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ATASCADERO BASIN Groundwater Sustainability Agency

GSI Water Solutions, Inc.

Water Year 2022

Annual Report for the Groundwater Sustainability Plan for the Atascadero Basin

March 2023

Prepared for: Atascadero Basin GSA

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Water Year 2022

Annual Report for the Groundwater Sustainability Plan for the Atascadero Basin

Prepared for:

Atascadero Basin GSA

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March 2023

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WATER YEAR 2022
ANNUAL REPORT FOR THE
GROUNDWATER SUSTAINABILITY PLAN FOR THE ATASCADERO BASIN

Certifications and Seals

This report and analysis were prepared by the following GEI Consultants Inc. professional geologists.

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Abbreviations and Acronyms

AEM	Airborne Electromagnetic
AF	acre-feet
AFY	acre-feet per year
AMWC	Atascadero Mutual Water Company
Basin	Atascadero Basin
BMP	Best Management Practice
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
DU	domestic units
DWR	California State Department of Water Resources
ET	evapotranspiration
ft/msl	feet above mean sea level
gpm	gallons per minute
gpm/ft	gallons per minute per foot
GAMA	Groundwater Ambient Monitoring and Assessment
GSA	Groundwater Sustainability Agency
GSP	Groundwater Sustainability Plan
GSP basin mode	GSP model
InSAR	interferometric synthetic-aperture radar
MOs	measurable objectives
MTs	minimum thresholds
MWC	Mutual Water Company
NWP	Nacimiento Water Project
PWS	public water system
RMS	representative monitoring site
S	storage coefficient
SGMA	Sustainable Groundwater Management Act
SLOFCWCD	San Luis Obispo Flood Control and Water Conservation District
SPI	Standardized Precipitation Index
TDS	total dissolved solids

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 Groundwater Elevation Monitoring (§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 Attachment D)
	(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])
	(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])

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	
	(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 Implementing the GSP (§356.2[c])

Executive Summary

With the submittal of the Atascadero Basin Groundwater Sustainability Plan (GSP), the Groundwater Sustainability Agency (GSA) is required to submit an annual report for the preceding Water Year (WR October 1 – September 30) to DWR by April 1, 2023. The annual report shall be provided by April 1 of each year following adoption of the plan and provide monitoring and water use data to the DWR and Atascadero Basin (Basin) stakeholders to gauge performance of the Basin relative to sustainability goals set forth in the GSP.

This document provides annual monitoring data required by the California Department of Water Resources (DWR) for a GSP and consistent with the GSP dated January 19, 2022, for the Basin. This report contains monitoring data for WY 2022 (October 1, 2021 – September 30, 2022). The values for WYs 2017 through 2022 are included for reference purposes.

Water levels, groundwater extractions, surface water diversions, and total water usage measurements and change in groundwater storage estimates are presented. The measurements and information presented demonstrate the groundwater in the Basin is sustainable, consistent with the GSP findings.

Sections of the WY 2022 Annual Report include the following:

- **Section 1. Introduction:** a brief background of the Atascadero Basin GSA and a location map.
- **Section 2. Atascadero Basin Setting and Monitoring Networks:** a summary of the Basin setting, Basin 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.
- **Section 8. Progress towards Implementing the GSP (§356.2[c]):** a summary of sustainability of the Basin.
- **Section 9. References:** includes the references used for this Annual Report.

Groundwater Elevations

In general, the groundwater elevations observed in the Basin during WY 2022 are lower than the previous water year. The decreased groundwater elevations are likely due predominantly to below-average rainfall conditions experienced in the past two years. Both positive and negative changes in groundwater elevations from year to year are observed in different parts of the Basin, as has been the pattern for many years. Seasonal trends of slightly higher spring groundwater elevations compared with lower fall levels continued in each of the water years.

Groundwater Extractions

Total groundwater extractions in the Basin for WY 2022 are estimated to be 16,000 acre-feet (AF). **Table ES-1** summarizes the groundwater extractions by water use sector for each WY from 2017 to 2022. The values for WYs 2017 to 2021 (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)
Source	Municipal (AF)	PWS and Rural Domestic (AF)	Agriculture (AF)	
2017	8,760	1,206	4,900	15,000
2018	10,227	1,218	4,300	15,800
2019	9,442	1,230	5,000	15,800
2020	10,611	1,243	4,700	16,600
2021	10,860	1,252	4,500	16,700
2022	10,242	1,262	4,500	16,000
Method of Measure	Metered	2016 Groundwater Model	Soil- Water Balance Model, OpenET (2021 and 2022 only)	
Level of Accuracy	high	low-medium	medium	

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

Surface Water Use

The Basin currently benefits from surface water entitlements from the Nacimiento Water Project (NWP) to supplement municipal demands in the City of Paso Robles, Templeton Community Services District (TCSD), and Atascadero Mutual Water Company. The City of Paso Robles uses a portion of their NWP deliveries within the Paso Robles 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 10**. There is currently no surface water available for agricultural or recharge project use within the Basin. 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 Water Available			Total (AF)	Nacimiento Water Project Water Used			Total (AF)
	City of Paso Robles[1] (AF)	Templeton CSD[2] (AF)	Atascadero MWC[3] (AF)		City of Paso Robles (AF)	Templeton CSD (AF)	Atascadero MWC (AF)	
2017	6,488	406	3,244	10,138	134	274	0	408
2018	6,488	406	3,244	10,138	862	258	854	1,974
2019	6,488	406	3,244	10,138	356	157	47	560
2020	6,488	406	3,244	10,138	804	0	1,372	2,176
2021	6,488	406	3,244	10,138	746	97	2,218	3,061
2022	6,488	406	3,244	10,138	1,102	131	1,945	3,088

Notes:
[1] Contract annual entitlement to the city of Pas Robles. Note that city of Paso Robles uses some water outside Atascadero Basin
[2] Contract annual entitlement to Templeton Community Services District
[3] Contract annual entitlement to Atascadero Mutual Water Company
AF= acre feet
CSD = Community Services District
MWC = Mutual Water Company

Total Water Use

For WY 2022, 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 Basin 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	8,760	408	1,206	4,900	**15,300**
2018	10,227	1,974	1,218	4,300	**17,700**
2019	9,442	560	1,230	5,000	**16,200**
2020	10,611	2,176	1,243	4,700	**18,700**
2021	10,860	3,061	1,252	4,500	**19,700**
2022	10,242	3,088	1,262	4,500	**19,100**
Method of Measure	Metered	Metered	2016 Groundwater Model	OpenET	
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 Basin 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 Basin as the aquifer becomes saturated (storage gain) or dewatered (storage loss). For example, fall 2021 groundwater elevations were subtracted from the fall 2022 groundwater elevations resulting in a map depicting the changes in groundwater elevations in the Paso Robles Formation Aquifer that occurred during WY 2021. This same analysis was completed for all WYs starting in 2017 through 2022 and for both the Alluvial and Paso Robles Formation Aquifer.

For both aquifers, change in storage fluctuates between slightly negative and slightly positive values depending on WY type and pumping activity. The greatest fluctuations in change of storage are just to the northeast of Templeton and just east of Asuncion, where presumably groundwater use is the highest. These regions tend to have the greatest declines in water level and the greatest rise in water level.

The annual change of groundwater in storage calculated for WY 2017 through WY 2022 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	14,600
2018	-5,400
2019	4,300
2020	100
2021	-5,200
2022	-8,000

Note: AF = acre-feet

Progress towards Meeting Basin Sustainability

Because the Basin is currently being managed sustainably, as evidenced by historic groundwater levels in the Basin, there are no projects or management actions that are required to achieve sustainability. A number of management actions and conceptual projects were included in the GSP to provide a means to ensure the Basin is operated to maintain its sustainable yield and sustainability. The Basin will continue to be managed in an adaptive management approach as described in the GSP.

While not required to achieve sustainability, there are ongoing activities in the Basin that shall contribute to a better understanding of the Basin hydrogeology and groundwater management in general. These projects include participation in the California Department of Water Resources (DWR) Airborne Electromagnetic (AEM) Survey and Expansion of the Monitoring Well Network. An Atascadero Basin groundwater model was developed that incorporated new information in the hydrogeologic conceptual model including use of the AEM data. The data management system for the Basin was also updated to the most current version which will be available to support improved groundwater management of the Basin and support future GSP updates.

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1. Introduction

1.1 Purpose

On January 19, 2022, Atascadero Basin Groundwater Sustainability Agency (GSA) voted to approve the Atascadero Basin Groundwater Sustainability Plan (GSP) and to submit the GSP for approval by the California Department of Water Resources (DWR). This Annual Report has been prepared for the GSA to provide annual monitoring data for water year (WY) 2022 (October 1, 2021 – September 30, 2022) consistent with the GSP and in accordance with GSP Regulations (356.2. Annual Reports) (**Attachment A**). Pursuant to DWR regulations, a GSP Annual Report must be submitted to DWR by April 1 of each year following the Adoption of the GSP. As the second annual report submitted by the GSA, additional information for WY 2017 through 2021 are provided for reference purposes.

1.2 Atascadero Basin

The Atascadero Basin (Basin) is identified by DWR in Bulletin 118 as Subbasin No. 3-004.11 (DWR 2016). The Basin is part of the greater Salinas Valley Basin in the Central Coast region of California. The Basin encompasses an area of approximately 19,735 acres, or 31 square miles. It includes portions of the incorporated cities of Paso Robles and Atascadero as well as the unincorporated census-designated places of Santa Margarita and Templeton.

The Basin is bounded to the east by the Paso Robles Subbasin, as shown on **Figure 1**. The shared boundary between the subbasins is the Rinconada Fault zone, which contains areas that are impervious and other areas that are considered to be a leaky barrier to groundwater flow.

The Paso Robles Formation makes up most of the water bearing sediments for the Basin. The lateral extents are defined primarily by the contact with the Monterey Shale (bedrock) while the southern end of the Basin is bounded by the Santa Margarita Formation, which impedes groundwater flow. The other major aquifer unit of the Basin is the Quaternary Alluvium, which overlays the Paso Robles Formation.

In 2018, DWR designated the Basin as a very low priority basin with no overdraft. Because of this designation, the Basin was not subject to the development of a GSP under the Sustainable Groundwater Management Act (SGMA) regulations. However, the forming and participating parties, described below, developed the GSP to proactively manage the groundwater of the Basin to sustainable levels.

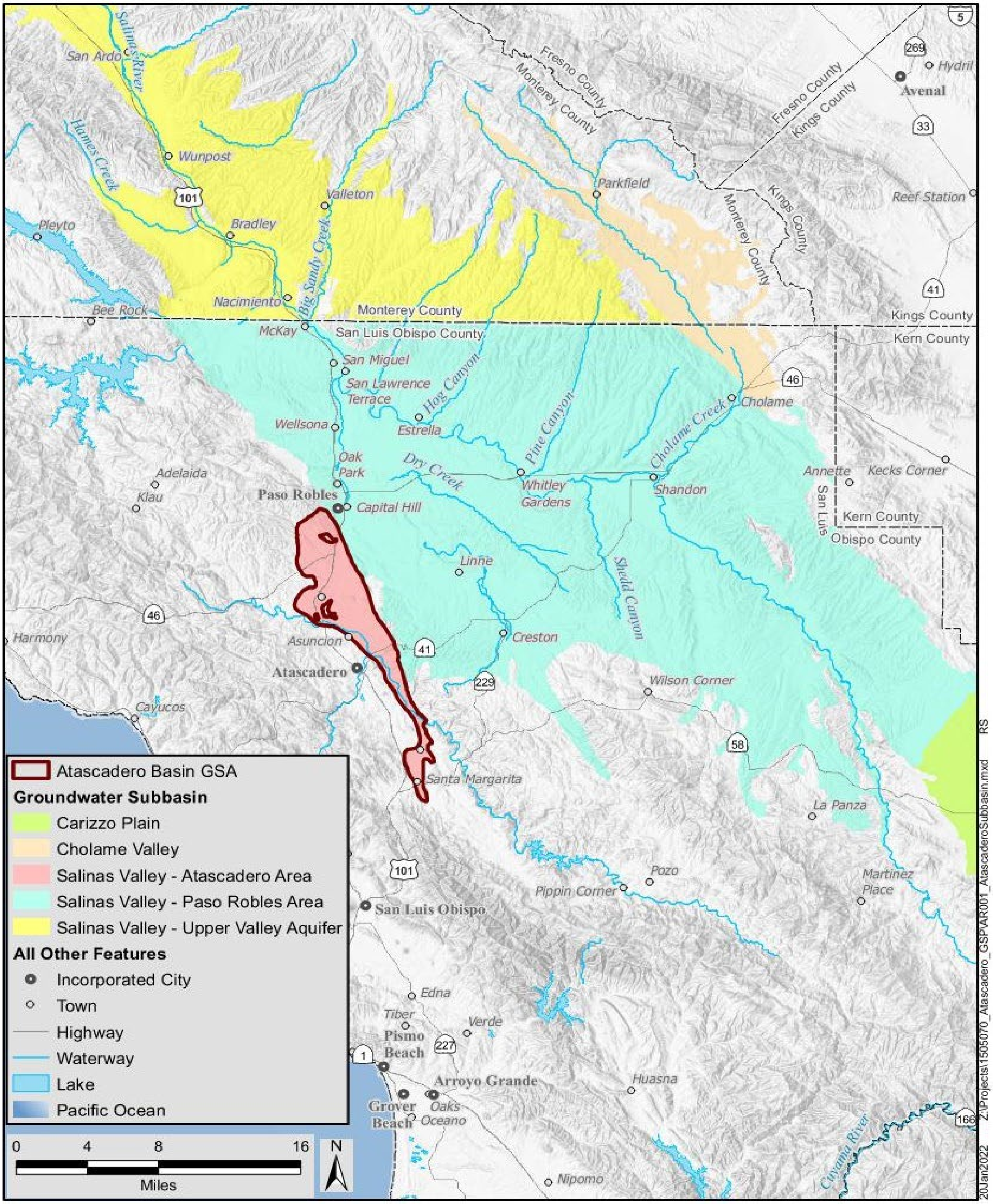

Figure 1: Atascadero Basin and Surrounding Subbasins

1.3 Atascadero Basin GSA

The Basin's GSA is a single GSA covering the entire Basin and is comprised of four forming parties and six participating parties.

