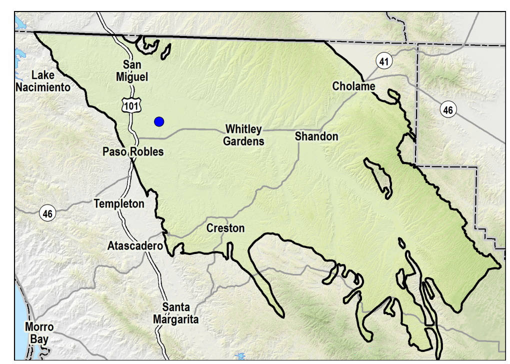
Measurable Objective

Average of spring and fall 2020 water elevations

Measurement Not Verified*

Minimum Threshold





CLIMATE PERIOD CLASSIFICATION

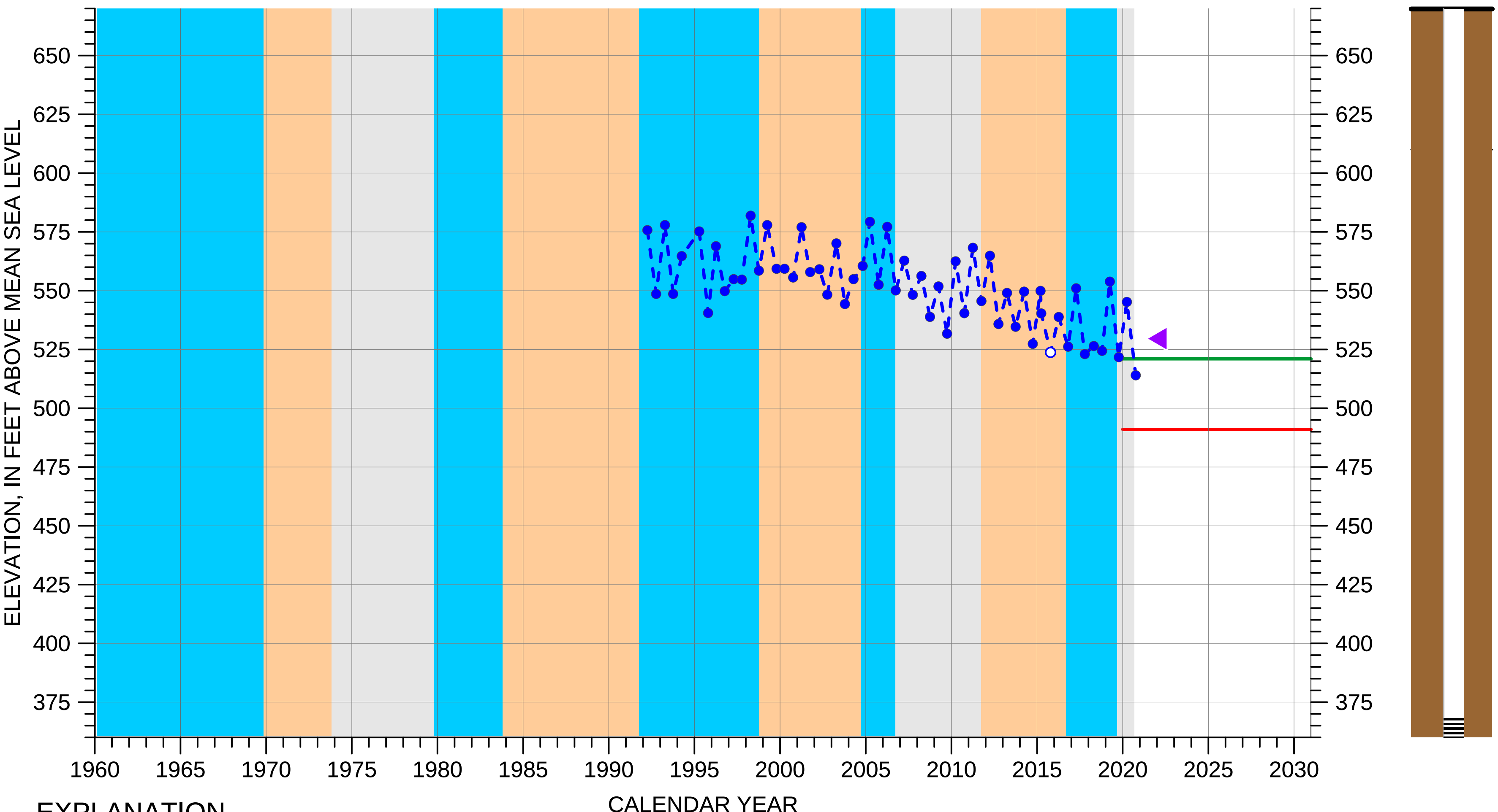
Dry Average/Alternating Wet

Well Depth: 840 feet
Screened Interval: 640-840 feet below ground surface
Reference Point Elevation: 787 feet above mean sea level

* Measurement reported as not static

HYDROGRAPH OF MEASURED GROUNDWATER ELEVATION FOR 26S/12E-14G02

P:\Portland\824-Paso Robles\002-GSP Second Annual Report\Analysis\Hydrographs\Grapher\Annual Rpt\Hydr_26S_12E-14G02.grf



EXPLANATION

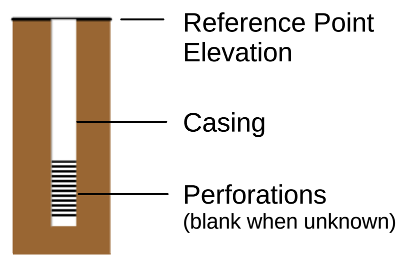
Groundwater Elevation

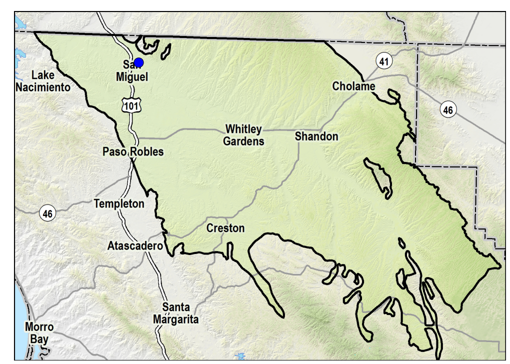
Measurable Objective

Average of spring and fall 2020 water elevations

Measurement Not Verified*

Minimum Threshold





CLIMATE PERIOD CLASSIFICATION

Dry

Average/Alternating

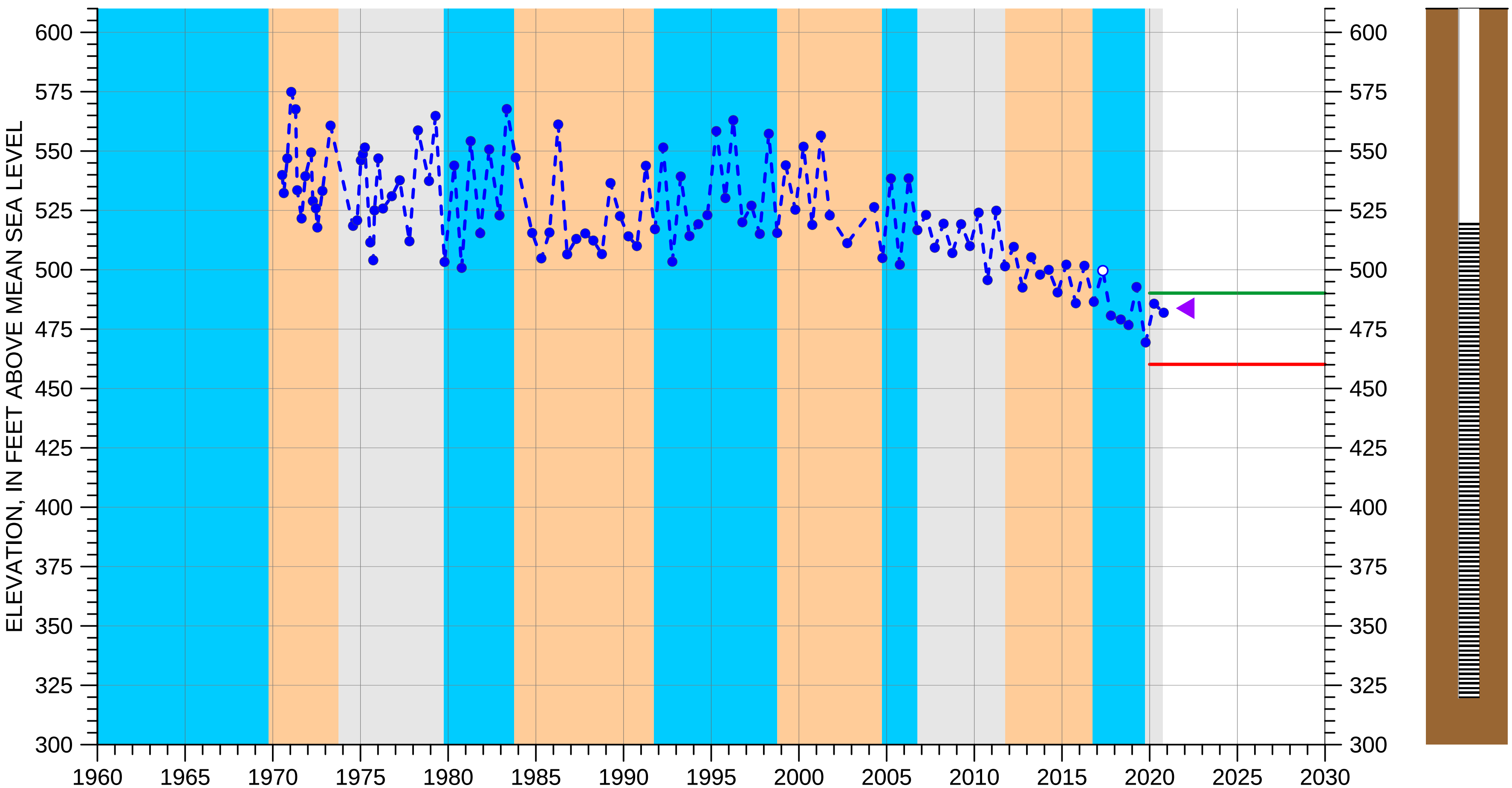
Wet

Well Depth: 350 feet
Screened Interval: 300-310, 330-340 feet below ground surface
Reference Point Elevation: 669.8 feet above mean sea level

* Measurement reported as not static

HYDROGRAPH OF MEASURED GROUNDWATER ELEVATION FOR 25S/12E-16K05

P:\Portland\824-Paso Robles\002-GSP Second Annual Report\Analysis\Hydrographs\Grapher\Annual Rpt\Hydr_25S_12E-16K05.gpj



EXPLANATION

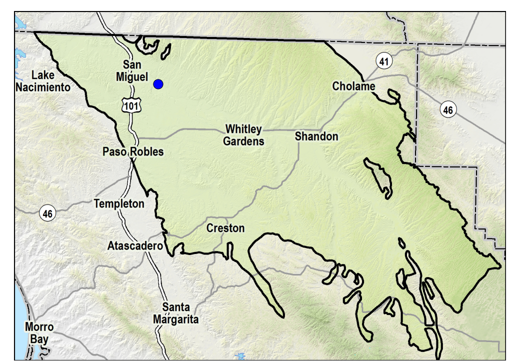
Groundwater Elevation

Measurable Objective

Average of spring and fall 2020 water elevations

Measurement Not Verified*

Minimum Threshold



CLIMATE PERIOD CLASSIFICATION

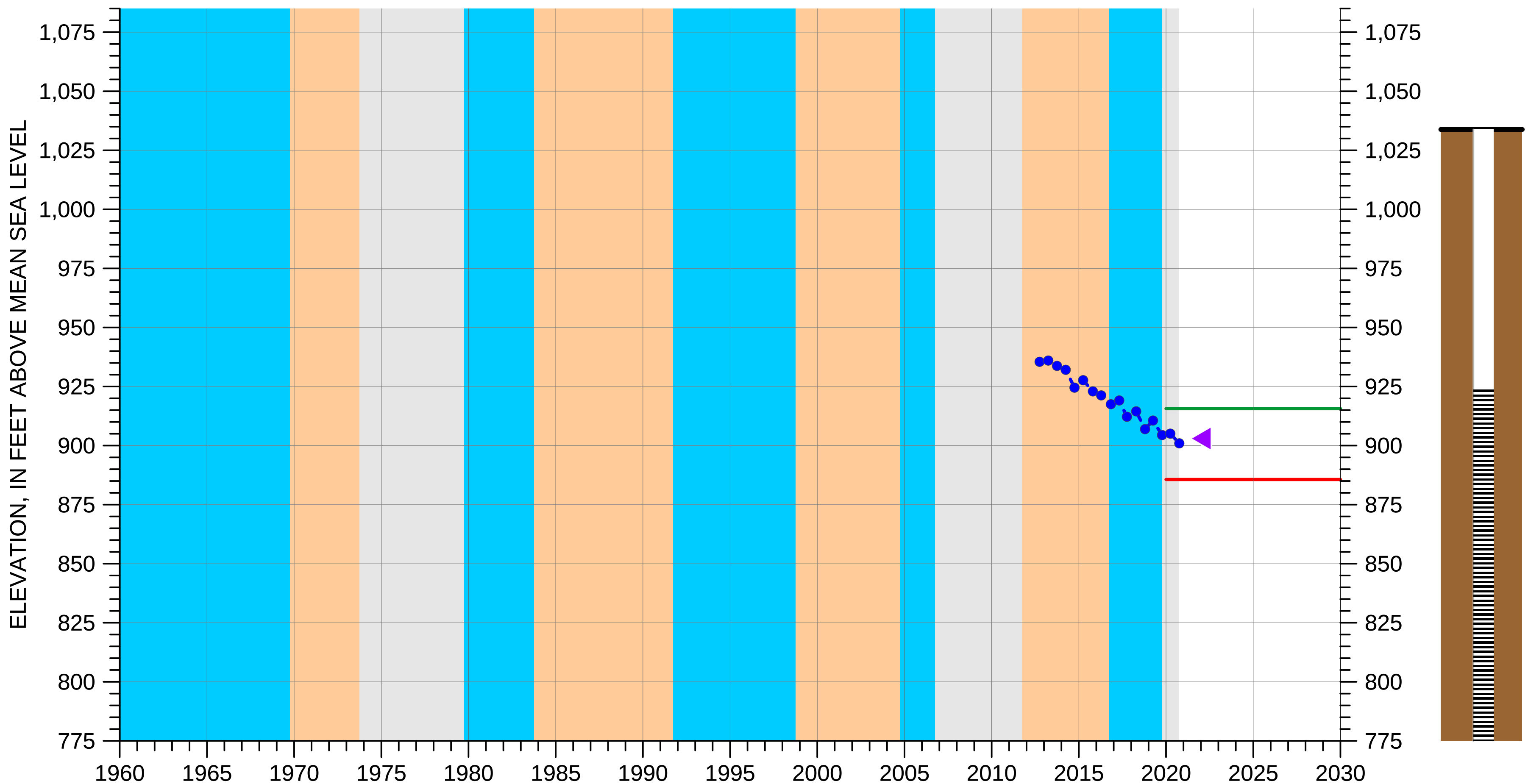
Dry Average/Alternating Wet

Well Depth: 400 feet
Screened Interval: 200-400 feet below ground surface
Reference Point Elevation: 719.7 feet above mean sea level

* Measurement reported as not static

HYDROGRAPH OF MEASURED GROUNDWATER ELEVATION FOR 25S/12E-26L01

P:\Portland\824-Paso Robles\002-GSP Second Annual Report\Analysis\Hydrographs\Grapher\Annual Rpt\Hydr_25S_12E-26L01.gpj



EXPLANATION

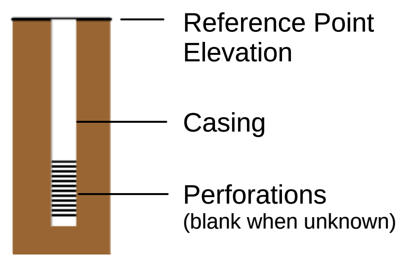
Groundwater Elevation

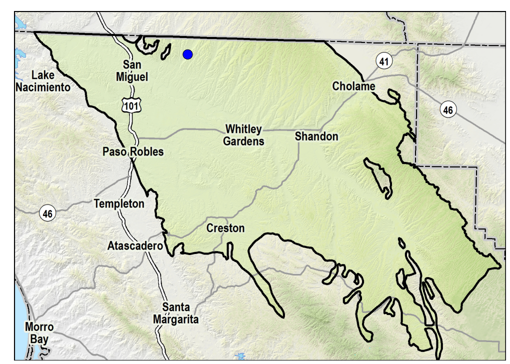
Measurable Objective

Average of spring and fall 2020 water elevations

Measurement Not Verified*

Minimum Threshold





CLIMATE PERIOD CLASSIFICATION

Dry

Average/Alternating

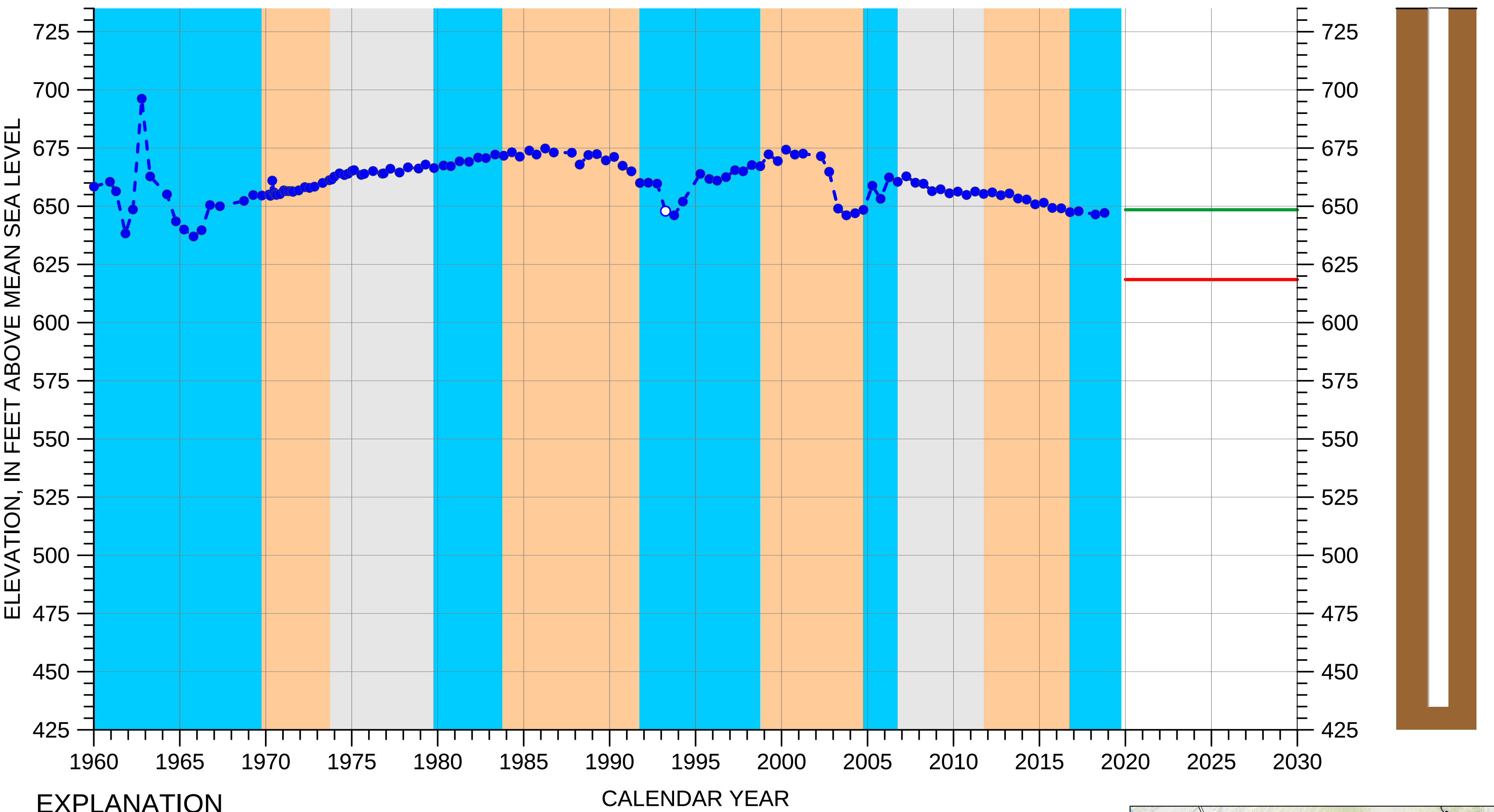
Wet

Well Depth: 270 feet
Screened Interval: 110-270 feet below ground surface
Reference Point Elevation: 1033.8 feet above mean sea level

* Measurement reported as not static

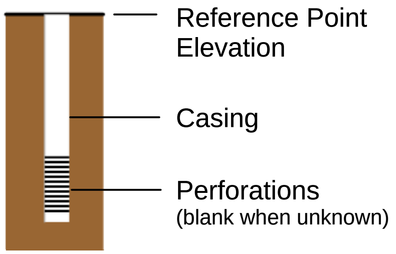
HYDROGRAPH OF MEASURED GROUNDWATER ELEVATION FOR 25S/13E-08L02

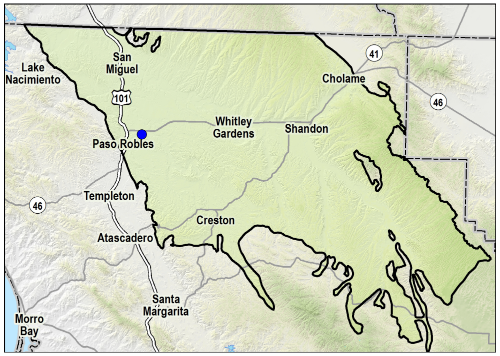
P:\Portland\824-Paso Robles\002-GSP Second Annual Report\Analysis\Hydrographs\Grapher\Annual Rpt\Hydr_25S_13E-08L02.gpj



EXPLANATION

- Groundwater Elevation
- Measurable Objective
- Measurement Not Verified*
- Minimum Threshold





CLIMATE PERIOD CLASSIFICATION

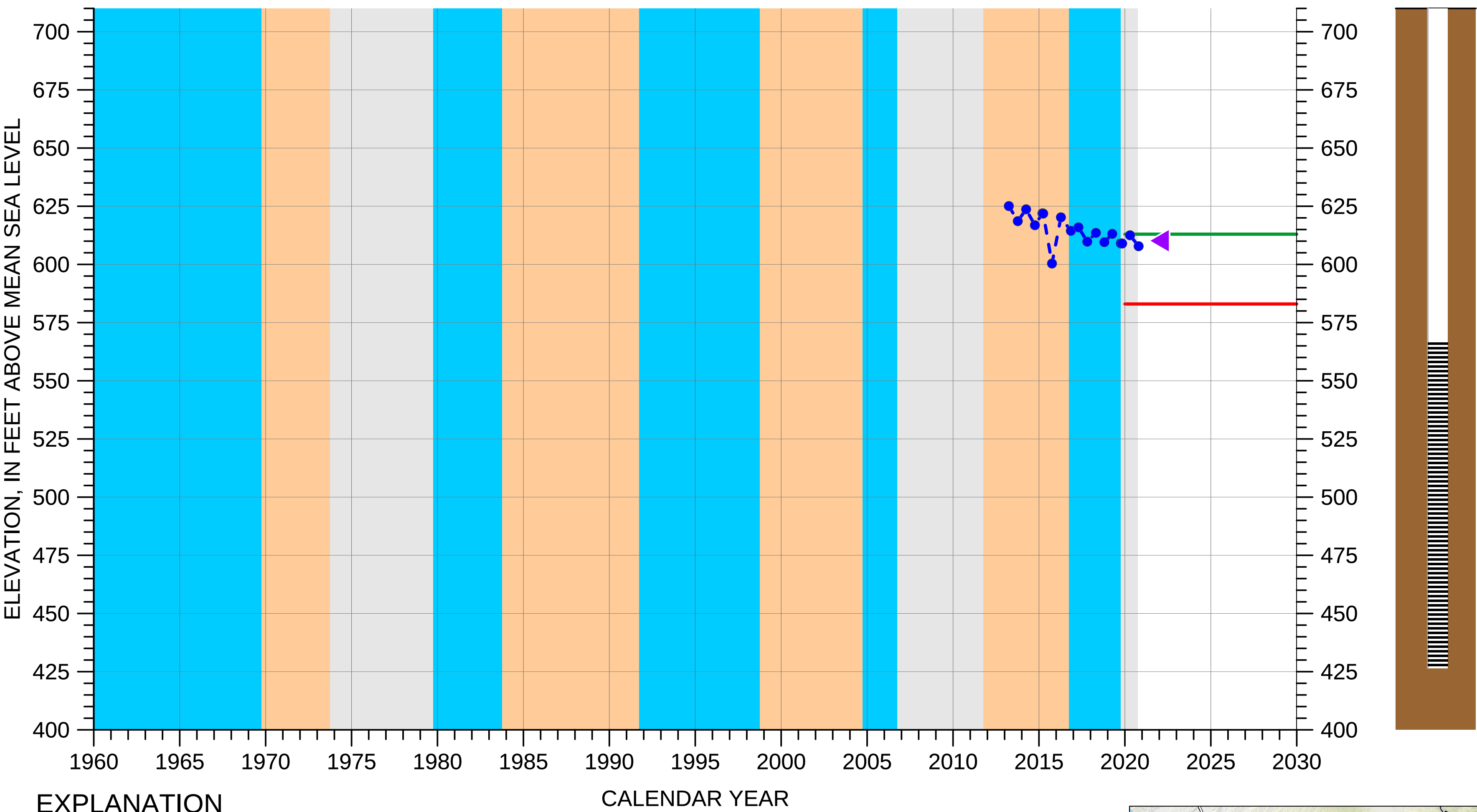
Dry | Average/Alternating | Wet

Well Depth: 400 feet
Screened Interval: unknown
Reference Point Elevation: 835 feet above mean sea level

* Measurement reported as not static

HYDROGRAPH OF MEASURED GROUNDWATER ELEVATION FOR 26S/12E-26E07

P:\Portland\824-Paso Robles\002-GSP Second Annual Report\Analysis\Hydrographs\Grapher\Annual Rpt\Hydr_26S_12E-26E07.grf



EXPLANATION

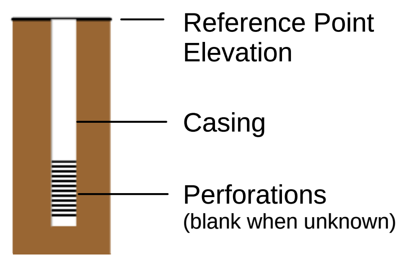
Groundwater Elevation

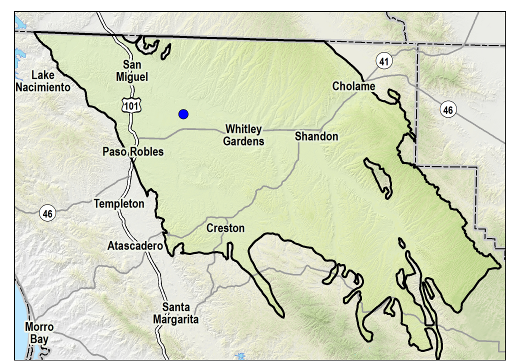
Measurable Objective

Average of spring and fall 2020 water elevations

Measurement Not Verified*

Minimum Threshold





CLIMATE PERIOD CLASSIFICATION

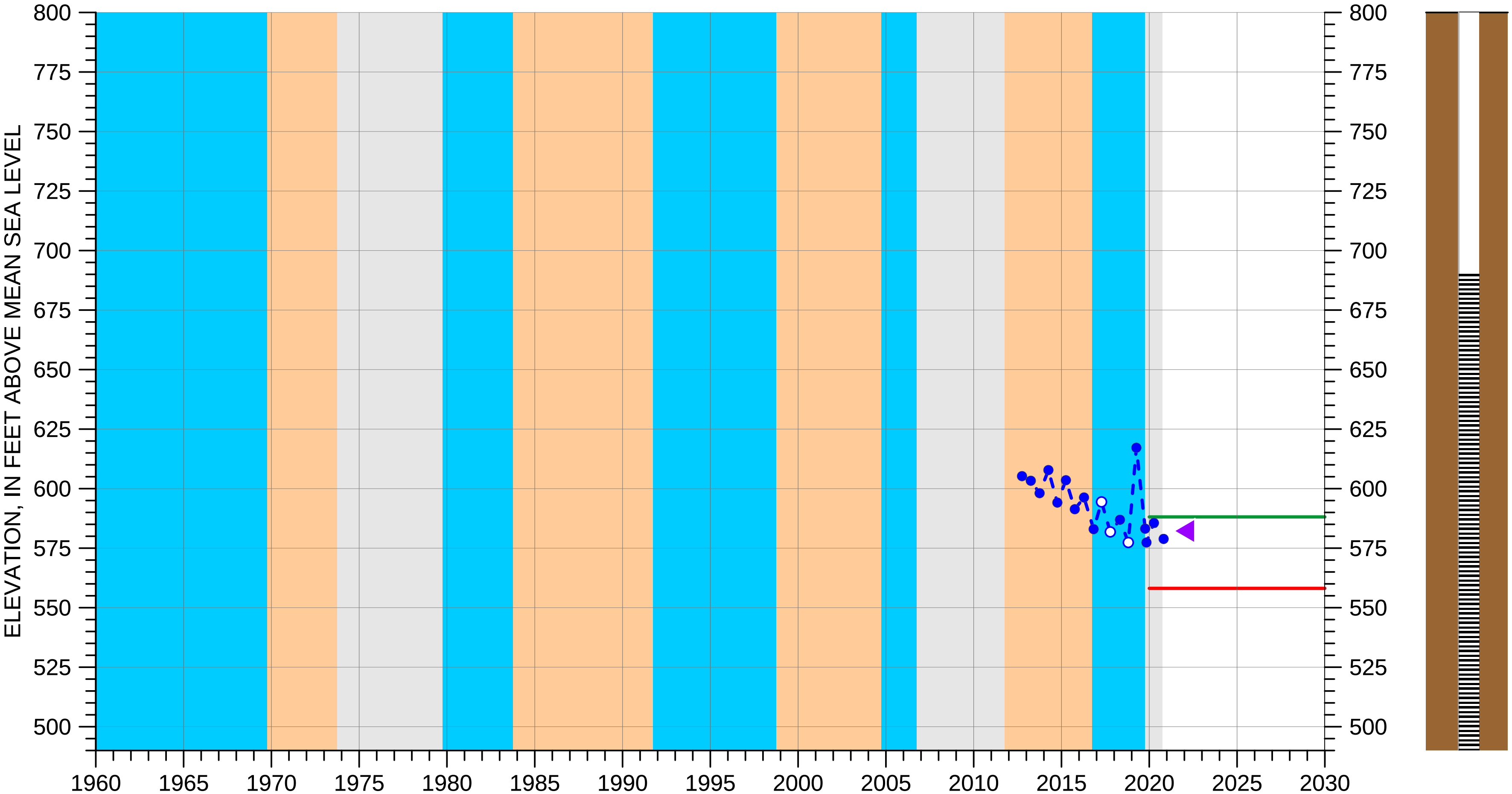
Dry Average/Alternating Wet

Well Depth: 400 feet
Screened Interval: 260-400 feet below ground surface
Reference Point Elevation: 827.9 feet above mean sea level

* Measurement reported as not static

HYDROGRAPH OF MEASURED GROUNDWATER ELEVATION FOR 26S/13E-08M01

P:\Portland\824-Paso Robles\002-GSP Second Annual Report\Analysis\Hydrographs\Grapher\Annual Rpt\Hydr_26S_13E-08M01.grf



EXPLANATION

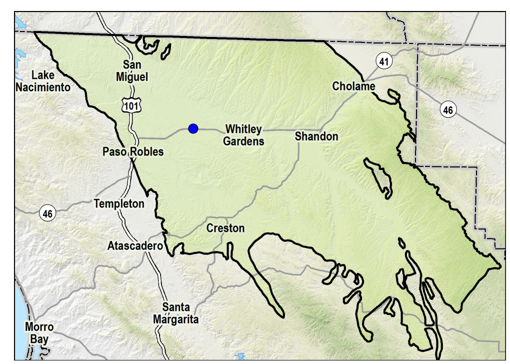
Groundwater Elevation

Measurement Not Verified*

Measurable Objective

Minimum Threshold

Average of spring and fall 2020 water elevations



CLIMATE PERIOD CLASSIFICATION

Dry

Average/Alternating

Wet

Well Depth: 400 feet
Screened Interval: 200-400 feet below ground surface
Reference Point Elevation: 890.2 feet above mean sea level

* Measurement reported as not static

HYDROGRAPH OF MEASURED GROUNDWATER ELEVATION FOR 26S/13E-16N01

P:\Portland\824-Paso Robles\002-GSP Second Annual Report\Analysis\Hydrographs\Grapher\Annual Rpt\Hydr_26S_13E-16N01.grf

APPENDIX F

Paso Robles Formation Aquifer Storage Coefficient Derivation and Sensitivity Analysis (GSI, 2020)

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Paso Robles Formation Aquifer Storage Coefficient Derivation and Sensitivity Analysis

The annual changes in groundwater in storage calculated for water years 2017, 2018, and 2019 in the Paso Robles Formation Aquifer presented in this first annual report are based on a fixed storage coefficient (S) value derived from groundwater modeling and groundwater elevation data presented in the Groundwater Sustainability Plan (GSP) for water year 2016. The derivation of S for the Paso Robles Formation Aquifer and a sensitivity analysis are presented below. It should be noted that while the GSP groundwater model utilizes a spatially variable S (both laterally and vertically) the S value derived here and used in this first annual report is a single average value representing the Paso Robles Formation Aquifer within the Subbasin.

1.1 Derivation of the Storage Coefficient Term

Derivation of S was accomplished through a back calculation using the change in groundwater in storage in the Paso Robles Formation Aquifer determined from the GSP groundwater model for water year 2016 and the total volume change represented by a Paso Robles Formation Aquifer groundwater elevation change map prepared for water year 2016. The change in groundwater in storage for water year 2016 in the Paso Robles Formation Aquifer is -59,459 acre-feet (AF) based on the GSP groundwater model.

The Paso Robles Formation Aquifer groundwater elevation change map for water year 2016 was prepared for this annual report by comparing the fall 2015 groundwater elevation contour map to the fall 2016 groundwater elevation contour map. The fall 2015 groundwater elevations were subtracted from the fall 2016 groundwater elevations resulting in a map depicting the changes in groundwater elevations in the Paso Robles Formation Aquifer that occurred during the 2016 water year (not pictured, but similar to Figures 12, 13, and 14 in this first annual report).

The groundwater elevation change map for water year 2016 represents a total volume change within the Paso Robles Formation Aquifer of -807,490 AF. As described in Section 7.2 of this annual report, this total volume change includes the volume displaced by the aquifer material and the volume of groundwater stored within the void space of the aquifer. The portion of void space in the aquifer that can be utilized for groundwater storage is represented by S. The change in groundwater in storage is equivalent to the product of S and the total volume change, as shown here:

$$Change\ of\ Groundwater\ in\ Storage = S \times Total\ Volume\ Change$$

This equation can be re-arranged and solved for S:

$$S = \frac{Change\ of\ Groundwater\ in\ Storage}{Total\ Volume\ Change} = \frac{-59{,}459\ AF}{-807{,}490\ AF} = 0.07$$

Therefore, based on analysis of data for water year 2016, an average S value for the Paso Robles Formation Aquifer in the Paso Robles Subbasin is 0.07.

1.2 Sensitivity Analysis

The annual changes in groundwater in storage in the Paso Robles Formation Aquifer calculated for water years 2017, 2018, and 2019 presented in this first annual report are 60,106, 6,398, and 59,682 AF, respectively. These values, calculated using an S value of 0.07, appear reasonable when compared to historical changes in groundwater in storage (see Figure 15 in this first annual report). While the calculated value of S, presented above, is based on sound science and using the best readily available information, it is necessary to acknowledge that the true value of S in the Paso Robles Formation Aquifer is spatially variable (as indicated in the GSP groundwater model) and ranges in value both above and below the calculated value of 0.07. A sensitivity analysis was performed to demonstrate the range of annual changes in groundwater in storage that result from using a range of S values. Table F1 shows that the annual change in groundwater in storage volumes can range from 27 percent less to 27 percent more than presented in this first annual report based on S values ranging from 0.05 to 0.09. This shows the sensitivity of the S value to determination of annual change in groundwater in storage. However, neither the 27 percent lower nor the 27 percent higher annual change in groundwater in storage volumes seem reasonable when compared to historical changes in groundwater in storage (as shown in Figure 15 in this first annual report). Based on this sensitivity analysis, GSI believes that the calculated value of S (0.07) is reasonable and defensible for the purposes of this first annual report.

