Eastern Management Area Groundwater Sustainability Agency

Santa Ynez River Valley Groundwater Basin – Eastern Management Area First Annual Report (2019–2021)

March 21, 2022

EMA
Santa Ynez River Valley Groundwater Basin
Eastern Management Area
Groundwater Sustainability Agency

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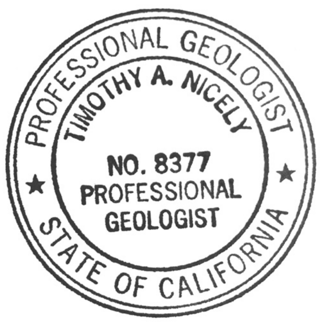
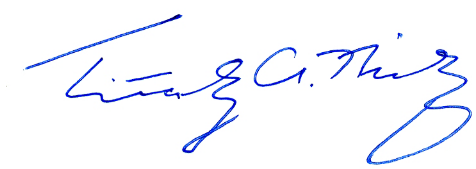
Santa Ynez River Valley Groundwater Basin
Eastern Management Area
First Annual Report (2019–2021)

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

AF	acre-feet
AFY	acre-feet per year
Basin	Santa Ynez River Valley Groundwater Basin
CGPS	Continuous Global Positioning System
COC	constituent of concern
COGG	California Oil, Gas, and Groundwater
DDW	Division of Drinking Water
DWR	California Department of Water Resources
EMA	Santa Ynez River Valley Groundwater Basin – Eastern Management Area
ET	evapotranspiration
ft/ft	feet per foot
GDE	groundwater-dependent ecosystem
gpm	gallons per minute
GSI	GSI Water Solutions, Inc.
HCM	hydrogeologic conceptual model
ID No. 1	Santa Ynez River Water Conservation District, Improvement District No. 1
ILRP	Irrigated Lands Regulatory Program
InSAR	Interferometric Synthetic Aperture Radar
MCL	maximum contaminant level
Plan	Groundwater Sustainability Plan
RMS	representative monitoring site
San Antonio Groundwater Basin	San Antonio Creek Valley Groundwater Basin
SGMA	Sustainable Groundwater Management Act
SMCL	secondary maximum contaminant level
SWP	State Water Project
SWRCB	State Water Resources Control Board
UNAVCO	University NAVSTAR Consortium

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Executive Summary (§ 356.2[a])

ES-1 Introduction

The 2021 Annual Report for the Santa Ynez River Valley Groundwater Basin (Basin) Eastern Management Area (EMA) has been prepared in accordance with the Sustainable Groundwater Management Act (SGMA) regulations.

Following adoption and submittal of the EMA Groundwater Sustainability Plan (Plan) (GSI, 2022) by January 31, 2022, the EMA Groundwater Sustainability Agency (EMA GSA) is required to submit an Annual Report for the preceding water year (October 1 through September 30) to the California Department of Water Resources (DWR) by April 1, 2022. Because this is the first Annual Report for the EMA, this report documents and updates data from October 1, 2018 (the reporting period for the Plan included water years 1981 through 2018) through September 30, 2021.

This Annual Report includes the following sections:

- **Section 1: Introduction.** A brief background of the formation and activities of the EMA GSA and development and submittal of the Plan.
- **Section 2: 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 contours for seasonal high and low groundwater elevations and representative hydrographs.
- **Section 4: Groundwater Extractions (§ 356.2[b][2]).** Compilation of metered, self-reported, and estimated groundwater extractions by land use sector and approximate locations of extraction.
- **Section 5: Surface Water Supply (§ 356.2[b][3]).** Summary of the volume of surface water use that occurs in the EMA.
- **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 annual groundwater elevation differences.
- **Section 8: Progress toward Basin Sustainability (§ 356.2[c]).** A summary of management actions taken throughout the EMA and by individual entities toward sustainability of the EMA's Plan.
- **Section 9: References.**

ES-2 Groundwater Elevations

Generally, groundwater levels have declined somewhat from the spring 2018 levels presented in the Plan. The groundwater elevations in the Paso Robles Formation have declined modestly during the reporting period: groundwater elevations have dropped an average of 5 feet in the representative Paso Robles Formation Wells between the spring of 2019 and 2020 and an additional 2 feet in the spring of 2021. The groundwater elevations in the representative Careaga Sand wells have declined during the reporting period by an average of 2 feet between the spring of 2019 and 2020 and an additional 4 feet on average by the spring of 2021. Year over year, the groundwater elevations in individual wells have varied in response to precipitation and pumping. Seasonal trends of slightly higher spring groundwater elevations compared with fall levels continued in each of the water years. The water year types for water years 2019 and 2020 were both "above normal" while water year 2021 was "dry." Although 2 of the 3 water years included above normal precipitation, groundwater elevations in some of the representative wells are continuing to trend downward.

ES-3 Groundwater Extractions

The total annual volume of groundwater extracted in the EMA for water years 2019, 2020, and 2021 was between 14,900 and 17,000 acre-feet (AF). Table ES-1 summarizes the metered and estimated groundwater extractions by water use sector for each water year.