Forming Parties

- City of Atascadero
- City of Paso Robles
- County of San Luis Obispo
- Templeton Community Services District

Participating Parties

- Atascadero Mutual Water Company
- Atascadero State Hospital
- SMR Mutual Water Company
- Santa Ysabel Ranch Mutual Water Company
- Walnut Hills Mutual Water Company
- Garden Farms Water District

The GSA is governed by an Executive Committee which is described in the Memorandum of Agreement, dated May 30, 2017, which was included with submittal of the 2022 Atascadero Basin GSP (GEI 2022).

1.4 Organization of This Report

The required contents of an annual report are provided in the GSP Regulations (§ 356.2), included as **Attachment A**. Organization of the report is meant to follow the regulations where possible to assist in the review of the document. Sections of the WY 2022 Annual Report include the following:

- **Section 1. Introduction**: a brief background of the Basin's GSA and a map of the Basin and surrounding basins.
- **Section 2. Atascadero Basin Setting and Monitoring Networks**: a summary of the Basin setting, Basin 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.
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- **Section 8. Progress towards Implementing the GSP (§356.2[c])**: a summary of sustainability of the Basin.
- **Section 9**. References

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2. Atascadero Basin Setting and Monitoring Networks

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 2022. Information provided for WYs 2017-2021 are for reference purposes. Much of the background information reported on in this WY 2022 Annual Report was taken from the Atascadero GSP prepared by GEI Consultants Inc, and GSI Water Solutions, Inc. (GEI 2022).

2.1 Basin Setting

The Basin is a narrow structural northwest-trending trough that extends from the Santa Margarita area at its southern end to the city of Paso Robles in the north. The Basin is bounded by the Santa Lucia Range on the west. The ground surface elevation of the Basin ranges from approximately 1,300 feet above mean sea level (ft/msl) in the highlands at the northern tip of the Basin to approximately 700 ft/msl where the Salinas River exits the Basin to the north. The southern tip of the Basin is approximately 1,000 ft/msl. The middle part of the Basin forms an elongate narrow valley along the Salinas River, flanked by areas of variable topographic relief. The Basin encompasses an area of approximately 19,735 acres. It is generally bounded by geologic units with low permeability, sediments with poor groundwater quality, rock, and structural faults. Along a portion of the northeast boundary, sediments of the Basin are continuous with the adjacent Paso Robles Area Groundwater Sub-basin of the Salinas Valley Basin (Paso Robles Basin).

Specific Basin lateral boundaries include the following:[1]

- The northwestern, western, and southern boundaries of the Basin are defined by the contact of Basin sediments with older, relatively impermeable geologic units, including Tertiary-age consolidated sedimentary beds, Cretaceous-age metamorphic rocks, and granitic rock.
- Along the northern portion of the eastern boundary, north of Templeton, the Rinconada Fault defines the eastern boundary of the Basin and is assumed to form a leaky hydraulic barrier between the Paso Robles Basin and the Atascadero Basin.
- Along the southern portion of the eastern boundary, south of Templeton, between Atascadero and Creston, the Rinconada Fault juxtaposes Monterey Formation rocks and other bedrock units with the Paso Robles Formation basin sediments.

The bottom of the Basin is generally defined as the base of the Paso Robles Formation, which is an irregular surface formed as the result of folding, faulting, and erosion (Fugro and Cleath 2002). The exception to this is the Santa Margarita area at the southern end of the Basin. In this area, the bottom of the Basin is defined as the base of the Alluvium. The Basin boundary and bottom are not considered absolute barriers to flow because some of the geologic units underlying the Paso Robles Formation

[1] Minor discrepancies between these boundary descriptions and the Bulletin 118 boundary are discussed in Section 4.3.2

produce sufficient quantities of water, but the water is generally of poor quality, and it is therefore not considered part of the Basin.

There are two principal aquifers in the Basin: the Alluvial Aquifer and the Paso Robles Formation Aquifer. There are no formally defined or laterally continuous aquitards within the Basin. However, the upper portions of the Paso Robles Formation often contain thin, discontinuous clay layers interbedded with sand and "shale gravels" that can act as a leaky confining layer. These upper clay layers are generally pervasive throughout the Basin. In the Templeton area from Graves Creek to approximately Highway 46, the contact between the Alluvial Aquifer and the Paso Robles Formation Aquifer is characterized by a thick (60 feet) clay-rich aquitard that forms a hydraulic barrier to vertical groundwater flow, effectively separating the Alluvial Aquifer from the Paso Robles Formation Aquifer (Torres 1979).

Water wells penetrating and extracting groundwater from the Alluvial Aquifer are located along the Salinas River and its tributaries, including within the Santa Margarita area. The unit, consisting almost entirely of sand and gravel, is everywhere unconfined with high to very high transmissivity values. The thickness of the Alluvium ranges widely, with an estimated maximum thickness of 75 to 90 feet. Specific capacity values for wells in the Alluvium range from 20 to 60 gallons per minute per foot (gpm/ft) at production rates as high as 1,000 gpm (Fugro and Cleath 2002). Overall, within the Basin, the geometric mean hydraulic conductivity of the Alluvial Aquifer is estimated at 481 ft/day (Fugro and Cleath 2002).

In the Atascadero area and the area north of Templeton, the Paso Robles Formation Aquifer underlies and is in direct hydraulic contact with the Alluvial Aquifer along the Salinas River channel. Wells in the Paso Robles Formation Aquifer in hydraulic communication with the overlying Alluvium tend to have higher transmissivity values than wells that penetrate the portions of the Paso Robles Formation not in contact with the Alluvium. Constant discharge aquifer pumping tests for wells in Atascadero on the west side of the Salinas River showed production rates up to 1,300 gpm, with an average specific capacity of 15 gpm/ft (Fugro and Cleath 2002).

Elsewhere in the Basin the upper 300 feet or so of the Paso Robles Formation is characterized by thin (5-15 feet thick) interbedded brown or yellow clays with sand and "shale gravel," as described above. The beds tend to be thicker below 300 feet, with an increasing proportion of sand and gravel. The results of several controlled aquifer pumping tests were reviewed for wells in the Paso Robles Formation Aquifer, including wells in both the Templeton and Atascadero areas. None of these wells were in direct hydraulic communication with the Alluvial Aquifer. The specific capacity in these wells ranged from 0.9 to 5.7 gpm/ft at pumping rates of 110 to 810 gpm. Overall, within the Basin, the geometric mean hydraulic conductivity of the Paso Robles Formation Aquifer is estimated at 8.6 ft/day and the storativity ranges from 0.04 to 0.0001 (Fugro and Cleath 2002).

2.2 Precipitation and Climatic Period

Annual precipitation recorded at the Atascadero Mutual Water Company (AMWC) Station #34 is presented by WY in **Figure 2**. The average annual precipitation for the period 1968 through 2022 is 17.6 inches per WY, as recorded at AMWC Station #34. Climatic periods in the Subbasin have been determined based on analysis of data from AMWC Station #34 using the Standardized Precipitation Index (SPI), which quantifies deviations from normal precipitation patterns, using a 24-month period for analysis. The 24-month period SPI analysis provides insight into the relationship between WY type and groundwater elevation response (WMO 2012). Climatic periods are categorized according to the following designations: wet, dry, and average/alternating wet and dry (**Figure 2)**. Historical precipitation records are provided in **Attachment B**.

2.3 Monitoring Network

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 Basin:

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

Monitoring for the chronic lowering of groundwater levels, reduction of groundwater in storage, and depletion of interconnected surface water is implemented using the representative monitoring sites (RMS), is discussed in the next section, Section 2.3.1 – Groundwater Elevation Monitoring Network. Monitoring for degraded water quality and land subsidence is discussed in Section 2.3.2 – Additional Monitoring Networks.

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

The groundwater elevation monitoring network is used to assess Basin health against the chronic lowering of groundwater levels sustainability indicator outlined in the GSP. As groundwater levels are used as a proxy for the reduction in groundwater storage and depletion of interconnected surface water monitoring, this network is used for those sustainability indicators as well. Routine monitoring of groundwater levels is conducted by the San Luis Obispo County Flood Control and Water Conservation District. The groundwater elevation monitoring network RMS locations are shown on **Figure 3** and a summary of information for each of the wells is included in **Attachment C**. The monitoring network also includes other wells in the GSP area designated as private that are not shown on this map.

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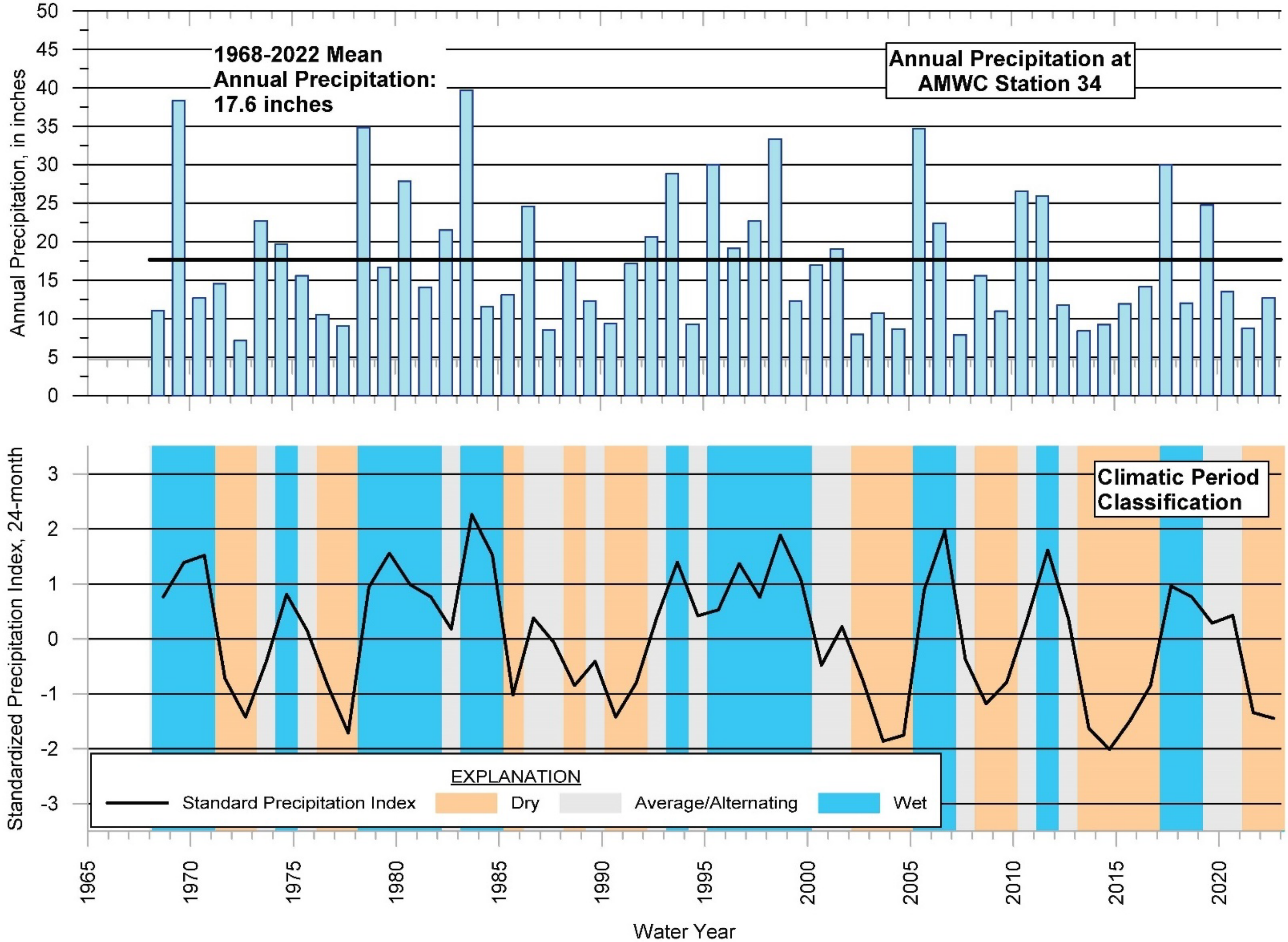