Table F 1. Change in Groundwater in Storage Sensitivity Analysis

Water Year	Total Volume of Change (AF)	Change in Groundwater in Storage (AF), based on:								
		S = 0.05		S = 0.06		Calculated S [0.07]	S = 0.08		S = 0.09	
		(AF)	% Diff	(AF)	% Diff	(AF)	(AF)	% Diff	(AF)	% Diff
2017	816,274	43,781	-27%	51,943	-14%	60,106	68,269	14%	76,432	27%
2018	86,885	4,660		5,529		6,398	7,267		8,135	
2019	810,508	43,471		51,577		59,682	67,787		75,892	

notes:

AF = acre-feet, S = storage coefficient, % Diff = percent difference from calculated S

APPENDIX G

Amendment No. 1 to the Memorandum of Agreement

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AMENDMENT NO. 1
TO MEMORANDUM OF AGREEMENT REGARDING
PREPARATION OF A GROUNDWATER SUSTAINABILITIY PLAN
FOR THE PASO ROBLES GROUNDWATER BASIN

This Amendment No. 1 to Memorandum of Agreement Regarding Preparation of a Groundwater Sustainability Plan for the Paso Robles Groundwater Basin ("Amendment") is entered into by and between the City of El Paso de Robles, the San Miguel Community Services District, the County of San Luis Obispo and the Shandon-San Juan Water District (collectively, "Parties").

WHEREAS, on or about September 20, 2017, the Parties and the Heritage Ranch Community Services District ("HRCSD") entered into a Memorandum of Agreement Regarding Preparation of a Groundwater Sustainability Plan for the Paso Robles Groundwater Basin ("MOA"), a copy of which is attached hereto as Attachment 1 and incorporated herein by this reference, for purposes of establishing a framework for preparing a single groundwater sustainability plan for the Paso Robles Area Subbasin ("GSP") and for continued cooperation among the Parties; and

WHEREAS, the HRCSD provided written notice of its withdrawal from the MOA pursuant to Section 9.1 on or around January 18, 2019 and its withdrawal became effective shortly thereafter; and

WHEREAS, the Parties desire to continue cooperating on the GSP pursuant to the framework established by the MOA on an interim basis regardless of the date of any approval of the GSP by the California Department of Water Resources.

NOW, THEREFORE, the PARTIES agree with the above recitals, and hereby further agree as follows:

1. Section 1 (Purpose) of the MOA shall hereafter be and read as follows:

   The purpose of this MOA is to establish a committee to develop a single GSP that will be considered by each individual Party and subsequently submitted to DWR for approval. This MOA may also serve as the basis for continued cooperation among the Parties in the management of the Basin during the period between adoption of the GSP by each Party and development of a long-term governance structure for implementation of the GSP.

WHEN FULLY EXECUTED PLEASE RETURN TO
COUNTY ADMINISTRATIVE OFFICE
ATTN: CLERK OF THE BOARD
1055 Monterey Street Ste. D430
San Luis Obispo, CA 93408 Item No. 33

2. Section 2 (Term) of the MOA shall hereafter be and read as follows:

   This MOA shall become effective on the date that the last of the five (5) Parties signs ("Effective Date") and shall remain in effect until terminated in accordance with Section 9.2 below.

3. Section 4.9 of the MOA shall hereafter be and read as follows:

   The creation of the Cooperative Committee shall not be construed as a delegation of any powers or authorities, and all powers and authorities of each individual Party, including, without limitation, the power to implement the GSP within its jurisdictional boundaries, shall reside with that Party.

4. Section 12.2 of the MOA is hereby deleted in its entirety.

5. Except as expressly modified by this Amendment, all terms and provisions of the MOA shall remain in full force and effect.

6. This Amendment shall be effective as of the date that it has been signed by all Parties.

IN WITNESS THEREOF, the Parties hereto have executed this Amendment on the dates shown below.

CITY OF EL PASO DE ROBLES

By: ______________________
Tom Frutchey

Its: City Manager

Date: ______________________

APPROVED AS TO FORM AND LEGAL EFFECT:

By: ______________________

Its: ______________________

Date: ______________________

SHANDON SAN JUAN WATER DISTRICT

By: ______________________
Willy Cunha

Its: President, Board of Directors

Date: ______________________

APPROVED AS TO FORM AND LEGAL EFFECT:

By: ______________________

Its: ______________________

Date: ______________________

2. Section 2 (Term) of the MOA shall hereafter be and read as follows:

   This MOA shall become effective on the date that the last of the five (5) Parties signs ("Effective Date") and shall remain in effect until terminated in accordance with Section 9.2 below.

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5. Except as expressly modified by this Amendment, all terms and provisions of the MOA shall remain in full force and effect.

6. This Amendment shall be effective as of the date that it has been signed by all Parties.

IN WITNESS THEREOF, the Parties hereto have executed this Amendment on the dates shown below.

CITY OF EL PASO DE ROBLES

By: Thomas Frutchey

Tom Frutchey

Its: City Manager

Date: 1-8-20

APPROVED AS TO FORM AND LEGAL EFFECT:

By: K J Hood

Its: Interim City Attorney

Date: 1/7/2020

SHANDON SAN JUAN WATER DISTRICT

By: ____________________

Willy Cunha

Its: President, Board of Directors

Date: ____________________

APPROVED AS TO FORM AND LEGAL EFFECT:

By: ____________________

Its: ____________________

Date: ____________________

2. Section 2 (Term) of the MOA shall hereafter be and read as follows:

   This MOA shall become effective on the date that the last of the five (5) Parties signs ("Effective Date") and shall remain in effect until terminated in accordance with Section 9.2 below.

3. Section 4.9 of the MOA shall hereafter be and read as follows:

   The creation of the Cooperative Committee shall not be construed as a delegation of any powers or authorities, and all powers and authorities of each individual Party, including, without limitation, the power to implement the GSP within its jurisdictional boundaries, shall reside with that Party.

4. Section 12.2 of the MOA is hereby deleted in its entirety.

5. Except as expressly modified by this Amendment, all terms and provisions of the MOA shall remain in full force and effect.

6. This Amendment shall be effective as of the date that it has been signed by all Parties.

IN WITNESS THEREOF, the Parties hereto have executed this Amendment on the dates shown below.

CITY OF EL PASO DE ROBLES

By: ____________________
Tom Frutchey

Its: City Manager

Date: ____________________

APPROVED AS TO FORM AND LEGAL EFFECT:

By: ____________________

Its: ____________________

Date: ____________________

SHANDON SAN JUAN WATER DISTRICT

By: Willy Cunha
Willy Cunha

Its: President, Board of Directors

Date: November 21, 2019

APPROVED AS TO FORM AND LEGAL EFFECT:

By: ____________________

Its: ____________________

Date: ____________________

COUNTY OF SAN LUIS OBISPO

By: ______________________
Debbie Arnold

Its: Chairperson, Board of Supervisors

Date: ______________________

APPROVED AS TO FORM AND
LEGAL EFFECT:

By: ______________________

Its: ______________________

Date: ______________________

SAN MIGUEL COMMUNITY
SERVICES DISTRICT

By: ______________________
Rob Roberson

Its: General Manager

Date: 3/3/2020

APPROVED AS TO FORM AND
LEGAL EFFECT:

By: ______________________

Its: Douglas White

Date: 3-13-20

COUNTY OF SAN LUIS OBISPO

By: Debbie Arnold

Debbie Arnold

Its: Chairperson, Board of Supervisors

Date: December 17, 2019

APPROVED AS TO FORM AND
LEGAL EFFECT:

By: [signature]

Its: Deputy County Counsel

Date: 12/3/19

ATTEST:
Wade Horton, County Clerk of the Board and Ex-Officio Clerk of the Board of Supervisors

By, I'Ana N. Christensen
Deputy Clerk

The undersigned Deputy Clerk of the Board of Supervisors certifies that, pursuant to Section 25103 of the Government Code, delivery of this document has been made on December 27, 2019

WADE HORTON
County Clerk of the Board and Ex-Officio Clerk of the Board of Supervisors

By, I'Ana N. Christensen
Deputy Clerk

SAN MIGUEL COMMUNITY
SERVICES DISTRICT

By: ____________________

Rob Roberson

Its: General Manager

Date: ____________________

APPROVED AS TO FORM AND
LEGAL EFFECT:

By: ____________________

Its: ____________________

Date: ____________________

L:\Water Resources\2019_CC\Adopt Paso Basin GSP Amendment No.1 to MOA\Amendment No. 1 MOU GSP PRGWB.docxAR.mj

ATTACHMENT 1

MEMORANDUM OF AGREEMENT REGARDING PREPARATION OF A GROUNDWATER SUSTAINABILITY PLAN FOR THE PASO ROBLES GROUNDWATER BASIN

This Memorandum of Agreement regarding Preparation of a Groundwater Sustainability Plan for the Paso Robles Groundwater Basin ("MOA") is entered into by and between the City of El Paso de Robles ("City"), the San Miguel Community Services District ("SMCSD"), the Heritage Ranch Community Services District ("HRCSD"), the County of San Luis Obispo ("County") and the Shandon-San Juan Water District ("SSJWD") (each referred to individually as a "Party" and collectively as the "Parties") for purposes of preparing a groundwater sustainability plan for the Paso Robles Area Subbasin.

Recitals

WHEREAS, on September 16, 2014, Governor Jerry Brown signed into law Senate Bills 1168 and 1319 and Assembly Bill 1739, known collectively as the Sustainable Groundwater Management Act (Water Code §§ 10720 *et seq.*) ("SGMA"), which became effective on January 1, 2015 and which have been and may continue to be amended from time to time; and

WHEREAS, SGMA requires the establishment of a groundwater sustainability agency ("GSA") or agencies for all basins designated as medium or high priority by the California Department of Water Resources ("DWR") on or before June 30, 2017; and

WHEREAS, SGMA further requires the adoption of a groundwater sustainability plan ("GSP") or coordinated GSPs for all basins designated by DWR as high or medium priority and subject to critical conditions of overdraft on or before January 31, 2020; and

WHEREAS, DWR has designated the Paso Robles Area Subbasin (Basin No. 3-004.06) ("Basin") as a high priority basin subject to critical conditions of overdraft; and

WHEREAS, each of the Parties has decided to become the GSA within its respective service area overlying the Basin and has informed DWR of its decision and intent to undertake sustainable groundwater management therein; and

WHEREAS, each of the Parties desires to collectively develop and implement a single GSP to sustainably manage the portions of the Basin underlying their combined service areas (*i.e.* all portions of the Basin located within the County of San Luis Obispo); and

WHEREAS, the Parties share the common goal of cost effective, sustainable groundwater management that considers the interests and concerns of all beneficial uses and users of groundwater within the Basin; and

WHEREAS, on April 6, 2017, the San Luis Obispo Local Agency Formation Commission conditionally approved the formation of the Estrella-El Pomar-Creston Water District ("EPCWD"), subject to, among other things, a successful vote on the formation pursuant to Water Code Section 34500, for purposes of serving as a GSA within its service area; and

WHEREAS, the EPCWD, if formed, will not be formed until after the June 30, 2017 deadline, and the County included the potential service area of the EPCWD within the Paso Basin – County of San Luis Obispo Groundwater Sustainability Agency that the County formed on May 16, 2017 by Resolution 2017-134; and

WHEREAS, the Parties acknowledge the cooperative efforts of the working group, including representatives of each Party and the applicant and several petitioners desiring to form the EPCWD, that commenced meeting in August 2016 and that culminated in this MOA; and

WHEREAS, this MOA provides for the future addition of EPCWD as a Party to this MOA provided that certain conditions are satisfied, including, but not limited to, a successful vote on the formation of the EPCWD pursuant to Water Code Section 34500 and the County Board of Supervisors decides to withdraw from serving as the GSA for the EPCWD service area; and

WHEREAS, the active involvement and cooperation of all users of groundwater within the Basin is highly valued by the Parties and their continued willing cooperation in SGMA implementation is deemed critical for successful sustainable management of the Basin.

NOW, THEREFORE, it is mutually understood and agreed as follows:

Section 1
Purpose

The purpose of this MOA is to establish a committee to develop a single GSP that will be considered for adoption by each individual Party and subsequently submitted to DWR for approval. This MOA may also serve as the basis for continued cooperation among the Parties in the management of the Basin during the period between adoption of the GSP by each Party and approval of the GSP by DWR. As more specifically set forth in Section 12.2 below, this MOA shall automatically terminate upon DWR's approval of the GSP for the Basin.

Section 2
Term

This MOA shall become effective on the date that the last of the five (5) Parties signs ("Effective Date") and shall remain in effect until terminated in accordance with Section 9.2 or Section 12.2 below.

Section 3
EPCWD

If and only if the EPCWD is formed and its Board of Directors decides to become the GSA within its service area and the County Board of Supervisors decides to withdraw from serving as the GSA within said area, the EPCWD may become a Party to this Agreement by signing the Addition of Party to Memorandum of Agreement regarding Preparation of a Groundwater Sustainability Plan for the Paso Robles Groundwater Basin in the form attached hereto as Exhibit A ("Addition") provided that the County Board of Supervisors has accepted the Addition as part of its decision to withdraw.

Section 4
Paso Basin Cooperative Committee

4.1 The Parties hereby establish the Paso Basin Cooperative Committee ("Cooperative Committee") which shall be composed of a member and alternate member from each of the five (5) Parties.

4.2 The governing body of each Party shall promptly appoint a member and alternate member to the Cooperative Committee. Each Cooperative Committee member and alternate member shall serve at the pleasure of the appointing Party, and may be removed from the Cooperative Committee by the appointing Party at any time. Each Cooperative Committee member's compensation, if any, for his or her service on the Cooperative Committee shall be the responsibility of the appointing Party.

4.3 If and only if the EPCWD becomes a Party to this MOA in accordance with Section 3 of this MOA, the Cooperative Committee shall also include a member and alternate member from the EPCWD appointed by the EPCWD.

4.4 The Cooperative Committee shall conduct activities related to GSP development and SGMA implementation at the pleasure and under the guidance of the Parties, including, but not limited to:

A. Development of a GSP that achieves the goals and objectives outlined in SGMA;

B. Review and participation in the selection of consultants related to Cooperative Committee efforts, as more specifically set forth in Section 6 below;

C. Development of recommended annual budgets and additional funding needs for consideration and approval of the Parties and development of a record of expenditures, in accordance with and subject to Section 5 below. Consistent with Section 7 below, it is expected that each of the Parties will contribute in-kind staff support; therefore, recommended annual budgets shall generally not include the staff or overhead costs of any Party associated with participation in this MOA;

D. Development of a plan that describes the anticipated tasks to be performed under this MOA and a schedule for performing said tasks;

E. Implementation of the actions and/or policies undertaken pursuant to this MOA and resolution of any issues related to these actions and/or policies;

F. Development of measures that may be implemented in the event insufficient or unsatisfactory progress is being made in development of the GSP;

G. Development of a stakeholder participation plan that includes public outreach and education programs and workshops as appropriate and that involves the interested stakeholders in developing and implementing the GSP (*e.g.* workshops at key milestones); if determined necessary by the Cooperative Committee and supported by the Parties, the Cooperative Committee may lead implementation of the stakeholder participation plan or other stakeholder engagement activities;

H. Establishment from time to time of one or more standing or *ad hoc* committees to assist in carrying out the purposes and objectives of the Cooperative Committee as may be necessary;

I. Recommendation that each individual Party adopt the GSP developed under this MOA;

J. Resolution of differences among the Parties;

K. Coordination with neighboring GSAs in the Salinas Valley Groundwater Basin and with neighboring GSPs as may be required and/or to ensure no adverse effects.

4.5 The Cooperative Committee shall meet at least quarterly to carry out the activities described above. The Cooperative Committee shall prepare and maintain minutes of its meetings, and all meetings of the Cooperative Committee shall be conducted in accordance with the Ralph M. Brown Act (Government Code §§ 54950 *et seq.*). A majority of the members of the Cooperative Committee shall constitute a quorum for purposes of transacting business, except that less than a quorum may vote to adjourn the meeting. Attendance at all Cooperative Committee meetings may be augmented to include Parties' staff or consultants to ensure that the appropriate expertise is available.

4.6 Subject to Section 4.7 below, on all matters considered by the Cooperative Committee, the vote of each member shall be weighted in accordance with the following percentages:

City Member	15%
SMCSD Member	3%
HRCSD Member	1%

SSJWD Member	20%
County Member	61%

4.7 If and only if the EPCWD becomes a Party to this MOA in accordance with Section 3 of this MOA, the voting percentages set forth in Section 4.6 shall be modified as follows:

City Member	15%
SMCSD Member	3%
HRCSD Member	1%
SSJWD Member	20%
County Member	32%
EPCWD Member	29%

4.8 Any action or recommendation considered by the Cooperative Committee shall require the affirmative vote of 67 percent based on the percentages set forth in Section 4.6 or 4.7 above, as applicable. Notwithstanding the foregoing, the following shall require the affirmative vote of 100 percent based on the percentages set forth in Section 4.6 or 4.7 above, as applicable: (A) a recommendation that each of the Parties adopt the GSP or adopt any amendment thereto prepared in response to comments from DWR and (B) a recommendation that the Parties amend this MOA. For purposes of determining whether the requisite voting threshold has been met, the voting percentage of each member must be included in the calculation with the following limited exception: in the event that a member recuses himself or herself (A) said member's voting percentage shall be allocated *pro rata* to the other members for purposes of determining whether the 67 percent threshold has been met and (B) said members' affirmative vote shall not be required to reach the 100 percent threshold (i.e. all members who have not recused themselves must vote in the affirmative). Without limiting the foregoing, an absence by any member(s) shall not result in any *pro rata* distribution for purposes of determining whether the 67 percent threshold has been met or result in elimination of the requirement that said member vote in the affirmative for purposes of determining whether the 100 percent threshold has been met.

4.9 The creation of the Cooperative Committee shall not be construed as a delegation of any powers or authorities, and all powers and authorities of each individual Party shall reside with that Party.

Section 5
Funding

5.1 The Fiscal Year of the Cooperative Committee shall be July 1 through June 30.

5.2 For Fiscal Years 2017 – 2018, 2018 – 2019 and 2019 – 2020, the Cooperative Committee shall develop a recommended budget for consideration by each Party. Subject to each Party's approval of the budget for the relevant Fiscal Year, each Party shall be responsible for funding a portion of said budgeted costs in accordance with the percentages set forth in Section 4.6 or Section 4.7 above, as applicable. Neither the Cooperative Committee nor any Party on behalf of the Cooperative Committee shall make any financial expenditures or incur any financial obligations or liabilities pursuant to this MOA for Fiscal Years 2017 – 2018, 2018 – 2019 or 2019 – 2020 prior to approval of the budget for the relevant Fiscal Year by each Party.

5.3 For Fiscal Year 2020 – 2021 and following, the Cooperative Committee shall develop a recommended budget and recommended contribution percentages for consideration by each Party. Subject to each Party's approval of the budget and its contribution percentage, each Party shall be responsible for funding a portion of said budgeted costs in accordance with the percentages approved by each Party. Neither the Cooperative Committee nor any Party on behalf of the Cooperative Committee shall make any financial expenditures or incur any financial obligations or liabilities pursuant to this MOA for Fiscal Year 2020 – 2021 and following prior to approval of the budget and contribution percentages for the relevant Fiscal Year by each Party.

5.4 It is anticipated that the vast majority of budgeted costs will involve costs for consultant services. Consequently, most contributions shall be paid to the City in the manner described in Section 6.6 below. For budgeted costs that do not involve consultant services (if any), the Cooperative Committee shall determine the manner in which such contributions shall be paid consistent with Section 5.2 and Section 5.3 above.

5.5 The Cooperative Committee shall make recommendations related to any additional non-budgeted funding needs, but shall have no authority to require any Party to contribute funds over and above those included in the budgets approved by each Party.

5.6 On an annual basis, the Cooperative Committee and/or contracting agent shall provide the Parties with a record of expenditures from the previous Fiscal Year related to this MOA.

Section 6
Engagement of Consultants

6.1 It is anticipated that the Cooperative Committee will desire to retain the services of one or more consultants in conducting the activities identified in Section 4.4 above, including, but not necessarily limited to, its development of the GSP.

6.2 The City agrees to act as the contracting agent on behalf of the Cooperative Committee and shall follow its own procurement policies in the engagement of such consultant(s) subject to Section 6.3 below.

6.3 The City agrees that the Parties and the Cooperative Committee shall be included in the selection of any consultant retained by the City on behalf of the Cooperative Committee.

More specifically, staff representatives from each of the Parties shall be given an opportunity to review and approve all requests for proposals prior to their release and to participate in the various stages of the selection process, including, but not limited to, review of proposals and participation on interview panels. In addition, the City shall not issue a notice to proceed to any selected consultant until the Cooperative Committee has confirmed the consultant and related contract.

6.4 The Cooperative Committee may request that the City terminate a consultant contract entered into on behalf of the Cooperative Committee subject to and in accordance with the terms specified in the contract.

6.5 All consultant contracts entered into by the City on behalf of the Cooperative Committee shall include the following: (A) a provision that the consultant shall not commence work until a notice to proceed is issued and acknowledgement that a notice to proceed will not be issued until the Cooperative Committee confirms the consultant and contract; (B) a provision requiring that the consultant name each Party, its employees, officers and agents as an additional insured; and (C) an expected spend plan estimating the amount of the not to exceed contract amount that the consultant expects to invoice the City each month.

6.6 Upon receipt of each invoice from a consultant retained on behalf of the Cooperative Committee, the City shall calculate each Party's payment obligation based on the percentages set forth in Section 4.6 or Section 4.7, as applicable, or on the percentages approved by each Party as set forth in Section 5.3, depending on the Fiscal Year. The City shall submit an invoice to each Party showing the foregoing calculation, and each Party shall remit payment to the City within thirty (30) days.

Section 7
Roles and Responsibilities of the Parties

In addition to performance of the roles and responsibilities set forth above related to, among other things, appointment of members and alternate members to the Cooperative Committee, consideration of annual budgets and cost contributions and participation in the selection of consultants, the Parties shall:

A. Work to jointly to meet the objectives of this MOA through, among other things, coordination of all activities related to fulfillment of said objectives;
B. Internally or jointly designate a staff person(s) to provide expertise and existing information in a timely manner and to participate in the development of the GSP and/or related technical studies and/or other materials or actions being considered by the Cooperative Committee;
C. Upon recommendation of the Cooperative Committee, consider adoption of the GSP and, as defined in the GSP once approved, implement the GSP within its respective GSA service area. Notwithstanding the foregoing, nothing contained

in this MOA shall be construed as obligating any Party to adopt the GSP developed under this MOA, or as preventing any Party from adopting the GSP developed under this MOA in the event that the Cooperative Committee fails to recommend approval or another Party (or Parties) elects not to adopt the GSP developed under this MOA;

D. Bring any dispute over any of the activities discussed in this MOA to the Cooperative Committee in order to provide the Cooperative Committee with an opportunity to resolve the dispute.

Section 8
Interagency Communication and Providing Proper Notice

8.1 In order to provide for consistent and effective communication among the Parties, each Party agrees to designate a representative as its central point of contact on all matters relating to this MOA and the GSP. Additional representatives from the community or staff may be appointed to serve as points of contact on specific actions or issues.

8.2 All notices, statements or payments related to implementing the objectives of this MOA shall be deemed to have been duly given if given in writing and delivered electronically, personally or mailed by first-class, registered, or certified mail to the Parties at the addresses set forth in Exhibit B. Notwithstanding any other provision of this MOA, the Parties may update Exhibit B from time to time without formally amending this MOA.

Section 9
Withdrawal and Termination

9.1 Any Party may unilaterally withdraw from this MOA without causing or requiring termination of this MOA. Withdrawal shall become effective upon thirty (30) days written notice to the remaining Parties' designated addresses as listed in Exhibit B. Nothing contained in this Section 9 shall be construed as prohibiting a Party that has withdrawn from this MOA from developing its own GSP for its service area within the Basin. A Party that has withdrawn from this MOA shall remain obligated to pay its percentage cost share of expenses and obligations as outlined in the current budget incurred, accrued or encumbered up to the date the Party provided notice of withdrawal, including, but not limited to, its cost share obligation under any existing consultant contract for which the City has issued a notice to proceed. If a Party withdraws, the Cooperative Committee shall reassess the contributions of each remaining Party to fund the current budget and determine if the Cooperative Committee needs to request the contribution of additional funding from the governing board of each Party.

9.2 This MOA may be terminated upon unanimous written consent of all current Parties.

Section 10
Amendments

This MOA may be amended only by unanimous written consent of all current Parties. Approval from a Party is valid only after that Party's governing body approves the amendment at a public meeting. Neither individual Cooperative Committee members nor individual members of the Parties' governing boards have the authority, express or implied, to amend, modify, waive or in any way alter this MOA or the terms and conditions hereof.

Section 11
Indemnification

No Party, nor any officer or employee of a Party, shall be responsible for any damage or liability occurring by reason of anything done or omitted to be done by another Party under or in connection with this MOA. The Parties further agree, pursuant to Government Code Section 895.4, that each Party shall fully indemnify and hold harmless each other Party and its agents, officers, employees and contractors from and against all claims, damages, losses, judgments, liabilities, expenses and other costs, including litigation costs and attorney fees, arising out of, resulting from, or in connection with any work delegated to or action taken or omitted to be taken by such Party under this MOA.

Section 12
Miscellaneous

12.1 Execution in Counterparts. This MOA may be executed in counterparts.

12.2 Automatic Termination of MOA. This MOA shall automatically terminate upon DWR's approval of the adopted GSP. Depending on the content of the GSP, the Parties may decide to enter into a new agreement to coordinate GSP implementation.

12.3 Choice of Law. This MOA is made in the State of California, under the Constitution and laws of said State and is to be so construed.

12.4 Severability. If any provision of this MOA is determined to be invalid or unenforceable, the remaining provisions shall remain in force and unaffected to the fullest extent permitted by law and regulation.

12.5 Entire Agreement. This MOA constitutes the sole, entire, integrated and exclusive agreement between the Parties regarding the contents herein. Any other contracts, agreements, terms, understandings, promises, representations not expressly set forth or referenced in this writing are null and void and of no force and effect.

12.6 Construction and Interpretation. The Parties agree and acknowledge that this MOA has been developed through negotiation, and that each Party has had a full and fair

opportunity to revise the terms of this MOA. Consequently, the normal rule of construction that any ambiguities are to be resolved against the drafting party shall not apply in construing or interpreting this MOA.

IN WITNESS WHEREOF, the Parties have executed this MOA on the dates shown below.

CITY OF EL PASO DE ROBLES	SHANDON SAN JUAN WATER DISTRICT
By: ____________ Tom Frutchey	By: ____________ Willy Cunha
Its: City Manager	Its: President, Board of Directors
Date: ____________	Date: ____________
APPROVED AS TO FORM AND LEGAL EFFECT:	APPROVED AS TO FORM AND LEGAL EFFECT:
By: ____________	By: ____________
Its: ____________	Its: ____________
Date: ____________	Date: ____________
COUNTY OF SAN LUIS OBISPO	HERITAGE RANCH COMMUNITY SERVICES DISTRICT
By: [signature] John Peschong	By: ____________ Scott Duffield
Its: Chair, Board of Supervisors	Its: General Manager
Date: 8/22/2017	Date: ____________
APPROVED AS TO FORM AND LEGAL EFFECT:	APPROVED AS TO FORM AND LEGAL EFFECT:
By: [signature]	By: ____________
Its: Deputy County Counsel	Its: ____________
Date: [illegible] 2017	Date: ____________

ATTEST:

Tommy Gong, County Clerk-Recorder and
Ex-Officio Clerk of the Board of Supervisors

By, [signature]
Deputy Clerk

Page 10 of 14

opportunity to revise the terms of this MOA. Consequently, the normal rule of construction that any ambiguities are to be resolved against the drafting party shall not apply in construing or interpreting this MOA.

IN WITNESS WHEREOF, the Parties have executed this MOA on the dates shown below.

CITY OF EL PASO DE ROBLES	SHANDON SAN JUAN WATER DISTRICT
By: Thomas Frutchey Tom Frutchey	By: __________ Willy Cunha
Its: City Manager	Its: President, Board of Directors
Date: 9-20-17	Date: __________
APPROVED AS TO FORM AND LEGAL EFFECT:	APPROVED AS TO FORM AND LEGAL EFFECT:
By: [signature]	By: __________
Its: City Attorney	Its: __________
Date: 9/20/17	Date: __________
COUNTY OF SAN LUIS OBISPO	HERITAGE RANCH COMMUNITY SERVICES DISTRICT
By: __________ John Peschong	By: __________ Scott Duffield
Its: Chair, Board of Supervisors	Its: General Manager
Date: __________	Date: __________
APPROVED AS TO FORM AND LEGAL EFFECT:	APPROVED AS TO FORM AND LEGAL EFFECT:
By: __________	By: __________
Its: __________	Its: __________
Date: __________	Date: __________

opportunity to revise the terms of this MOA. Consequently, the normal rule of construction that any ambiguities are to be resolved against the drafting party shall not apply in construing or interpreting this MOA.

IN WITNESS WHEREOF, the Parties have executed this MOA on the dates shown below.

CITY OF EL PASO DE ROBLES

By: ____________________
Tom Frutchey

Its: City Manager

Date: ____________________

APPROVED AS TO FORM AND LEGAL EFFECT:

By: ____________________

Its: ____________________

Date: ____________________

SHANDON SAN JUAN WATER DISTRICT

By: Willy Cunha
Willy Cunha

Its: President, Board of Directors

Date: 7-26-2017

APPROVED AS TO FORM AND LEGAL EFFECT:

By: [signature] of Young Wooldridge, LLP

Its: District Counsel

Date: 7/26/17

COUNTY OF SAN LUIS OBISPO

By: ____________________
John Peschong

Its: Chair, Board of Supervisors

Date: ____________________

APPROVED AS TO FORM AND LEGAL EFFECT:

By: ____________________

Its: ____________________

Date: ____________________

HERITAGE RANCH COMMUNITY SERVICES DISTRICT

By: ____________________
Scott Duffield

Its: General Manager

Date: ____________________

APPROVED AS TO FORM AND LEGAL EFFECT:

By: ____________________

Its: ____________________

Date: ____________________

opportunity to revise the terms of this MOA. Consequently, the normal rule of construction that any ambiguities are to be resolved against the drafting party shall not apply in construing or interpreting this MOA.

IN WITNESS WHEREOF, the Parties have executed this MOA on the dates shown below.

CITY OF EL PASO DE ROBLES	SHANDON SAN JUAN WATER DISTRICT
By: ____________________ Tom Frutchey	By: ____________________ Willy Cunha
Its: City Manager	Its: President, Board of Directors
Date: ____________________	Date: ____________________
APPROVED AS TO FORM AND LEGAL EFFECT:	APPROVED AS TO FORM AND LEGAL EFFECT:
By: ____________________	By: ____________________
Its: ____________________	Its: ____________________
Date: ____________________	Date: ____________________
COUNTY OF SAN LUIS OBISPO	HERITAGE RANCH COMMUNITY SERVICES DISTRICT
By: ____________________ John Peschong	By: Scott Duffield Scott Duffield
Its: Chair, Board of Supervisors	Its: General Manager
Date: ____________________	Date: 07/31/2017
APPROVED AS TO FORM AND LEGAL EFFECT:	APPROVED AS TO FORM AND LEGAL EFFECT:
By: ____________________	By: ____________________
Its: ____________________	Its: District Counsel
Date: ____________________	Date: 7/26/17

SAN MIGUEL COMMUNITY
SERVICES DISTRICT

By: ____________________
Rob Roberson

Its: Interim General Manager

Date: 8/29/2017

APPROVED AS TO FORM AND
LEGAL EFFECT:

By: ____________________

Its: Douglas White

Date: 9/6/17

EXHIBIT A

Addition of Party to Memorandum of Agreement regarding Preparation of a Groundwater Sustainability Plan for the Paso Robles Groundwater Basin

WHEREAS, certain local agencies that each decided to become the groundwater sustainability agency within their respective service areas overlying the Paso Robles Area Subbasin (Basin No. 3-004.06) have entered into an agreement entitled "Memorandum of Agreement regarding Preparation of a Groundwater Sustainability Plan for the Paso Robles Groundwater Basin" ("Agreement"); and

WHEREAS, the Estrella-El Pomar-Creston Water District ("EPCWD") could not be an original signatory to the Agreement, because it had not yet been formed; and

WHEREAS, Section 3 of the Agreement sets forth the process by which the EPCWD can become a party to the Agreement provided that certain conditions are met; and

WHEREAS, the EPCWD has received and reviewed a copy of the Agreement; and

WHEREAS, on ___________, the EPCWD Board of Directors held a public hearing and by Resolution __________decided to become the groundwater sustainability agency within its service area and a signatory to the Agreement; and

WHEREAS, on ___________, the County of San Luis Obispo Board of Supervisors held a public hearing and by Resolution __________decided to withdraw from serving as the groundwater sustainability agency within the EPCWD's service area and to accept the signature below.

NOW, THEREFORE, acknowledging that the recitals above are correct and are part of this agreement, the EPCWD, upon acceptance by signature below by the County of San Luis Obispo Board of Supervisors, shall become a party to the Agreement effective immediately. The EPCWD shall bear the benefits and enjoy the burdens of the Agreement as though the EPCWD had originally executed said Agreement as it now exists or may be amended in the future, and for so long as the Agreement remains in effect or for so long as the EPCWD is a party to the Agreement.

ACCEPTED AND APPROVED BY THE ESTRELLA-EL POMAR-CRESTON WATER DISTRICT BOARD OF DIRECTORS:

By: ________________________ Date: ______________________

Its: _________________________

APPROVED AS TO FORM AND LEGAL EFFECT:

By: ______________________ Date: ____________________

Its: ______________________

Address for purposes of Exhibit B to the Agreement:

Estrella-El Pomar-Creston Water District

____

____

Attention: ____________

ACCEPTED AND APPROVED BY
THE COUNTY OF SAN LUIS OBISPO
BOARD OF SUPERVISORS IN ACCORDANCE WITH
THE AGREEMENT:

By: ______________________ Date: ____________________

Its: ______________________

APPROVED AS TO FORM AND LEGAL EFFECT:

By: ______________________ Date: ____________________

Its: ______________________

EXHIBIT B
PARTY ADDRESS LIST

County of San Luis Obispo
976 Osos Street, Room 206
San Luis Obispo, CA 93408
Attention: Wade Horton, Public Works Director

City of El Paso de Robles
1000 Spring Street
Paso Robles, CA 93451
Attention: Dick McKinley, Public Works Director

San Miguel Community Services District
1150 Mission Street
San Miguel, CA 93451
Attention: Rob Roberson, Interim General Manager

Heritage Ranch Community Services District
4870 Heritage Road
Paso Robles, CA 93446
Attention: Scott Duffield, General Manager

Shandon San Juan Water District
365 Truesdale Road PO Box 150
Shandon, CA 93461
Attention: Willy Cunha, President, Board of Directors

APPENDIX H

Installation of Monitoring Wells and Stream Gages Technical Memoranda

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MONITORING WELL WORK PLAN
SUPPLEMENTAL ENVIRONMENTAL PROJECT

PASO ROBLES AREA GROUNDWATER SUBBASIN
SAN LUIS OBISPO COUNTY
CALIFORNIA

Prepared for

CITY OF PASO ROBLES

NOVEMBER 2020

CLEATH-HARRIS GEOLOGISTS
75 Zaca Lane, Suite 110
San Luis Obispo, California 93401

(805) 543-1413

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APPENDIX B – SEP Project Description
APPENDIX C – Preliminary Design for 13th Street Monitoring Wells
APPENDIX D – Preliminary Design for Airport Road Monitoring Wells

1.0 BACKGROUND

The Groundwater Sustainability Agencies (GSAs) for the Paso Robles Area Subbasin of the Salinas Valley Groundwater Basin include the County of San Luis Obispo, the Shandon-San Juan Water District, the City of Paso Robles, and the San Miguel Community Services District. These GSAs adopted a Groundwater Sustainability Plan (GSP) for the Subbasin[1], which has been submitted to the California Department of Water Resources (DWR) in compliance with the Sustainable Groundwater Management Act (SGMA).

The GSP identified a need to expand the network of stream gages and monitoring wells within alluvial deposits associated with the major drainages in the Subbasin. Per the recommendations set forth in the GSP, "*Definitive data delineating any interactions between surface water and groundwater or a lack of interconnected surface waters is a data gap that will be addressed during implementation of this GSP*".

The Supplemental Environmental Project (SEP) will begin expanding the network of both stream gages and adjacent monitoring wells in order to better assess the potential for interconnected surface water and groundwater across the Subbasin. Long-term plans in the original proposal included a minimum of three monitoring wells (paired or nested) at each existing and future stream gage site in the Subbasin[2]. One well would be completed within the alluvial aquifer, one completed a short distance below the base of the alluvial aquifer into the Paso Robles Formation, and at least one to be completed deeper into the Paso Robles Formation at elevations similar to production wells in the general vicinity of each individual site.

Under the current SEP phase, monitoring wells are planned for two sites with existing U.S. Geological Survey stream gages. Additional stream gages are also planned as part of the current SEP phase and are described in the Stream Gage Siting Memorandum. This work plan describes the recommended locations and preliminary design of monitoring wells at the following existing stream gage sites: Salinas River at 13th Street Bridge in the City of Paso Robles, and Estrella River at Airport Road in the unincorporated County area.

---

1 Montgomery & Associates, 2020. Paso Robles Subbasin Groundwater Sustainability Plan dated January 31, 2020.

2 SEP Grant Proposal *in* City of Paso Robles Request for Proposal dated April 7, 2020.

2.0 SITE SELECTION PROCESS

Ten locations were identified by the Subbasin GSAs that would help provide hydrologic and hydrogeologic data with appropriate monitoring equipment installations[3]. These locations represent sites where a stream gage, coupled with a set of nested or paired monitoring wells, would help to fill in data gaps related to surface water and groundwater interaction throughout the Subbasin. The original locations are shown in Appendix A.

Two of these ten sites (Site 1 and Site 9) currently have U.S. Geological Survey stream gages installed and have been selected by the GSAs to have monitoring wells installed as part of this SEP project. Given the compressed schedule for project completion by the end of the year, and limited funding for this SEP phase, construction of two monitoring wells at each site (four total) is anticipated. An option for a third well at the Airport Road site is included if the budget permits, along with an alternate well site at the 13th Street Bridge, pending results of test hole drilling (details in Section 4).

3.0 DRILLING METHODS AND DESIGN CONSIDERATIONS

For siting and design purposes, SEP monitoring wells are classified as Shallow, Intermediate, or Deep. Shallow wells would be used to monitor water levels and water quality in the alluvial deposits, Intermediate wells are those completed in the Paso Robles Formation aquifers immediately below the alluvial deposits, and Deep wells are those completed at greater depth in the Paso Robles Formation aquifers used locally for water supply.

Individual monitoring wells (rather than nested wells) are proposed for the SEP to allow the use of appropriate drilling methodology and to accommodate recommended casing diameters. The Shallow (alluvial) wells would be constructed using the hollow stem auger (HSA) drilling method. HSA is more cost effective for shallow monitoring well construction, does not require water or drilling mud, and provides useful depth to water information during drilling. Continuous core samples are collected from the borehole for lithologic logging. Upon reaching the intended depth, the hollow stem stabilizes the sides of the borehole and allows installation of the recommended Shallow monitoring well casing design (4-inch diameter Sch 40 PVC).

The Intermediate and Deep wells are planned to be drilled using the mud-rotary method and cased with 4-inch diameter Sch 40 PVC. Formation lithology is logged from drill cuttings that are separated from the drilling fluid using a shaker table and desander cones. Wellhead completions will consist of a 12-inch diameter, traffic-rated and water-tight monitoring well box with cement apron. An example of a typical monitoring well at ground surface is shown in Figure 1.

---

[3] Monsoon Consultants, 2019. Figure 1 - Paso Robles Groundwater Basin - Proposed Monitoring Sites, Paso Robles GSP Data Gap Assessment dated September 6, 2019.

Figure 1. Typical 12-inch monitoring well box

The work areas and SEP project description were reviewed by environmental consultant SWCA for potential impacts to biological and cultural resources. Protective measures recommended by SWCA have been incorporated into the project description, which is included in Appendix B.

4.0 MONITORING WELL SITES

Monitoring wells are planned for existing stream gages on the Salinas River (Site 1) and the Estrella River (Site 9). Descriptions of the hydrogeologic setting, site layout and preliminary well designs are presented below.

4.1 Site 1 – City of Paso Robles 13th Street Bridge

The 13th Street bridge in the City of Paso Robles is near the eastern edge of the Subbasin and within the area of geothermal (hot water) resource potential. Geologic cross-sections from DWR[4], along with Subbasin GSP Figure 4-2 (Base of Subbasin as Defined by the Base of the Paso Robles Formation) indicate the Subbasin is several hundred feet thick beneath the 13th Street Bridge. However, the log of test borings at the bridge site document hard shale immediately beneath the alluvial deposits. A drillers log from a well (26S/12E-33B1) at the old City yard on the east side of the bridge reported mostly shale beginning at 60 feet depth through 400 feet depth, with 1 gallon per minute (gpm) of artesian flow ("sulphurous water"). Several hot water wells are reported within a few thousand feet southwest of the bridge, the closest of which (26S/12E-33F) reported an artesian flow of 347 gpm with a surface temperature of 105 degrees Fahrenheit (well depth was 230 feet)[5]. A geothermal survey also showed higher than normal soil-air temperatures on the west side of the 13th Street Bridge[6]. Historical well records indicate shallow (alluvial) wells along North River Road near the 13th Street Bridge, with Paso Robles Formation logged in wells along Union Road (formerly Paso Robles Boulevard) to the east and Niblick Road to the southeast.

Considering the above indications of shallow bedrock at Site 1 and geothermal activity west and southwest of the bridge, only two monitoring wells are proposed, a Shallow and Intermediate well. Constructing a Deep well is not recommended at this site given the geothermal resource potential. The Shallow well would be located in the River Walk area (City of Paso Robles property), on the east side of the River and south of the bridge, while the proposed Intermediate well is located on City of Paso Robles property northeast of the bridge (Figure 2). An alternate site is also provided for the Intermediate well on Navajo Avenue (Figure 3), in the event bedrock is too shallow at the proposed location and the Paso Robles Formation would not be saturated.

Depth to water in the Shallow well is estimated at approximately 25 feet (stream invert elevation). Depth to water in the Intermediate well is estimated from the Spring 2019 water level contour map in the 2019 Annual Report[7] at 60 feet depth, and at 130 feet depth for the alternate Intermediate well. Preliminary design for the Shallow and Intermediate wells (with alternate) at Site 1 are shown in Appendix C.

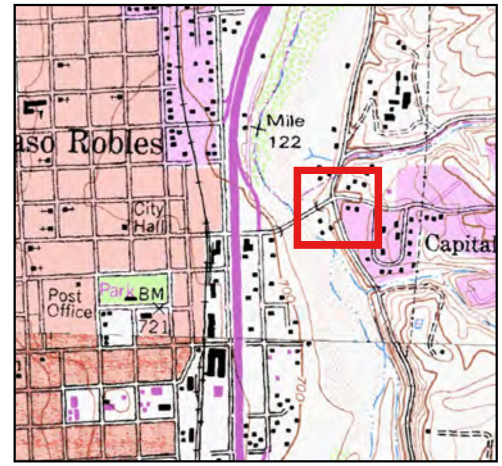
---

[4] DWR, 1981, Water Quality on the Paso Robles Are, Southern District Memorandum Report, June 1981.

[5] California Division of Mines and Geology, 1983, Resource investigation of Low- and Moderate-Temperature Geothermal Areas in Paso Robles, California, Open File Report 83-11.

[6] GSi/Water, 1983, Geothermal Resource Assessment of the Paso Robles Area, September 1983.

[7] GSI Water Solutions, 2020, Paso Robles Subbasin First Annual Report (2017-2019), Draft Final dated February 26, 2020.



Explanation

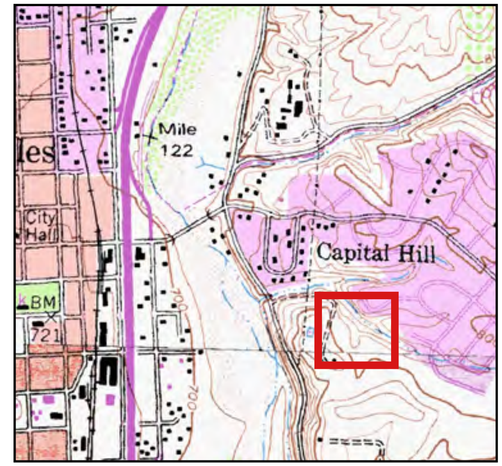
- Well Site
- Work Area
- USGS Stream Gauge

N

0 25 50 75 100 ft

Figure 2
Site 1 - 13th Street Bridge
Monitoring Well Locations
Supplemental Environmental Project
City of Paso Robles

Cleath-Harris Geologists



Explanation

- Well Site
- Work Area

N

0 25 50 75 100 ft

Figure 3
Site 1 - 13th Street Bridge
Alternate Intermediate
Monitoring Well Location
Supplemental Environmental
Project
City of Paso Robles

Cleath-Harris Geologists

4.2 Site 9 – Airport Road at Estella Road

The Airport Road site is immediately east of a paved crossing of the Estrella River approximately 5 miles north of the intersection of Airport Road and Highway 46, and 3 miles north of the Paso Robles Municipal Airport. Geologic cross-sections from Fugro[8], along with Subbasin GSP Figure 4-2 (Base of Subbasin as Defined by the Base of the Paso Robles Formation) and an oil well log in the vicinity (3,000 feet south of crossing) indicate the Subbasin is 1,800-2,700 feet thick beneath the site vicinity. Wells in the site vicinity are up to 890 feet deep wells and tap aquifers in both the Intermediate and Deep zones targeted for monitoring.

Three monitoring wells are proposed, a Shallow, Intermediate, and an optional Deep well. All the wells would be on private property on the north side of the Estrella River (Figure 4). Funding limitations may necessitate drilling the Deep monitoring well in a future project phase.

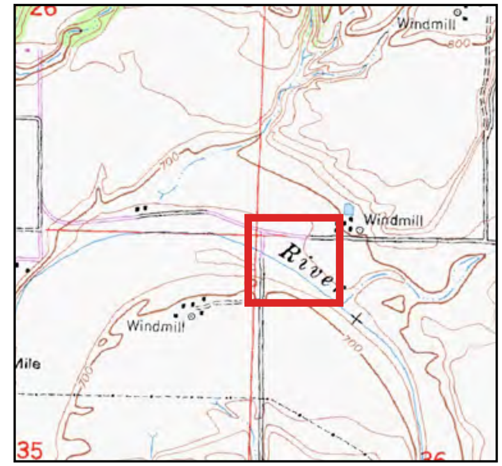
The alluvium tapped by the Shallow well is anticipated to be dry under most conditions, becoming saturated during periods of flow in the Estrella River. Depth to water in the Paso Robles Formation is estimated from the Spring 2019 water level contour map in the 2019 Annual Report at approximately 140 feet depth, although there is likely to be a vertical hydraulic gradient with a lower water level in the Deep well (estimated at 200 feet depth), compared to the Intermediate well.

Review of logs for wells in the site vicinity indicate potentially confining clay layers between approximately 220 feet and 360 feet depth. Therefore, the zones monitored by the Intermediate well should not extend past 220 feet depth, and the Deep well should monitor zones below 360 feet depth. Preliminary design for the Shallow, Intermediate, and Deep wells at Site 9 are shown in Appendix D.

5.0 SUMMARY

Two existing stream gage sites were selected for monitoring well installation under this SEP to help fill data gaps in the Subbasin with respect to surface water and groundwater interaction. Hydrogeologic reviews indicate that Site 1 (13th Street Bridge) is suitable for Shallow and Intermediate well installation. Deep monitoring well construction at Site 1 is not recommended due to the potential for geothermal resources at depth. Site 9 is suitable for Shallow, Intermediate, and Deep monitoring well installation, although the Shallow well is likely to be dry during most parts of the year. Information showing a lack of connectivity between surface water and groundwater, if apparent, is also needed to fill data gaps. Proceeding with the SEP monitoring well sites, with the Shallow and Intermediate wells as a priority under the current phase, is recommended.

[8] Fugro West and Cleath & Associates, 2002, Paso Robles Groundwater Basin Study, August 2002.



Explanation

- Well Site
- Work Area
- USGS Stream Gauge

N

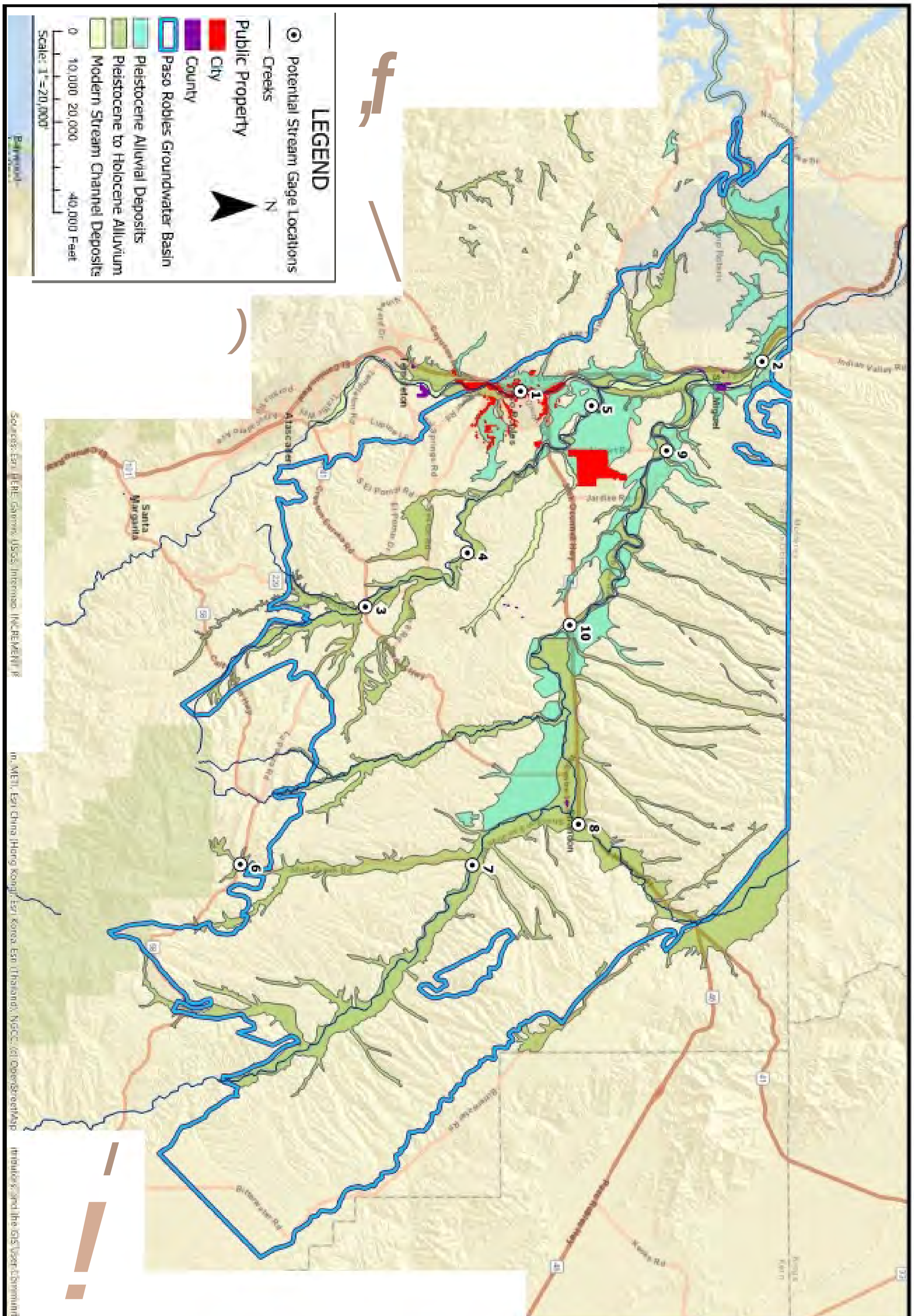
0 25 50 75 100 ft

Figure 4
Site 9 - Airport Road
Monitoring Well Locations
Supplemental Environmental Project
City of Paso Robles

Cleath-Harris Geologists

APPENDIX A

Paso Robles Groundwater Basin Proposed Monitoring Sites



Paso Robles Groundwater Basin - Proposed Monitoring Sites

2019.09.006 - Paso Robles GSP Data Gap Assessment

San Luis Obispo County

Figure1

MONSOON CONSULTANTS

APPENDIX B

SEP Project Description

MONITORING WELL INSTALLATION

Alluvial Monitoring Wells (HSA borings)

Alluvial borings will be drilled using the hollow stem auger (HSA) drilling method. The HSA method is a clean drilling method, as it does not require water or drilling mud. Continuous core samples are collected during drilling to allow for recording of material penetrated. Upon reaching the intended depth, the hollow stem stabilizes the sides of the borehole and allows installation of the monitoring well casing (4-inch diameter Schedule 40 PVC). The soil boring/casing annulus is filled with sand opposite the well perforations and sealed with bentonite clay opposite the blank casing while the augers are simultaneously removed. With a 10-inch diameter boring and a completion depth of up to 70 feet, approximately 1.5 cubic yards of formation materials or less are expected to be generated for each proposed boring. Drill cuttings from the HSA operations will be spread on site.

A log of the core samples will be prepared and analyzed before decisions on elevation zones of perforated pipe are finalized. The well will be developed by bailing. Discharge water will be allowed to percolate on site (natural groundwater with some sediment).

The site will be clearly marked and the test hole covered to prevent access when contractor is not present. Traffic control will be provided if required by the encroachment permit.

Depending upon site specific requirements a typical wellhead, Figure 2 (see Appendix 2) shall consist of a 12” diameter traffic-rated water-tight well box in the center of a minimum 36” by 4” thick cement concrete pad. The pad surface shall have a gentle slope to drain water. The lid of the well box should be labeled “Monitoring Well”.

Paso Robles Formation Monitoring Wells (Mud-Rotary Drilling)

The Paso Robles Formation monitoring wells will be drilled and constructed using conventional mud-rotary drilling equipment. The equipment includes the drilling rig, mud tank, water truck, service rig, pipe trailer, dump truck, and backhoe. The equipment requires a drilling area of approximately 80’ by 40’.

These deeper monitoring wells would be also be constructed with 4-inch diameter Schedule 40 PVC well casing in a 10-inch borehole with a 50-foot minimum depth annular cement grout sanitary seal. Minimal site grading is anticipated for construction activities that may include making a pad for the drilling equipment and forming berms to control fluids on-site. Drilling fluid will include the use of drilling clay and additives to maintain down-hole fluid properties. Drilling cuttings and drilling fluids will be removed from the site for disposal.

The estimated depth of a Paso Robles Formation intermediate zone monitoring well would depend on the geologic conditions but at 13th Street we estimate that it would be 140 feet deep (210 feet deep at the alternative site) and at the Estrella River crossing at Airport Road it would be 220 feet deep. No deep well is planned for the 13 Street site. A deep well at Airport Road would be 500 feet deep. The drilling cuttings volume would be roughly 20 cubic yards for two intermediate and one deep well.

A log of the drill cuttings samples will be prepared and analyzed before decisions on elevation zones of perforated pipe are finalized. The wells will be developed by air lifting. Discharge water will be contained and safely disposed of on site after settling or taken to a City discharge site.

The site will be clearly marked and the test hole covered to prevent access when contractor is not present. Traffic control will be provided if required by the encroachment permit.

Depending upon site specific requirements a typical wellhead, Figure 2 (see Appendix 2) shall consist of a 12" diameter traffic-rated water-tight well box in the center of a minimum 36" by 4" thick cement concrete pad. The pad surface shall have a gentle slope to drain water. The lid of the well box should be labeled "Monitoring Well".

Site Access, Equipment, and Management

Proposed access routes to each construction site are shown on Figures A1 and A2. While access is primarily along existing paved and dirt roads, traction mats would be used if need by the hollow-stem auger (HSA) drill rig to traverse any soft or sandy alluvial material near channels.

Well Drilling Permits and Utility Clearance

Prior to mobilizing in the field, a drilling permit will be obtained from San Luis Obispo County Environmental Health Services. Additionally, underground utility clearance will be obtained from Underground Service Alert.

Schedule

The proposed field activities are currently scheduled to take place in Fall/Winter 2020. Total cumulative duration of work is not expected to exceed 14 days at each site.

Prevention and Mitigation of Potential Impacts

The City has reviewed field conditions and the proposed work with our environmental consultant. The following measures and activities will be incorporated into the proposed work to prevent and mitigate potential impacts:

- Limited site grading will be conducted as part of this activity.
- Approximately eight cubic yards of material (total) will be generated from the intermediate Paso Robles Formation monitoring well boreholes and will be collected and disposed offsite at a City facility. If the optional deep Airport Road well or the alternate 13th Street Bridge well is drilled, add up to 12 more cubic yards.
- No fueling will occur within 100 feet of any channel.
- Inadvertent impacts to the site from personnel and equipment will be prevented through flagging and/ or fencing.
- Equipment will be inspected for presence of noon-native invasive species.
- Potential fuel or oil contamination will be prevented, as needed, from leaking onto ground using drip pans, tarps, plastic sheeting, etc.
- Emergency spill containment materials and kit will be available on site.
- Prior to beginning activities adjacent to a stream bank all contractors and other persons visiting the site shall receive training from a qualified biologist.

- Drilling will not occur during or within 24 hours following a significant rainfall event, defined as ¼-inch or more of rain in a 24 period unless a qualified biologist completes a daily survey of the project area during the significant rainfall event and the 24 hours following the event.
- The activities would be overseen and documented by a monitor.
- A nesting bird survey will be conducted by a qualified biologist no more than two weeks prior to the start of any construction activities between February 15 and September 15 to determine the presence/absence of nesting birds. If active nest sites ae found, work will be scheduled in a way that avoids those sites until a qualified biologist determines that all young have fledged and are no longer reliant upon the nest or parental care for survival.
- In the unlikely event that archaeological resources are exposed during project implementation, work will stop in the immediate vicinity, and a qualified archaeologist will be retained to evaluate the find and recommend relevant mitigation measures. In the event that human remains are discovered, State of California Health and Safety Code Section 7050.5 shall be followed.

Truck-mounted HSA drilling rig

Rotary Water Well Drilling Equipment: Filipponi & Thompson Drilling

A site visit has been conducted by the City and its consultants to confirm site conditions and access routes. It was determined that mobilization drilling rigs to all sites will not cause disturbance to banks, trees or vegetation. The sites will be returned to their existing grade. No drilling mud will be discharged as part of these activities. Upon completion of work at each site, any wastes generated from drilling operations (e.g., trash, excess materials) will be removed and properly disposed.

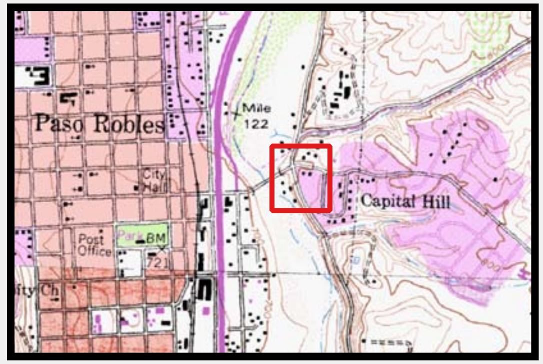
STREAM GAGE INSTALLATION

Once the sites have been selected, stream gages will be installed. Radar type systems are planned.

A radar type stream gage is typically mounted on a bridge and includes a datalogger, a VHS transmitter, a Pulse Radar water level sensor, a solar panel and voltage regulator, an antenna, a battery, a system enclosure and an antenna pole.

Radar Sensor Stream Gage: County of San Luis Obispo

Installation of the stream gage equipment is planned to be led by County Public Works personnel who have installed other stream gages in the County and will likely be maintaining the gages.



Explanation

Work Site

Well Access Route

Proposed Monitoring Well

0 60 120 180 ft

N

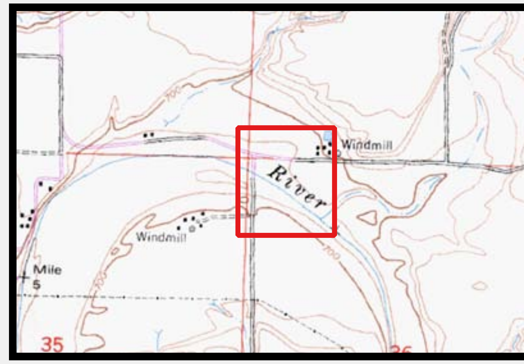
Figure B1
Well Site Access Routes
Site 1 - 13th Street Bridge

Monitoring Well Work Plan
Appendix B

Paso Robles Groundwater Basin
Supplemental Environmental Project

City of Paso Robles

Cleath-Harris Geologists



Explanation

- Work Site
- Well Access Route
- Proposed Monitoring Well

0 100 200 300 ft

N

Figure B2
Well Site Access Routes
Site 9 - Airport Road

Monitoring Well Work Plan
Appendix B

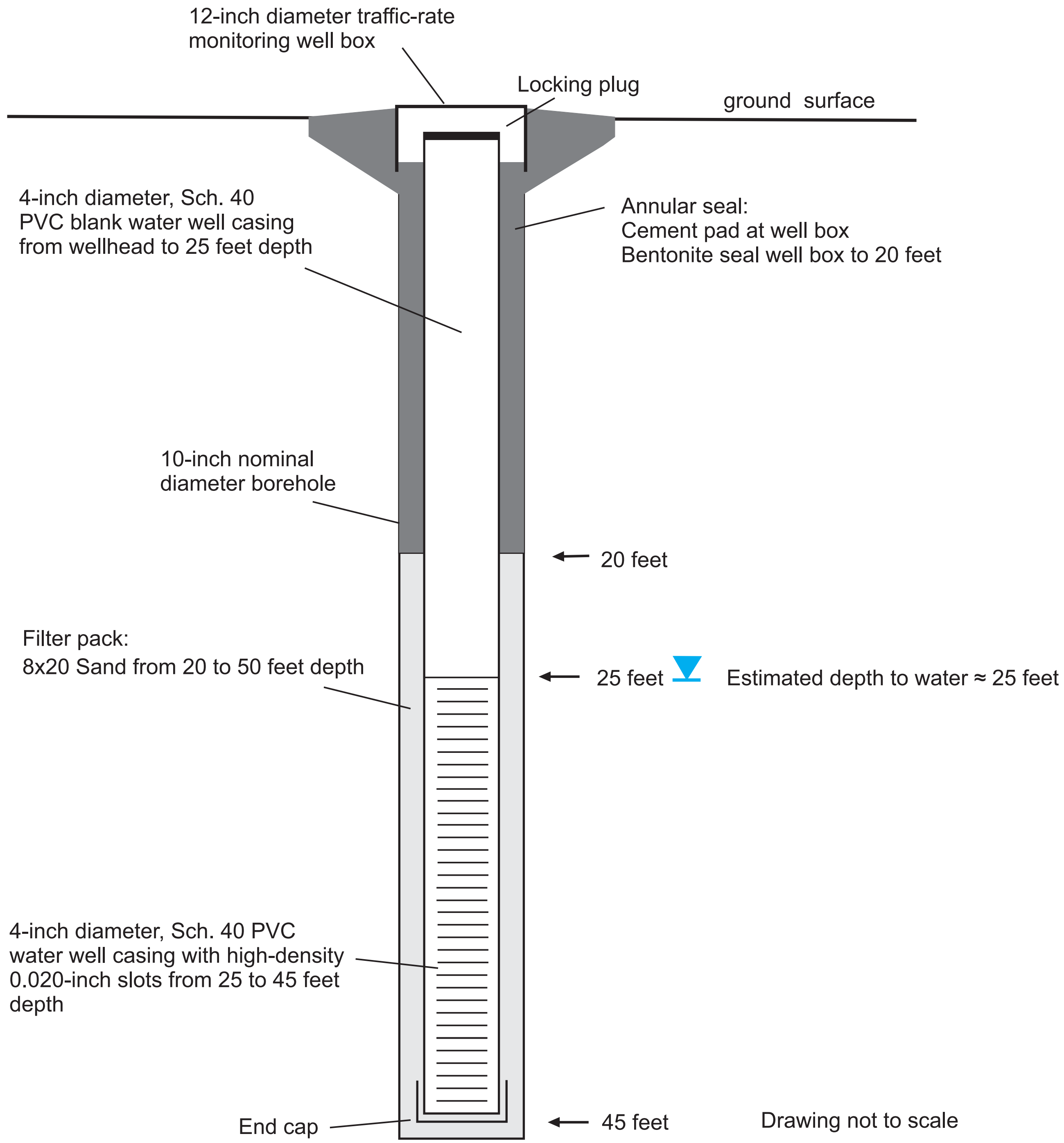
Paso Robles Groundwater Basin
Supplemental Environmental Project

City of Paso Robles

Cleath-Harris Geologists

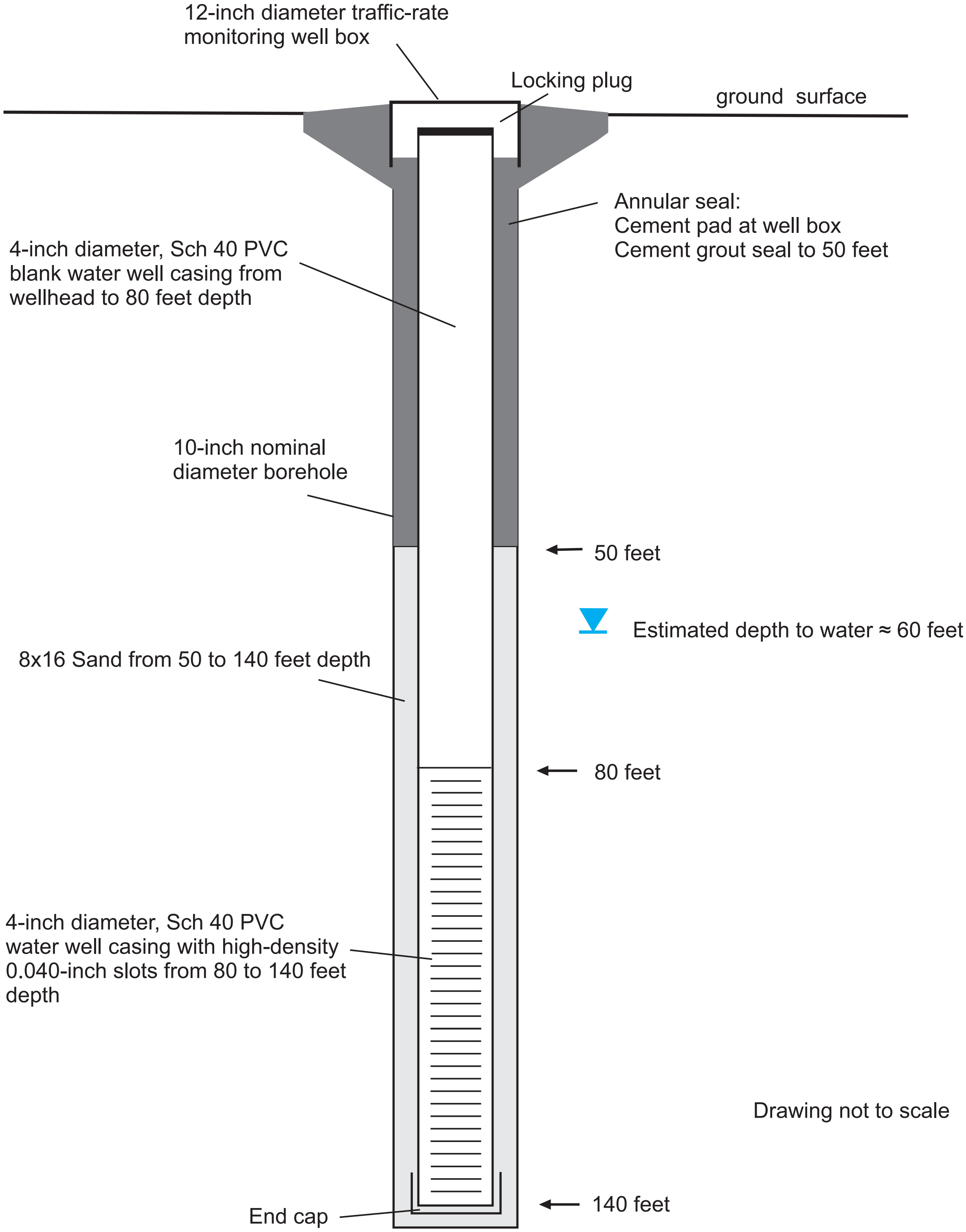
APPENDIX C

Preliminary Design for 13th Street Bridge Monitoring Wells



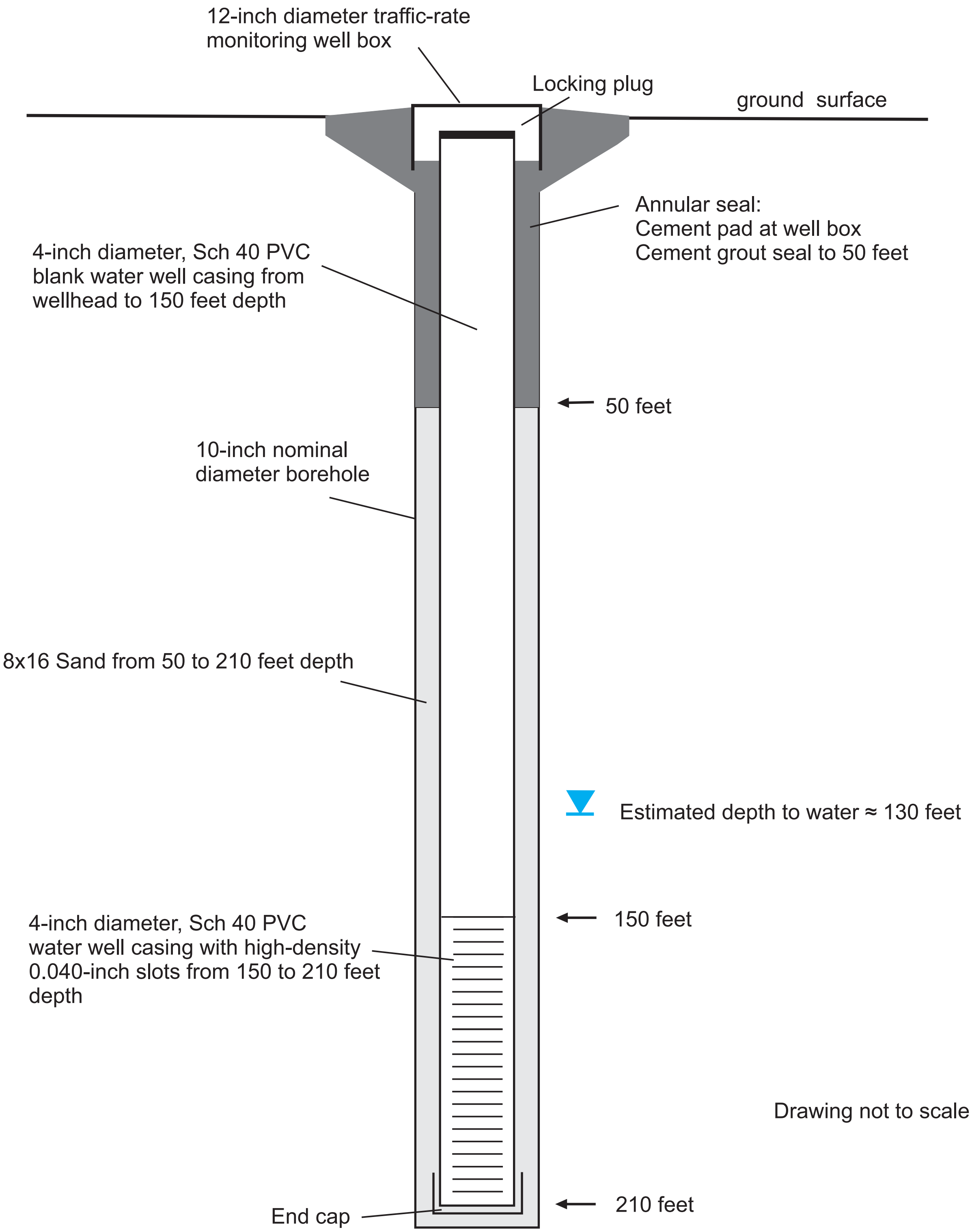
Shallow Well Preliminary Design
Site 1 - 13th Street Bridge
Supplemental Environmental Project
City of Paso Robles

Cleath-Harris Geologists



Intermediate Well Preliminary Design
Site 1 - 13th Street Bridge
Supplemental Environmental Project
City of Paso Robles