Figure 2: Annual Precipitation and Climatic Periods in the Atascadero Basin

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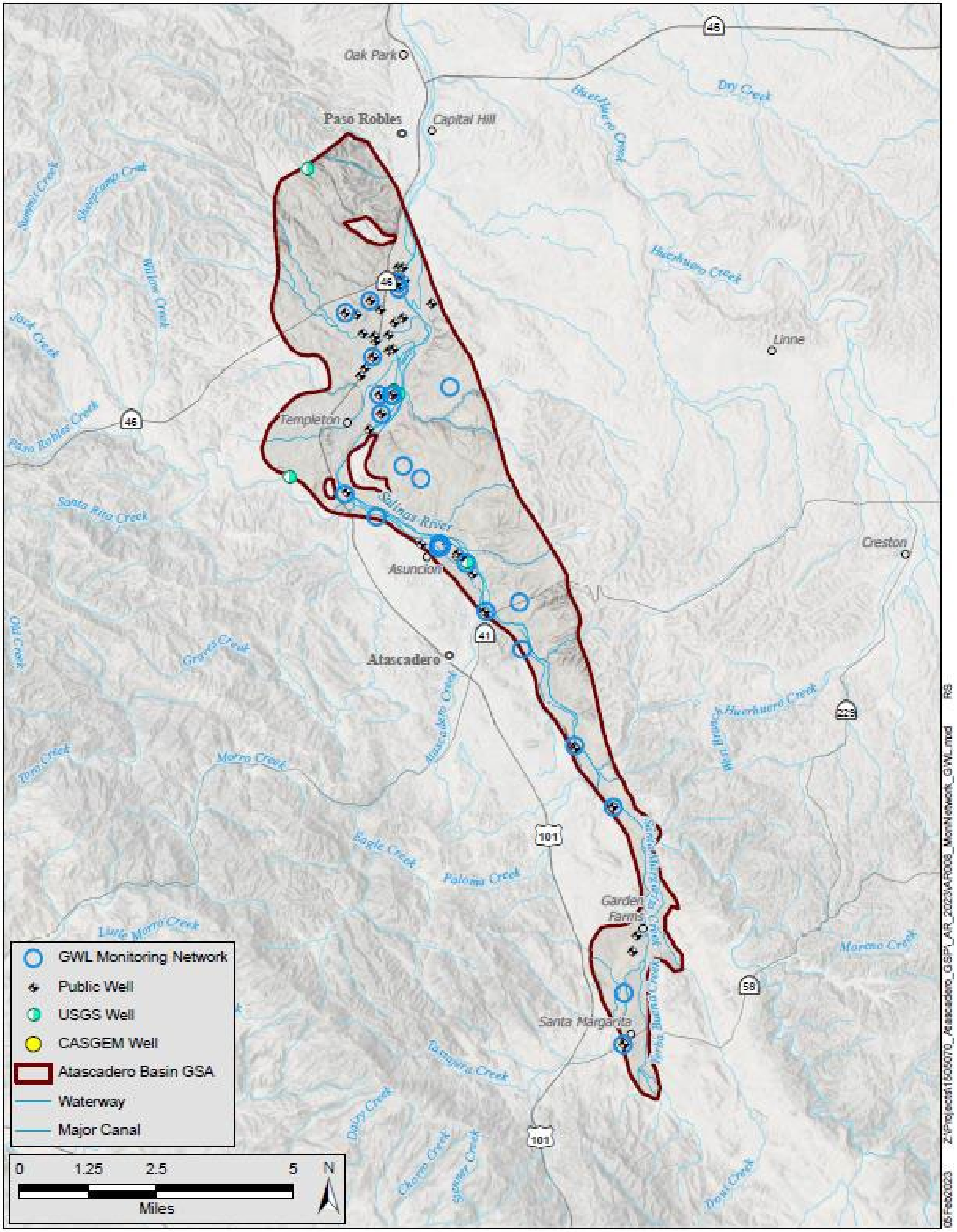

Figure 3: Atascadero Basin Groundwater Elevation Monitoring Network

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 Basin to provide sufficient data quality, frequency, and spatial distribution to evaluate changing aquifer conditions in response to GSP implementation. To this purpose, the GSP identifies an existing network of 24 RMS wells for water level monitoring. Of these 24 wells, 13 are wells that screen the Paso Robles Formation, and 11 are Alluvial Aquifer wells[2]. The 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 (MOs) and MTs documented in the GSP
- Quantify annual changes in water use
- Monitor impacts to the beneficial uses and users of groundwater

2.3.1.1 Monitoring Data Gaps

The GSP identified data gaps in the current RMS network based on professional judgement. These data gaps are shown by the absence of monitoring wells in the northwest portion of the Basin and eastern portion of the Basin (*refer to* **Figure 3**). Potential wells were identified to fill said data gaps and efforts to bring the wells into the RMS network are continuing during the implementation phase of the GSP. This includes possible construction of new wells. Additionally, a program to increase monitoring frequency may be considered during the implementation phase if deemed necessary to better determine seasonal high and low groundwater elevation and measure response to recharge and other activities.

2.3.2 Additional Monitoring Networks

Evaluation of the water quality sustainability indicator is achieved through monitoring of an existing network of supply wells in the Basin. There are no known plumes in the Basin and therefore monitoring is only for non-point source constituents of concern (COCs) and naturally occurring water quality impacts. COCs identified in the GSP that have the potential to impact suitability of water for public supply or agricultural based on Title 22 drinking water regulations and Water Quality Control Plan (WQCP) water quality objectives (WQOs). These include:

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

Title 22 Drinking Water Regulations

- Arsenic
- Gross Alpha
- Nitrate (as N)
- Selenium
- *Chloride (SMCL)*
- *Sulfate (SMCL)*
- *Iron (SMCL)*
- *Manganese (SMCL)*
- *Total Dissolved Solids (TDS)*
- *Constituent regulated under a secondary MCL*

WQCP Water Quality Objectives

- Boron
- Chloride
- Nitrate (as N)
- Sulfate
- Sodium
- TDS

As COCs assigned different MTs for drinking water standards and agricultural standards, outlined in the Title 22 drinking water requirements and WQOs from the Basin's WQCP and Irrigated Lands Program, different RMS wells are assessed for different constituents. At public water system (PWS) wells, domestic wells, and monitoring wells associate with the State Water Board Geotracker contamination sites, COCs for Title 22 drinking water requirements are assessed. At agricultural supply wells, WQO COCs for crop health are assessed.

The water quality monitoring network consists of 54 PWS wells, 74 agricultural and domestic supply wells, and 55 monitoring wells. There are 41 PWSs in the Subbasin. Agricultural and domestic supply wells are monitored for COCs under the Irrigated Lands Regulatory Program.

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 that impacts infrastructure. The GSAs will annually assess subsidence using the InSAR data provided by DWR.

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3. Groundwater Elevations (§ 356.2[b][1])

This section provides a report on groundwater elevations in the Basin measured during spring and fall of 2022. Accompanying maps present the most up-to-date seasonal conditions in the Basin.

Data provided characterizes conditions for the two principal aquifers in the Basin – the Alluvial Aquifer and Paso Robles Formation Aquifer. 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 (replacing the current California State Groundwater Elevation Monitoring Program [commonly knowns as, CASGEM] program) 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 Principal Aquifers

Water-bearing sand and gravel beds are generally grouped together into zones that are referred to as aquifers. The aquifers can be vertically separated by fine-grained zones that can impede movement of groundwater between aquifers. As discussed in Section 2, there are two principal aquifers in the Basin:

- **Alluvial Aquifer** – A relatively continuous aquifer comprising alluvial sediments that underlie the Salinas River and tributary streams
- **Paso Robles Formation Aquifer** – An interbedded aquifer comprised of sand and gravel lenses in the Paso Robles Formation

Some of the groundwater level information in this report, such as contour maps, is provided by aquifer.

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

The assessment of groundwater elevation conditions in the Basin as described in the GSP is largely based on data from the county of San Luis Obispo 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 Annual Report. To maintain consistency with the GSP and represent conditions that can be easily compared from year to year, this Annual Report used the same set of wells as was used in the GSP. Groundwater level data from 29 to 30 Paso Robles Formation wells and 33 to 35 alluvial wells are used to create the groundwater elevation contour maps. The well locations and data points are not shown on the maps to preserve confidentiality. Twenty-four wells in the Subbasin are being used as RMS wells for the purpose of monitoring sustainability indicators. Owners of these wells have agreed to allow public use of the well data. As implementation of the GSP progresses, it is anticipated that additional wells will be added to the data set and that some of the wells with current confidentiality agreements will be modified to allow for public use of the data. No wells were added to the monitoring network during the last year.

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 in each principal aquifer. 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. The most recent presentation of groundwater conditions representing the spring and fall for WY 2022 are shown in this section.
- Change in groundwater in storage maps for each principal aquifer are prepared comparing the groundwater elevations between spring 2021 to spring 2022 and fall 2021 to fall 2022 are also shown in Section 7.
- Hydrographs for RMS wells (**Attachment D**).

3.2.1 Alluvial Aquifer Groundwater Elevation Contours

Data from public and private Alluvial Aquifer wells were used for contouring groundwater elevation contour maps for spring and fall for WY 2022 (**Figures 4 and 5**). Contour maps were generated using a computer-based contouring program and checked/modified by a qualified hydrogeologist. Groundwater elevation data deemed unrepresentative of static conditions or obviously erroneous were not used for contouring.

In general, alluvial groundwater elevations range from approximately 950 feet above mean sea level (ft msl) in the Santa Margarita area to approximately 660 to 670 ft msl in the north where the Salinas River exits the Basin. Alluvial groundwater elevations are generally slightly higher in the spring than in the fall.