Cleath-Harris Geologists

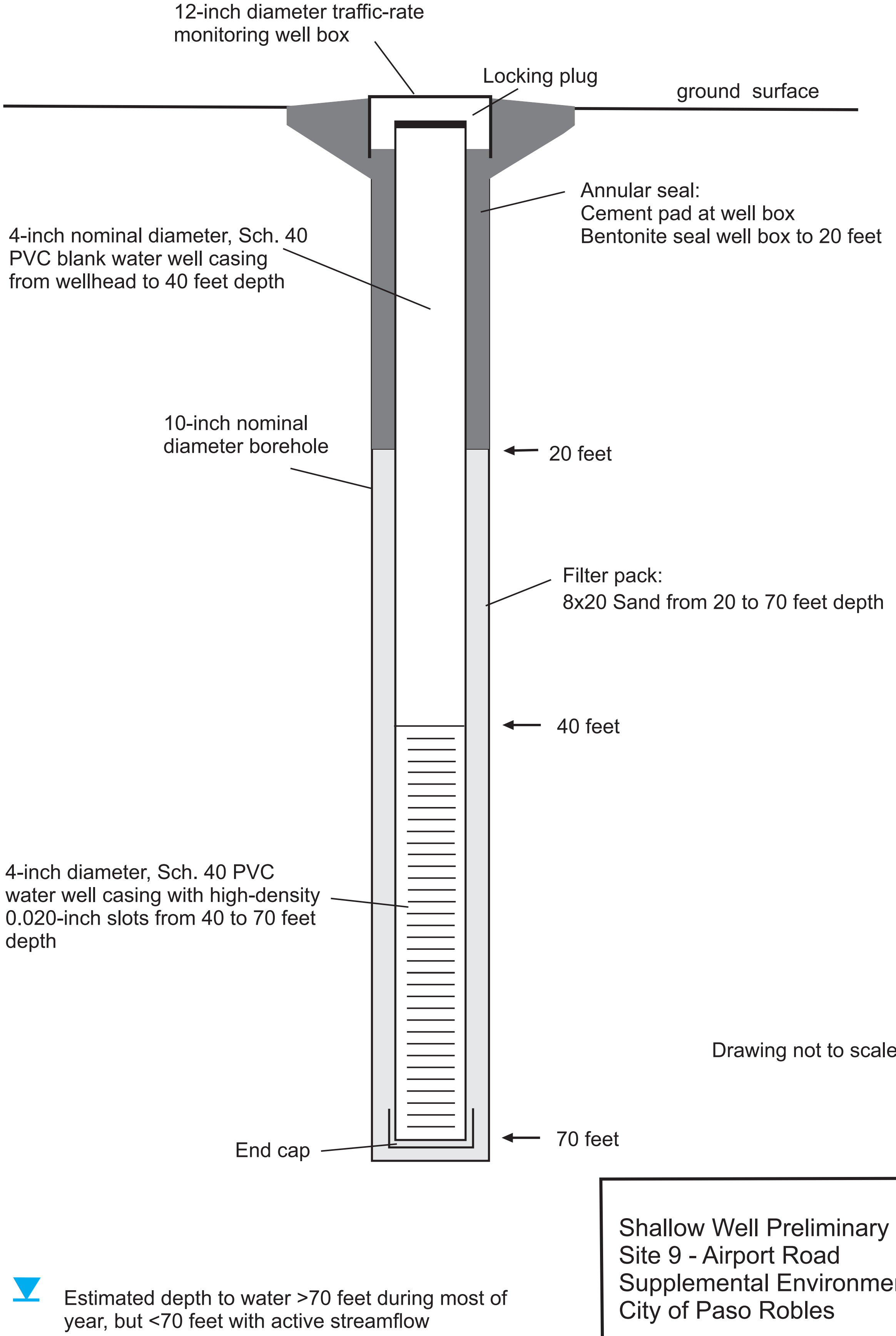


Alternate Site Intermediate Well
Preliminary Design
Site 1 - 13th Street Bridge
Supplemental Environmental Project
City of Paso Robles

Cleath-Harris Geologists

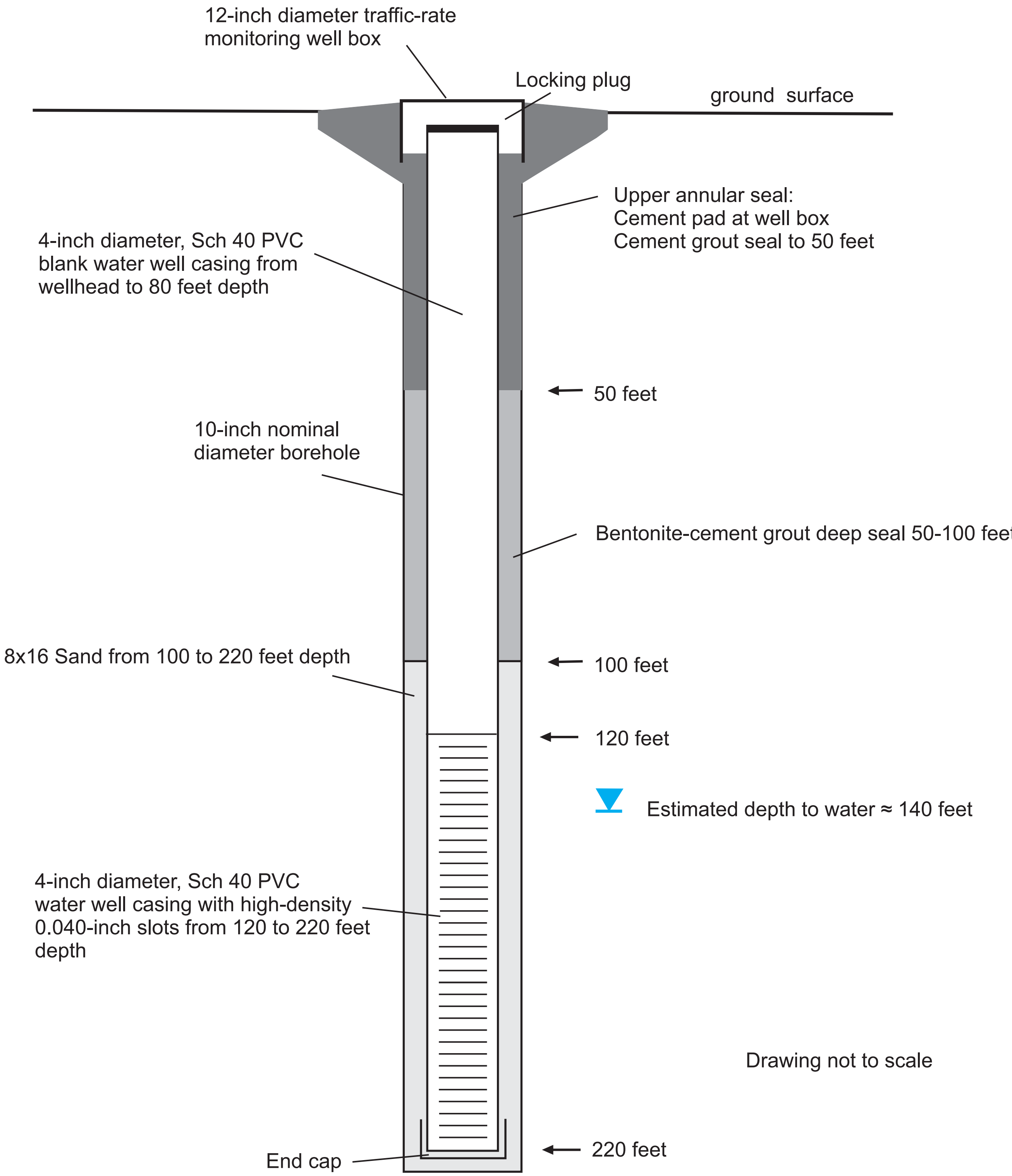
APPENDIX D

Preliminary Design for Airport Road Monitoring Wells



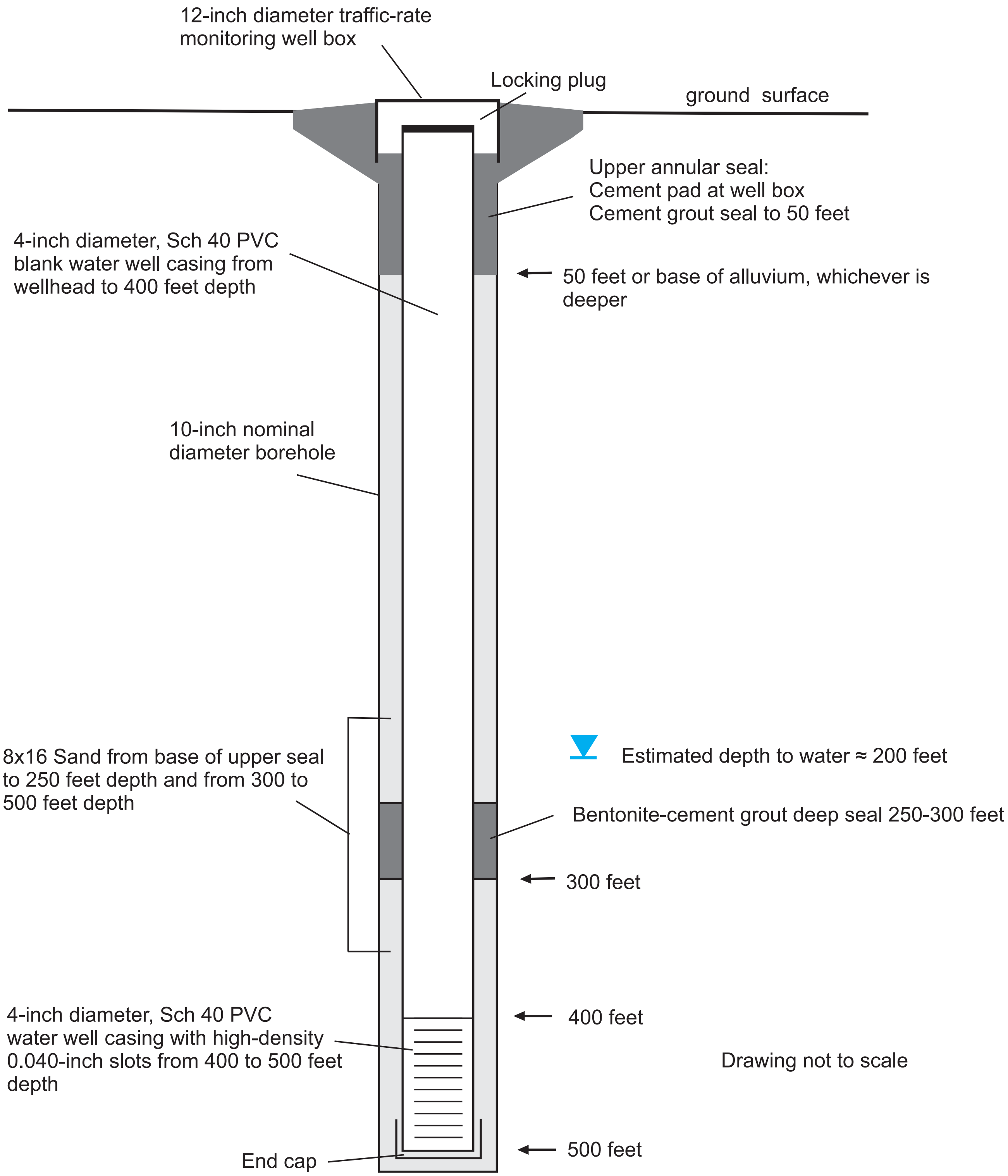
Shallow Well Preliminary Design
Site 9 - Airport Road
Supplemental Environmental Project
City of Paso Robles

Cleath-Harris Geologists



Intermediate Well Preliminary Design
Site 9 - Airport Road
Supplemental Environmental Project
City of Paso Robles

Cleath-Harris Geologists



Deep Well Preliminary Design
Site 9 - Airport Road
Supplemental Environmental Project
City of Paso Robles

Cleath-Harris Geologists

STREAM GAGE SITING MEMORANDUM
SUPPLEMENTAL ENVIRONMENTAL PROJECT

PASO ROBLES AREA GROUNDWATER SUBBASIN
SAN LUIS OBISPO COUNTY
CALIFORNIA

Prepared for

CITY OF PASO ROBLES

NOVEMBER 2020

CLEATH-HARRIS GEOLOGISTS
75 Zaca Lane, Suite 110
San Luis Obispo, California 93401

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APPENDIX A – Streamflow Measurement
APPENDIX B – GDE indicators in proximity to SEP Sites
APPENDIX C – Stream Profiles at SEP Sites

1.0 BACKGROUND

The Groundwater Sustainability Agencies (GSAs) for the Paso Robles Area Subbasin of the Salinas Valley Groundwater Basin include the County of San Luis Obispo, the Shandon-San Juan Water District, the City of Paso Robles, and the San Miguel Community Services District. These GSAs adopted a Groundwater Sustainability Plan (GSP) for the Subbasin[1], which has been submitted to the California Department of Water Resources (DWR) in compliance with the Sustainable Groundwater Management Act (SGMA).

The GSP identified a need to expand the network of stream gages and monitoring wells within alluvial deposits associated with the major drainages in the Subbasin. Per the recommendations set forth in the GSP, "*Definitive data delineating any interactions between surface water and groundwater or a lack of interconnected surface waters is a data gap that will be addressed during implementation of this GSP*".

A critical component of the current groundwater model is streamflow, and available streamflow data is very limited as there are only two existing stream gages operating in the Subbasin. This Supplemental Environmental Project (SEP) will begin expanding the network of both stream gages and adjacent monitoring wells in order to better assess the potential for interconnected surface water and groundwater across the Subbasin. Monitoring well construction for the SEP is addressed in a separate Monitoring Well Work Plan.

The SEP will install stream gages that record stream stage; rating curve development is not part of this project. Stage data without a rating curve is useful for identifying flow/no flow conditions and the timing of stormwater runoff (when analyzed with rain gages and other stream gages in a watershed). The stage data may also be used to evaluate the inteconnectivity of surface water and groundwater. A rating curve would be needed to convert stage data to streamflow for water budget and groundwater model analyses. A brief summary of streamflow measurement in natural channels is include in Appendix A.

2.0 SITE SELECTION PROCESS

Ten locations were identified by the Subbasin GSAs that would help provide hydrologic, geologic and hydrogeologic data with appropriate monitoring equipment installations[2]. These locations

[1] Montgomery & Associates, 2020. Paso Robles Subbasin Groundwater Sustainability Plan dated January 31, 2020.

[2] Monsoon Consultants, 2019. Figure 1 - Paso Robles Groundwater Basin - Proposed Monitoring Sites, Paso Robles GSP Data Gap Assessment dated September 6, 2019.

represent sites where a stream gage, coupled with a set of nested or paired monitoring wells, would help to fill in data gaps related to surface water/groundwater interactions throughout the Subbasin. The original locations are shown in Figure 1.

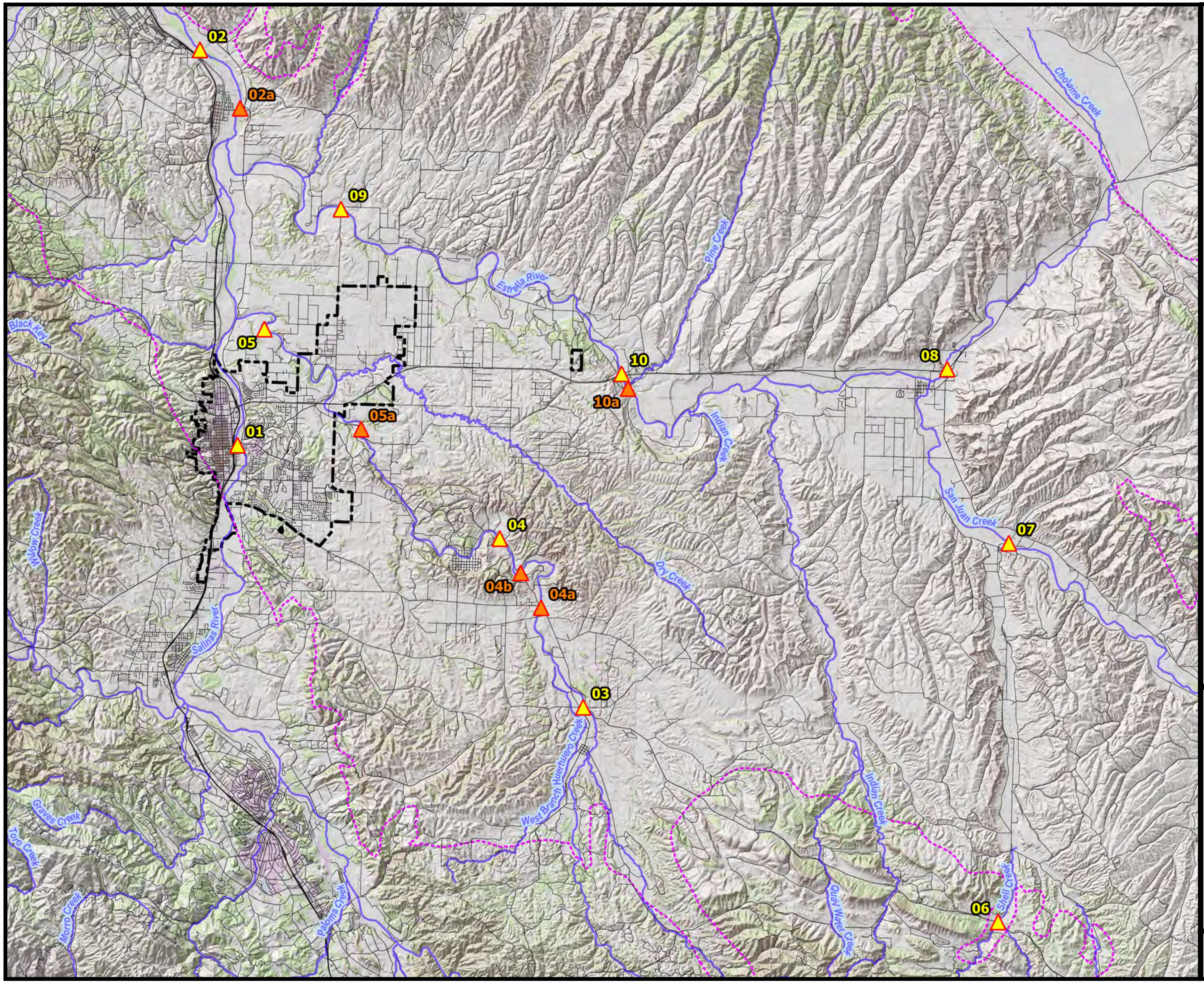
Two of these ten sites (Site 1 and Site 9) currently have U.S. Geological Survey (USGS) stream gages installed and will have monitoring wells installed as part of this SEP project. Of the eight potential stream gage sites, three sites are located in the upper Estrella River watershed: on Shell Creek (Site 6), San Juan Creek (Site 7), and Cholame Creek (Site 8). The Shandon-San Juan Water District GSA is currently pursuing stream gage placement in this area under a separate project with DWR. Therefore, this SEP project is focused on siting stream gages at/near three or more of the following five remaining sites: the Salinas River (Site 2), Huer Huero Creek (Sites 3, 4 and 5), and the Estrella River at Whitley Gardens (Site 10).

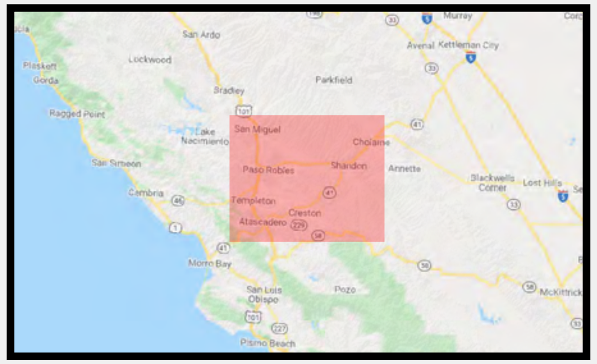
2.1 Replacement and Alternate Sites

Due to the funding requirement for installation before the end of the year, an initial key criterion that was used in the site selection process was ease of installation. For this project, non-contact radar sensors installed on bridges are preferred over bubbler or stilling well systems, as no actual work in the stream bed is needed, making the permitting and installation process significantly quicker. Radar sensors also require less maintenance than traditional water-level sensors as they are not susceptible to being obstructed by sediment or debris during high flow events. USGS testing and field experience has proven that radar water level sensors can be used at many sites to provide water level measurements that have accuracy similar or better than that of the older water level instruments[3].

Radar sensors have proven reliable and are being widely used by the County of San Luis Obispo. An example of a local radar sensor installation is shown in Figure 2.

[3] Fulford, J.M., 2016, Testing and Use of radar Water Level Sensors by the U.S. Geological Survey *in* Manual on sea level: Measurement and Interpretation Vol. V: Radar Gauges, JCOMM Technical Report No.89, pp. 121-124.





Explanation

Paso Robles City Limits

Paso Robles Groundwater Subbasin Boundary

Major Stream

Stream Gage Site

Original

Replacement/Alternate

0 2.5 5 mi

N

Figure 1
Site Locations

Stream Gage Siting Memo
Paso Robles Groundwater Basin
Supplemental Environmental Project

City of Paso Robles

Cleath-Harris Geologists

Figure 2. San Luis Obispo County radar sensor stream gage installation

Bridge sites are ideal for radar sensors and do not require cableway infrastructure for velocity measurements during rating curve (stage-discharge relation) development, therefore, sites with bridges were prioritized for this project. Bridge plans often have historic topographic information that can be compared to existing or future streambed topography. Bridge sites that are located on County roads or private property (with cooperative owners) were preferred over State of California (Caltrans) owned bridges to avoid administrative delays.

After review of the five remaining original sites under consideration for this project (Sites 2, 3, 4, 5, and 10) only Site 5 was located on a bridge not controlled by Caltrans. In order to provide a viable project and meet the SEP implementation schedule, replacement sites on County bridges were identified as close to the original sites as possible.

The site selection process also includes alternative site pairs. An alternative site pair consist of two stream gage sites that are viable but redundant with respect to general location, so only one of the two would be completed. Alternative sites offer an opportunity for broader agency input on final site selections.

A total of six potential stream gage sites have been identified as viable for this SEP phase (the SEP sites). Two of the sites considered for the SEP are replacements for original sites (Site 2a and Site 10a), and four SEP sites are alternative pairs, from which two sites could be selected (Site 4a or 4b, and Site 5 or 5a). Therefore, prioritization of these six SEP sites would result in four locations for potential stream gage installation.

2.2 SEP Site Prioritization

The basis for site prioritization is a simple ranking system. Five criteria are used to rank the sites, with three possible scores:

1 – Lower than average benefit
2 – Average benefit
3 – Greater than average benefit

The criteria for ranking stream gage sites included environmental considerations, hydrologic considerations, and constructability considerations, with emphasis on ease of installation due to the project time constraints. The criteria used to rank each site include the following:

- Proximity to indicators of Groundwater-Dependent Ecosystems (iGDEs) – closer for greater benefit
- Depth to groundwater – shallower for greater benefit
- Access for adjacent monitoring wells – easier for greater benefit
- Subbasin flow model – broader coverage for greater benefit
- Channel definition and future rating curve development – narrower for greater benefit

The first three criteria listed above are associated with evaluating the interconnectivity of surface water and groundwater, which is the primary data gap beginning to be addressed by the SEP. The last two criteria relate to improving the groundwater model by considering the overall distribution of gage sites for broader water budget determination, and also the suitability of the sites for flow channel consistency and ease of future rating curve development.

2.2.1 Proximity to iGDEs

Proximity to iGDEs was evaluated using the same tool used in Appendix C (Methodology for Identifying Potential Groundwater Dependent Ecosystems) of the Paso Basin GSP. Geospatial data showing iGDEs were downloaded from The Nature Conservancies website for Natural Communities Associated with Groundwater (NCCAG)[4]. Figures showing each of the six SEP sites and nearby iGDEs (if any) are in Appendix B.

2.2.2 Depth to Groundwater

Depth to groundwater was evaluated using the Spring 2019 groundwater elevation contour map from the 2019 Annual Report for the Subbasin[5]. The contoured groundwater elevation at each SEP site was compared to ground surface elevation in the stream bed at the SEP sites to determine an estimated depth to water. Depth to groundwater in the alluvial deposits could be shallower than the 2019 basin contour map indicates.

2.2.3 Access for Adjacent Monitoring Wells

Property ownership and County right-of-way were reviewed at each of the six SEP sites. Most sites were surrounded by private property, with variable right-of-way conditions. Sites with wide right-of-way or public parcels in vicinity were considered easier for future monitoring well construction.

2.2.4 Subbasin Flow Model

Filling data gaps with respect to the interconnectivity of surface water and groundwater is the primary driver for the SEP and can be accomplished with the raw stage data. However, once the stage data is converted to streamflow data using a rating curve (not part of this project), the information can also be used to develop water budget information and refine groundwater model estimates for surface water inflow, stream bed conductance, and recharge areas. Sites with historical streamflow data can also provide useful comparison to new data, and provide a better calibration for the model streamflow input.

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4 https://data.cnra.ca.gov/dataset/natural-communities-commonly-associated-with-groundwater

5 GSI Water Solutions, 2020. Paso Robles Subbasin First Annual Report (2017-2019), Draft Final dated February 26, 2020.

2.2.5 Channel Suitability and Rating Curve Development

Radar is a non-contact method of measuring stage at one location over time, and is best suited to channels where low flow consistently appears in a specific area of the channel, which also means the lowest point in the channel does not change from year to year. Other in-stream (contact) methods, such as bubble gages or stilling wells, are set into the channel bottom and can record stage from any location in the channel, with surface flow interpreted to occur when the stage rises above a predetermined channel or pool elevation. As previously noted, this SEP proposes radar sensor equipment installation. Some of the sites appear better suited for low flow detection than others, based on site reconnaissance. Stream bed profiles with anticipated placement of the radar gage are shown in Appendix C.

Future rating curve development, which will be needed to convert raw stage measurements to streamflow data for the groundwater model, require in-stream depth profiles and flow velocity surveys. Measuring rating curves during high flow conditions can be challenging, especially when the stage is rising or falling fairly quickly.

3.0 SEP SITE DESCRIPTIONS

There are six sites under consideration for stream gage installation. Descriptions of these SEP sites are provided below.

3.1 Site 2a – Salinas River, River Road Bridge at San Miguel

Site 2a is a replacement for Site 2, which was two miles further downstream where no bridge or road crossing exists. Site 2a encompasses a watershed area of 1,986 square miles (compared to 2,047 square miles at the original Site 2). The replacement site is on River Road bridge in San Miguel, a 1,000-foot structure that spans the roughly 700-foot wide Salinas River, with a bridge deck 50-60 feet above the channel. Historical imagery shows a relatively consistent and distinct 60-foot wide subchannel towards the east end of the bridge that appears suitable for a radar gage, but there are often multiple channels when the river is flowing. There are abundant iGDEs in the site vicinity. Depth to water below the stream channel was approximately 15 feet in Spring 2019. There is currently a nested monitoring well at the east end of the bridge (intermediate and deep piezometers) and a private well off the west end of the bridge. There are locations for additional monitoring wells in a wide County right-of way. A significant disadvantage for Site 2a is the difficulty in future development of an accurate rating curve due to the wide, braided channel.

3.2 Site 4b – Mid Huer Huero Creek, Geneseo Road Bridge

Site 4b is the closest replacement option to the original Site 4 (an unpaved road crossing) and is located on the newly constructed (2019) Huer Huero Creek bridge on Geneseo Road near Eagle Oak Ranch Way. Site 4b encompasses a watershed area of 101 square miles (compared to 103 square miles at the original Site 4. The bridge deck is roughly 15 feet above a swale-shaped 30-foot wide channel with gently sloping banks. The channel is straight and constrained immediately upstream and through about 300 ft downstream where a large bend occurs towards the northwest. This site is also located at an inactive USGS stream gage (11147600) with data from 1958 to 1972. There are no reported iGDEs close to this site. Depth to water below the stream channel was approximately 65 feet in Spring 2019. Monitoring wells could likely be placed in the right-of-way adjacent to the bridge.

3.3 Site 4a – Mid Huer Huero Bridge, Creston Road Bridge at Geneseo Road

As an alternative to site 4b, the older concrete bridge on Creston Road by the intersection of Geneseo Road is another potential location for a stream gage on upper Huer Huero Creek. Site 4a encompasses a watershed area of 98 square miles. The bridge deck is roughly 15 feet above a flat, 100-foot wide channel below, and is the first bridge downstream of the confluence of the West, East and Middle branches of Huer Huero Creek. Depth to water below the stream channel was approximately 85 feet in Spring 2019. The bridge is just upstream of where surface flow was identified to stop in the wet winter of 2016-17[6]. There is an adjacent County parcel to the southeast of the bridge that would be an ideal place for monitoring well installations.

3.4 Site 5 - Lower Huer Huero Creek / Buena Vista Drive

Site 5 is located at a bend on lower Huer Huero Creek about 1.5 miles upstream of the confluence with the Salinas River. The bridge is located on private property but could be used with an agreement with the landowner. Site 5 encompasses a watershed area of 159 square miles. The steel and wood bridge has a deck approximately 7 feet above a flat 50-foot wide channel below. Data from this site would record runoff from the entire Huer Huero Creek watershed. Depth to water below the stream channel was approximately 35 feet in Spring 2019. Monitoring wells would be need to located on private property, where there are vineyards and two nearby irrigation wells.

[6] Todd Groundwater et al., 2018, Paso Robles Basin Recharge Feasibility Study for the Huer Huero Creek, prepared for San Luis Obispo County Flood Control and Water Conservation District.

3.5 Site 5a – Lower Huer Huero Creek, Union Road Bridge near Kit Fox Lane

An alternative gage site to the originally proposed Site 5 on lower Huer Huero Creek is at the bridge on Union Road approximately 5 miles upstream of Site 5. Site 5a encompasses a watershed area of 130 square miles. The 15-foot-high bridge is narrow with very narrow shoulders and has a relatively blind curve to the north. The roughly 60-foot wide channel is flat and straight with minimal vegetation. There are no iGDEs identified in the area. Depth to water below the stream channel was approximately 190 feet in Spring 2019 (within a major Subbasin pumping depression). Its southeastern banks are mildly sloping and northwestern banks are steep and high (~150 feet). An irrigation well is present near the southeastern bank roughly 75 feet from the center of the bridge. The right-of-way is narrow along that part of Union Road and monitoring wells would need to be located on private property.

3.6 Site 10a: Estrella River, Whitley Gardens / River Grove Drive Bridge

Site 10a is a replacement site for Site 10, which wa 0.4 miles downstream at State Highway 46. The one-lane steeltruss River Grove Drive bridge in Whitley Gardens was renovated in November 2019. Site 10a encompasses a watershed area of 1,210 square miles. The bridge deck is 15-20 feet above the roughly 40-foot-wide channel, with gently-sloping banks. The upstream and downstream reaches are straight and constrained and the main channel under the bridge has a distinct center channel. There are iGDEs both upstream and downstream of the site. Depth to water below the stream channel was approximately 40 feet in Spring 2019. Site 10a is also the location of an inactive USGS stream gage that has limited streamflow data from 1939 to 1941. There appears to be sufficient width in the right-of-way to install monitoring wells east of the bridge.

4.0 SITE RANKING CRITERIA

Table 1 presents the results of site criteria evaluation. Descriptions of these criteria and scoring are described in the Section 2.2 above (SEP Site Prioritization).

Table 1
Stream Gage Site Criteria Evaluation

Criteria	SEP SITE					
	2a	4a	4b	5	5a	10a
Proximity to iGDEs	3	2	2	2	2	3
Depth to Groundwater	3	2	2	3	1	3
Access for monitoring wells	3	3	2	3	1	2
Hydrologic Value*	3	3	3	2	2	3
Channel morphology/Rating curve dev.	1	2	3	2	2	3
Score (higher = more benefit)	**13**	**12**	**12**	**12**	**8**	**14**

*requires rating curve to achieve full benefit

5.0 SITE RANKING RECOMMENDATION

Site 10a (Estrella River at Whitley Gardens) has the highest ranked score for a gage location under the criteria used, with a greater than average relative benefit of all criteria except access for monitoring wells (average rank). Site 2a (Salinas at San Miguel) is second in the rankings, with a greater than average relative benefit of all criteria except channel morphology/rating curve development (below average rank).

The remaining locations are all on Huer Huero Creek, with a tie between Sites 4a, 4b, and 5. All three sites have greater than average benefit in two criteria and average in three criteria. Site 5a (Lower Huer Huero, Union Road near Kit Fox Lane) has the lowest ranking of all sites, due to average to below average ranking for all criteria.

Mid Huer Huero sites 4a and 4b are both good options. Site 4a is the first bridge that captures all three Huer Huero branches and would experience the longest duration of seasonal flow of the two sites. Site 4a also has access to an adjacent County parcel for monitoring well siting. Site 4b is located closer the original Site 4 on a newly constructed bridge where the contoured channel is better suited to low flow measurements, and is also at an inactive historical USGS gage location which is valuable for data continuity. One or the other of these two sites could be used for stream gaging.

Assuming Site 3 (Highway 41 bridge – East and Middle Branches of Huer Huero Creek) is to be installed as the Upper Huer Huero stream gage under a future GSP project phase, then Site 4b would provide a more suitable location for the Mid Huer Huero gage. Data from a Site 3 gage (61 square miles of watershed) could be used to estimate inflow to the Subbasin on the West Branch. If Site 3 is not planned under future GSP project phases, then Site 4a would be preferred and would effectively represent Upper Huer Huero Creek.

Lower Huer Huero Site 5 would be viable if cooperation with the property owner(s) (including a permanent easement and room for monitoring well installation) can be established. The assumption is that this can be accomplished, which gives above average access for monitoring wells. The relatively shallow depth to groundwater is an indicator of potential surface water and ground water interaction, although no iGDEs exist in proximity. Site 5 could have an above average hydrologic value if paired with a Mid Huer Huero gage, which would allow a calculation of basin recharge along the Lower Huer Huero.

Assuming future GSP project phases will construct Site 3 to represent Upper Huer Huero Creek, the following stream gage site prioritization is recommended for the SEP, beginning with the top priority:

- Site 10a (Estrella River at River Grove Bridge, Whitley Gardens)
- Site 2a (Salinas River at San Miguel Bridge)
- Site 4b (Mid Huer Huero Creek at Geneseo Road Bridge near Eagle Oak Ranch Way)
- Site 5 (Lower Huer Huero Creek at private bridge near Buena vista Drive)

APPENDIX A

Streamflow Measurement in Natural Channels

Streamflow Measurement in Natural Channels

The most practical method for measuring streamflow in natural channels is the velocity-area method, which has the following computation[7]:

$$Q = \sum_{i=1}^{n} (a_i v_i)$$

where:

Q = total discharge (reported in cubic feet per second).

a_i = cross-sectional area of flow for the *i*th segment of the *n* segments into which the cross section is divided (square feet), and

v_i = the corresponding mean velocity of flow normal to the *i*th segment (feet per second).

The conceptual model for the velocity area-method is shown below. A stream is divided into segments, each with an individual area and velocity, which are then multiplied and summed using the above equation.

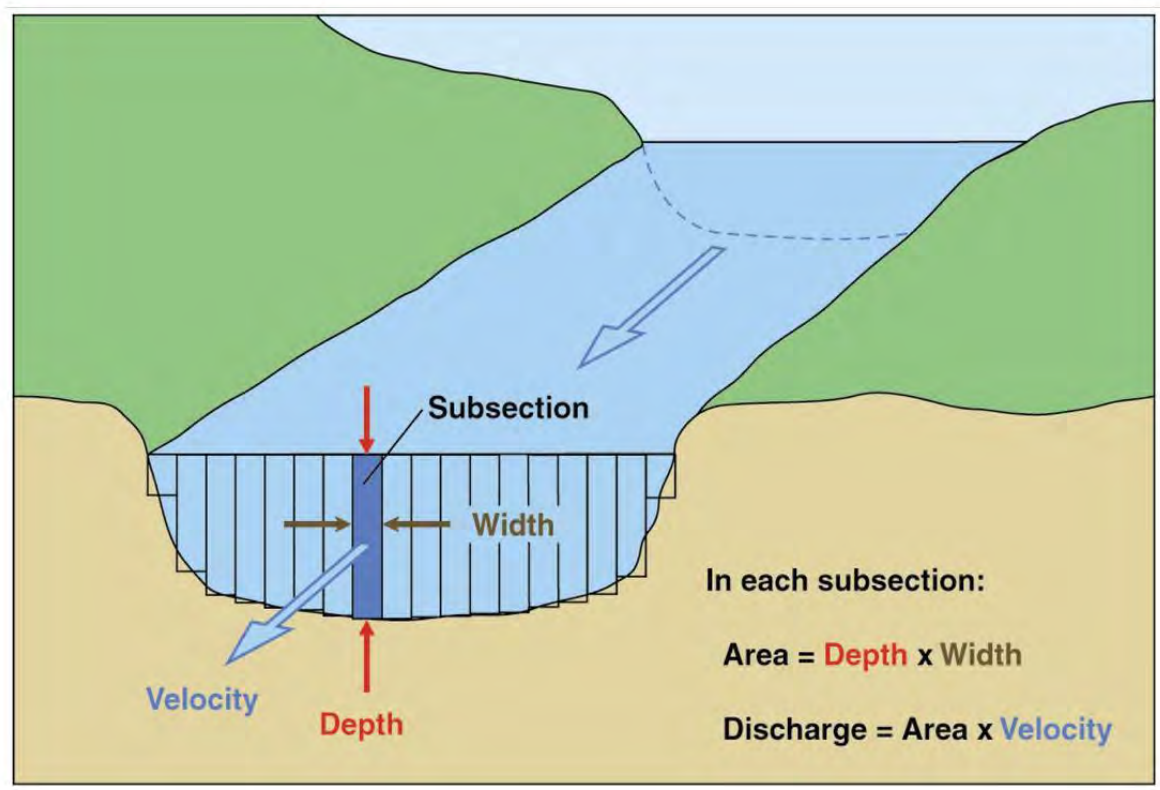


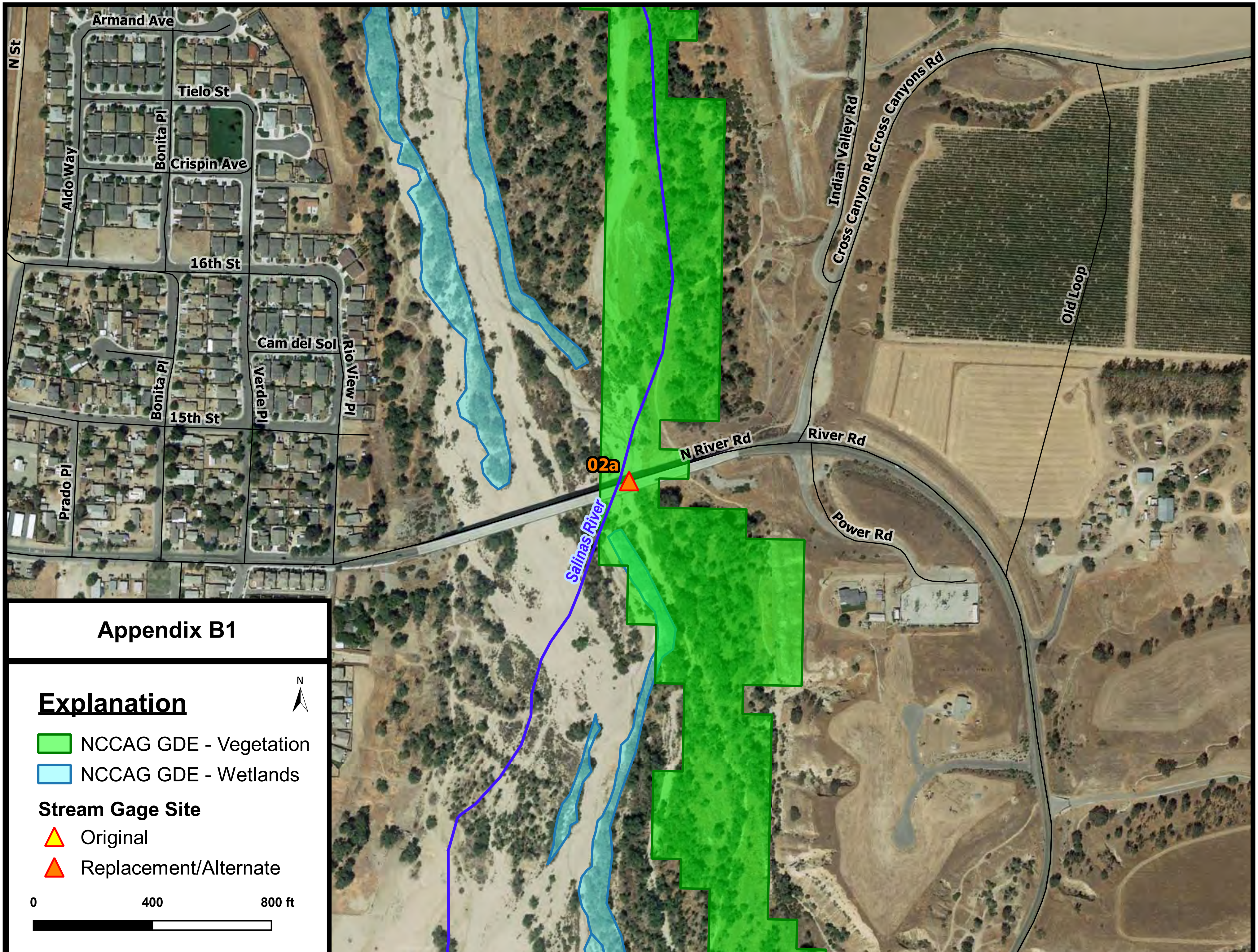
Diagram of Channel cross-section with segments for discharge computation (USGS)

[7] Turnipseed, D.P. and Sauer, V.B., 2010. Discharge Measurements at Gaging Stations, USGS Techniques and Methods 3-A8.