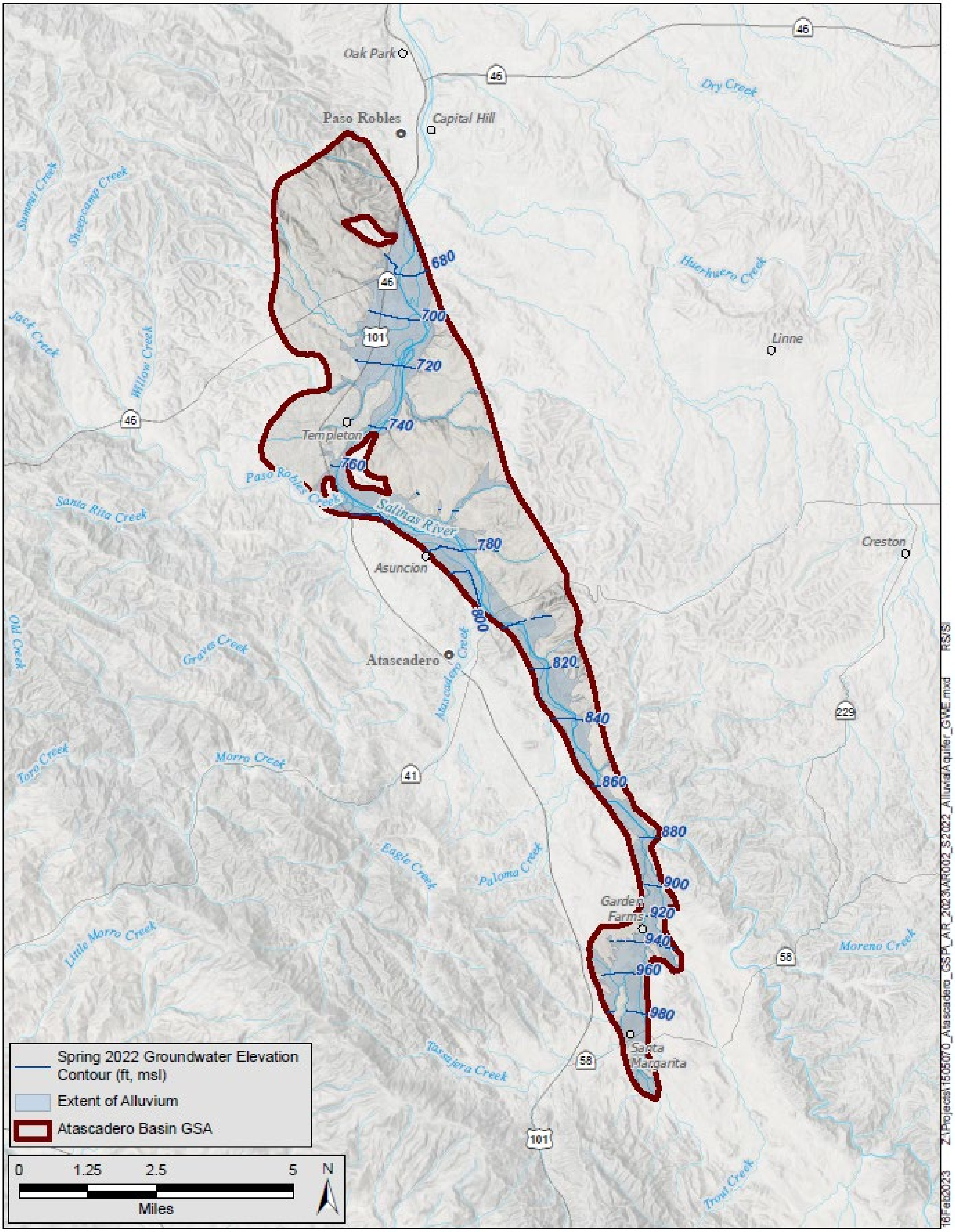

Figure 4: Alluvial Aquifer - Groundwater Elevations Spring 2022

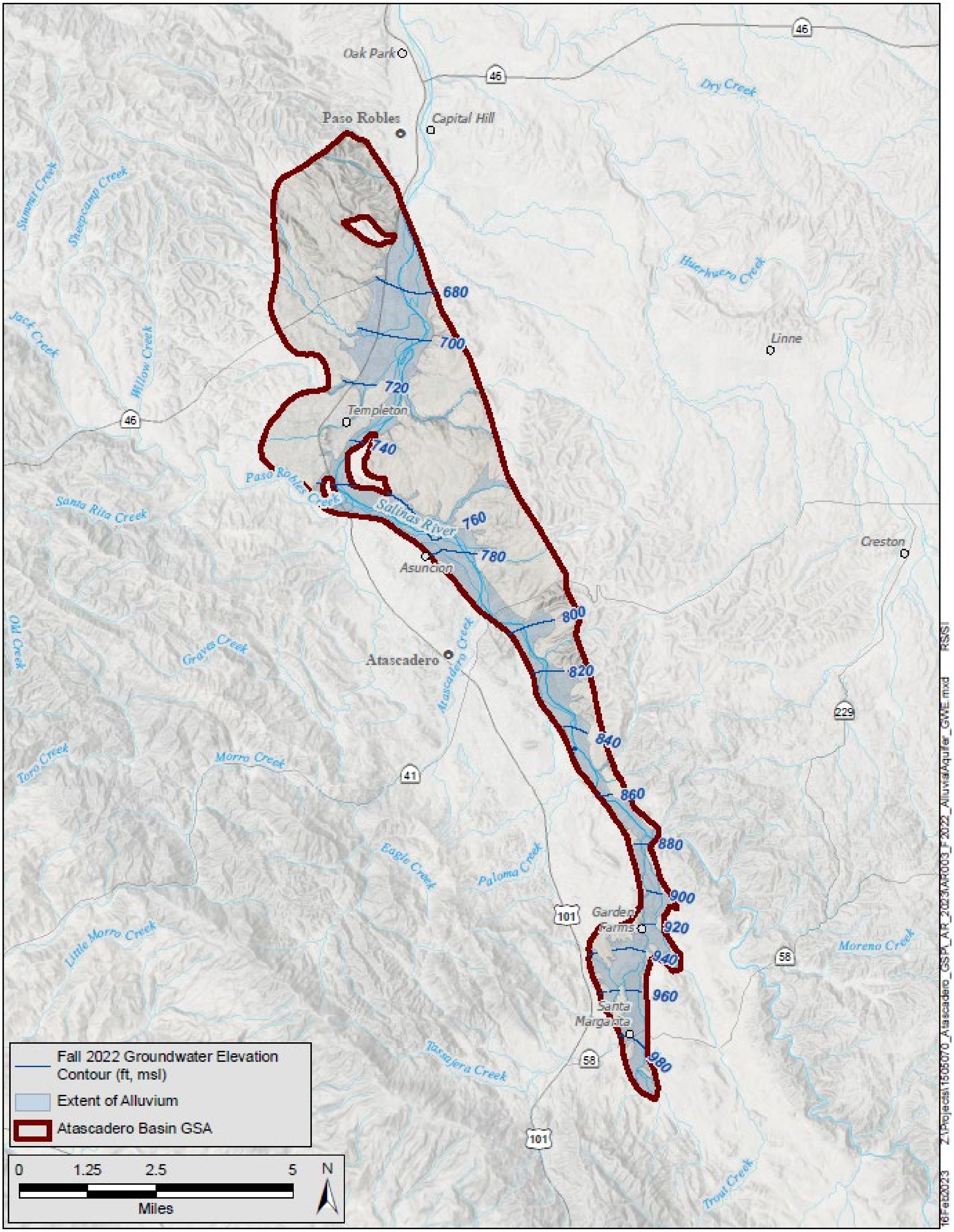

Figure 5: Alluvial Aquifer - Groundwater Elevations Fall 2022

3.2.2 Paso Robles Formation Aquifer Groundwater Elevation Contours

Data from public and private Paso Robles Formation Aquifer wells were used for contouring groundwater elevation contour maps for spring and fall of WY 2022 (**Figures 6 and 7**). Contour maps were generated using a computer-based contouring program and checked/modified by a qualified hydrogeologist. Groundwater elevation data deemed unrepresentative of static conditions or obviously erroneous were not used for contouring.

Groundwater elevations observed in the Paso Robles Formation Aquifer were generally slightly lower in WY 2022 than in WY 2021. Positive and negative changes in groundwater elevations from year to year are observed in different parts of the Subbasin, as has been observed historically. Seasonal trends of slightly higher spring groundwater elevations compared with fall levels continued in each of the water years.

3.3 Hydrographs (§ 356.2[b][1][B])

Groundwater elevation hydrographs for the 24 RMS wells in the Subbasin are presented in **Attachment D**. These hydrographs also include information on well screen interval (if available), reference point elevation, as well as the chronic lowering of groundwater levels MOs and MTs for each well that were developed during the preparation of the GSP.

As described in the GSP, the average of the spring and fall groundwater elevation measurements in any one WY constitutes the value that shall be measured against MTs and MOs established for each RMS well. If only one measurement was taken for the year, then that value alone is measured against the MT and MO.

The 24 RMS hydrographs presented in Attachment D show the measured spring and fall 2022 groundwater elevations. Of the 24 RMS hydrographs presented in Attachment D all the RMS wells exhibit an average of spring and fall 2022 groundwater elevations above the MT.

Hydrographs for the Alluvial Aquifer RMS wells show no discernable long-term trends. Although the Alluvial Aquifer hydrographs typically show declining water levels in response to drought periods, they also demonstrate the ability of the alluvial aquifer to fully recharge during wet periods.

Hydrographs for the Paso Robles Formation RMS wells generally illustrate overall stability of water levels throughout the Subbasin. Although, hydrographs for Paso Robles Formation Aquifer wells completed in the northern part of the Subbasin exhibit a trend of declining water levels since the 1990's, each of the wells show a notable recovery since the end of the recent drought in 2017. Seventeen of the 24 RMS wells have current groundwater elevations greater than the MO for that RMS well.