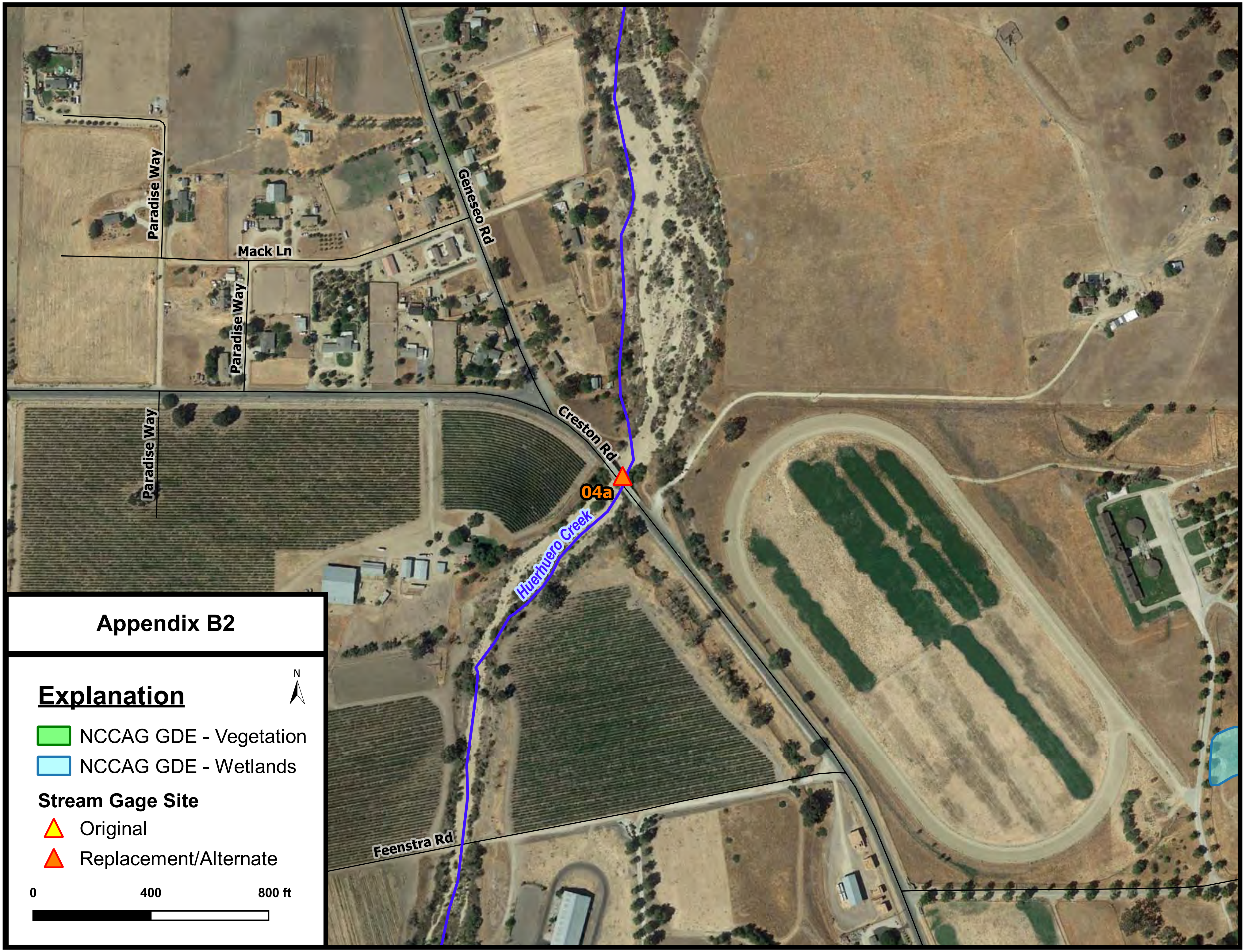
In natural channels, stream gages are used to record stage (feet), which is the height of water in the stream above an arbitrary point, usually at or below the stream bed. The stage is then converted to streamflow through the use of a rating curve, or stage-discharge relation. A rating curve incorporates information collected that is specific to each site, including the cross-sectional area of the channel and the average velocity for a given flow stage. These rating curves are developed using depth profiles and average flow velocity measurements during storm-runoff events. Rating curves may need to be revised periodically as they can shift due to changes in channel geometry. Measuring average flow velocity across a channel at different stream stages is the most challenging part of developing a rating curve.

APPENDIX B

GDE Indicators in Proximity to SEP Sites



Armand Ave
N St
Tielo St
Bonita Pl
Crispin Ave
Aldo Way
16th St
Cam del Sol
Rio View Pl
Bonita Pl
Verde Pl
15th St
Prado Pl
Indian Valley Rd
Cross Canyon Rd
Cross Canyons Rd
Old Loop
N River Rd
River Rd
02a
Salinas River
Power Rd
Appendix B1
Explanation
N
NCCAG GDE - Vegetation
NCCAG GDE - Wetlands
Stream Gage Site
Original
Replacement/Alternate
0
400
800 ft



Appendix B2

Explanation

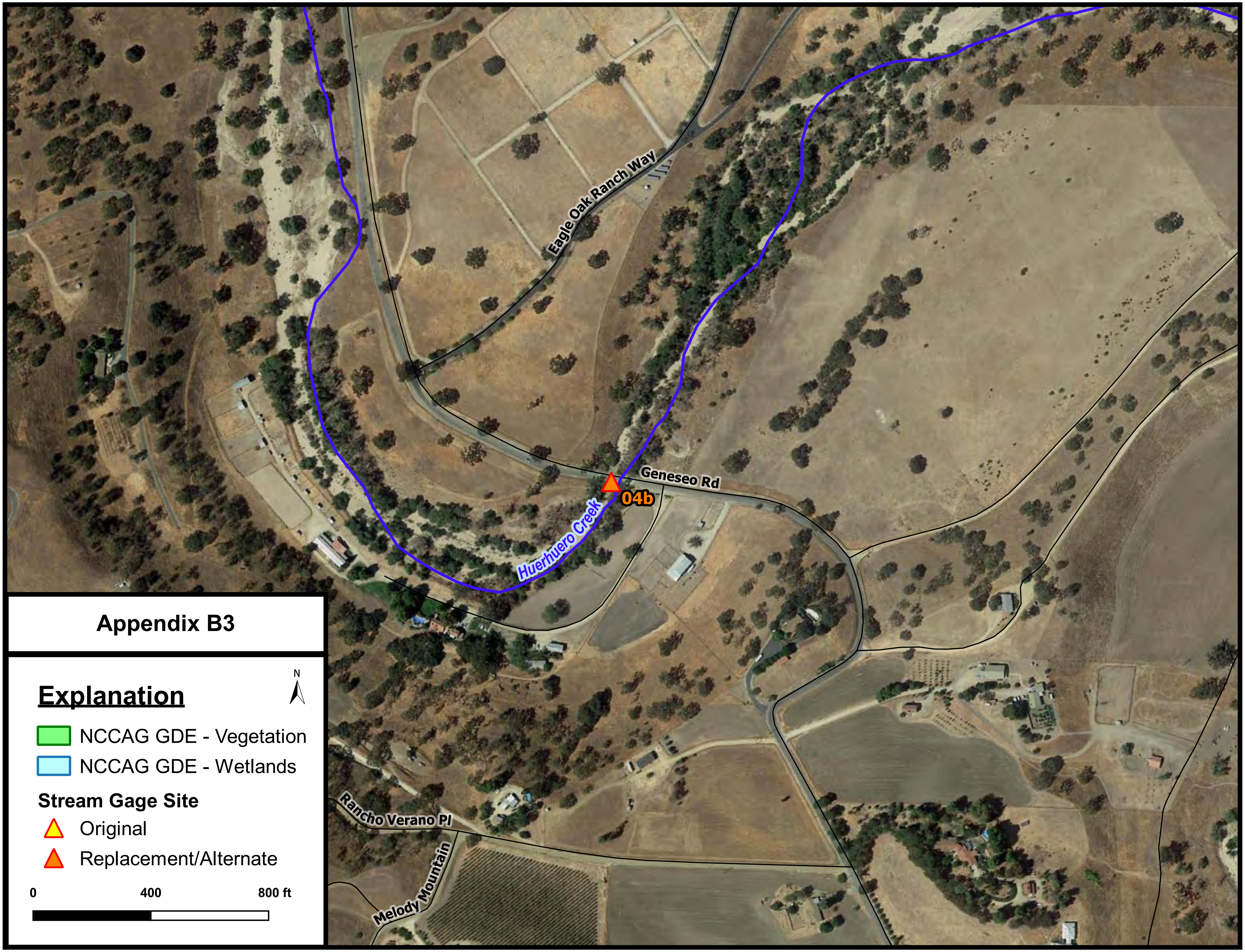
NCCAG GDE - Vegetation

NCCAG GDE - Wetlands

Stream Gage Site

Original

Replacement/Alternate



Appendix B3

Explanation

N

NCCAG GDE - Vegetation

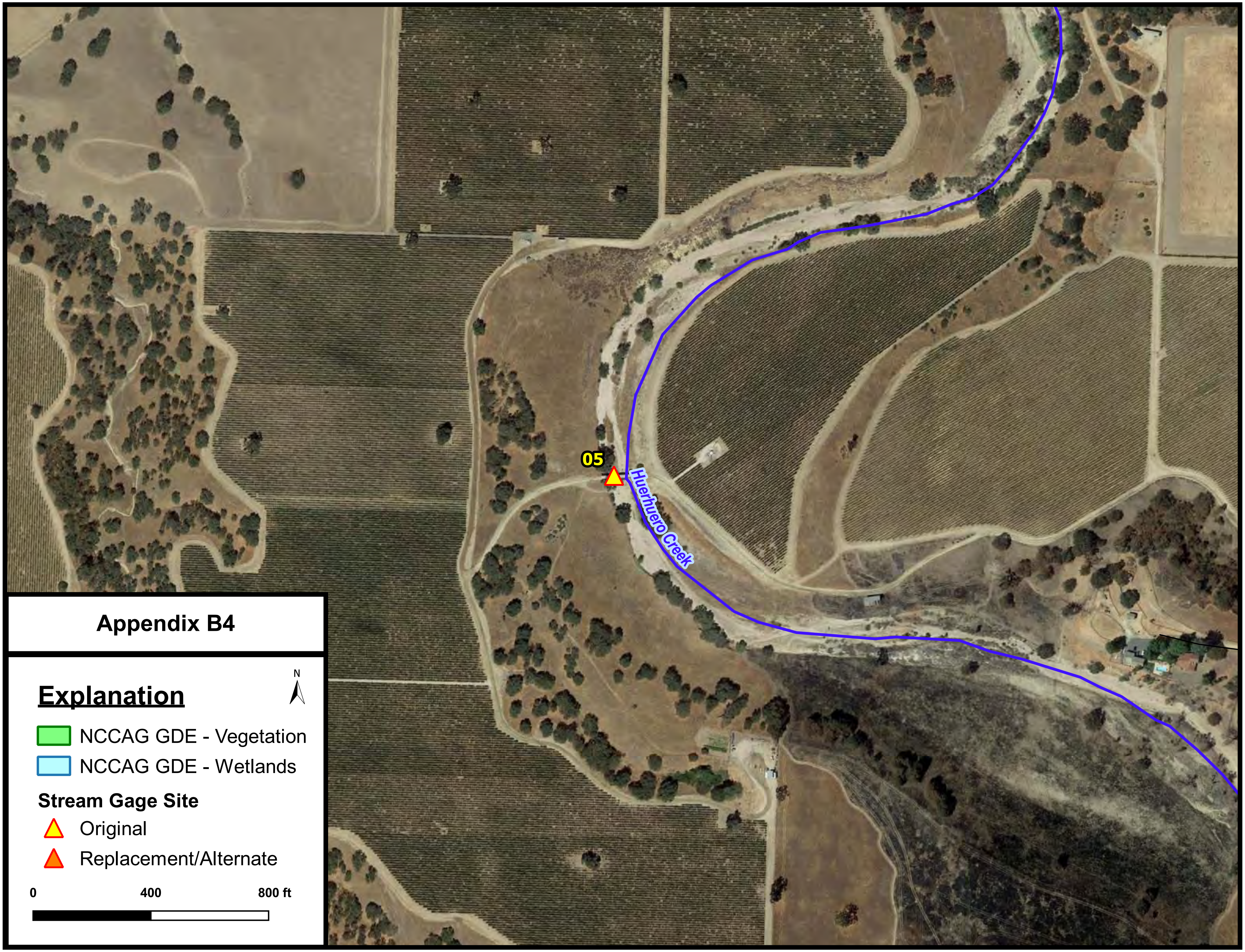
NCCAG GDE - Wetlands

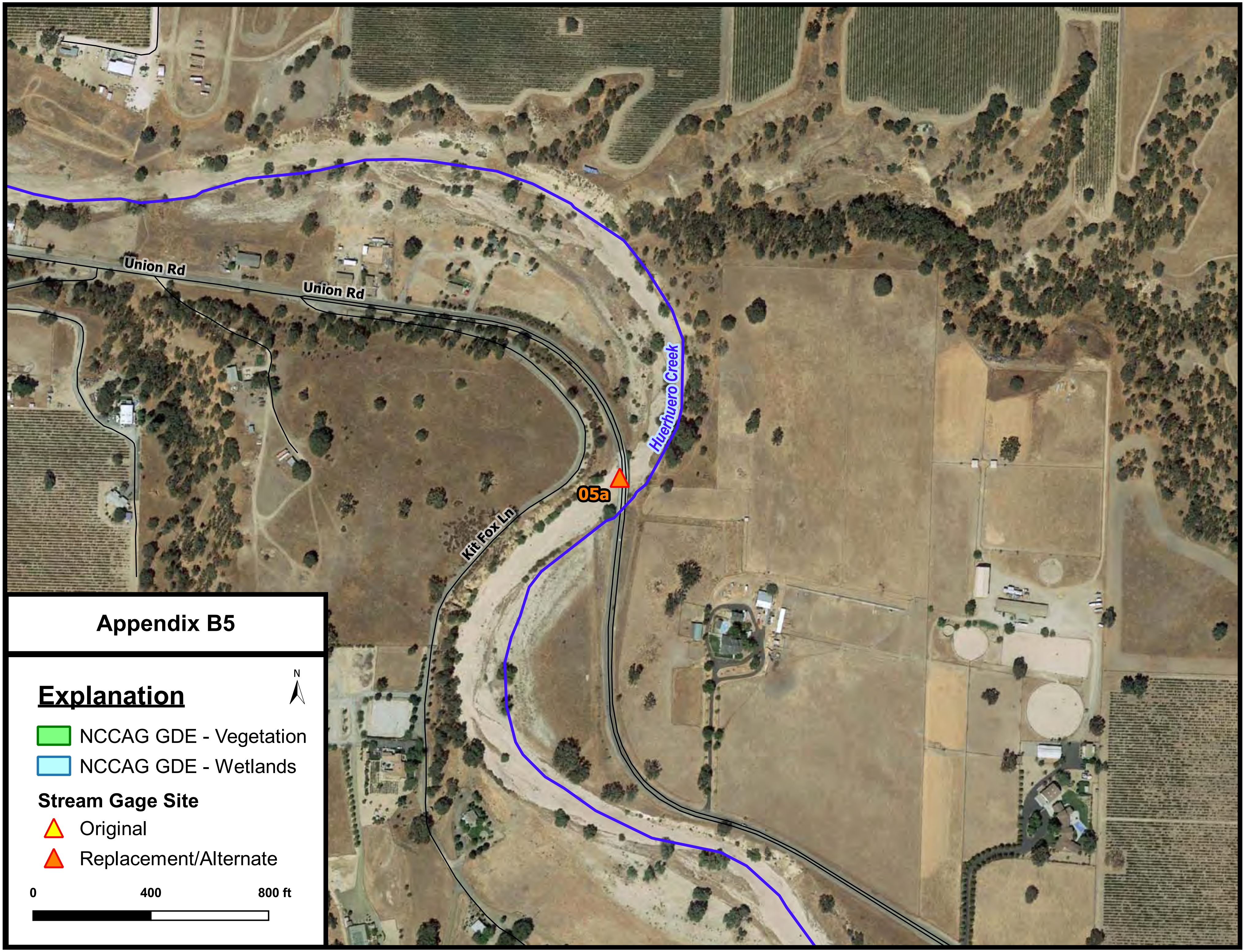
Stream Gage Site

Original

Replacement/Alternate

0 400 800 ft


05
Huerhuero Creek
Appendix B4
Explanation
N
NCCAG GDE - Vegetation
NCCAG GDE - Wetlands
Stream Gage Site
Original
Replacement/Alternate
0
400
800 ft



Appendix B5

Explanation

NCCAG GDE - Vegetation

NCCAG GDE - Wetlands

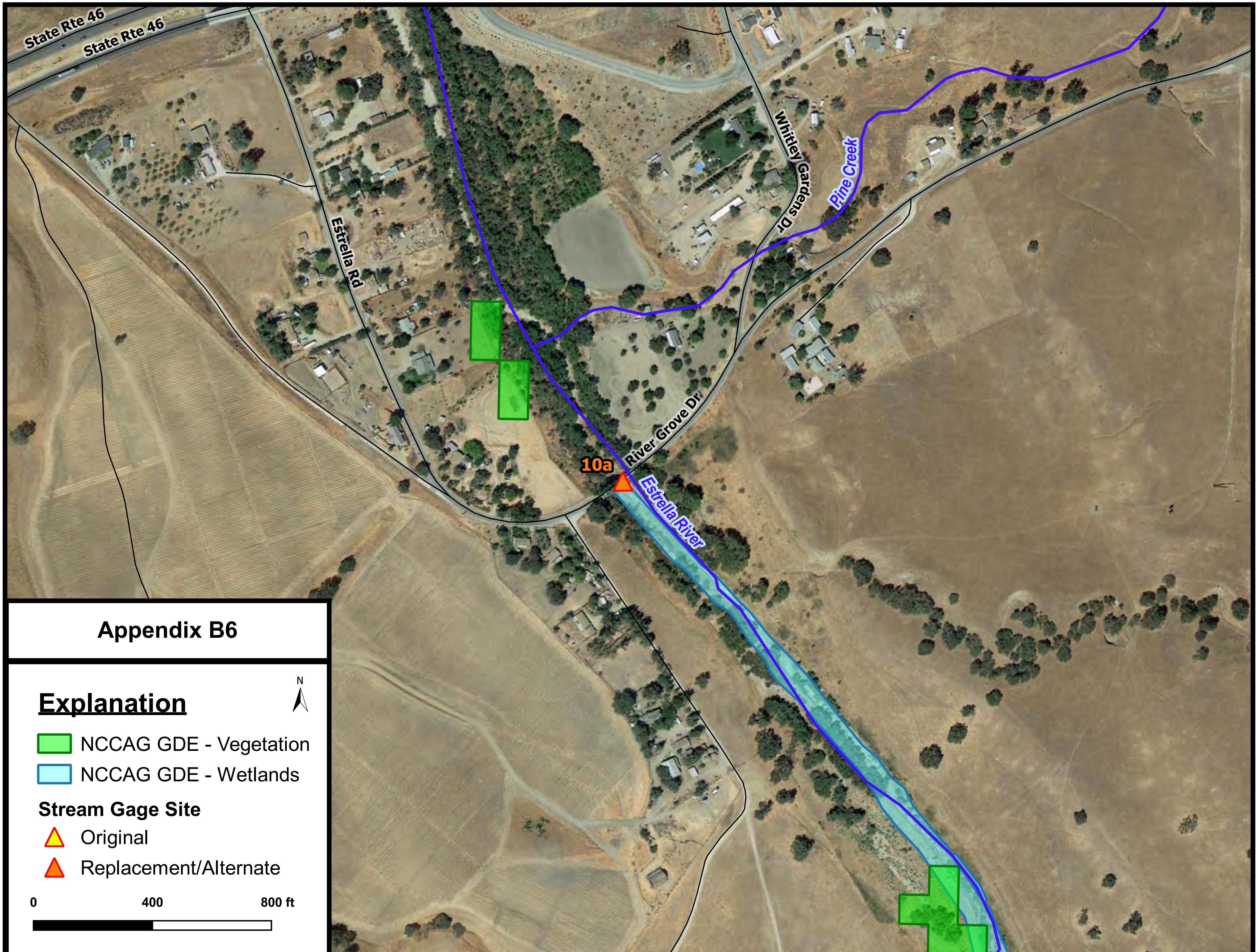
Stream Gage Site

Original

Replacement/Alternate

0 400 800 ft

N



Appendix B6

Explanation

NCCAG GDE - Vegetation
NCCAG GDE - Wetlands

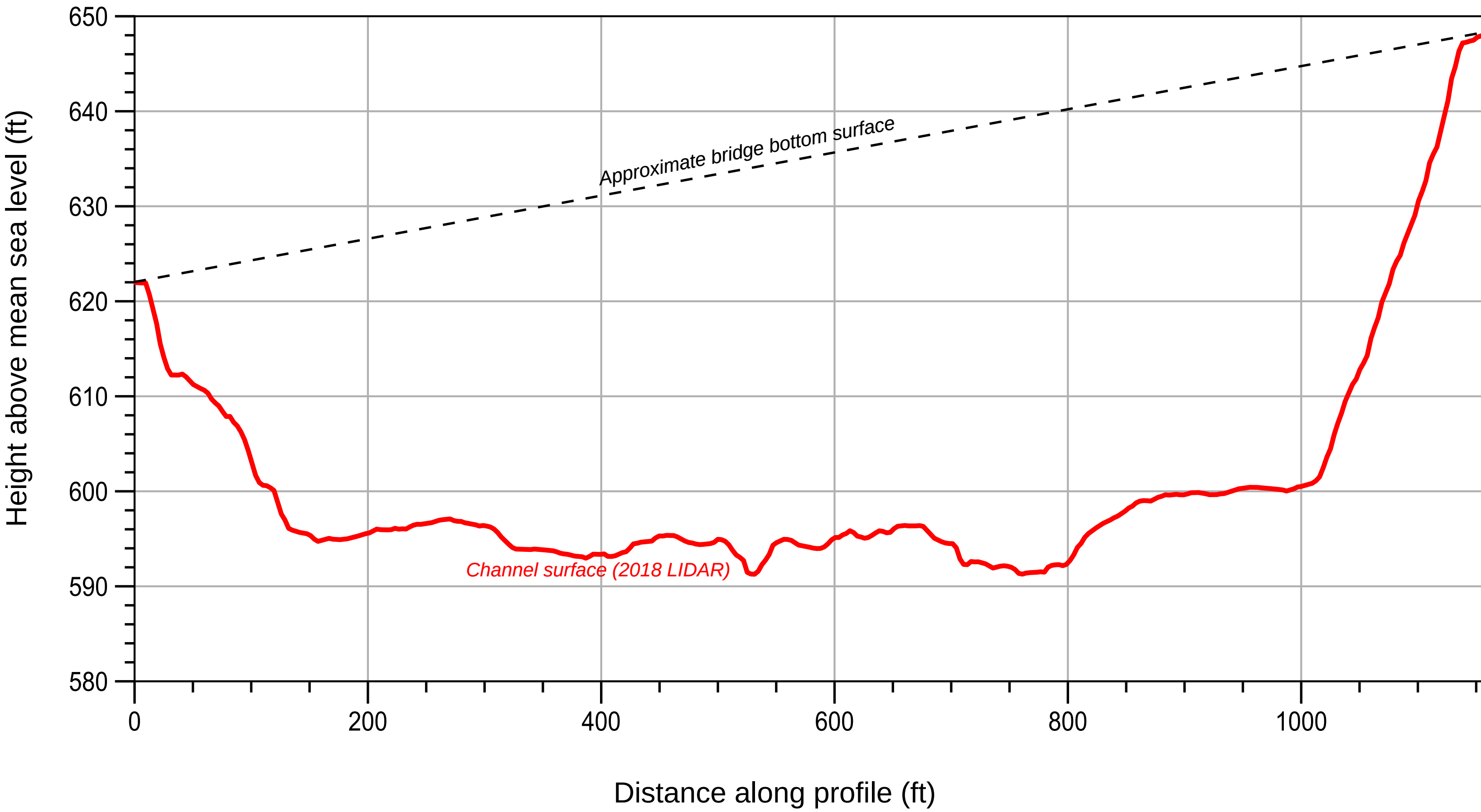
Stream Gage Site

Original
Replacement/Alternate

0 400 800 ft

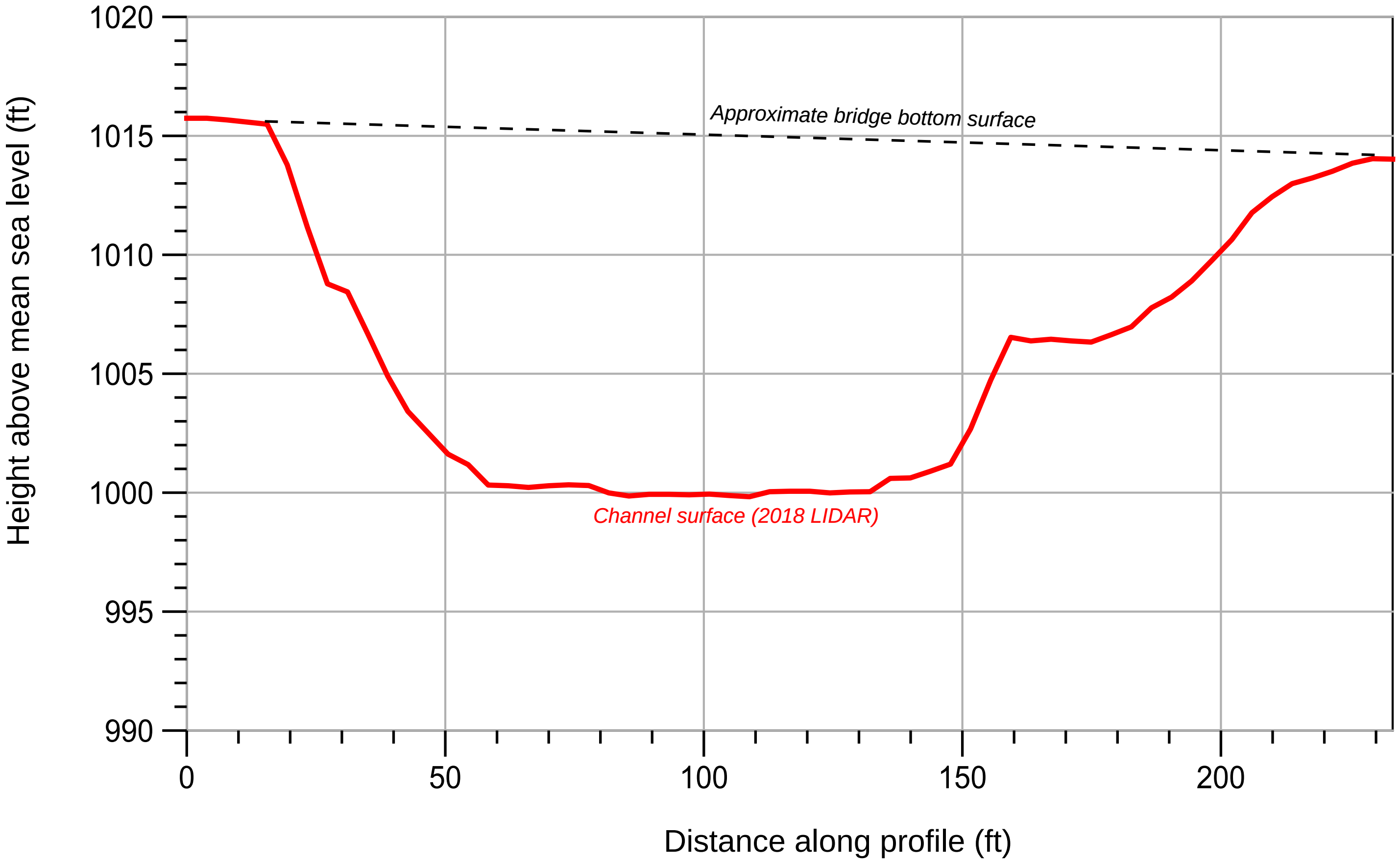
APPENDIX C

Stream Profiles at SEP Sites



Appendix C1

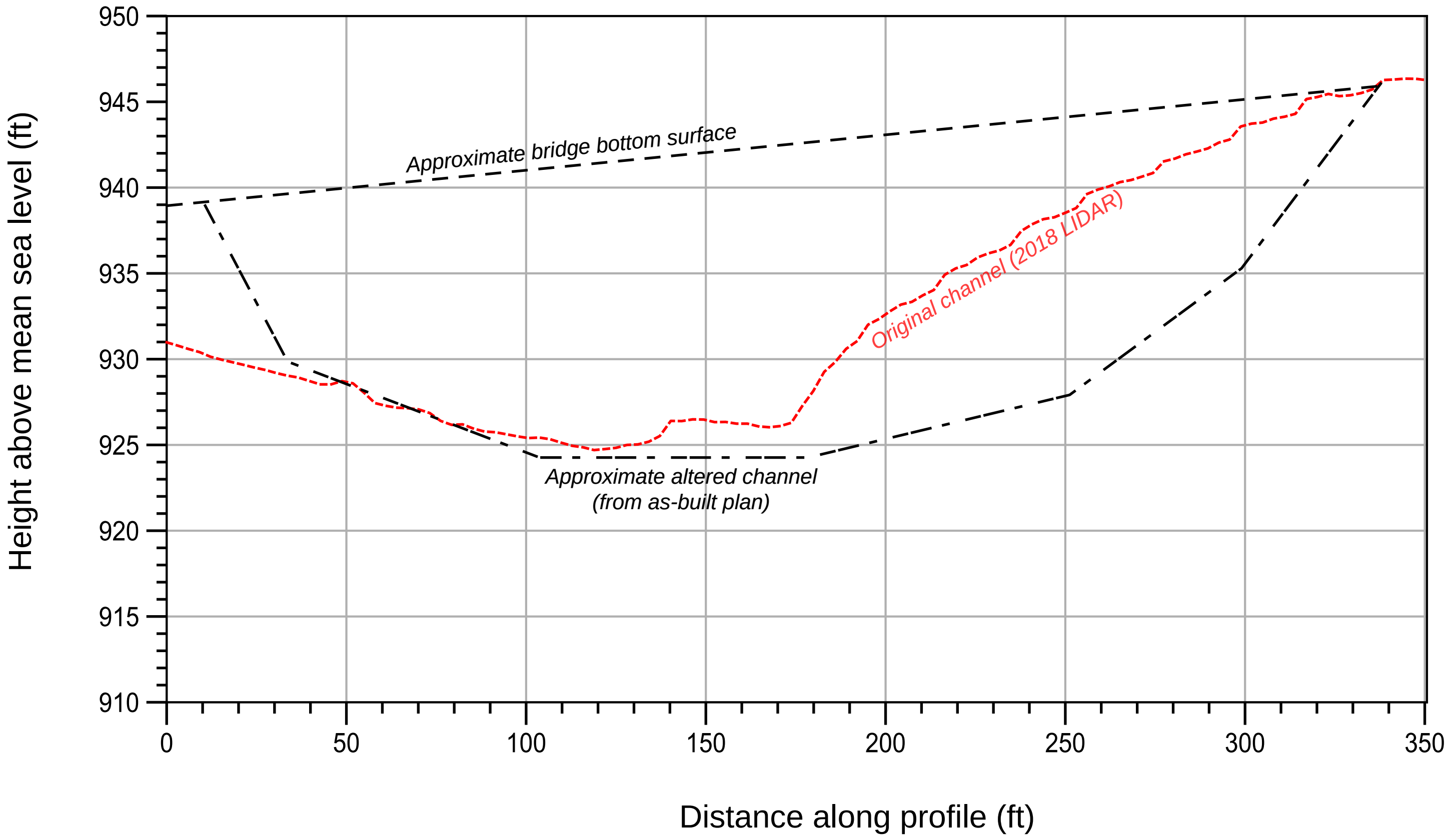
Channel Profile Site 2a



Appendix C2

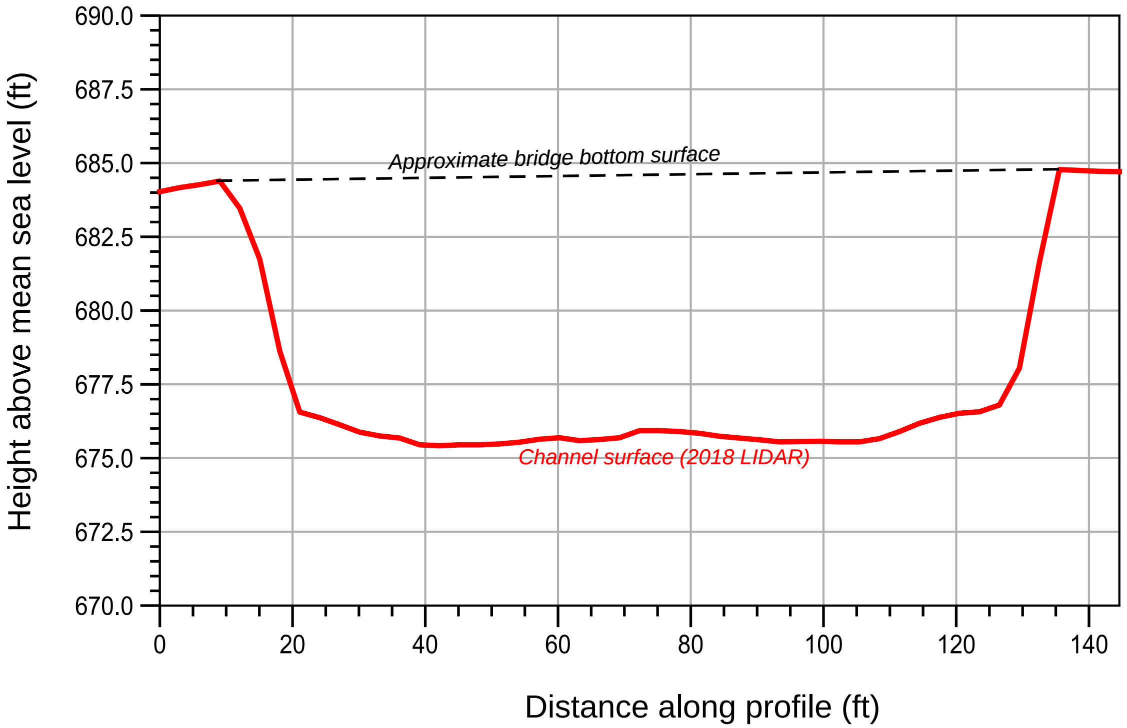
Channel Profile
Site 4a

Note: Aerial imagery reflects conditions prior to the construction of bridge 49C0431