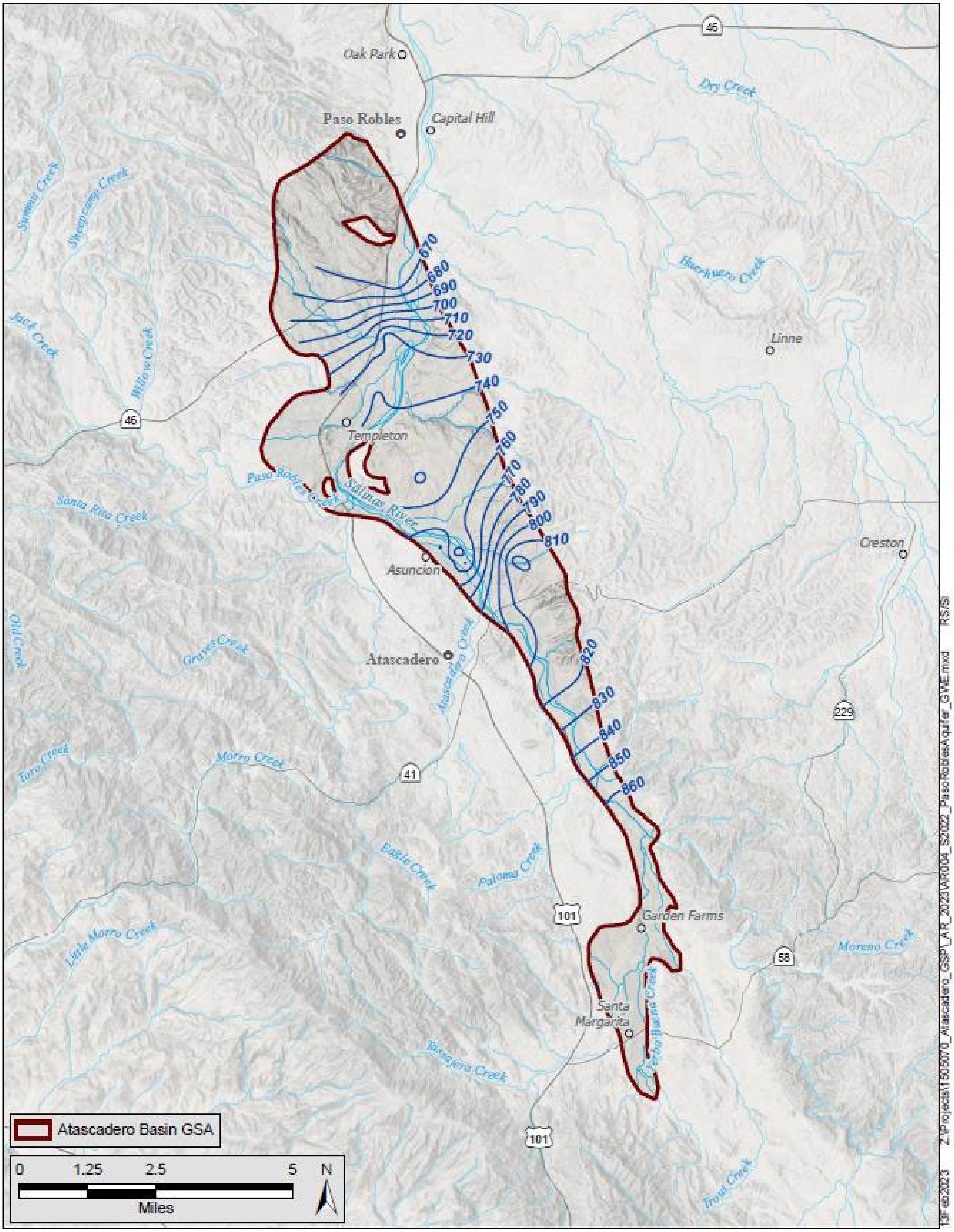

Figure 6: Paso Robles Aquifer - Groundwater Elevations Spring 2022

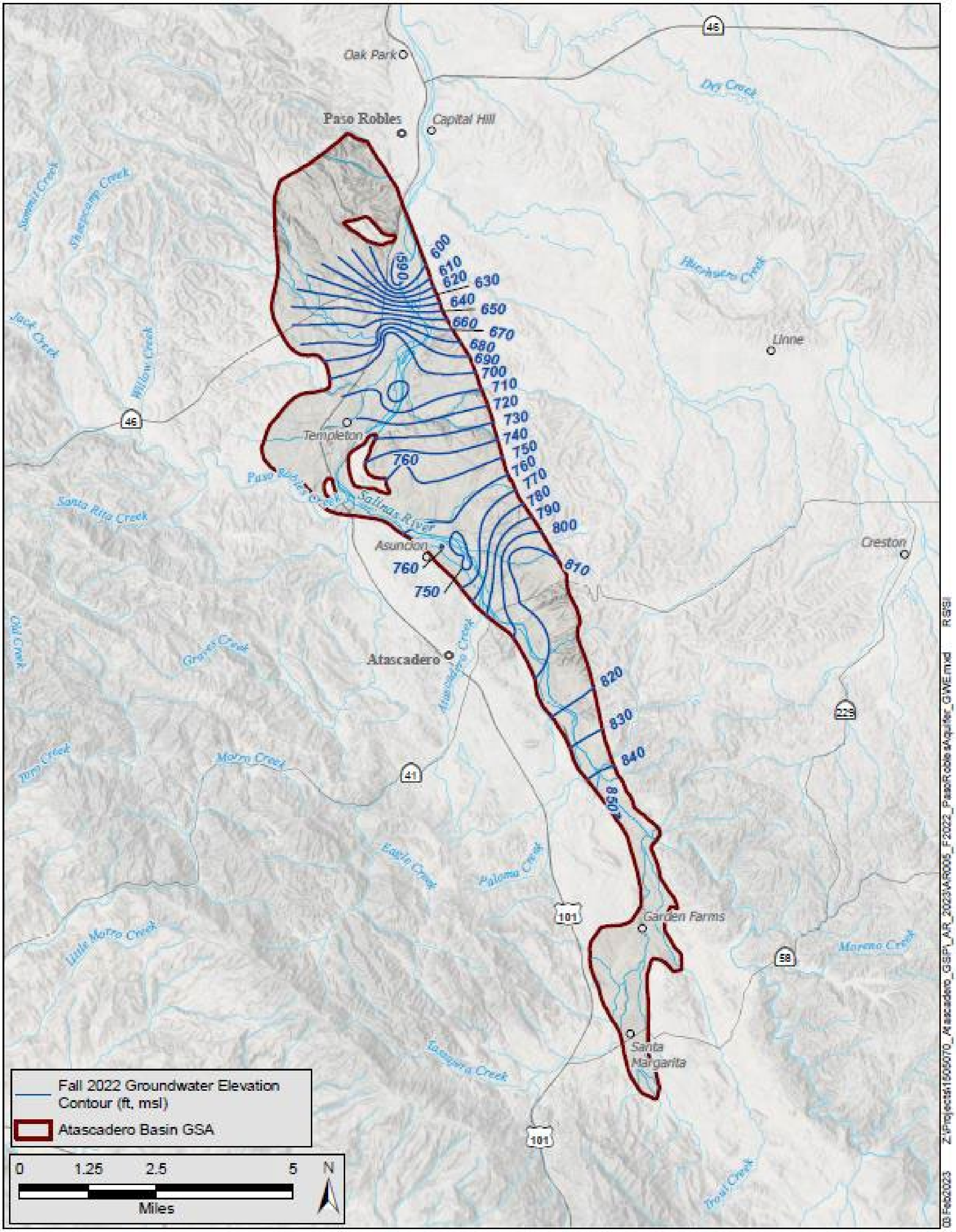

Figure 7: Paso Robles Aquifer - Groundwater Elevations Fall 2022

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4. Groundwater Extraction

This section presents the metered and estimated groundwater extractions from the Basin for WYs 2017 to 2022. The types of groundwater extraction include agricultural, municipal, rural domestic, and small PWSs. **Tables 1 through 5** summarize the groundwater extractions for each WY.

For WY 2022, estimated total groundwater pumping was 16,000 AF. Municipal pumping was the largest component of total groundwater pumping and accounts for about 65 percent of total pumping during the current water budget period. Agricultural pumping accounts for 27 percent of groundwater pumping while PWS and rural domestic pumping account for 8 percent of total average pumping during the current water budget period.

4.1 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, Templeton Community Services District (CSD), AMWC, and the county of San Luis Obispo for Community Service Area 23 (CSA 23), providing service to the community of Santa Margarita. 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 Metered Well Production Data

Water Year	Metered Groundwater Extractions				Total (AF)
	City of Paso Robles[1] (AF)	Templeton CSD (AF)	Atascadero MWC (AF)	CSA 23 (AF)	
2017	2,609	1,207	4,807	137	8,760
2018	3,352	1,396	5,332	147	10,227
2019	3,075	1,308	4,917	142	9,442
2020	3,852	1,395	5,221	143	10,611
2021	3,612	1,531	5,575	143	10,860
2022	3,349	1,424	5,330	138	10,242

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

4.2 Estimate of Agricultural Extraction

To estimate agricultural groundwater extraction, WY 2022 specific land use data from Land IQ was used in conjunction with the OpenET ensemble model.[3] OpenET provides satellite-based estimates of the total amount of water that is transferred from the land surface to the atmosphere through the process of evapotranspiration (ET). The OpenET ensemble model uses Landsat satellite data to produce ET data at a spatial resolution of 30 meters by 30 meters (0.22 acres per pixel). Additional inputs include gridded weather variables such as solar radiation, air temperature, humidity, wind speed, and precipitation (OpenET 2023). OpenET provides estimates of ET for the entire land surface, or in other words, "wall to wall." To produce an estimate of ET specific to the irrigated crop acreage in the Subbasin the OpenET ensemble model results are screened by the Land IQ land use data set, thereby removing the estimated ET volumes associated with bare ground, non-irrigated crops, or native vegetation. A total of nine irrigated crop types were identified in the WY 2022 Land IQ spatial dataset shown on **Figure 8**. Irrigated agricultural crop types were identified by inspection of monthly ET for each mapped crop type versus monthly ET for fallow ground. Essentially, crop types were considered irrigated if monthly ET remained high throughout the latter part of the growing season as opposed to the diminishing monthly ET following the rainy season on fallow ground. ET associated with precipitation events were removed from the analysis by subtracting the volume of rain received (irrigated acreage times decimal feet of spatially variable precipitation received based on gridMET[4]) on a monthly time-step. Applied irrigation volumes are estimated by scaling up the estimated irrigated crop ET volumes using assumed crop specific irrigation efficiency factors.[5] The resulting volumes are summed by water year, which then represent estimated annual agricultural groundwater extraction. Deficit irrigation is captured in the satellite-based method through the measurement of actual ET. Groundwater extractions for frost protection are captured to the extent that the produced water results in increased ET. It is assumed that the remainder of the water produced for frost protection remains within the Subbasin and percolates back to groundwater. The estimated agricultural groundwater extraction volumes are summarized in **Table 2**. The accuracy level rating of these estimated volumes is medium.

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[3] OpenET uses reference ET data calculated using the American Society of Civil Engineers (ASCE) Standardized Penman-Monteith equation for a grass reference surface, and usually notated as 'ETo'. For California, OpenET uses Spatial CIMIS meteorological datasets generated by the California DWR to compute ASCE grass reference ET. OpenET provides ET data from multiple satellite-driven models and calculates a single "ensemble value" from those models. The models currently included are ALEXI/DisALEXI, eeMETRIC, geeSEBAL, PT-JPL, SIMS, and SSEBop. More information about these models can be found at: https://openetdata.org/methodologies/. All of the models included in the OpenET ensemble have been used by government agencies with responsibility for water use reporting and management in the western U.S., and some models are widely used internationally (OpenET 2023).

[4] gridMET is a public domain dataset of daily high-spatial resolution (~4-km, 1/24th degree) surface meteorological data covering the contiguous United States from 1979-yesterday (https://www.climatologylab.org/gridmet.html). The methodology behind gridMET is described in Abatzoglou (2013).

[5] Irrigation efficiencies were assigned based on FAO (1989) and Martin (2011). Vineyard, the dominant crop in the Subbasin was assigned an irrigation efficiency of 90%.

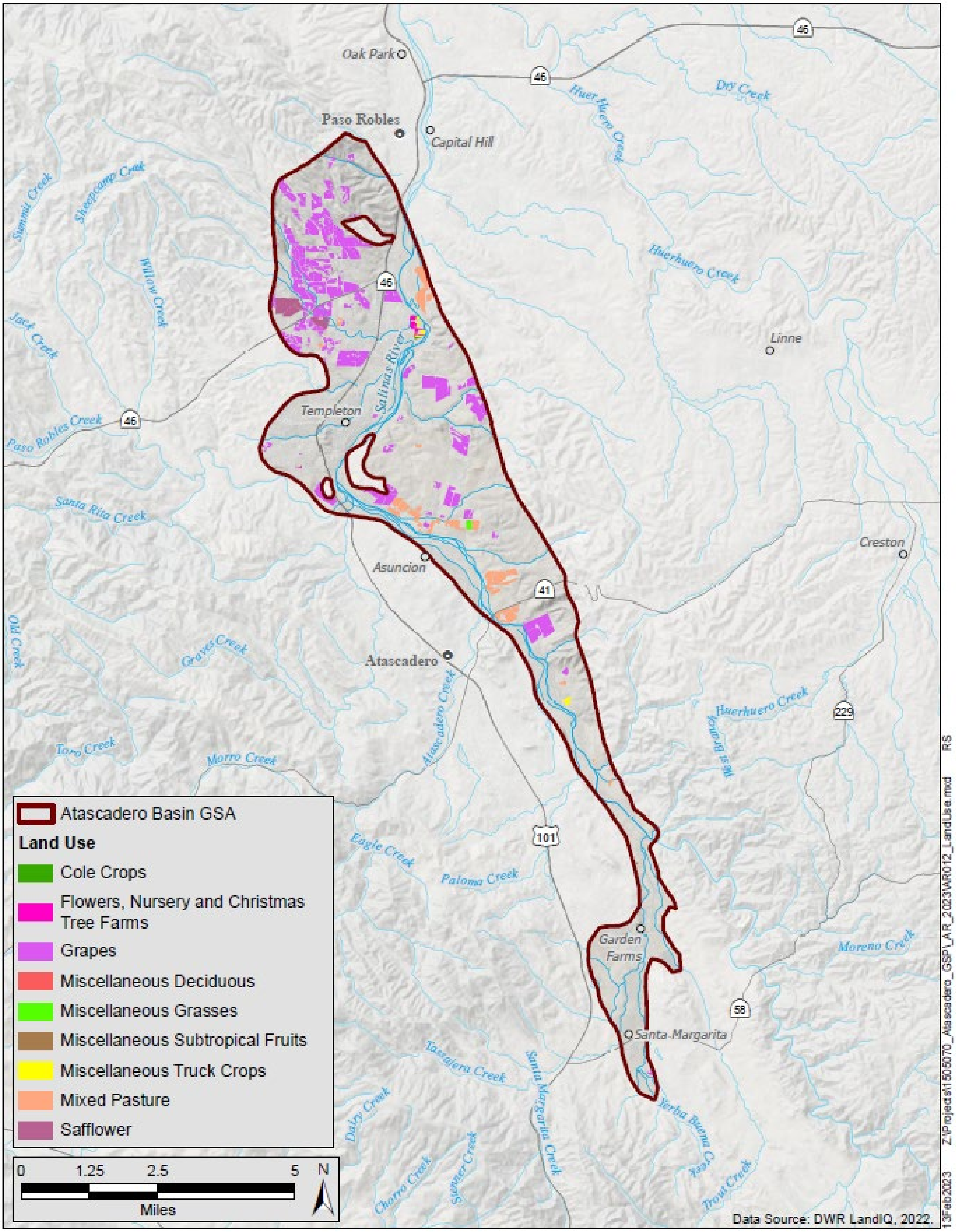

Figure 8: Existing Land Use Designations

Table 2: Estimated Agricultural Irrigation Groundwater Extractions

Water Year	Agricultural Demand (AF)
2017	4,900
2018	4,300
2019	5,000
2020	4,700
2021	4,500
2022	4,500

Note: AF = acre-feet

4.3 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.

4.3.1 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 (GEI/GSI 2022) 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 a 1 percent annual growth rate in rural domestic water demand from WY 2016 going forward. Therefore, the rural domestic demand volumes presented in this annual report are based on the same assumption. The 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 (Acre Feet)
2017	493
2018	498
2019	503
2020	508
2021	514
2022	519

4.3.2 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 et al. 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 golf courses was estimated using reference ET 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 (GEI 2022) assumes a 1 percent annual growth rate in small PWS water demand from WY 2016 going forward. Therefore, the small PWS demand volumes presented in this annual report are based on the same assumption. The 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	712
2018	720
2019	727
2020	734
2021	738
2022	743

Note: AF = acre-feet

4.4 Total Groundwater Extraction Summary

Total groundwater extractions in the Subbasin for water year 2022 is 16,000 AF. **Table 5** summarizes the total water 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 year (*see* **Figure 9**).

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	8,760	1,206	4,900	14,900
2018	10,227	1,218	4,300	15,700
2019	9,442	1,230	5,000	15,700
2020	10,611	1,243	4,700	16,600
2021	10,860	1,252	4,500	16,600
2022	10,242	1,262	4,500	16,000
Method of Measure	Metered	2016 Groundwater Model	Soil- Water Balance Model, OpenET (2021 and 2022 only)	
Level of Accuracy	high	low-medium	medium	

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

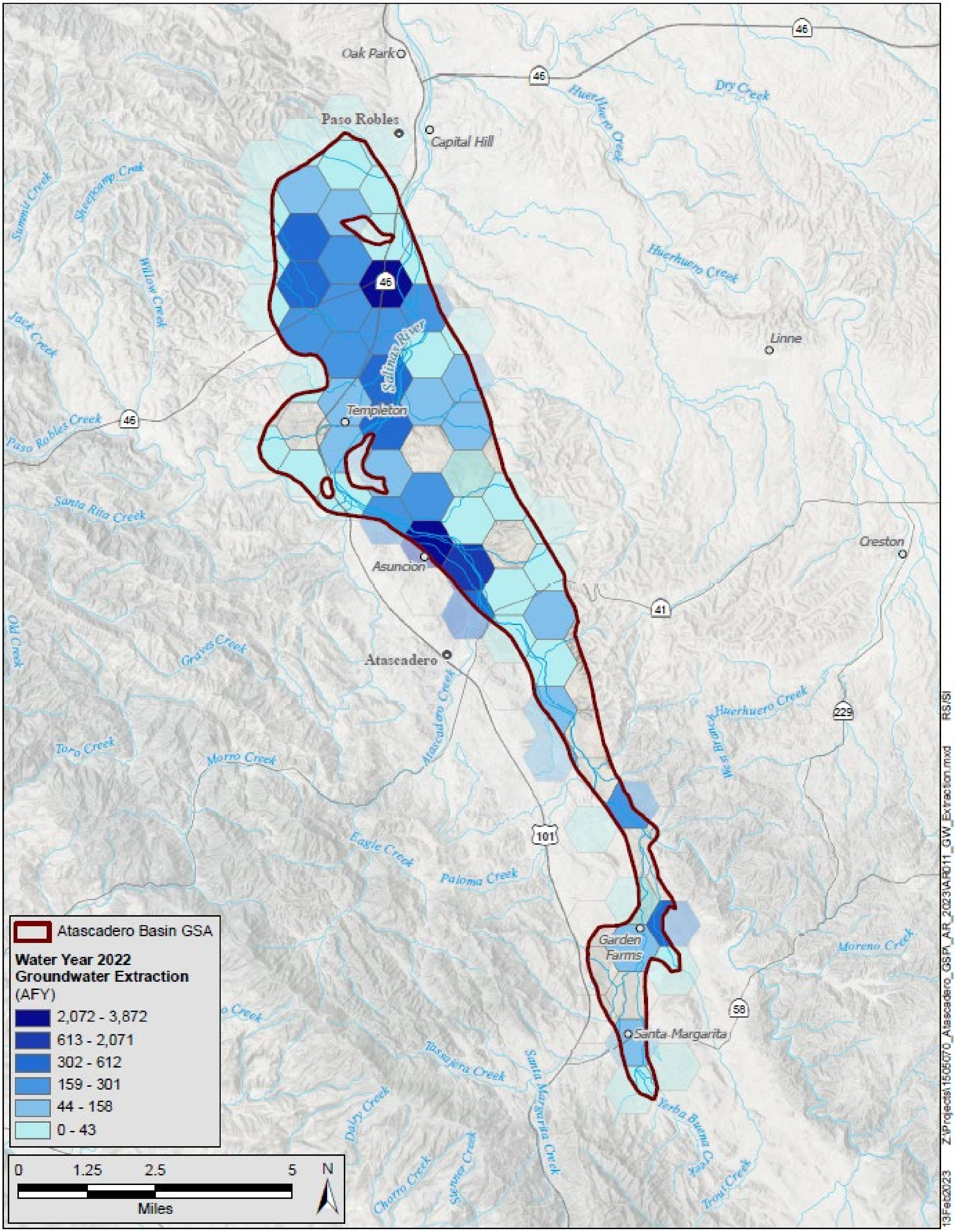

Figure 9: General Locations and Volumes of Groundwater Extraction

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5. Surface Water Use

This section addresses the reporting requirement of providing surface water supplies used, or available for use, and describes the annual volume of sources for the WY 2022. The method of measurement and level of accuracy is rated on a qualitative scale. As described in the GSP (Section 6.3.1), the Basin relies on two surface water source types: local imported supplies and local supplies.

Imported supplies are provided via the Nacimiento Water Project (NWP) regional raw water transmission facility delivers water from Lake Nacimiento to communities in the Basin, including Atascadero MWC, Templeton CSD, and the city of Paso Robles. **Figure 10** identifies the communities within the Atascadero Basin that have access to surface water. Within the Basin, all three municipal purveyors utilize their imported NWP water to recharge the Basin *via* percolation ponds or direct discharge located in the Alluvium adjacent to the Salinas River [6].

- Templeton CSD has an allocation of 406 AFY of NWP water and began taking deliveries in 2011. A total of 74 AF was taken by Templeton CSD in 2011 and constitutes the only NWP deliveries in the historical period (water budget period ending in year 2011) presented in the 2022 GSP.
- Atascadero MWC and the city of Paso Robles began taking deliveries in 2012 and 2013, respectively.

Local surface water supplies include surface water flows that enter the Basin from precipitation runoff within the watershed and Salinas River inflow to the Basin (including releases from the Salinas Reservoir). Annual inflow from these sources is estimated at 90,600 AF with the largest component being releases and flow in the Salinas River.

5.1 Surface Water Available for Use

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

[6] The city of Paso Robles utilizes their NWP allocation in two ways: treatment in a package water treatment plant and applying directly to the ground surface on the alluvial gravels of the Salinas River floodplain in the north end of the Basin. The treated portion of NWP water is used outside of the Basin and is therefore not considered.

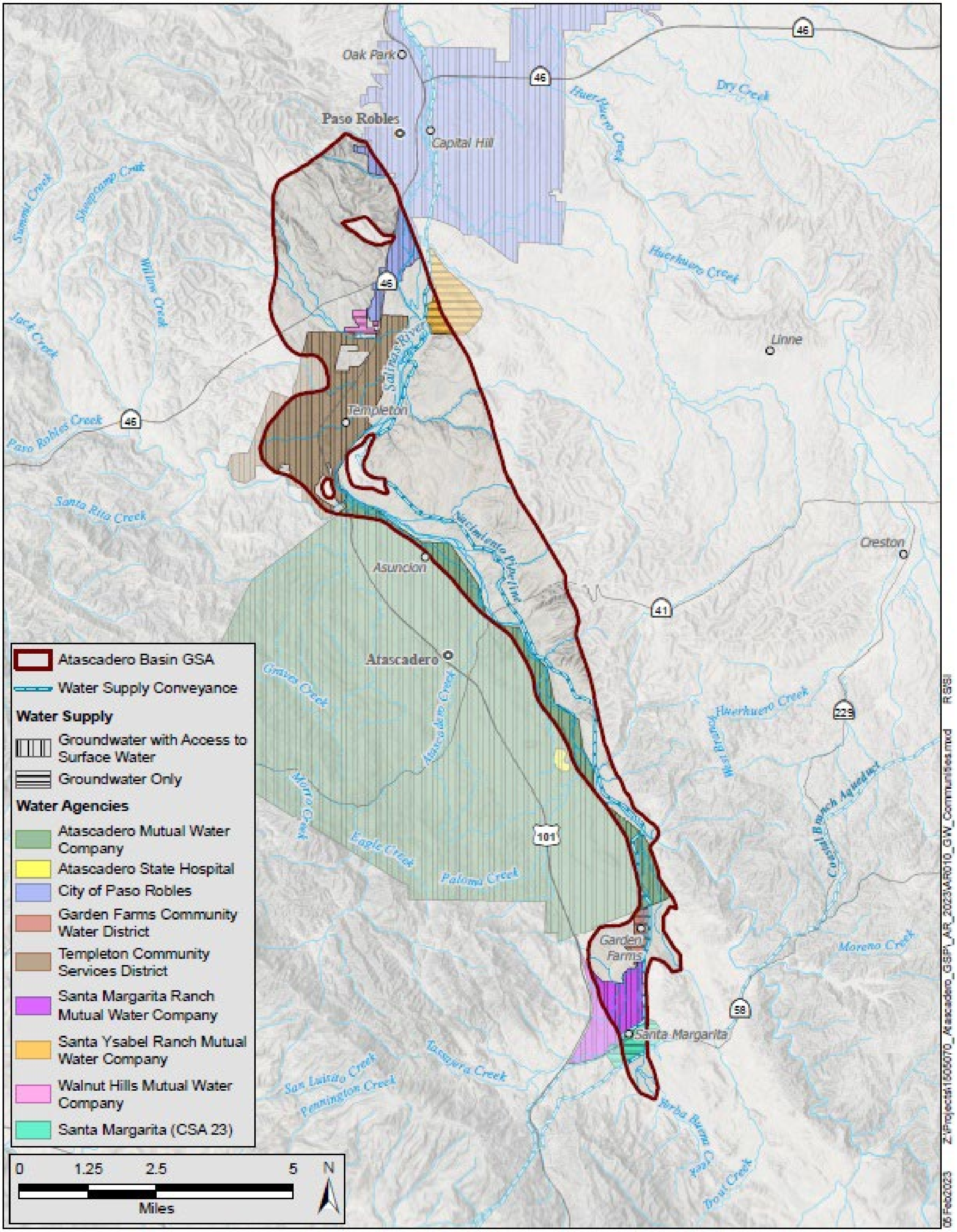

Figure 10: Communities Dependent on Groundwater and with Access to Surface Water

Table 6: Surface Water Available for Use

Water Year	Nacimiento Water Project			Total (AF)
	City of Paso Robles[1] (AF)	Templeton CSD[2] (AF)	Atascadero MWC[3] (AF)	
2017	6,488	406	3,244	10,138
2018	6,488	406	3,244	10,138
2019	6,488	406	3,244	10,138
2020	6,488	406	3,244	10,138
2021	6,488	406	3,244	10,138
2022	6,488	406	3,244	10,138

Notes:
[1] Contract annual entitlement to the city of Paso Robles. Note that city of Paso Robles uses Nacimiento Water Project water in both the Atascadero and Paso Robles Subbasins
[2] Contract annual entitlement to Templeton CSD
[3] Contract annual entitlement to Atascadero Mutual Water Company
AF = acre-feet
CSD = community services district
MWC = mutual water company

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

Table 7: Total Surface Water Use

Water Year	Nacimiento Water Project			Total (AF)
	City of Paso Robles[1] (AF)	Templeton CSD (AF)	Atascadero MWC (AF)	
2017	134	274	0	408
2018	862	258	854	1,974
2019	356	157	47	560
2020	804	0	1,372	2,176
2021	746	97	2,218	3,061
2022	1,012	131	1,945	3,088

Notes:
[1] The city of Paso Robles uses Nacimiento Water Project water in both the Atascadero Subbasin and the Paso Robles Subbasin. Only the portion used in the Atascadero Subbasin is included here.
AF = acre-feet
CSD = community services district
MWC = mutual water company

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6. Total Water Use

This section summarizes the total annual groundwater and surface water used to meet municipal, agricultural, and rural demands within the Basin. For the 2022 water year, 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 annual water use in the Basin by source and water use sector. The method of measurement and level of accuracy for each estimate is rated on a qualitative scale of low, medium, and high.

Table 8: Total Annual Water Use by Source and Water Use Sector

Water Year	Municipal (AF)		PWS and Rural Domestic (AF)	Agriculture (AF)	Estimated Total (AF)
Source:	Groundwater	Surface Water	Groundwater	Groundwater	
2017	8,760	408	1,206	4,900	15,300
2018	10,227	1,974	1,218	4,300	17,700
2019	9,442	560	1,230	5,000	16,200
2020	10,611	2,176	1,243	4,700	18,700
2021	10,860	3,061	1,252	4,500	19,700
2022	10,242	3,088	1,262	4,500	**19,100**
Method of Measure:	Metered	Metered	2016 Groundwater Model	Soil- Water Balance Model, OpenET (2021 and 2022 only)	
Level of Accuracy:	high	high	low-medium	medium	

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

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7. Change in Groundwater Storage

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

Annual changes in groundwater elevation are derived from comparison of fall groundwater elevation contour maps from one year to the next. For WY 2022, the fall 2021 groundwater elevations were subtracted from the fall 2022 groundwater elevations in both principal aquifers, resulting in maps depicting the changes in groundwater elevations that occurred during WY 2022. These groundwater elevation change maps are based on a reasonable and thorough analysis of the currently available data.

7.1.1 Alluvial Aquifer

Figure 11 shows the change in groundwater elevation for the Alluvial Aquifer from 2021 to 2022. There is a general decline in groundwater levels in the Alluvial Aquifer throughout the Basin, with the greatest decline occurring in the northern portion of the Basin. There are very small pockets of increasing water levels east of Asuncion and Atascadero.

7.1.2 Paso Robles Formation Aquifer

Figures 12 shows changes in groundwater elevations from 2021 to 2022, the most recent period evaluated. Slight declines in water levels were observed in the north and south portions of the Basin while water level increases was observed near Asuncion.

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

The groundwater elevation change maps presented above represent a volume change within each principal aquifer for each water year. The volume change depicted on each map 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 Paso Robles Subbasin GSP (Montgomery 2020), S is estimated to be 7 percent for the Paso Robles Formation Aquifer.[7] The aquifer storage coefficient value used for the Alluvial Aquifer is 20 percent[8]. The annual change of groundwater in storage calculated for WY 2022 is presented in **Table 9** and the annual and cumulative change in groundwater in storage since 1981 are presented on **Figure 13**.