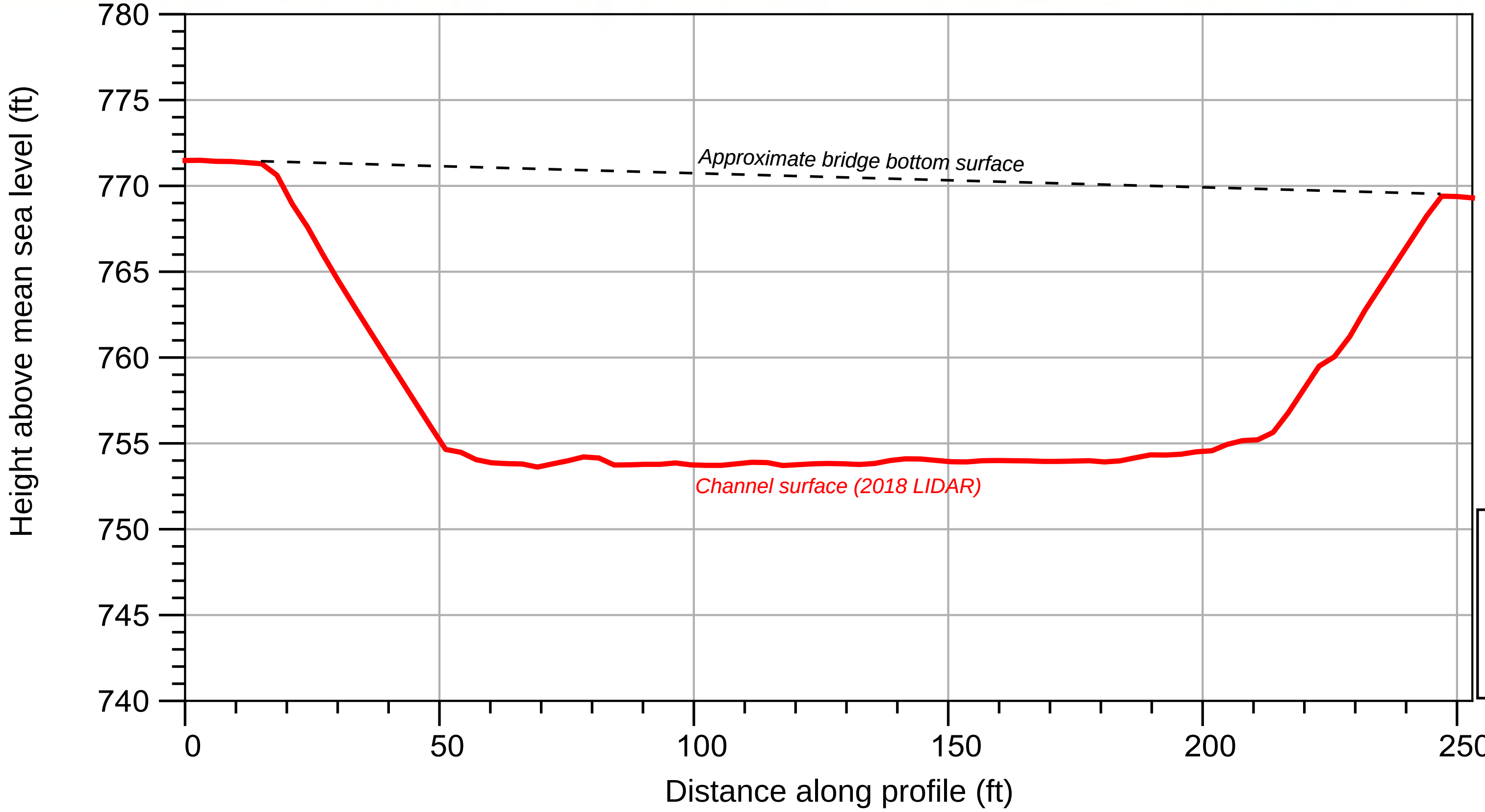
Appendix C3

Channel Profile Site 4b



Appendix C4

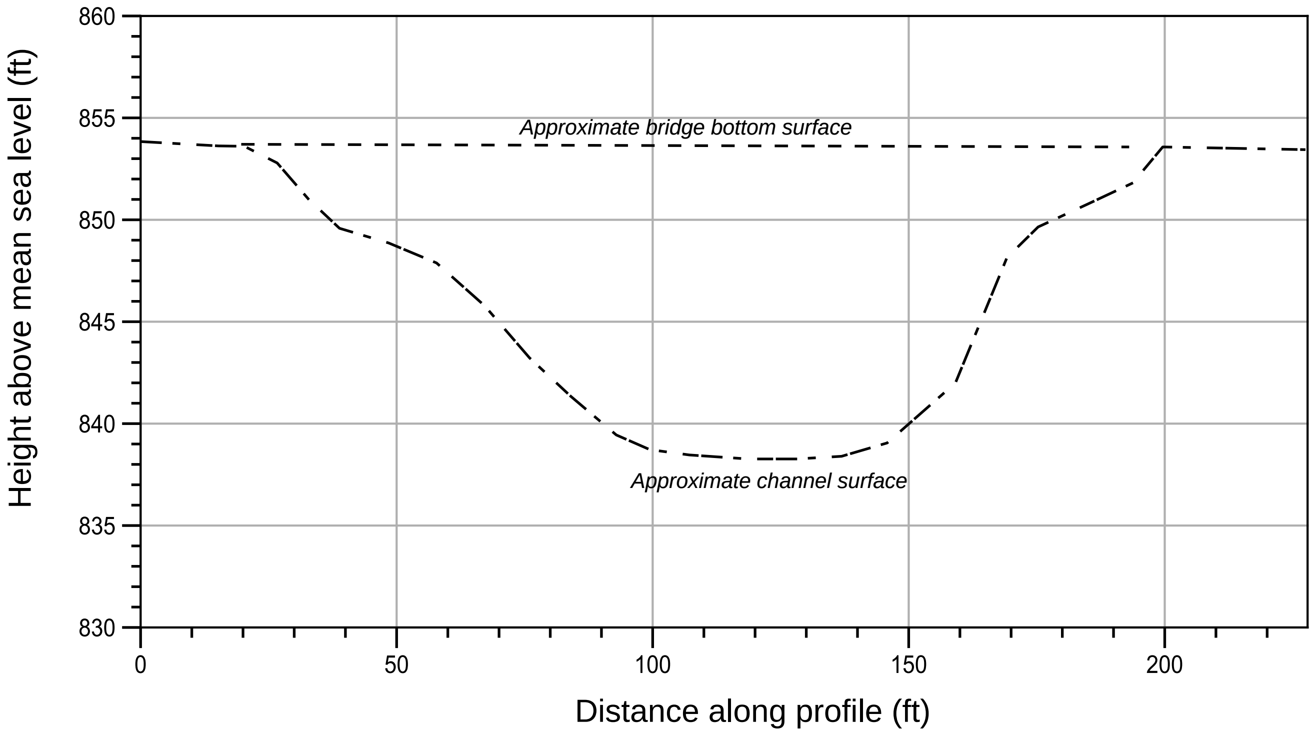
Channel Profile
Site 5



Appendix C5

Channel Profile Site 5a

Note: Aerial imagery reflects conditions prior to the renovation of bridge 49C0307



Appendix C6

Channel Profile
Site 10a

APPENDIX I
Stormwater Capture and Feasibility Study

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FINAL

Shandon-San Juan Water District and
Estrella-El Pomar-Creston Water District

Paso Robles Subbasin Stormwater Capture and Recharge Feasibility Study

December 30, 2020

Prepared by:
GSI Water Solutions, Inc.
5855 Capistrano Avenue, Suite C, Atascadero, CA 93422

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TECHNICAL MEMORANDUM

Paso Robles Subbasin Stormwater Capture and Recharge Feasibility Study

To: Willy Cunha, Board of Directors, Shandon-San Juan Water District
Dana Merrill, Board of Directors, Estrella-El Pomar-Creston Water District

From: Jeff Barry, Principal Hydrogeologist
Ailco Wolf, Supervising Hydrogeologist
Paul Sorensen, Principal Hydrogeologist

Date: December 30, 2020

Introduction

Stormwater capture and recharge is an approach used elsewhere in the State for augmenting natural recharge to a groundwater basin and thus improving groundwater levels. The concept involves building diversion structures (or canals) to divert storm flows from a stream above a certain allowed volume, capture those flows by diverting to nearby fields or undeveloped areas, and inundating the fields to allow for passive infiltration. This technical memorandum presents screening level feasibility study results for locating sites where stormwater (flood) flow can be captured and used to recharge aquifers within the Paso Robles Area Subbasin of the Salinas Valley Groundwater Basin (Paso Robles Subbasin or Subbasin). This study identifies areas with favorable soil, topography, and aquifer characteristics and estimates the stormwater amount from the tributary watersheds contributing to the surface flows in the Salinas and Estrella rivers and San Juan and Huer Huero creeks within the Paso Robles Subbasin, as shown on Figure 1. The Paso Robles Subbasin, as defined in the Groundwater Sustainability Plan (GSP), is the study area for this scope of work. Of particular interest are areas where the recharge water would migrate directly into the underlying Paso Robles Formation aquifer, the principal aquifer serving most irrigation demands in the basin. The feasibility study was conducted in accordance with the authorized scope of work prepared for the Shandon-San Juan Water District (SSJWD) and Estrella-El Pomar-Creston Water District (EPCWD). The scope proposed for the study, including this technical memorandum, comprises two main tasks, namely:

- Task 1 - Identify optimum target areas for stormwater recharge
- Task 2 - Quantify availability of stormwater for capture

To locate potential target areas with optimum recharge conditions for Task 1, the comparative distribution modeling method was used. A comparative distribution model takes into consideration the spatial distribution of multiple components that have an impact on recharge potential and creates a gridded weighted average index map of these components to elucidate preferred recharge areas within the study area.

In order to quantify the available stormwater for potential capture in Task 2, the modeled surface flows from the calibrated HSPF watershed model[1] used for the GSP were extracted for the study area tributary watersheds. The Paso Robles Subbasin HSPF watershed model is one of the components of the GSP model as described in the GSP (Montgomery, 2020a).

Comparative Distribution Modeling of Recharge Potential

Successful artificial recharge of surface water depends on a high rate of transmission through the soil profile into the unconfined aquifer below. The receiving aquifer should be permeable enough to allow for the infiltrating recharged water to move laterally away from the recharge site without causing excessive mounding, which would limit subsequent recharge. Because the majority of groundwater users pump from the Paso Robles Formation that underlies alluvium, it is also important to identify potential recharge areas that allow for direct communication with the deeper aquifer, thus providing maximum benefit to basin groundwater users. This is especially pertinent for stormwater that is only available within a narrow time frame during the rainy season. Additionally, the bulk of stormwater are available for recharge during an occasional wet year only. Comparative distribution modeling is used to determine areas that meet the conditions described above and are therefore best suited to receive stormwater recharge.

The comparative distribution modeling method (i.e., building models that combine the distributions of different components that affect recharge) was used to create a Recharge Potential Index Map for the study area. The distributed components used to construct a Recharge Potential Index Map include topography, saturated soil hydraulic properties, and aquifer hydraulic properties. Subsequent to the construction of the Recharge Potential Index Map, groundwater elevations and land use factors that could have a negative impact on recharge were also considered to refine the selection of the most promising recharge target areas.

An overview of key spatially distributed information and considerations used for the delineation of recharge target areas are as follows:

Recharge Potential Index Map:

- Topography
- Surficial soil hydraulic properties
- Aquifer hydraulic properties

Additional Land Use Considerations:

- Surficial geology
- Groundwater occurrence and depth
- Proximity to a 100-year flood zone area
- Proximity to water treatment plants
- Proximity to septic tanks
- Proximity to wells

[1] The Hydrological Simulation Program – FORTRAN model was developed by the U.S. Environmental Protection Agency (EPA) in the 1980s. More information on the HSPF watershed model is available at the EPA website: https://19january2017snapshot.epa.gov/sites/production/files/2016-08/documents/flyer_webinar_9-hspf.pdf (accessed May 1, 2020).

- Agricultural crop coverages

Construction of Recharge Potential Index Map

A spatially comparative gridded Recharge Potential Index Map for the study area was built inside a geographic information system (GIS) environment that shows the distribution of potentially promising recharge areas. The individual factors are summarized in the following sections.

Topography

Topography or slope affects the ability to recharge natural and/or captured stormwater. A shallow slope is more conducive to recharge. Relatively level topography is better suited to hold water, allow infiltration to occur over larger areas, and minimize engineering needs to contain the recharge water. The slope percentages for the study area were calculated from the U.S. Geological Survey (USGS) 10-meter Digital Elevation Model (DEM).

Ranges in slope percent were used to categorize soils into seven slope classes with rankings as shown in Table 1.

Table 1 - Topographic Slope Recharge Potential Index Map Rankings

% Slope	Recharge Ranking	
0 – 5	10	Very high
5 – 10	8	High
10 – 15	6	Medium high
15 – 20	4	Medium
20 – 25	3	Medium low
25 – 30	2	Low
30 – 70	1	Very low

The distribution of topographic slope percentages with the corresponding recharge rankings from Table 1 are shown in Figure 2.

Soil Vertical Hydraulic Conductivity

The surficial saturated soil hydraulic conductivities (or permeability) are indicators of infiltration or recharge rate. Greater saturated soil hydraulic conductivities are conducive to greater recharge. For this study, the National Resource Conservation Service (NRCS) Gridded National Soil Survey Geographic Database (gNATSGO) was used to determine the study area's saturated soil hydraulic conductivities.

Ranges in saturated soil hydraulic conductivities were used to categorize soils into six infiltration classes with rankings as shown in Table 2.

Table 2 – Saturated Soil Hydraulic Conductivity Recharge Potential Index Map Rankings

Soil Hydraulic Conductivity (inches/hour)	Recharge Ranking	
>4	10	Very high
3 – 4	8	High
Unknown	7	Medium high
2 – 3	6	Medium
1 – 2	4	Medium low
<1	2	Low

The distribution of mean saturated hydraulic conductivity with the corresponding recharge rankings shown in Table 2 are shown in Figure 3.

Aquifer Hydraulic Conductivity

The horizontal aquifer hydraulic conductivities are indicators of the degree that infiltrated recharged water can laterally move away from the recharge site, thus reducing mounding and allowing for greater volumes to be recharged and to migrate into aquifer production zones. Greater horizontal aquifer hydraulic conductivities are conducive to greater recharge. For this study, the modeled hydraulic conductivity values of the groundwater component of the GSP model were used to estimate horizontal aquifer hydraulic conductivity (Geoscience, 2015).

Ranges in horizontal aquifer hydraulic conductivities were used to categorize soils into six classes with rankings as shown in Table 3.

Table 3 – Aquifer Hydraulic Conductivity Recharge Potential Index Map Rankings

Aquifer Hydraulic Conductivity (ft/day)	Recharge Ranking	
> 20	10	Very high
15 – 20	9	High
10 – 15	7	Medium
5 – 10	5	Medium low
2 – 5	3	Low
0 – 2	1	Very low

The distribution of horizontal aquifer hydraulic conductivity with the corresponding recharge rankings shown in Table 3 are shown in Figure 4.

Paso Robles Basin Recharge Index Map

A final Recharge Potential Index Map was developed as a weighted average of the ranked distribution maps of slope, soil hydraulic conductivity, and aquifer horizontal hydraulic conductivity (Figures 2, 3, and 4). Using a general approach derived from similar studies (Todd, 2018; Sesser et al., 2011; Muir and Johnson, 1979; Aller et al., 1987), the following weights were assigned:

- Slope Distribution– 20 percent
- Saturated Soil Hydraulic Conductivity Distribution – 50 percent
- Aquifer Horizontal Hydraulic Conductivity Distribution – 30 percent

The final Recharge Potential Index Map values were calculated using the weighted average percentages (Figure 5). Index values are ranked from 1 (low potential index) to 10 (high potential index); higher index values are represented by the darker map colors, indicating the preferred recharge locations. In general, the higher-scoring (preferred) recharge areas occur in the river and stream valleys with shallow slopes and higher soil hydraulic conductivities, and are in the more upstream regions of the watershed where higher aquifer hydraulic conductivities occur.

Additional Considerations for Potential Stormwater Recharge Target Areas

Favorable physical recharge conditions are not the only considerations for selecting potential recharge target areas. Geology, groundwater occurrence, and anthropogenic land uses must also be evaluated.

Surficial Geology and Lithology

The Paso Robles Subbasin GSP provides a detailed description of geologic control of hydrologic conditions in the Paso Robles Subbasin (Montgomery, 2020). The sediments of both the alluvial aquifer and Paso Robles Formation aquifer are from erosion of the surrounding mountains. These erosional sediments are generally coarser near the source mountain and finer towards the center of the basin. The alluvium overlying the Paso Robles Formation occurs beneath the flood plains of the rivers and creeks and is typically no more than 100 feet thick. The Paso Robles Formation ranges from 700 to 1,200 feet in thickness throughout most of the study area and generally has lower permeability than the overlying alluvium.

In the floodplain areas, groundwater elevations tend to be higher in the alluvium than in the Paso Robles Formation, which induces downward flow from the alluvium to the Paso Robles Formation (Fugro, 2005). It has been observed that, in the Shandon area along the San Juan Creek, lithological well log data show limited fine-grained sediments (fines; silt and clays) compared with well logs in the Estrella area (unpublished report by GSI for Shandon Water Users). Similarly, lithological well logs show that the Creston area has less fines than the Estrella area. The lithological data suggest that recharged water will migrate more quickly from the alluvium into the Paso Robles Formation in the upstream areas of the San Juan Creek and Huer Huero Creek, because these areas have less fines and greater permeability. In the alluvium of the Estrella River floodplains, recharged water will percolate more slowly and have less of an immediate impact on water levels than in the Paso Robles Formation due to greater presence of fines.

San Luis Obispo County conducted an aerial geophysical survey (SkyTEM) of a large portion of the basin. That study provides important information about subsurface conditions (geology down to 800 feet) that could be beneficial to this project. The results of that study were not available for this stormwater capture and recharge feasibility project; however, review of early results indicate that it could be very beneficial. The results of the SkyTEM survey are expected to be released early 2021.

Groundwater Occurrence and Potential for Mounding

In general, groundwater in the Paso Robles Subbasin consists of a shallow alluvial aquifer and the deeper Paso Robles Formation aquifer. Groundwater generally flows from southeast to northwest across the subbasin. Depth to water is an important consideration as it can limit artificial recharge. If depth to groundwater is too shallow, it facilitates groundwater mounding under the recharge site, which will impede infiltration of water. On the other hand, groundwater elevations that are excessively deep will have increased travel time to the water table and can significantly delay the benefits of recharge with a slow response in water level increases. The depths to groundwater in this feasibility study are described for the selected target recharge areas for both wet and dry conditions. The determination of how the depth to groundwater may affect potential recharge, however, has not been evaluated quantitatively for this screening level study. This would require a more detailed investigation and further local testing of selected target areas.

Land Use Factors

Anthropogenic land uses were superimposed on the Recharge Potential Index Map to select the recharge target areas that avoid potential negative impacts from certain land use features. The following land use conditions were considered:

- Proximity to 100-year flood zone areas (closer areas are preferred)
- Proximity to wastewater treatment plant effluent percolation ponds (potential for mounding)
- Proximity to septic tank locations (potential for contamination)
- Proximity to wells (potential to capture recharge water without benefiting aquifer)
- Agricultural crop coverages (some crop types cannot handle inundation)

The Federal Emergency Management Authority (FEMA) delineated 100-year flood zone areas in the basin that are susceptible to flooding and will likely not be developed due to zoning laws (Figure 6). The 100-year flood zone areas are located within preferred areas of the Recharge Potential Index Map along the alluvial channels of the rivers and streams that receive stormwater runoff that can be diverted without large engineering efforts. Therefore, target areas within the 100-year flood zone are considered to be beneficial.

Existing or proposed wastewater treatment facilities add treated water to the streamflow, thereby artificially recharging the nearby groundwater and potentially creating high groundwater conditions that can impede recharge. Based on the GSP model, depth to water is about 10 feet (ft) below ground surface (bgs) near existing wastewater treatment plants and is therefore not considered to be beneficial for additional stormwater recharge.

Septic tank discharges are undesirable for artificial recharge projects and should be avoided to protect the water quality. Physical addresses outside municipalities are assumed to have a septic system as shown on Figure 6. Areas with high distribution of septic tanks were avoided in selecting recharge target areas.

Location of active nearby groundwater wells were taken into account for the selection of the recharge target areas. Both active private and public well locations were assumed to have a negative effect on increasing aquifer storage from stormwater recharge. Due to the confidentiality of the well locations, none are shown in the figures; however, the quantity of wells inside the selected recharge target areas are considered in this analysis.

Aquifer recharge from agricultural land is a potential option, as indicated for State of California by the Soil Agricultural Groundwater Banking Index (SAGBI) map (O'Geen et al., 2015). The SAGBI is a comparative distribution model, similar to this feasibility study, showing distributed factors pertaining to the aquifer recharge potential from agricultural crop areas on a statewide scale. This study shows that vineyards have much greater tolerance for saturated conditions compared with most other crops.[2] Hence, nearby vineyards

[2] Vineyards can tolerate saturated conditions for approximately 2 to 4 weeks (O'Geen et al., 2015).

are considered to be potentially beneficial for artificial recharge and were considered in the selection of target recharge areas (see Figure 7).

Average Stormwater Available for Capture and Recharge

For cost-effective artificial recharge, a local source of water, such as stormwater, is preferred. The results of the existing HSPF watershed model, which is a component of the Paso Robles Basin GSP model, were used to assess and quantify stormwater availability.

Simulated HSPF Surface Water and Streambed Percolation in Sub-Watersheds

The GSP model consists of three parts; the HSPF watershed model, a soil-water balance model, and a groundwater model. This three-part model is calibrated to gaged streamflow and groundwater elevations measured in wells to within industry standards and provides a reasonable approach to quantify streamflow and diversion potential for this feasibility study. The accuracy of modeled quantities from the GSP model varies spatially and temporally within the model domain and, as such, the quantified results used in this study should be viewed in a relative rather than an absolute sense.

Results from the existing updated HSPF watershed model (Montgomery, 2020b) were exported at a sub-watershed scale for the available model period from 2001 through 2016. The sub-watershed scale of the HSPF model is shown in Figure 8, along with the model reaches along which the surface water inflows and outflows and streambed percolations are quantified. Modeled streamflow and streambed percolation are important parameters because they indicate locations along the river and stream valleys that either have good recharge potential and/or have available capturable stormwater.

The HSPF watershed model results were used to estimate potential diversion volumes at the sub-watershed scale for the target areas. The State Water Resources Control Board will permit diversion of stormflows that are 20 percent of the 90 percent exceedance flows, which occur, on average, 10 percent of the time. The estimated diversion estimates are based the USGS daily statistics for the Salinas River near Paso Robles, at USGS gage 111475000. USGS used the period of record from 1944 through 2019 to calculate the average daily flow percentiles for the Salinas River near Paso Robles. These statistics were applied to the observed daily Salinas River flows and, if these flows exceeded the USGS calculated 90 percent flow, then 20 percent of that exceedance is calculated as the diversion potential. The diversion potential as a percent of the total flow was calculated from 2001 through 2016 to coincide with the period of record of the HSPF watershed model on a monthly basis to match the monthly output of the model. The calculated monthly diversion percentages from the Salinas River were then applied to the HSPF model flow results, as an estimate of the diversion potential at the sub-watershed scale (see Figure 8).

Streambed percolation is estimated by the HSPF watershed model within each of the reaches of the sub-watersheds. Streambed percolation, at the sub-watershed scale, is an indication of a relative recharge rate along the river valleys. The HSPF watershed model streambed recharge rates are derived from the Green-Ampt infiltration equation (Green, et al., 1911) for a Hydrologic Soil Group as defined by the NRCS and possibly further refined through model calibration. In addition to the modeled HSPF model streambed percolation, estimated recharge rates from the NRCS Hydrologic Soil Groups are calculated. Based on the NRCS Soil Survey Hydrologic Soil Group and estimated soil water properties by Rawls et al. (1982) the following infiltration rate table was used for this study to estimate infiltration rates in the target areas.

Table 4 – NRCS Soils Data Infiltration Rates		
Soil Texture Class	**NRCS Hydrologic Soil Group**	**Infiltration Rate (Inches/Hour)**
Sand	A	8.27
Loamy Sand	A	2.41
Sandy Loam	B	1.02
Loam	B	0.52
Silt Loam	C	0.27
Sandy Clay Loam	C	0.17

Identification of Target Areas for Potential Stormwater Recharge

To select potential recharge target areas and incorporate all the considerations described in previous sections, information was compiled into a GIS environment overlaying a current areal image of the Paso Robles Subbasin to ensure that no impervious structures would interfere with the potential recharge. The selection of target areas considered the topography, soil and aquifer conditions, and land use environments that have the most beneficial effect on the potential artificial recharge of stormwater.

GSI selected five preliminary target areas that meet the range of conditions for recharge and available stormflow (Target Areas 1 through 5). Two of the selected target areas are along the Estrella River, two more along the San Juan Creek and one near the Huer Huero Creek (see Figure 9). Other locations could be considered if there is local knowledge indicating stormwater recharge could be feasible. The estimated average annual quantities of surface water flow, diversion potential, streambed percolation, and depth to groundwater all were derived from either the HSPF watershed model or MODFLOW groundwater model parts of the GSP model. A soil infiltration rate was also estimated from the dominant NRCS Hydrologic Soil Group present in the target areas. The dominant Hydrologic Soil Group in all target areas is A, loamy sand, with a published infiltration rate of 2.41 inches per hour. A loamy sand consists of approximately 80 percent sand with 20 percent fines, such as silt and clay.

To determine the average, wet, and dry conditions in the limited period of record of the HSPF model (2001 through 2016), observed annual streamflow data from 1941 through 2019 of the USGS Salinas River gage near Paso Robles was used. The annual average flow from 1941 through 2019 in the Salinas River is 97.7 cubic feet per second (cfs), which is close to the 2001 annual flow of 98.4 cfs. Similarly, flows in the lowest quartile (or less than the 25 percentile flows of 10 cfs) were considered as dry conditions, and flows in the highest quartile (or greater than the 75 percentile flows of 135 cfs) were considered as wet conditions. From this Salinas River flow analysis, it was determined that annual HSPF model results for water years 2001, 2005, and 2014 are representative of average, wet, and dry hydrologic conditions, respectively.

Target Area 1. Alongside the Estrella River, recharge Target Area 1 has the most estimated stormwater available compared with other target areas, as it is the most downstream location with the largest contributing watershed area (Figure 9). Target Area 1 has on average, for water years 2001 through 2016, an estimated surface water flow of 16,150 acre-feet per year (AFY), diversion potential of 1,890 AFY, streambed percolation of 160 AFY, and a depth to water of 40 ft bgs in 2005 (wet conditions) and 50 ft bgs in 2014 (dry conditions) (see Figures 9 and 10). The target area's approximate average potential recharge index is 6.5 (see Figure 5).

The target areas consist of NRCS Hydrologic Soil Group A with an estimated recharge rate 2.41 inches per hour (see Table 4) or 4.8 acre-ft/day per acre. The estimated annual potential diversions from 2001 through 2016 are shown in Figure 11, where most of the divertible flow is available during very wet years and no divertible flows are available in dry years. The HSPF modeled annual average diversion potentials are 280 AFY, 20,500 AFY, and 0 AFY for average (2001), wet (2005) and dry (2014) hydrologic years, respectively. In Target Area 1 there are no active non-confidential private or public wells. Stormwater recharge in this area probably has the least benefit to the overall groundwater basin because it is downgradient of the areas that are affected by chronic lowering of groundwater levels.

Target Area 2. Target Area 2 is upstream and to the east of Target Area 1 and has an estimated surface water flow of 15,360 AFY, diversion potential of 1,800 AFY, streambed percolation of 530 AFY, and a depth to water of 15 ft bgs in 2005 (wet conditions) and 25 ft bgs in 2014 (dry conditions) (see Figures 9 and 10). The target area's approximate average potential recharge index is 6.5 (see Figure 5). The target area consists of the NRCS Hydrologic Soil Group A with an estimated recharge rate 2.41 inches per hour (see Table 4) or 4.8 acre-ft/day per acre. The estimated annual potential diversions from 2001 through 2016 are shown in Figure 12, where most of the divertible flow is available during very wet years and no divertible flows are available in dry years. The HSPF modeled annual average diversion potentials are 250 AFY, 19,800 AFY, and 0 AFY for average (2001), wet (2005), and dry (2014) hydrologic years, respectively. In Target Area 2 there are no active non-confidential private or public wells. Again, this area is downgradient and does not substantially benefit the majority of the basin.

Target Area 3. Along the San Juan Creek, Target Area 3 has significantly less surface water flows compared with the more downstream Target Areas 1 and 2; however, as expected due to coarser aquifer material, Target Area 3 has greater streambed recharge. Target Area 3 has on average, for water year 2001 through 2016, an estimated surface water flow of 5,030 AFY, diversion potential of 590 AFY, streambed percolation of 1,160 AFY, and a depth to water of 60 ft bgs in 2005 (wet conditions) and 70 ft bgs in 2014 (dry conditions) (see Figures 9 and 13). The target area's approximate average potential recharge index is 7.5 (see Figure 5). The target area consists of NRCS Hydrologic Soil Group A with an estimated recharge rate 2.41 inches per hour (see Table 4) or 4.8 acre-ft/day per acre. The estimated annual potential diversions from 2001 through 2016 are shown in Figure 14, where most of the divertible flow is available during very wet years and no divertible flows are available in dry years. The HSPF modeled annual average diversion potentials are 15 AFY, 6,800 AFY, and 0 AFY for average (2001), wet (2005) and dry (2014) hydrologic years, respectively. In Target Area 3 there are no active non-confidential private or public wells. Recharge in this part of the basin would benefit a larger portion of the basin because it is located upgradient of the areas that are affected by chronic lowering of groundwater levels and because more water would move into the Paso Robles Formation.

Target Area 4. Target Area 4, also along the San Juan Creek, has on average for water year 2001 through 2016, an estimated surface water flow of 4,950 AFY, diversion potential of 580 AFY, streambed percolation of 580 AFY, and a depth to water of 100 ft bgs in 2005 (wet conditions) and 120 ft bgs in 2014 (dry conditions) (see Figures 9 and 13). The target area's approximate average potential recharge index is 7.0 (see Figure 5). The target area consists of NRCS Hydrologic Soil Group A with an estimated recharge rate 2.41 inches per hour (see Table 4) or 4.8 acre-ft/day per acre. The estimated annual potential diversions from 2001 through 2016 are shown in Figure 15, where most of the divertible flow is available during very wet years and no divertible flows are available in dry years. The HSPF modeled annual average diversion potentials are 0 AFY, 6,200 AFY, and 0 AFY for average (2001), wet (2005) and dry (2014) hydrologic years, respectively. Inside Target Area 4 there is one active private non-confidential well. Recharge in this part of the basin would benefit a larger portion of the basin because it is located upgradient of the areas that are affected by chronic lowering of groundwater levels and because more water would move into the Paso Robles Formation.

Target Area 5. Target Area 5, in the upstream reaches of the Huer Huero Creek, has the best physical conditions to recharge stormwater. Because of this recharge potential, the natural flows occurring in Huer Huero Creek are already being recharged, leaving negligible additional naturally available stormwater. Although Target Area 5 is ideal for artificial recharge, the water source must be imported due to lack of natural flows. Target Area 5 has on average, for water year 2001 through 2016, an estimated surface water flow of 1,030 AFY, diversion potential of 60 AFY, streambed percolation of 1,220 AFY, and a depth to water of 70 ft bgs in 2005 (wet conditions) and 90 ft bgs in 2014 (dry conditions) (see Figures 9 and 16). The target area consists of NRCS Hydrologic Soil Group A with an estimated recharge rate 2.41 inches per hour (see Table 4) or 4.8 acre-ft/day per acre. The estimated annual potential diversions from 2001 through 2016 are shown in Figure 17, where most of the divertible flow is available during very wet years and no divertible flows are available in dry years. The HSPF modeled annual average diversion potential are 0 AFY, 630 AFY, and 0 AFY for average (2001), wet (2005), and dry (2014) hydrologic years, respectively. Inside Target Area 5 there is one active confidential private well and one active non-confidential public well. Recharge in this part of the basin would benefit a larger portion of the basin because it is located upgradient of the areas that are affected by chronic lowering of groundwater levels and because more water would move into the Paso Robles Formation. However, there is an insufficient quantity of natural stormwater flow. This area would be ideal for recharge if an imported source of water were available.

Conclusions

Based on comparative distribution modeling to determine the optimum recharge locations, considering land use, and quantifying the available stormwater in the Paso Robles Subbasin using the GSP model, the following conclusions can be drawn:

- The comparative distribution modeling of topographic slope, soil, and aquifer hydraulic conductivities, in general, delineates that the optimum recharge areas are located near river and creek drainages and toward the higher elevations in the eastern part of the basin, due to greater aquifer hydraulic conductivity.
- Based on the calibrated surface/groundwater GSP model results, capturable stormwater volumes increase in the downstream direction of the San Juan Creek and Estrella River, as the contributing watershed areas become larger. However, stormwater recharge at downgradient locations offer the least benefit to the rest of the basin.
- The areas along the more upstream locations of Huer Huero Creek have the best physical recharge properties in the Paso Robles Subbasin but with limited stormwater flows, since most of the existing surface water percolates into permeable soils connected to the underlying Alluvial Aquifer. It is therefore better suited for recharge of imported water.
- All of the five selected recharge target areas have soils classified as NRCS Hydrologic Soil Group A. NRCS A- soils are the most conducive soils for recharge with an estimated approximate infiltration rate of 2.41 inches/hour or 4.8 acre-ft/day per acre.
- Target Area 1 and 2 have the most available stormwater but lesser physical capacity to percolate water compared to the other target areas.
- Target Areas 3 and 4 have lesser available stormwater but have greater physical capacity to percolate water compared to Areas 1 and 2. The inverse is true compared to Target Area 5.

- Target Area 5 has very little available stormwater flow but has the greater physical capacity to percolate water compared to the other target areas.
- Stormwater is only available during wet periods and the return frequencies of these hydrologic conditions are on the scale of many years, during which no divertible storm water would be available for artificial recharge. While it may be feasible to capture and divert storm water, the cost of improvements and monitoring relative to the benefit of the recharge water to the basin is questionable and will have to be determined with additional evaluations.

Recommended Next Steps

This screening level feasibility study evaluated the five most promising recharge target areas in the Paso Robles Subbasin based on readily available regional data in the study area. Unfortunately, the analysis indicates that the capturable flows are only available for 2 or 3 years out of every 10-15 years and the quantities of flow that could be diverted are likely not large enough to make the cost versus benefit favorable. Rather than proceed with the original planned Phase 2 scope of work, a modified Phase 2 scope of work is suggested that will focus efforts and funds on developing one or more favorable sites where land owners are willing to participate in this program.

Site Specific Project Development

Task 3 – Identify Alternative Recharge Locations

The purpose of this task is to identify new locations where stormwater recharge would directly benefit the area of severe water level decline identified by the County of San Luis Obispo Department of Planning and Building and areas within the Shandon-San Juan Water District. Potential areas that have been suggested previously include parcels along the Estrella River west of Shandon and parcels along San Juan Creek. Based on present knowledge of hydrogeological conditions, recharge on parcels located along San Juan Creek would be less likely to benefit the area of severe decline observed to the west within a reasonable timeframe because of limited connectivity; however, recharge in the San Juan Creek area would infiltrate relatively quickly and may help maintain water levels in that area.

In this task, the results of the SkyTEM geophysical study (to be released by the County in early 2021) will be used to further identify favorable areas that lack significant clay layers and that have connectivity with the deeper Paso Robles Formation in the area of severe decline. These data will be integrated with the Phase 1 GIS recharge criteria layers to identify parcels that have the highest potential for recharging the largest amount of water into the area of severe decline.