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[7] Attachment B includes derivation of the storage coefficient from the Paso Robles Subbasin GSP groundwater model files and a sensitivity analysis as documented in the Paso Robles Subbasin First Annual Report (GSI 2020).

[8] In the case of the alluvial aquifer, the aquifer storage coefficient is equivalent to the specific yield, a unitless factor, which is estimated to be 20%.

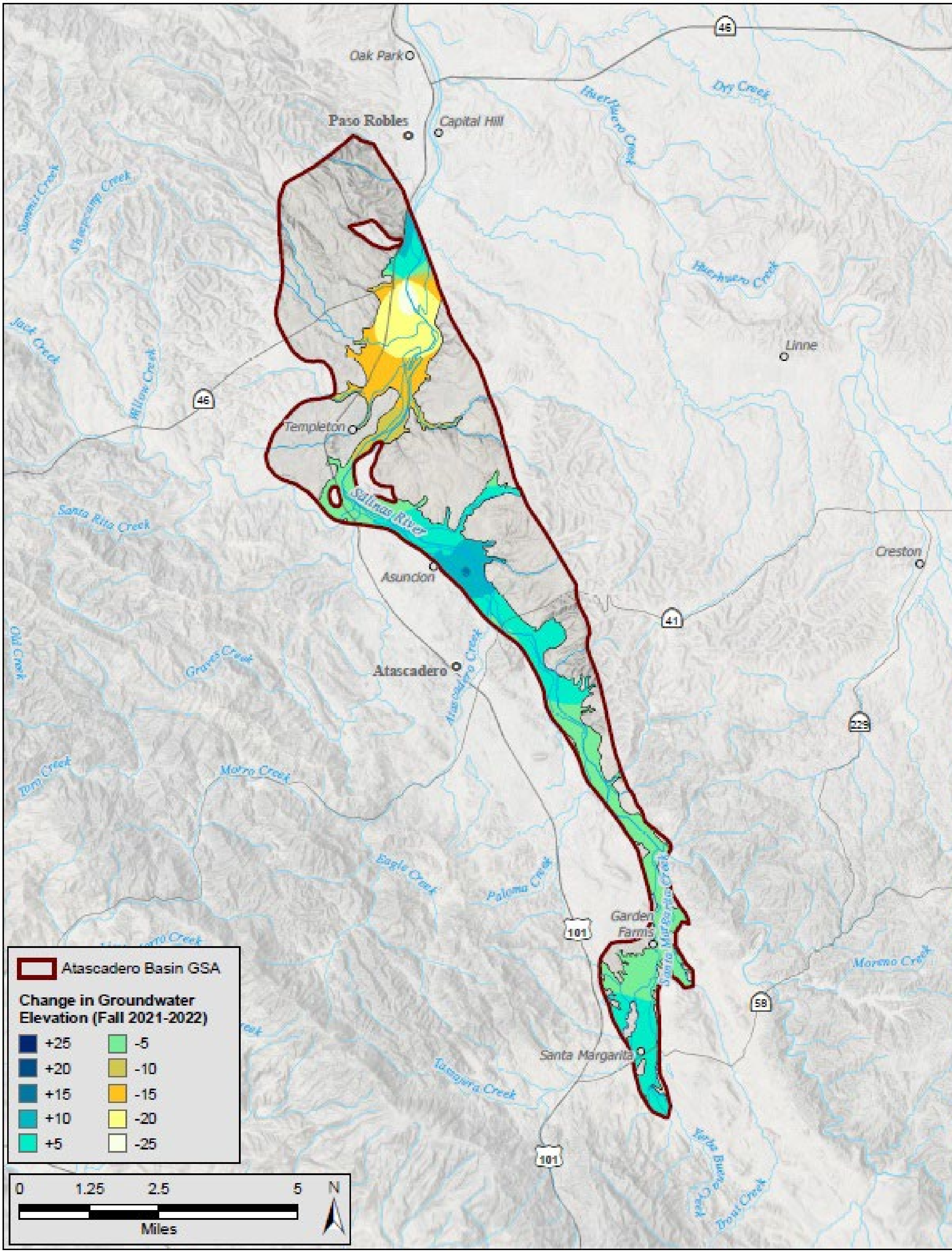

Figure 11: Alluvial Aquifer Change in Groundwater Elevation (Fall 2016 - Fall 2017)

Table 9: Annual Change in Storage

Water Year	Annual Change (AF)
2017	14,600
2018	-5,400
2019	4,300
2020	100
2021	-5,200
2022	-8,000

Note: AF = acre-feet

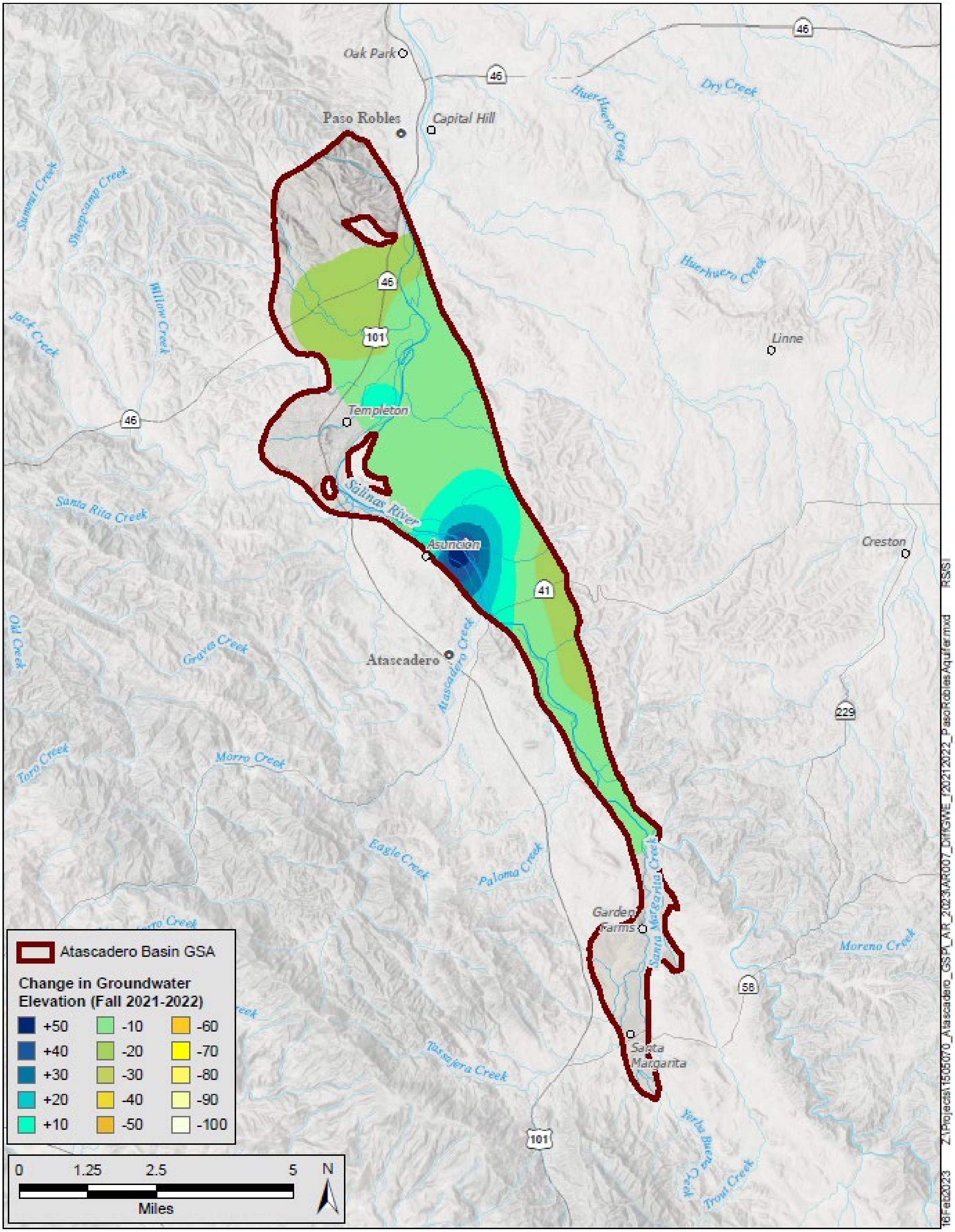

Figure 12: Paso Robles Aquifer Formation Change in Groundwater Elevation (Fall 2021 to Fall 2022)

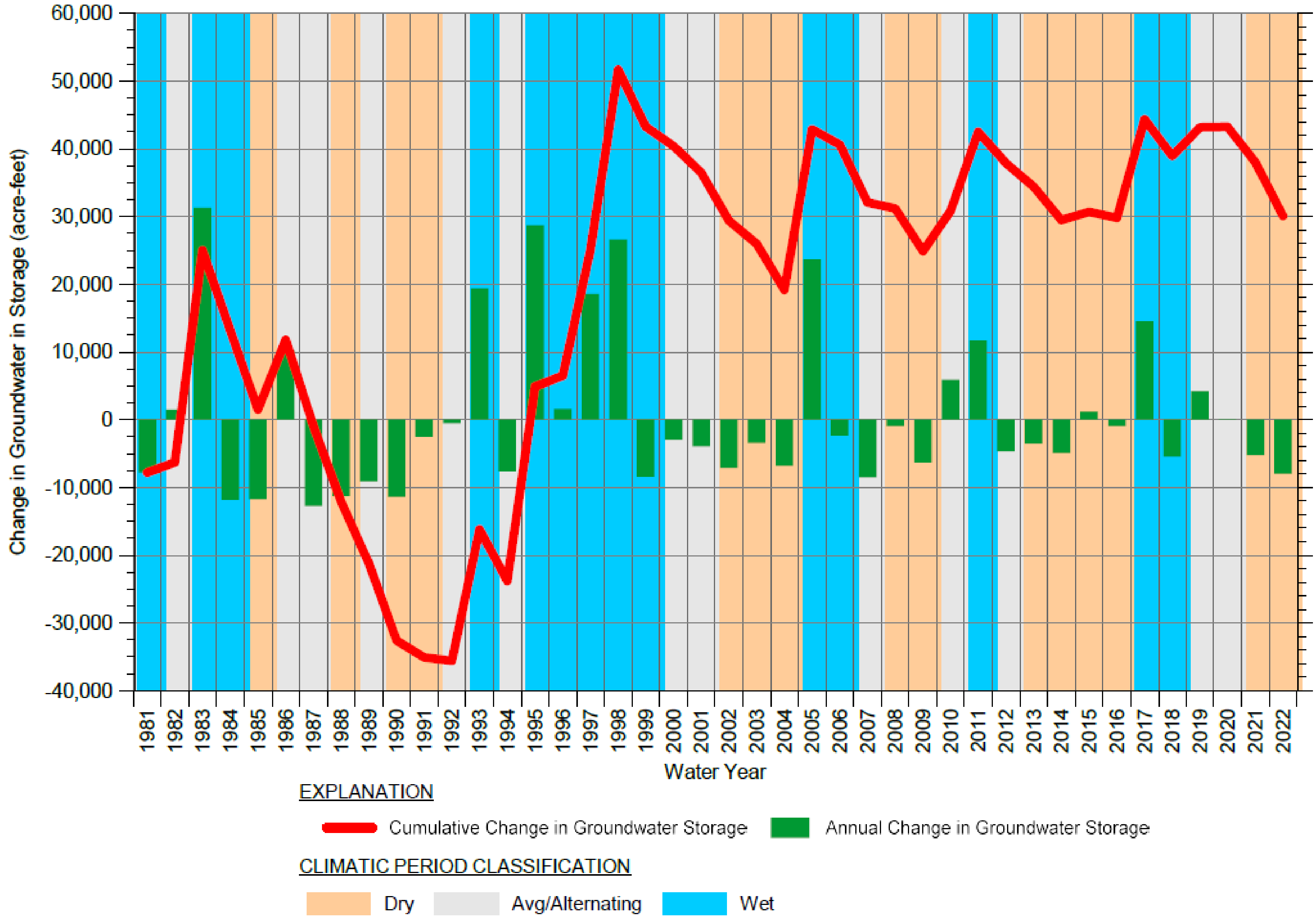

Figure 13: Estimated Annual and Cumulative Change in Storage

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8. Progress Towards Implementing the GSP

8.1 Introduction

The participating agencies of the Basin's GSA agree to work together to protect the groundwater resources of the Basin to meet the current and future beneficial uses in the Basin by developing a GSP that conforms with the requirements of the SGMA.

The hydrologic conditions and hydrogeologic setting of the Basin and ongoing proactive water management have demonstrated the resilient nature of the Basin and avoidance of groundwater overdraft conditions. As a result, the DWR has designated the Basin as very low basin priority that is being sustainably managed.