Task 4 – Site Specific Project Investigation

The purpose of this task is to obtain site specific information about infiltration rates and potential recharge volumes at the preferred locations identified in Task 3. This would better define the project, quantify the actual recharge potential, and determine what approach is needed to capture the stormwater at a specific location. Subtasks include:

- Work with landowners identified in Task 3 to map out where the project(s) would be sited.
- Assess river morphology to determine the best method for diverting stormwater into an area to be flooded.
- Develop contractor cost estimates once a site is selected.
- Drill a borehole and collect soil samples to assess the depth to the Paso Robles Formation and presence of clay layers that may impede downward movement of recharge water.

- Perform soil textural analysis using test pits and submit samples to a soils lab for measurement of grain size distribution and permeability.
- Perform infiltration testing in test pits to measure near surface infiltration rates.
- Perform a surface geophysical survey to identify the most suitable areas for recharge and estimate infiltration characteristics.

Task 5- Permitting and Regulatory Requirements

This task includes review of applicable County and State of California permitting and approval requirements pertaining to siting and operating stormwater capture and recharge projects. These approvals and permits may include land use approval from the County, stream diversion permit from the State Water Resources Control Board (SWRCB) or the Department of Water Resources (DWR), CEQA environmental review, and grading and building permits from the County.

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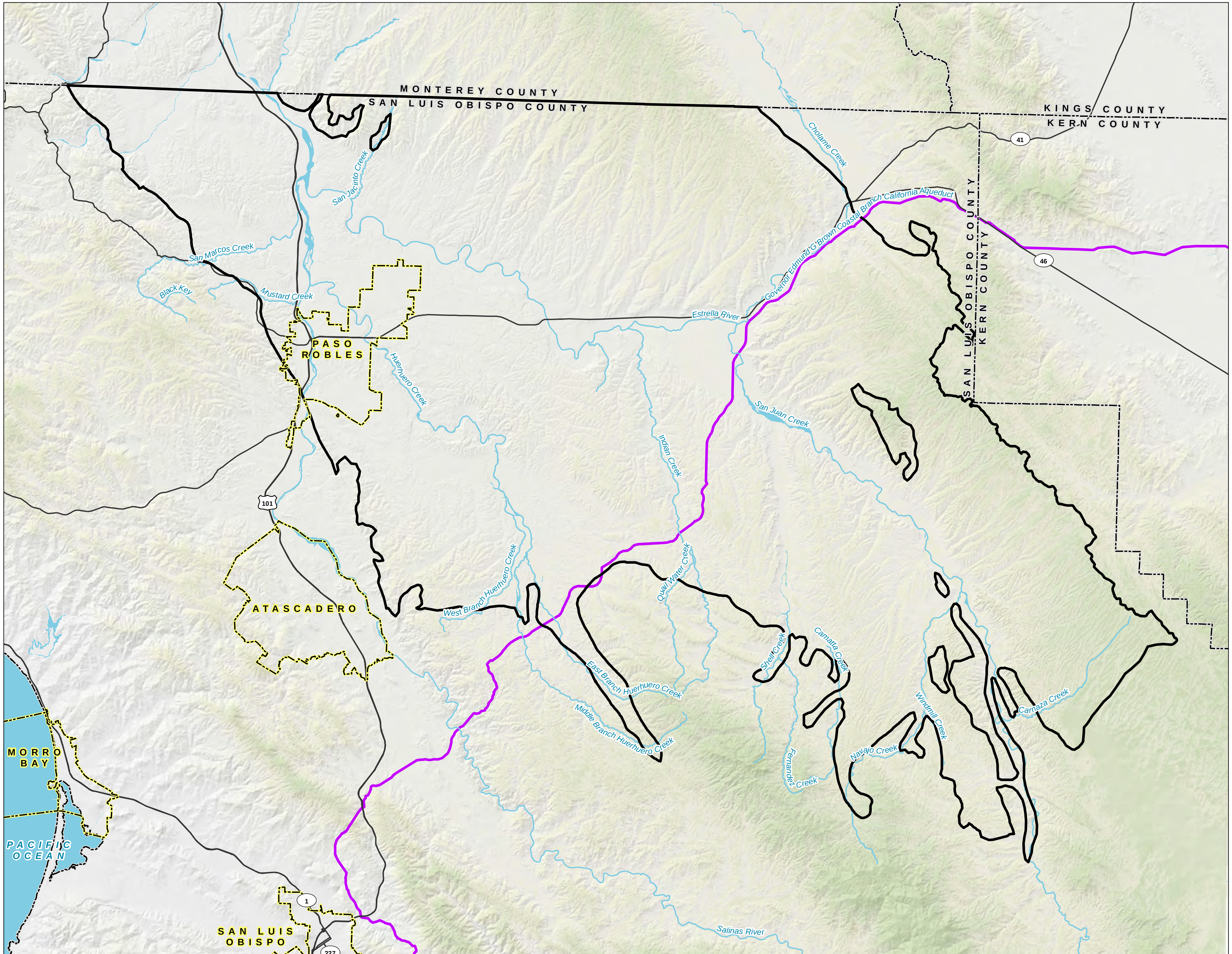
FIGURES

FIGURE 1

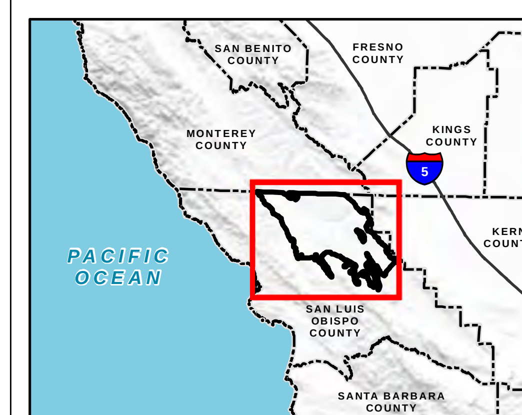
Study Area

Paso Robles Subbasin



LEGEND

- Major Watercourse
- Coastal Branch California Aqueduct
- Major Road
- Salinas Valley Groundwater Basin - Paso Robles Area
- City Boundary
- County Boundary



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0 2 4 6

Miles

Date: May 8, 2020
Data Sources: USGS, ESRI, SLO Co., CA DWR

GSI Water Solutions, Inc.

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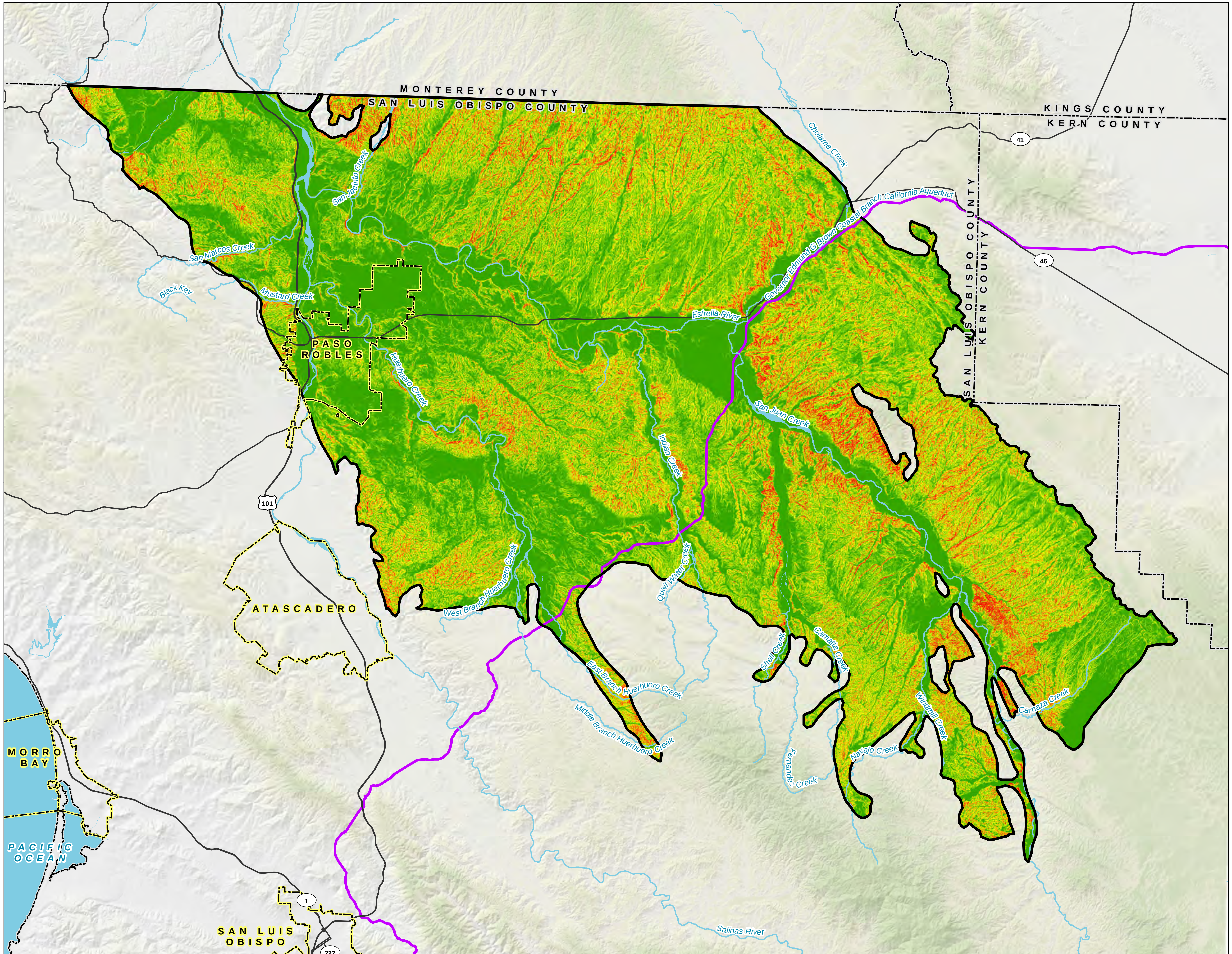

FIGURE 2

Topographic Slope Recharge Potential Index Ranking

Paso Robles Subbasin

LEGEND

Topographic Slope Recharge Potential Index Ranking

- 1: Very Low
- 2: Low
- 3: Medium Low
- 4: Medium
- 6: Medium High
- 8: High
- 10: Very High

All Other Features

- Major Watercourse
- Coastal Branch California Aqueduct
- Major Road
- Salinas Valley Groundwater Basin - Paso Robles Area
- City Boundary
- County Boundary

N

0 2 4 6
Miles

Date: May 8, 2020
Data Sources: USGS, ESRI, SLO Co., CA DWR

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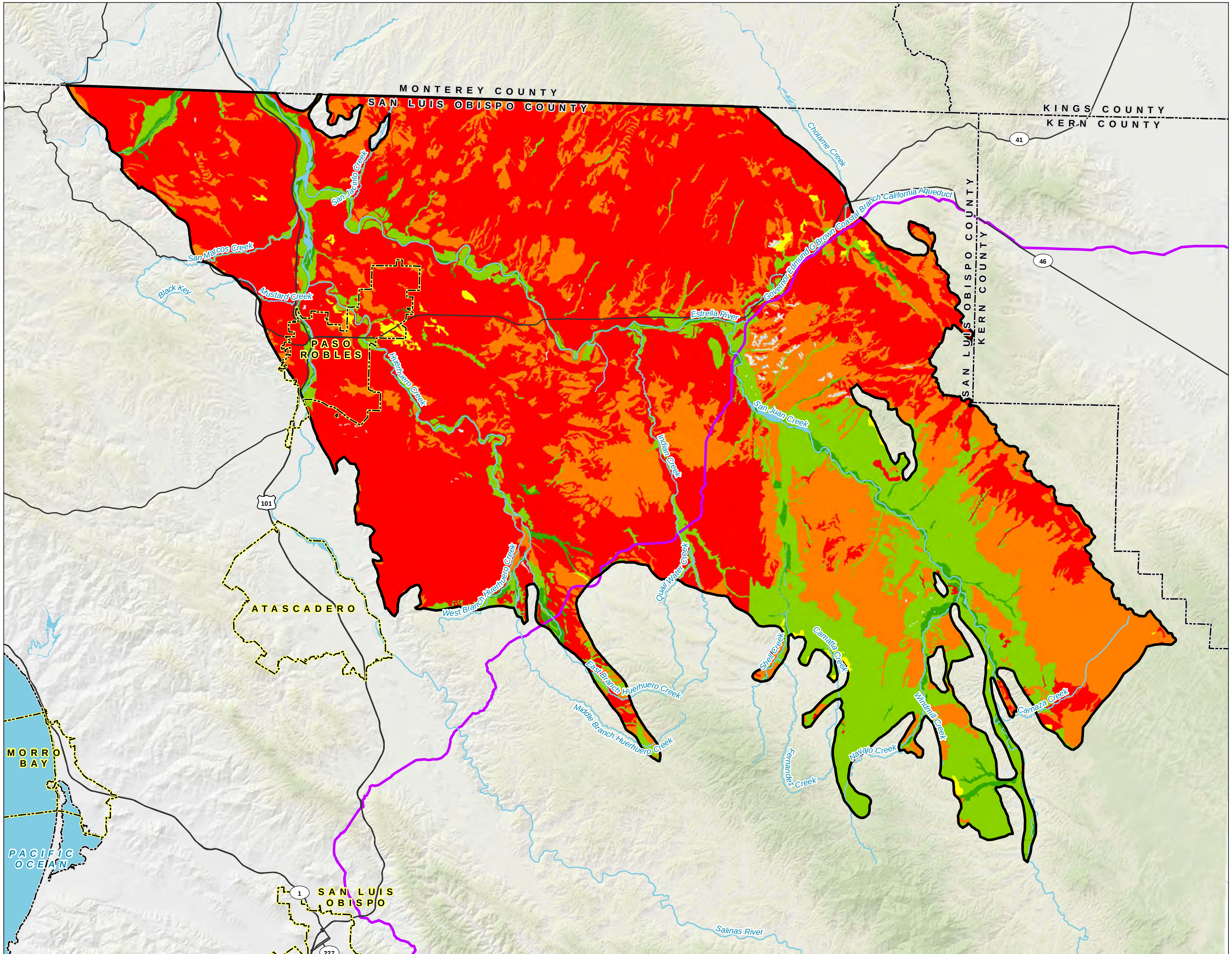

FIGURE 3

Saturated Soil Hydraulic Conductivity Recharge Potential Index Ranking

Paso Robles Subbasin

LEGEND

Saturated Soil Hydraulic Conductivity Recharge Potential Index Ranking

- 2: Low
- 4: Medium Low
- 6: Medium
- 8: High
- 10: Very High

All Other Features

- Major Watercourse
- Coastal Branch California Aqueduct
- Major Road
- Salinas Valley Groundwater Basin - Paso Robles Area
- City Boundary

N

0 2 4 6
Miles

Date: May 8, 2020
Data Sources: USGS, ESRI, SLO Co., CA DWR

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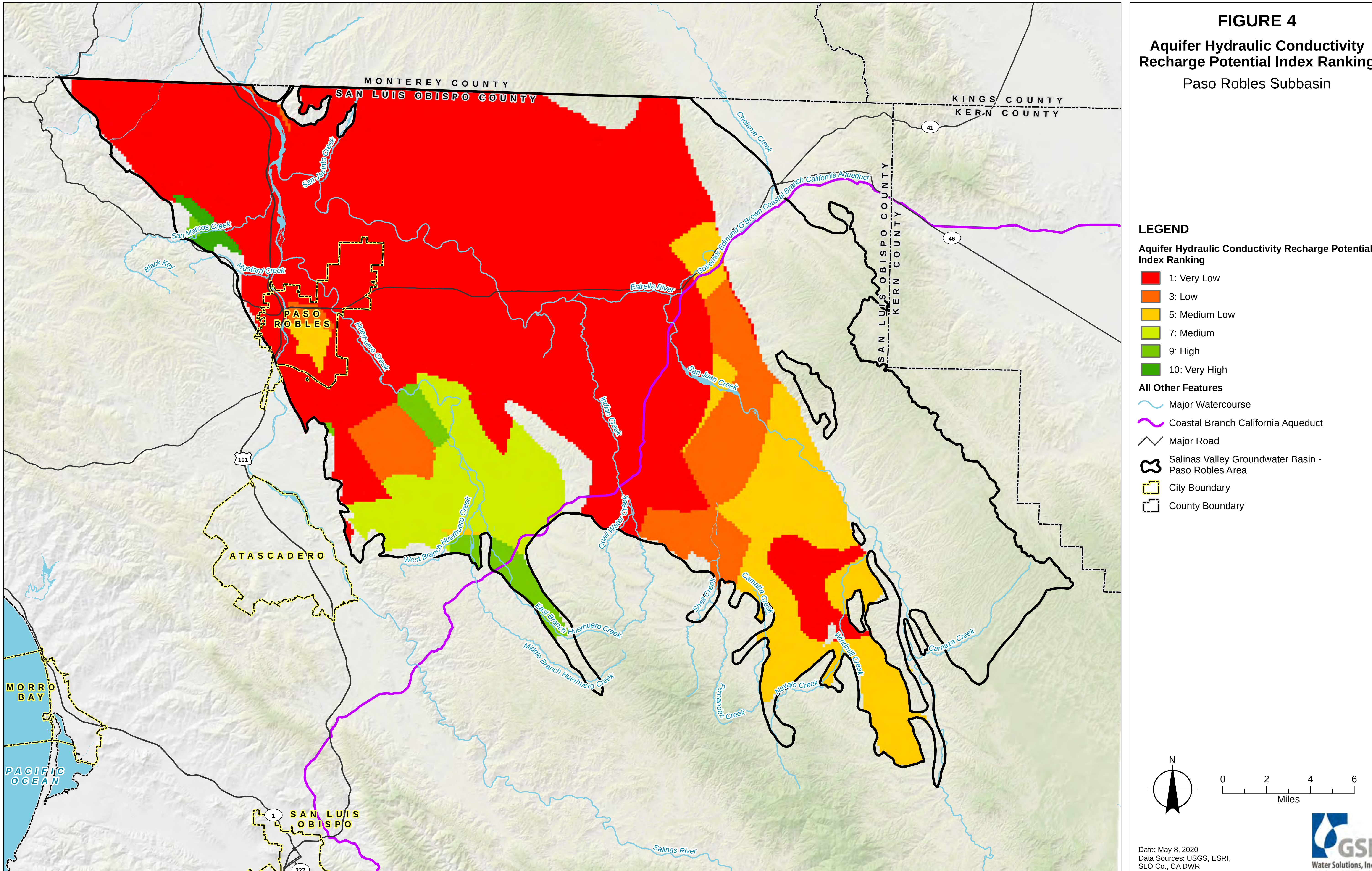

FIGURE 4

Aquifer Hydraulic Conductivity Recharge Potential Index Ranking

Paso Robles Subbasin

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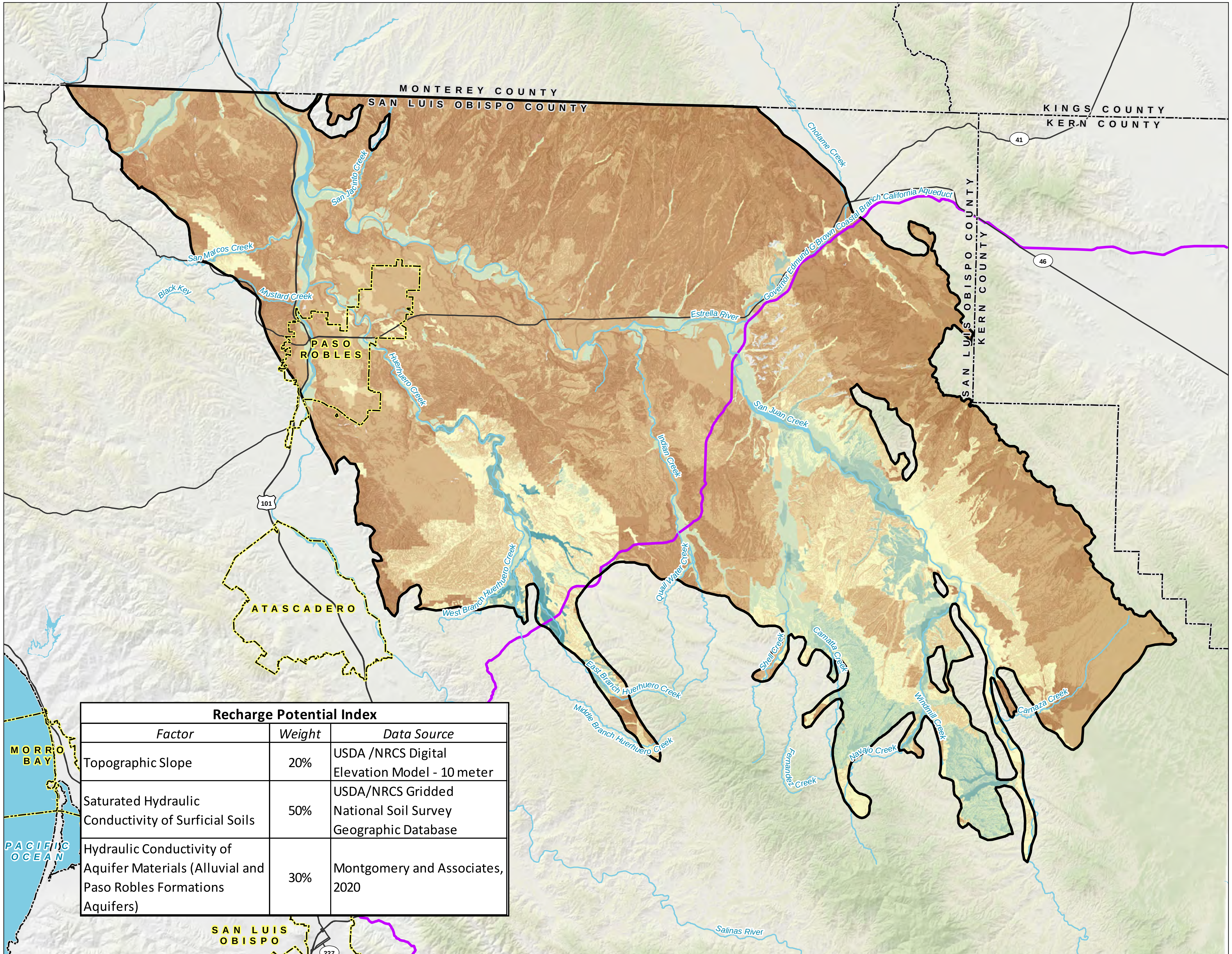
FIGURE 5

Recharge Potential Index Map

Paso Robles Subbasin



Recharge Potential Index		
Factor	*Weight*	*Data Source*
Topographic Slope	20%	USDA /NRCS Digital Elevation Model - 10 meter
Saturated Hydraulic Conductivity of Surficial Soils	50%	USDA/NRCS Gridded National Soil Survey Geographic Database
Hydraulic Conductivity of Aquifer Materials (Alluvial and Paso Robles Formations Aquifers)	30%	Montgomery and Associates, 2020

LEGEND

Recharge Potential Index

- 0 - 2 (Low)
- 2 - 3
- 3 - 4
- 4 - 5
- 5 - 6
- 6 - 7
- 7 - 8
- 8 - 9
- 9 - 10 (High)

All Other Features

- Major Watercourse
- Coastal Branch California Aqueduct
- Major Road
- Salinas Valley Groundwater Basin - Paso Robles Area
- City Boundary
- County Boundary

N

0 2 4 6
Miles

Date: May 8, 2020
Data Sources: USGS, ESRI, SLO Co., CA DWR

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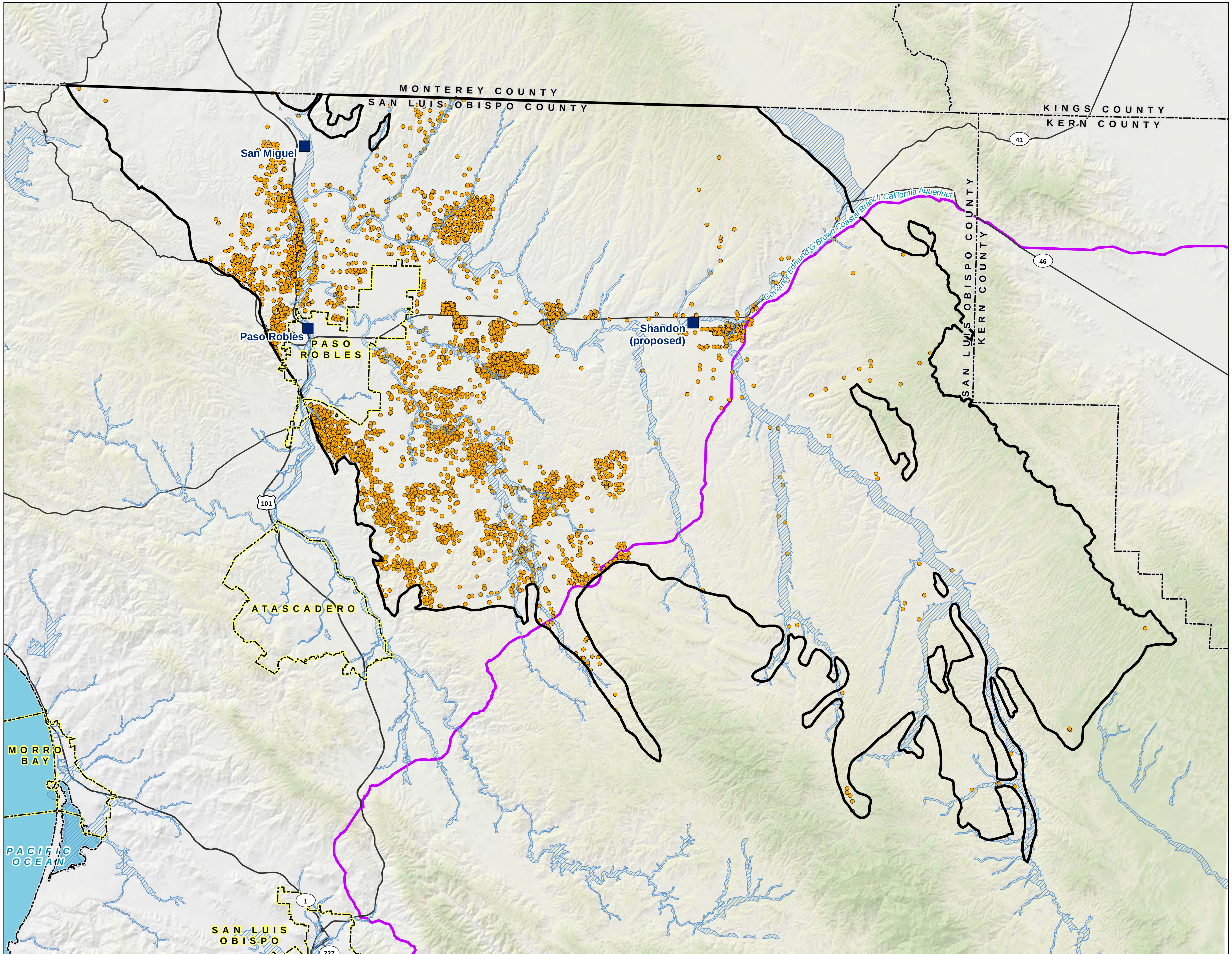

FIGURE 6

Key Physical Land Use Features

Paso Robles Subbasin

LEGEND

- Assumed Septic Tank Location (any address location outside of San Miguel or Paso Robles Service Area)
- Wastewater Treatment Facility
- 100-year Flood Zone
- Coastal Branch California Aqueduct

All Other Features

- Major Road
- Salinas Valley Groundwater Basin - Paso Robles Area
- City Boundary
- County Boundary

N

0 2 4 6
Miles

Date: May 8, 2020
Data Sources: USGS, ESRI, SLO Co., CA DWR

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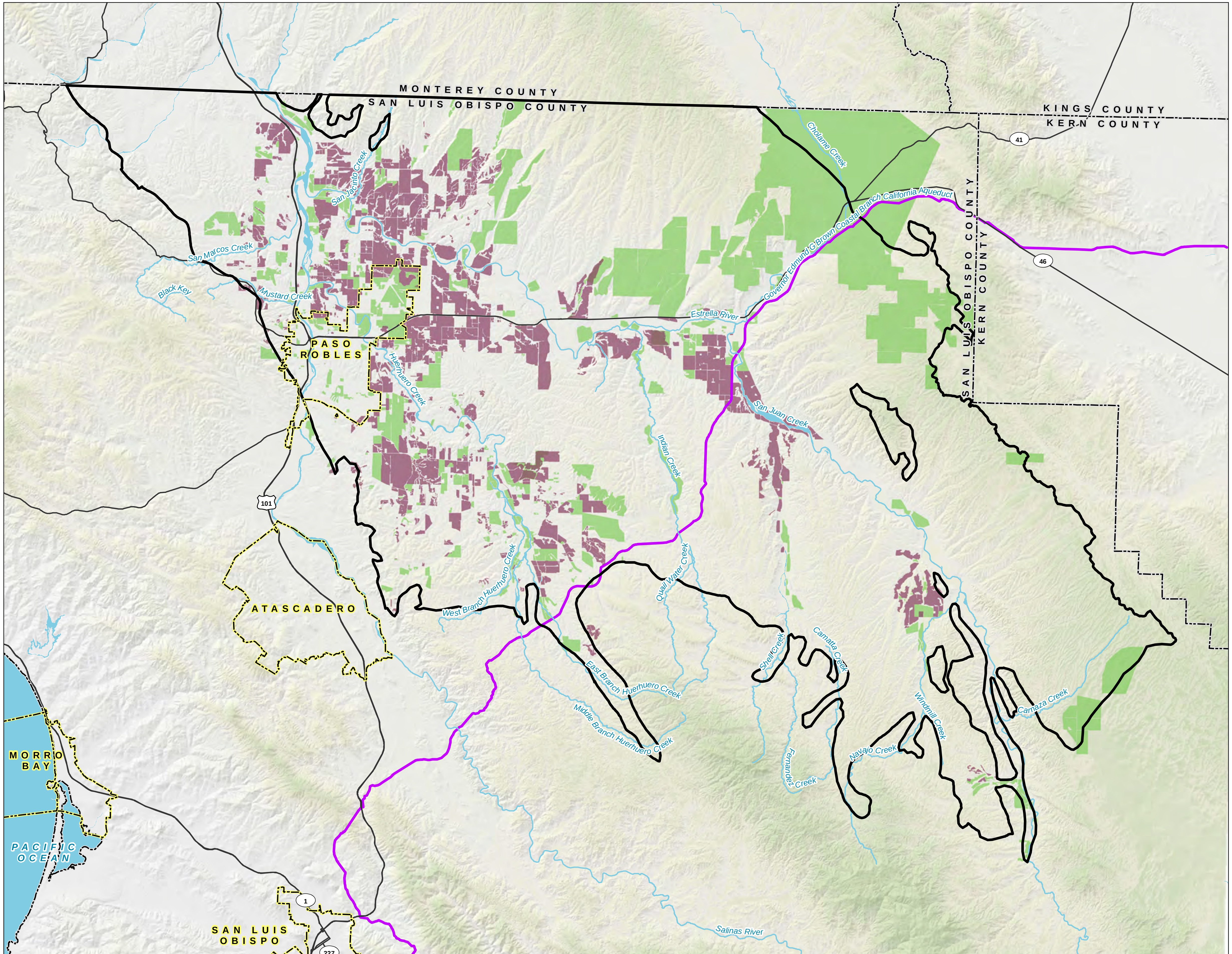
FIGURE 7

Agricultural Distribution of Vineyards Compared with Other Crop Types

Paso Robles Subbasin



LEGEND

Crop Type

- Vineyard
- Non-Vineyard

All Other Features

- Major Watercourse
- Coastal Branch California Aqueduct
- Major Road
- Salinas Valley Groundwater Basin - Paso Robles Area
- City Boundary
- County Boundary

N

0 2 4 6

Miles

Date: May 8, 2020
Data Sources: USGS, ESRI, SLO Co., CA DWR

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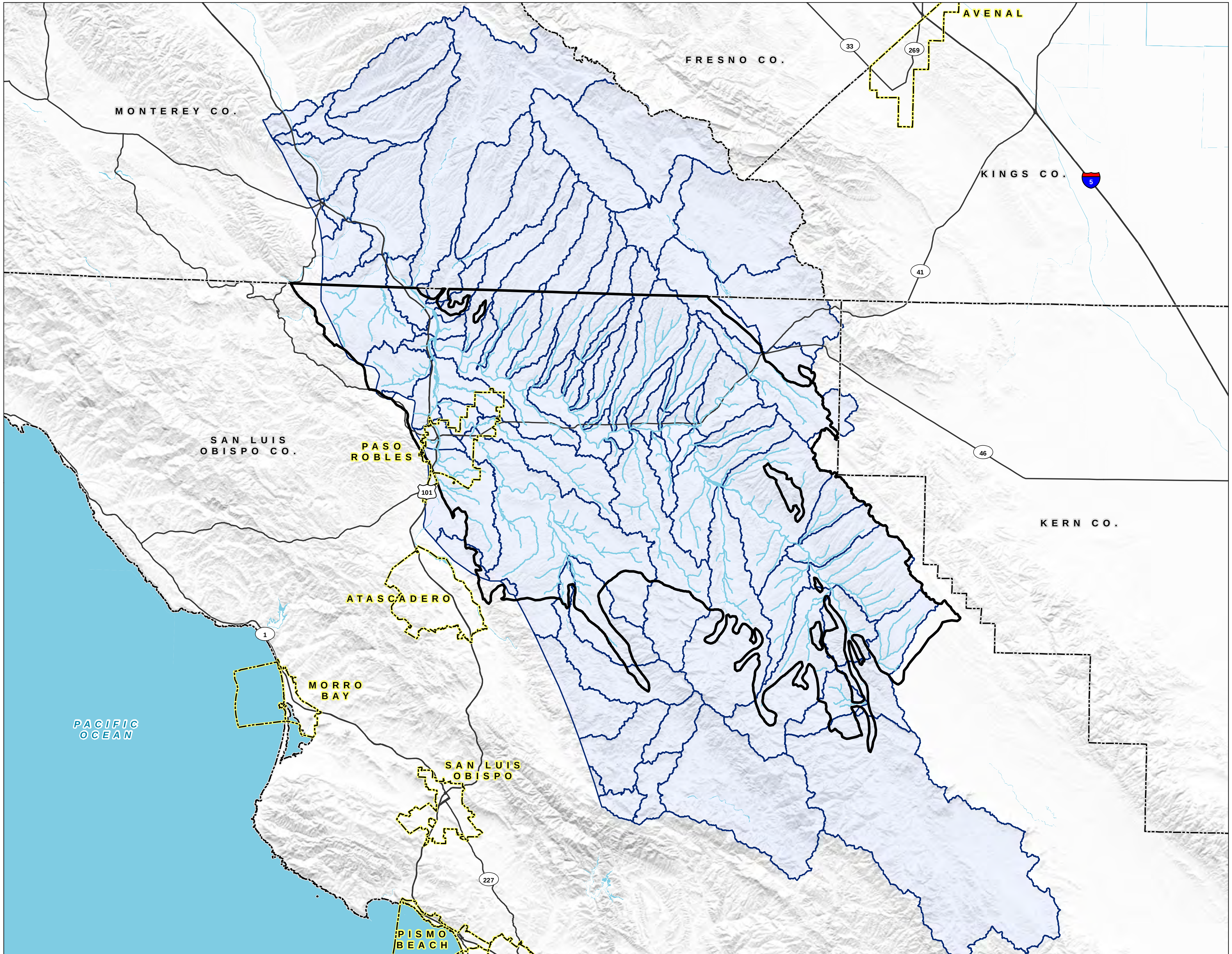

FIGURE 8

HSPF Watershed Model Sub-Watersheds

Paso Robles Subbasin

LEGEND

HSPF Model Reach

HSPF Model Sub-Watershed Boundary

All Other Features

Major Road

Salinas Valley Groundwater Basin - Paso Robles Area

City Boundary

County Boundary

NOTE

HSPF: Hydrologic Simulation Program - Fortran

N

0 3 6 9

Miles

Date: May 8, 2020
Data Sources: USGS, ESRI, CA DWR

GSI Water Solutions, Inc.

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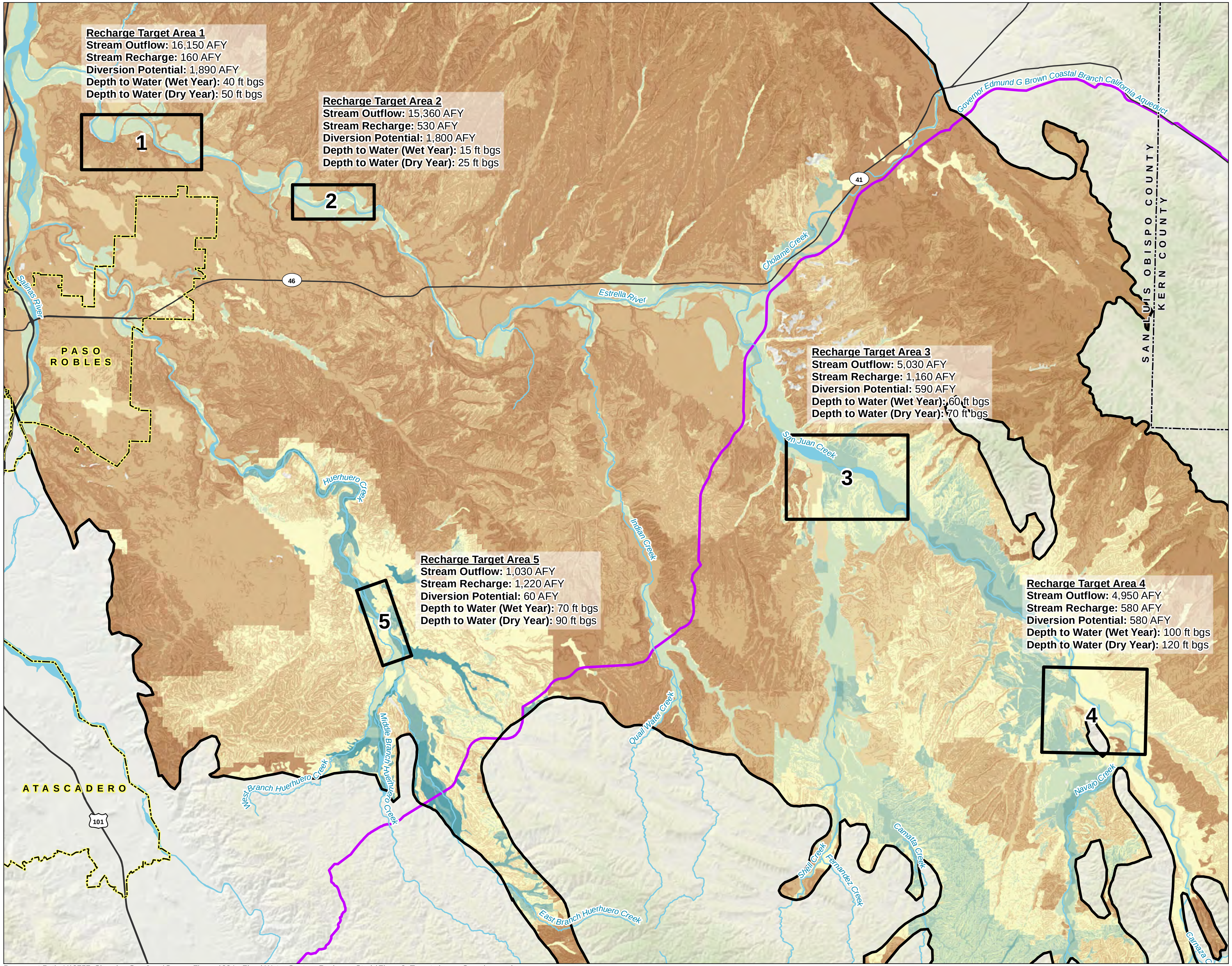

FIGURE 9

Selected Recharge Target Areas

Paso Robles Subbasin

LEGEND

- Target Area

Recharge Potential Index

- 0 - 2 (Low)
- 2 - 3
- 3 - 4
- 4 - 5
- 5 - 6
- 6 - 7
- 7 - 8
- 8 - 9
- 9 - 10 (High)

All Other Features

- Major Watercourse
- Coastal Branch California Aqueduct
- Major Road
- Salinas Valley Groundwater Basin - Paso Robles Area
- City Boundary
- County Boundary

NOTES

AFY: Acre Feet per Year
bgs: below ground surface

N

0 1 2 3
Miles

Date: May 8, 2020
Data Sources: USGS, ESRI, SLO Co., CA DWR

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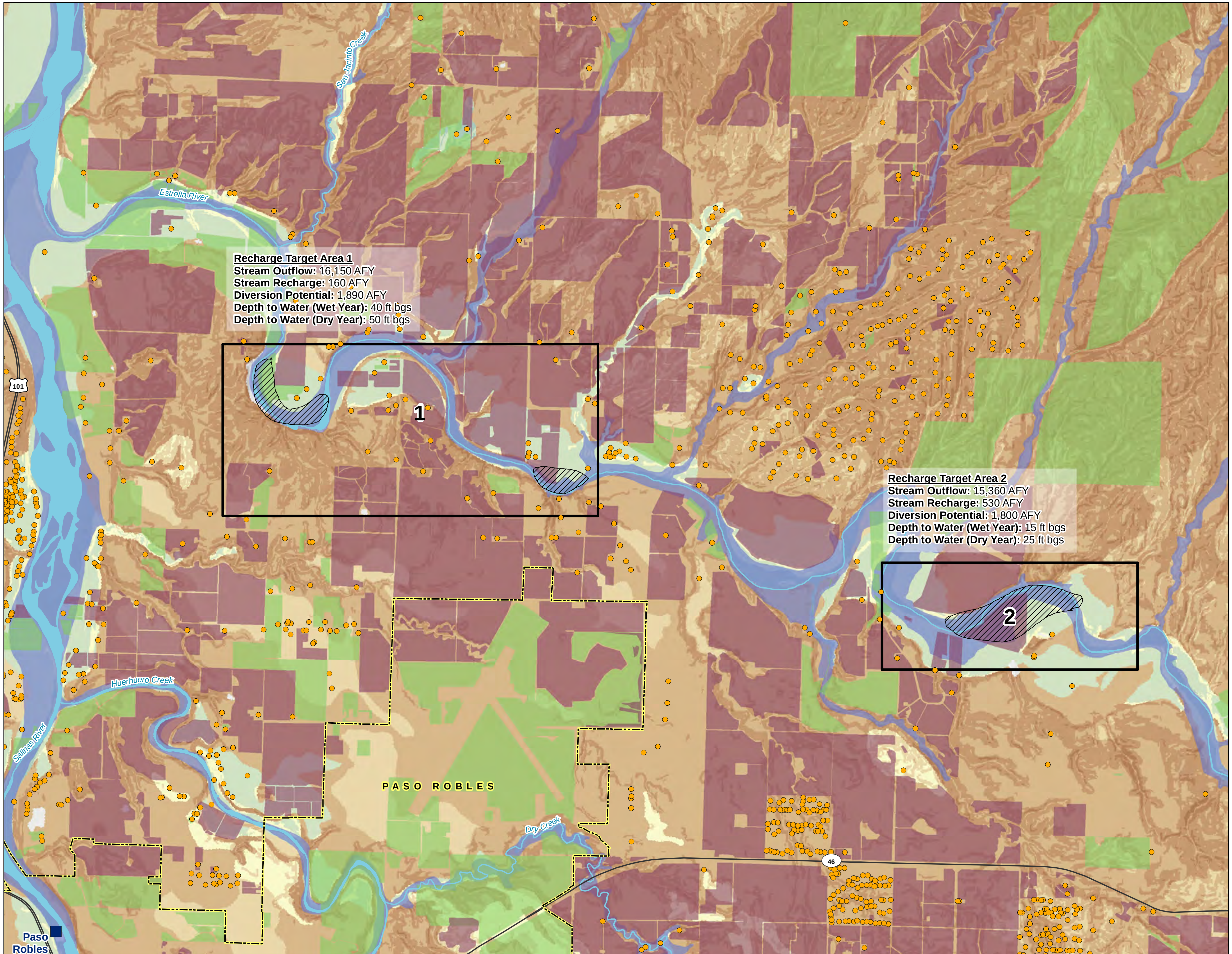

FIGURE 10

Selected Target Areas 1 and 2 Along the Estrella River

Paso Robles Subbasin

LEGEND

- Assumed Septic Tank Location (any address location outside of San Miguel or Paso Robles Service Area)
- Wastewater Treatment Facility
- Potential Recharge
- Target Area

Crop Type

- Vineyard
- Non-Vineyard

Recharge Potential Index

- 0 - 2 (Low)
- 2 - 3
- 3 - 4
- 4 - 5
- 5 - 6
- 6 - 7
- 7 - 8
- 8 - 9
- 9 - 10 (High)

All Other Features

- Watercourse
- Major Road
- Salinas Valley Groundwater Basin - Paso Robles Area
- 100-year Flood Zone
- City Boundary
- County Boundary

NOTE

bgs: below ground surface

N

0 2,000 4,000 6,000
Feet

Date: May 8, 2020
Data Sources: USGS, ESRI, SLO Co., CA DWR

GSI Water Solutions, Inc.

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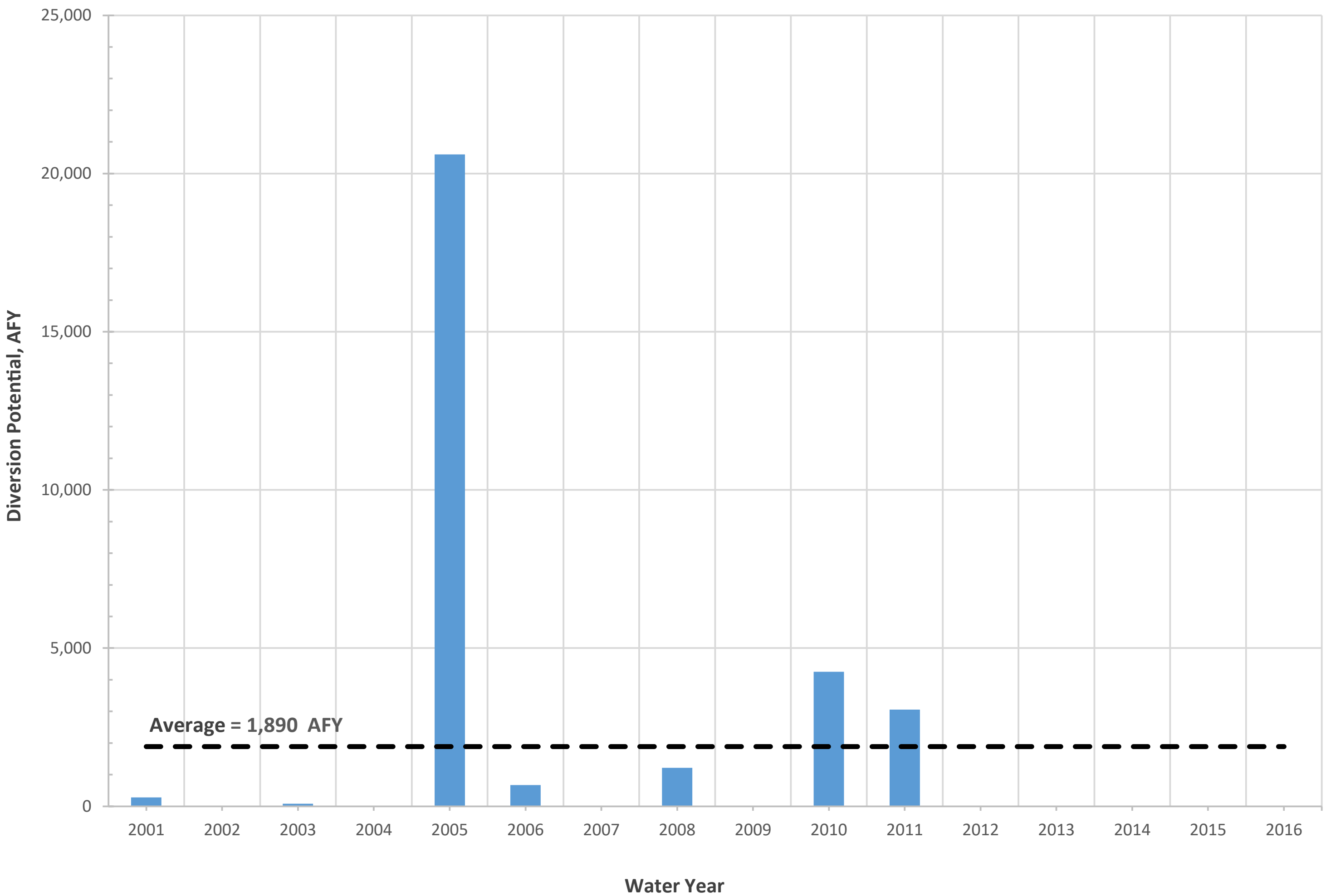

FIGURE 11

Annual Diversion Potential for Recharge Target Area 1 - Estrella River

Paso Robles Subbasin

LEGEND

Diversion Potential

Average Diversion Potential

NOTES

AFY: Acre Feet per Year

GSI Water Solutions, Inc.

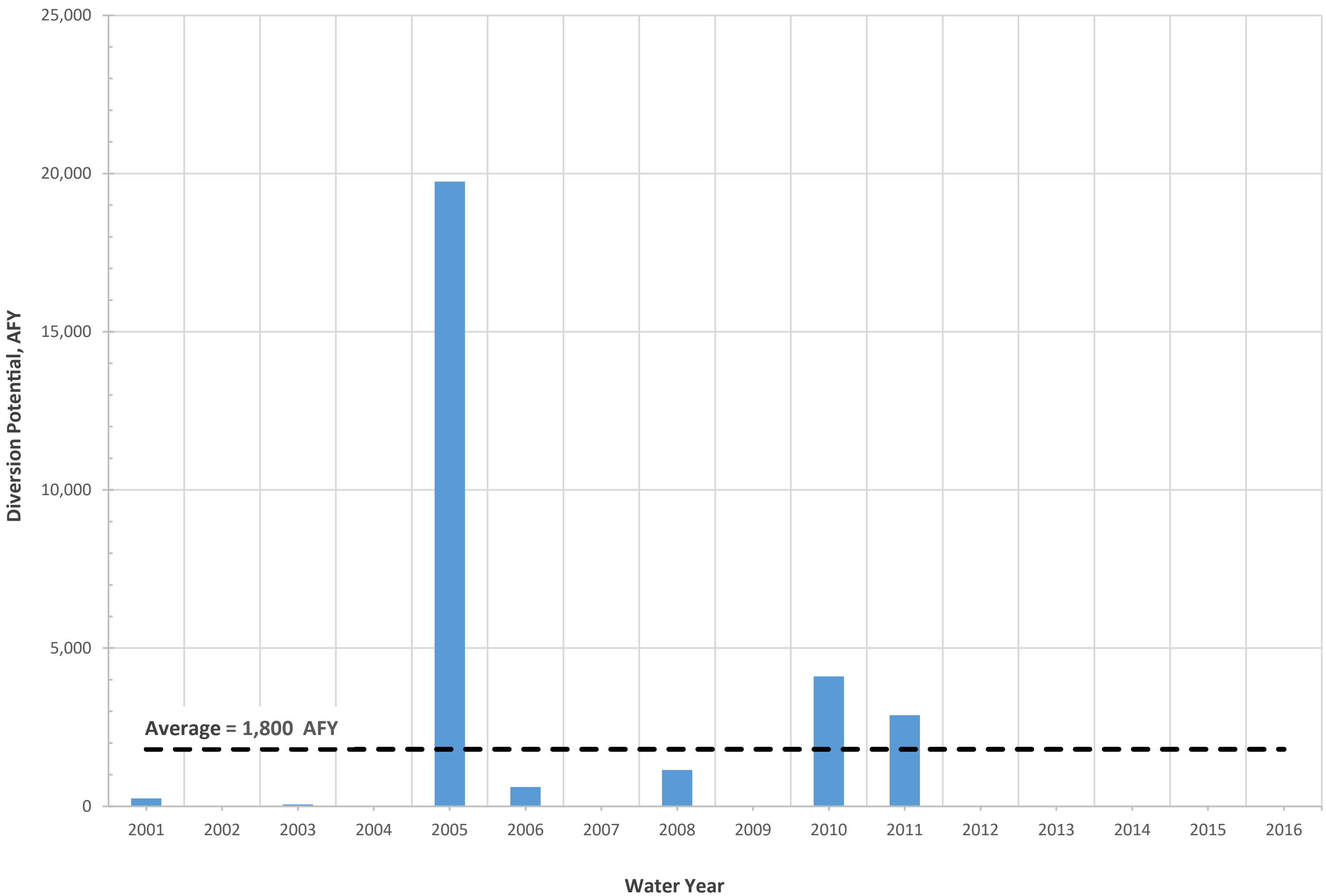

FIGURE 12

Annual Diversion Potential for Recharge Target Area 2 - Estrella River

Paso Robles Subbasin

LEGEND

Diversion Potential

Average Diversion Potential

NOTES

AFY: Acre Feet per Year

GSI Water Solutions, Inc.

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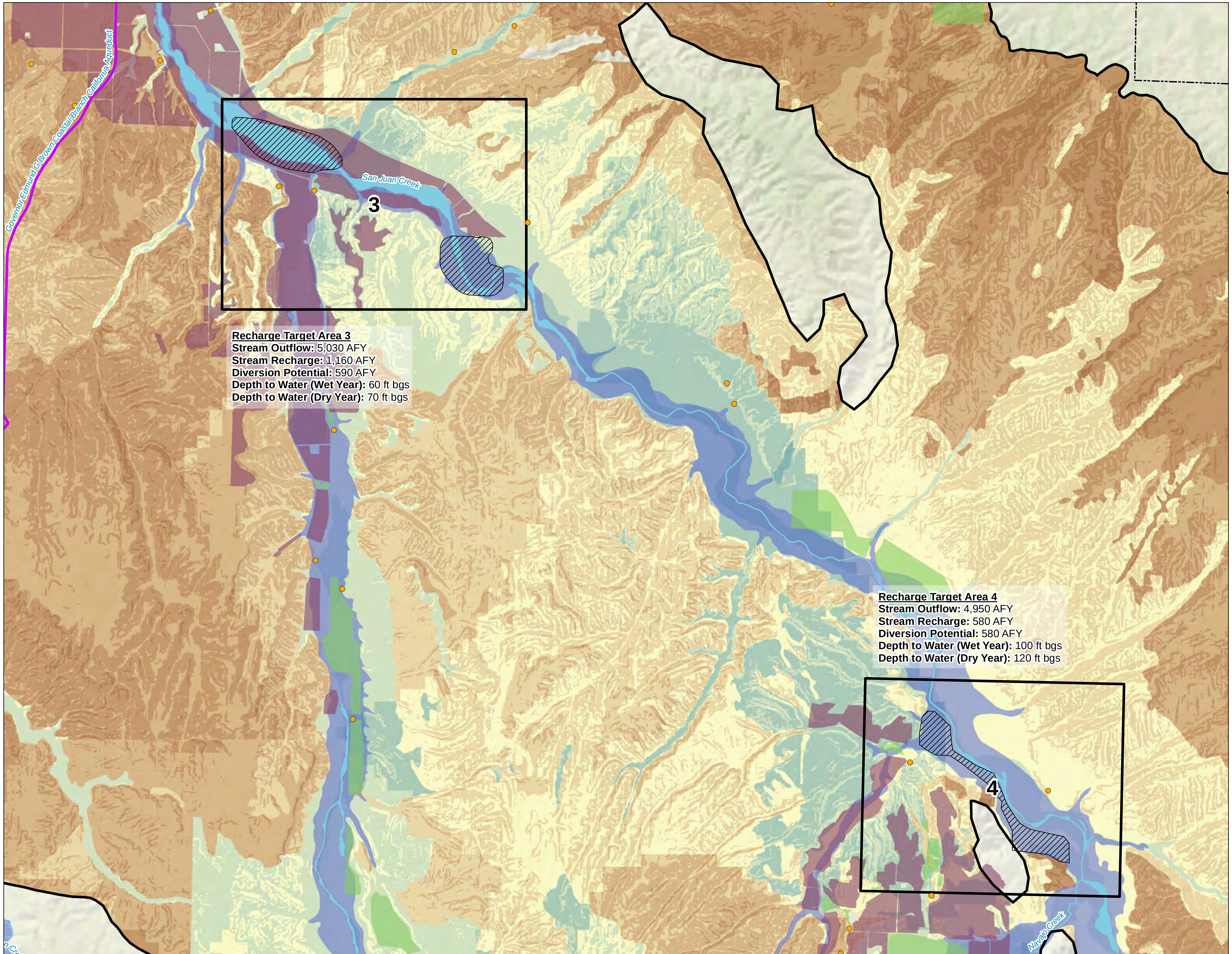

FIGURE 13

Selected Target Areas 3 and 4 Along San Juan Creek

Paso Robles Subbasin

LEGEND

- Assumed Septic Tank Location (any address location outside of San Miguel or Paso Robles Service Area)
- Wastewater Treatment Facility
- Potential Recharge Area
- Target Area

Crop Type

- Vineyard
- Non-Vineyard

Recharge Potential Index

- 0 - 2 (Low)
- 2 - 3
- 3 - 4
- 4 - 5
- 5 - 6
- 6 - 7
- 7 - 8
- 8 - 9
- 9 - 10 (High)

All Other Features

- Watercourse
- Coastal Branch California Aqueduct
- Major Road
- Salinas Valley Groundwater Basin - Paso Robles Area
- 100-year Flood Zone
- City Boundary
- County Boundary

N

0 2,500 5,000 7,500
Feet

Date: May 8, 2020
Data Sources: USGS, ESRI, SLO Co., CA DWR

GSI Water Solutions, Inc.

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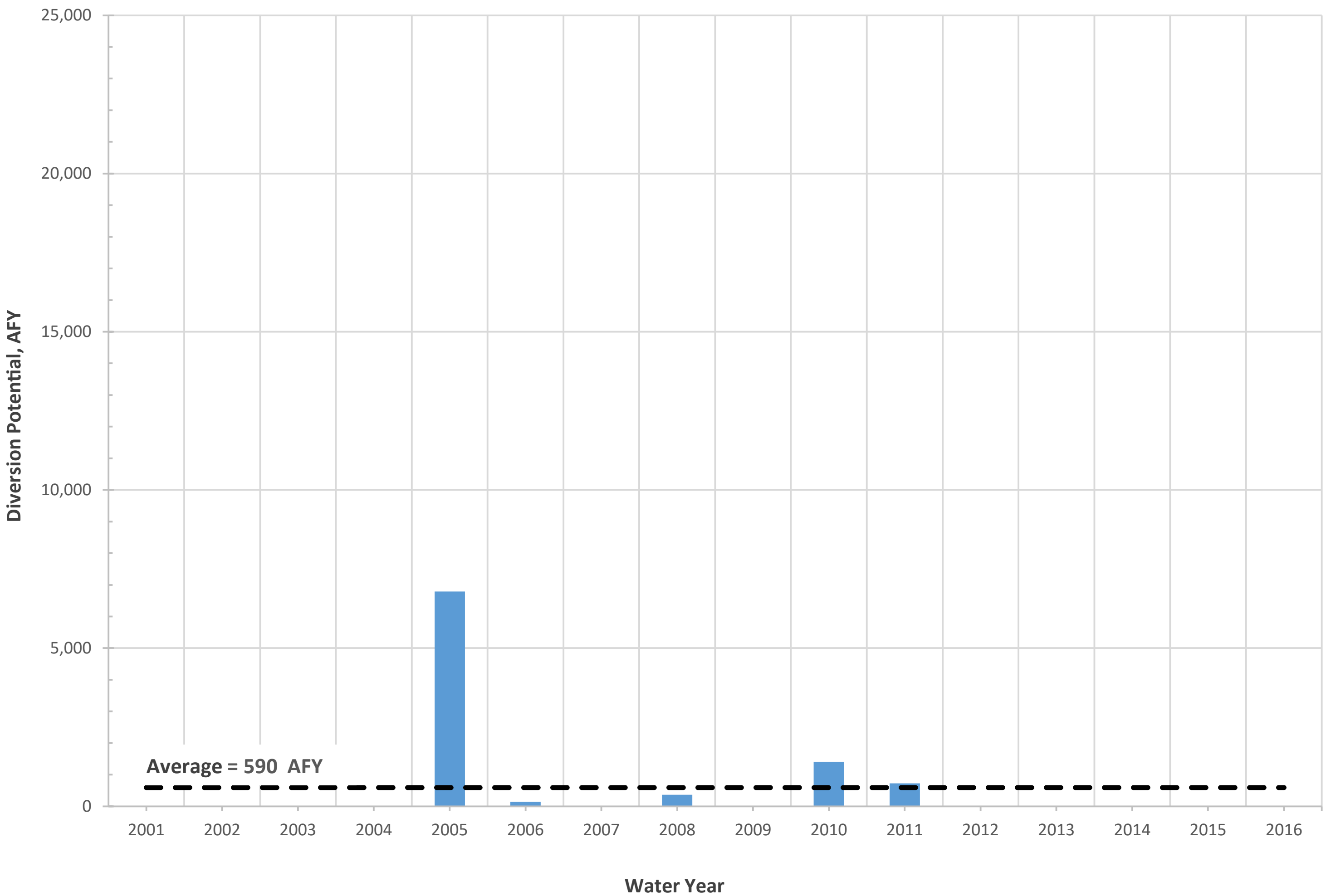


FIGURE 14

Annual Diversion Potential for Recharge Target Area 3 - San Juan Creek

Paso Robles Subbasin

LEGEND

Diversion Potential

Average Diversion Potential

NOTES

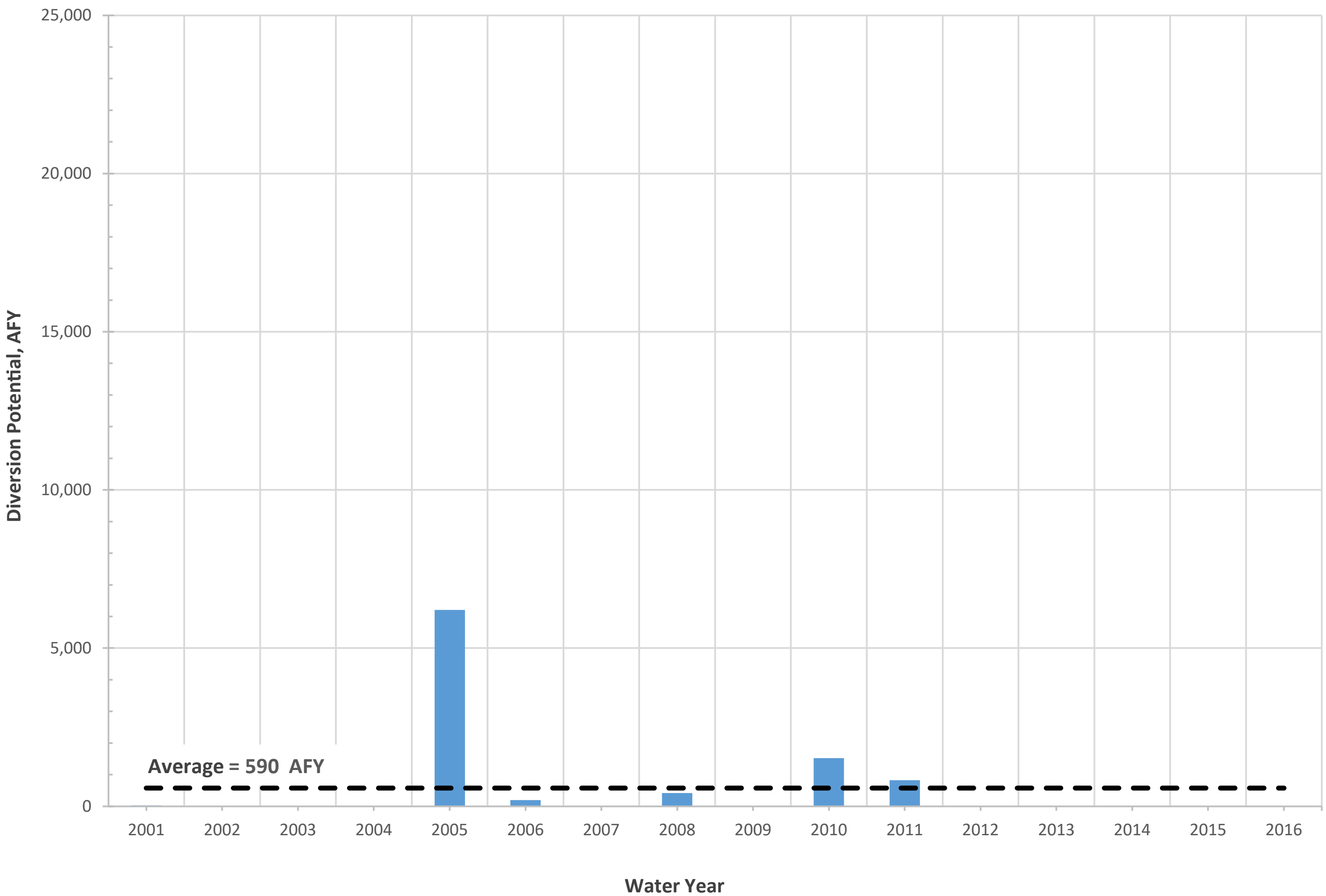
AFY: Acre Feet per Year

GSI Water Solutions, Inc.

FIGURE 15

Annual Diversion Potential for Recharge Target Area 4 - San Juan Creek

Paso Robles Subbasin



LEGEND

Diversion Potential

Average Diversion Potential

NOTES

AFY: Acre Feet per Year

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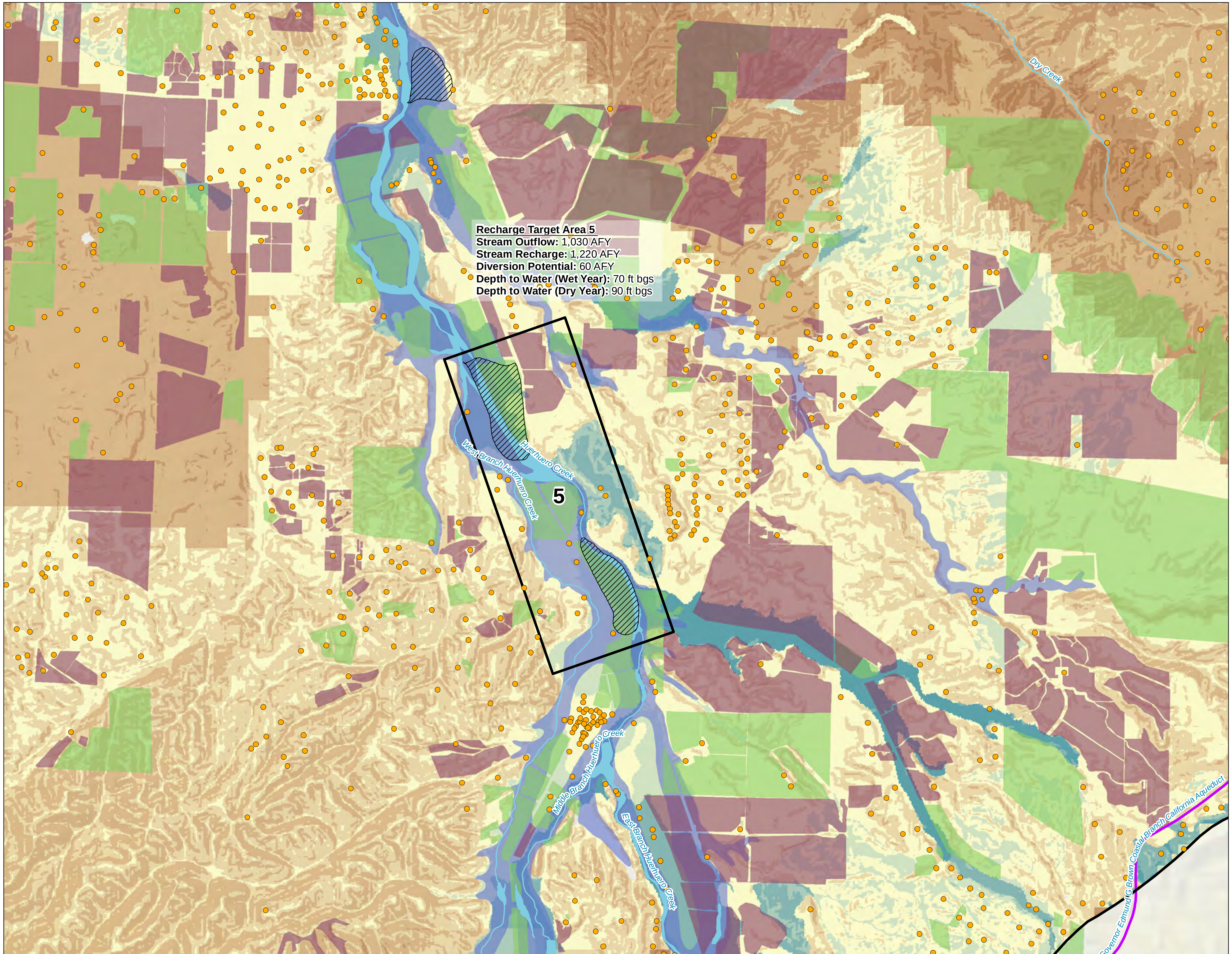

FIGURE 16

Selected Target Area 5 Along Huer Huero Creek

Paso Robles Subbasin

LEGEND

- Assumed Septic Tank Location (any address location outside of San Miguel or Paso Robles Service Area)
- Wastewater Treatment Facility
- Potential Recharge Area
- Target Area

Crop Type

- Vineyard
- Non-Vineyard

Recharge Potential Index

- 0 - 2 (Low)
- 2 - 3
- 3 - 4
- 4 - 5
- 5 - 6
- 6 - 7
- 7 - 8
- 8 - 9
- 9 - 10 (High)

All Other Features

- Watercourse
- Coastal Branch California Aqueduct
- Major Road
- Salinas Valley Groundwater Basin - Paso Robles Area
- 100-year Flood Zone
- City Boundary
- County Boundary

N

0 1,500 3,000 4,500
Feet

Date: May 8, 2020
Data Sources: USGS, ESRI, SLO Co., CA DWR

GSI Water Solutions, Inc.

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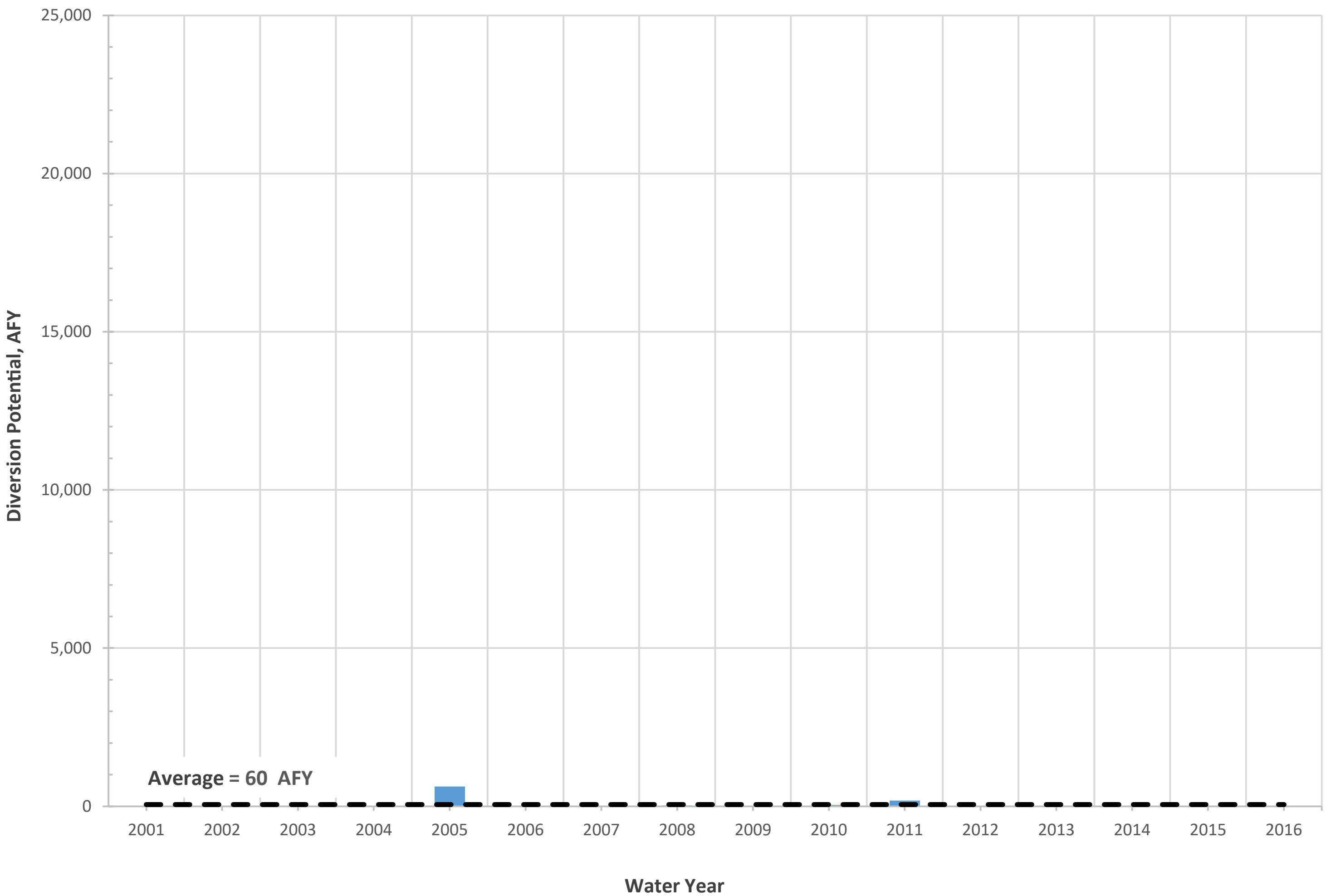
FIGURE 17

Annual Diversion Potential for Recharge Target Area 5 - Huer Huero Creek

Paso Robles Subbasin



LEGEND

Diversion Potential

Average Diversion Potential

NOTES

AFY: Acre Feet per Year

GSI Water Solutions, Inc.