Because the Basin is currently being managed sustainably, as evidenced by historic groundwater levels in the Basin, there are no projects or management actions that are required to achieve sustainability. Several management actions and conceptual projects were included in the GSP to provide a means to ensure the Basin is operated to maintain its sustainable yield and sustainability.

This section describes the project and management actions that are in progress, recently implemented, or anticipated in the Basin to maintain sustainability and address data gaps.

8.2 Implementation Approach

Because the Basin is currently being managed sustainably, implementation of additional project and management actions to reach or maintain sustainability are not necessary at this time. However, project and management actions are being taken to address identified data gaps in the GSP and develop a more complete model of the Basin. This projects and management actions are being implemented both at a Basin-wide scale and at smaller area-specific scales.

8.3 Basin-Wide Management Actions and Projects

8.3.1 DWR Aerial Electromagnetic Surveys

DWR has completed the process of conducting an airborne electromagnetic (AEM) survey to provide high and medium priority basins with additional geologic data to use in furthering the hydrogeologic conceptual model of their basins and promote sustainable groundwater management. The AEM survey uses magnetic fields to map the resistivity of subsurface material. These resistivity values are used in conjunction with local geologic data to ground truth resistivity values to geologic material. The Basin was flown during larger survey efforts in August of 2021. This data was used to further refine the Basin's GSP and the hydrogeologic conceptual model that supported the development of the Atascadero Basin groundwater model.

8.3.2 Expanded Groundwater Monitoring Network

The GSA is currently working to expand the existing groundwater monitoring network to fill in data gaps and create a more robust network. Existing wells have been identified to fill the data gaps and the GSA is working to obtain permission from well owners for inclusion in the RMS network. These wells include private agricultural and domestic supply wells. Additionally, the GSA is investigating the need for new monitoring wells to supplement the groundwater level monitoring network.

8.3.3 Groundwater Model Update

The historical and projected future water budgets presented in the GSP are informed by the existing Paso Basin groundwater model (existing GW model), which includes the Atascadero Basin area. Although the existing GW model was the best tool available at the time of GSP preparation, there are several issues with the existing GW model that render it sub-optimal for use in the Atascadero Basin. The primary issues related to the HCM are that 1) the existing GW model domain does not cover the entirety of the Atascadero Basin, and 2) the existing model grid cell size is coarse relative to the size of the Atascadero Basin.

During WY2022, the GSA initiated efforts to develop the groundwater model for the Atascadero Basin. This included updating the Basin's hydrogeologic conceptual model through development of a three-dimensional(3D) geologic model (geologic model).

8.3.4 Atascadero Basin Data Management System Update

During the development of the GSP, a data management system was developed for the Atascadero Basin. During WY 2022, an update of the DMS was initiated to provide additional functionality to the DMS. This update includes the addition of modules to support the preparation of SGMA Annual Reports and improved well hydrograph functionality, and an updated user's manual.

8.4 Area-Specific Projects

There are no area-specific projects being implemented at this time.

8.5 Summary of Progress toward Maintaining Basin Sustainability

Relative to the basin conditions at the end of the study period as reported in the GSP, this Second Annual Report (WY 2021–2022) indicates the Basin is still being managed in a sustainable fashion. There are fluctuations in groundwater levels, but elevations have been maintained above the MTs at all RMS locations. Continued evaluation of the Basin through Annual Reports, and implementation of projects and management actions, work to ensure the Basin continues to achieve sustainability.

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 (GEI 2022). 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 zero historical subsidence in the Subbasin based on data provided by DWR depicting the difference in InSAR measured ground surface elevations between June 2015 and June 2018. Likewise, the first annual report (GEI 2022) documents zero subsidence in the Subbasin between June 2018 and October 2020.

Updated Interferometric Synthetic Aperture Radar (InSAR) data has been provided by DWR through October 2022, allowing for analysis of potential land subsidence for both WY 2021 and WY 2022. 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 October 2020 through October 2021 InSAR and the October 2021 through October 2022 InSAR data show that zero land subsidence has occurred since October 2020 in **Figure 14**. 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.

8.5.2 Interconnected Surface Water

Although the Alluvial Aquifer hydrographs presented in **Attachment D** typically show declining water levels in response to drought periods, they also demonstrate the ability of the Alluvial Aquifer to fully recharge during wet periods. Based on this long-term stability of groundwater elevations exhibited in the Alluvial Aquifer RMS wells it appears that no long-term interconnected surface water depletion is occurring in the Basin.

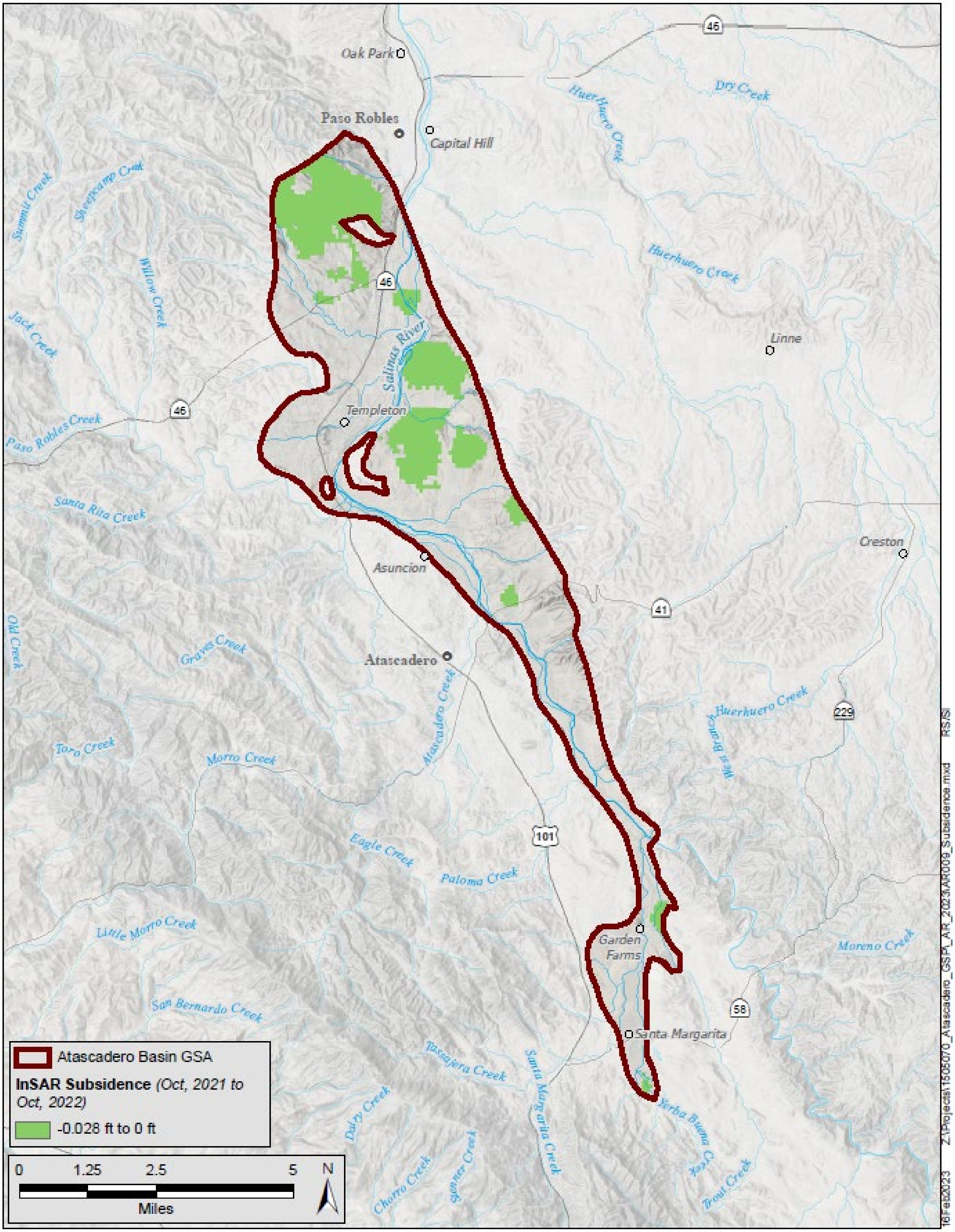

Figure 14: Land Subsidence Measured by InSAR

8.5.3 Groundwater Quality

Although groundwater quality is not a primary focus of SGMA, actions or projects undertaken 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 (GEI 2022). Five constituents of concern (COC's) were identified and discussed in the GSP. These COC's identified in the GSP are total dissolved solids (TDS), sodium, chloride, nitrate, and boron. For this annual report, concentrations of these five COC's were analyzed for WY 2022 using data from the GeoTracker Groundwater Ambient Monitoring and Assessment (GAMA) Program database (GAMA 2023). All of the COC's reviewed show a steady concentration trend since 2016.

Overall, there are no significant changes to groundwater quality since 2016, as documented in the GSP. Implementation of sustainability projects and/or management actions, as presented in the GSP, in this 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

Groundwater elevations have remained relatively consistent. While fluctuations are observed between years based on climatic conditions, groundwater elevations remain consistent with the historical record and no threshold exceedances occurred. Similarly, groundwater in storage in the Basin remained relatively constant, with fluctuations due to climatic conditions observed. 2018 and 2020 showed declines in storage of approximately 5,000 to 5,500 AF while 2017 (significant increase of approximately 15,000 AF) 2018, and 2019 showed increases in groundwater storage. These fluctuations are within the historical record. The volume of groundwater extractions in the Subbasin has remained relatively consistent with a slight upward trend (averaging between 15,000 and 16,000 AFY; Section 4.4) This slight increased has not manifested as a significant change to groundwater levels or groundwater in storage.

8.5.5 Summary of Impacts of Projects and Management Actions

As of this Annual Report, projects and management actions have yet to be implemented in the Basin at a level impacting the management of the Basin. The AEM survey and efforts to enhance the monitoring network shall be furthered during GSP implementation with the results documented in subsequent annual reports and incorporated in GSP updates. Additional projects and management actions, as outlined in the GSP, shall be implemented if deemed necessary to maintain groundwater sustainability in the Basin.

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9. References

California Department of Water Resources (DWR). 2016. California's Groundwater: Bulletin 118 Interim Update.

Carollo, RMC Water and Environment, Water Systems Consulting Inc., 2012. Paso Robles Groundwater Basin Supplemental Supply Options Feasibility Study: unpublished consultant report prepared for San Luis Obispo County Flood Control and Water Conservation District.

Fugro West, Cleath and Associates (Fugro). 2002. Paso Robles Groundwater Basin Study Phase I: unpublished consultant report prepared for the San Luis Obispo County Flood Control & Water Conservation District.

GAMA. 2022. California Water Boards Groundwater Information System. http://geotracker.waterboards.ca.gov/gama/gamamap/public/

GEI Consultants, Inc., GSI. 2022. Atascadero Basin Groundwater Sustainability Plan: Prepared for the Atascadero Basin Groundwater Sustainability Agency. January 2022.

GEI Consultants, Inc., GSI. 2022. Water Year 2022 Annual Report for the Groundwater Sustainability Plan for the Atascadero Basin

Geoscience Support Services, Inc. (GSSI). 2014. Paso Robles Groundwater Basin Model Update: unpublished consultant report prepared for the San Luis Obispo County Flood Control and Water Conservation District, December 19, 2014.

_____. 2016. Refinement of the Paso Robles Groundwater Basin Model and Results of Supplemental Water Supply Options Predictive Analysis, December 2016.

GSI. 2020. Paso Robles Subbasin First Annual Report (2017-2020). March 2020.

Montgomery & Associates, Inc. (M&A). 2020. Paso Robles Subbasin Groundwater Sustainability Plan. Prepared for the Paso Robles Subbasin Cooperative Committee and the Groundwater Sustainability Agencies. November 13, 2019.

OpenET, 2022. OpenET, Filling the Biggest Data Gap in Water Management. https://openetdata.org/, accessed January 2022.

Todd Engineers. 2009. Evaluation of Paso Robles Groundwater Basin Pumping – Water Year 2006: unpublished consultant report prepared for the San Luis Obispo County Flood Control and Water Conservation District.

Torres, Gil. 1979. Staff Report on Hydrogeologic Conditions Pertinent to Permit 5882 (Application 10216) of the City of San Luis Obispo, Diversion from Salinas River at Salinas Dam, San Luis Obispo County, in California State Water Resources Control Board, Prehearing engineering staff analysis for the protested application on tributaries to Salinas River (Salinas Dam to Nacimiento River) San Luis Obispo and Monterey Counties: typed document, Appendix B.

World Meteorological Organization (WMO). 2012. Standardized Precipitation Index User Guide (M. Svoboda, M. Hayes and D. Wood). (WMO-No. 1090), Geneva.