Table ES-1. Groundwater Extractions by Water Use Sector

(Values in acre-feet)

Water Year	Municipal and Self-Reported Domestic	Mutual Water Companies	Rural Domestic	Agriculture	Total
2019	1,431	951	305	12,278	14,965
2020	1,880	957	307	11,812	14,956
2021	2,320	963	309	13,379	16,972

ES-4 Surface Water Supply

Table ES-2 presents the volume of surface water supply that was delivered to the EMA in water years 2019, 2020, and 2021. Santa Ynez River Water Conservation District, Improvement District No. 1 (ID No. 1) imports water into the EMA via the Cachuma Project and the State Water Project (SWP). ID No. 1 does not receive its Cachuma Project water directly; instead, it receives additional SWP water through an Exchange Agreement with the South Coast members of the Cachuma Project. A portion of the SWP water is contractually committed for use by the City of Solvang. ID No.1 also produces water from the Santa Ynez River underflow pursuant to licenses issued by the State Water Resources Control Board for use in the Santa Ynez Uplands.

Table ES-2. Surface Water Use

(Values in acre-feet)

Water Year	City of Solvang	ID No. 1 Table A	ID No. 1 Exchange	Solvang River Wells	ID No. 1 River Wells	Other River Wells[1]	Total River Wells	Total
2019	759	50	2,213	160	739	1,658	2,557	5,579
2020	745	315	1,740	148	567	1,566	2,281	5,081
2021	612	0	1,439	240	1,142	1,775	3,157	5,208

Notes

[1] Includes other river wells reported to the Santa Ynez River Water Conservation District.

ID No. 1 = Santa Ynez River Water Conservation District, Improvement District No. 1

ES-5 Change in Groundwater in Storage

Due to loss of access to several wells, the groundwater elevation monitoring network used for contouring groundwater elevations for both principal aquifers provided greater spatial coverage of the EMA in water year 2018 compared to the data available for water years 2019 through 2021. The current groundwater monitoring network for the Paso Robles Formation does not adequately represent the groundwater conditions for this aquifer throughout the EMA. The EMA GSA is working to implement planned management actions to address the identified data gaps.

Because of the uncertainty associated with the lack of data, the groundwater elevation contour maps for water years 2019 through 2021 were not able to be compared and a change in groundwater in storage was unable to be calculated using that methodology. Instead, change in groundwater in storage in the Paso Robles Formation was calculated by using the water budget to estimate the total change in storage for both aquifers, and then removing the change in storage calculated for the Careaga Sand. The remaining change in storage was attributed to the Paso Robles Formation.

The change in groundwater in storage within the Careaga Sand was calculated for water years 2019, 2020, and 2021 from the comparison of spring groundwater elevation contour maps from one year to the next. For example, the spring 2021 groundwater elevations for the Careaga Sand (Figure 13) were subtracted from the spring 2020 groundwater elevations (Figure 11) resulting in a map depicting the changes in groundwater elevations that occurred during the 2020 water year (Figure 15). The groundwater elevation change depicted on each map, along with the storage coefficient, is used to calculate the proportion of that change that is due to groundwater in storage. The portion of void space in the aquifer that can be used for groundwater storage is represented by the aquifer storage coefficient, which is similar to porosity and is a unitless factor that is multiplied by the total volume change between water years to derive the change in groundwater in storage.

Table ES-3 presents the total annual changes of groundwater in storage for water years 2019, 2020, and 2021. As shown, the volume of groundwater in storage rose by about 4,000 AF in water year 2019, when a total of 20 inches of rain fell during the above normal year. In 2020, when 15 inches of rain fell, the groundwater in storage declined by about 2,100 AF. Lastly, when a dry year occurred during final year of this period and only half of the normal rain fell, the groundwater in storage declined by about 13,600 AFY. Overall, since 2018, when the historical period presented in the Plan ended, a net decrease of 11,700 AF of groundwater in storage has occurred. As required by the SGMA regulations for annual reports, Figure 17 presents the cumulative change in storage since January 1, 2015.

Table ES-3. Annual Change in Groundwater in Storage

(Values in acre-feet)

Water Year	Change in Storage (Paso Robles Formation)	Change in Storage (Careaga Sand)	Total Annual Change in Storage
2019	3,047	996	4,043
2020	-1,662	-477	-2,139
2021	-12,737	-825	-13,562

ES-6 Progress toward Basin Sustainability

To achieve the sustainability goal established by the EMA GSA before 2040, and avoid undesirable results as required by SGMA, several management actions will be implemented in the EMA. These management actions are focused primarily on filling identified data gaps, developing funding for EMA GSA operations and future EMA monitoring, registering and metering wells, developing new and expanded existing water use efficiency programs, and implementing a groundwater pumping fee program, if warranted. As described in the Plan (GSI, 2022), the EMA GSA has begun planning for Group 1 management actions, including:

- Address Data Gaps
  - Expand Monitoring Well Network in the EMA to Increase Spatial Coverage and Well Density
- Groundwater Pumping Fee Program
- Well Registration Program and Well Meter Installation Program

Relative to the most current conditions as reported in the Plan, this First Annual Report (2019–2021) indicates continued modest declines in groundwater levels. Groundwater elevations have declined in most of the representative monitoring wells, indicating a decrease in total groundwater in storage. It is not clear how much of this is driven by reduced rainfall or by pumping. Group 1 management actions are planned to address data gaps through improvement of the monitoring and data-collection networks, as well as program implementation for better measurement of groundwater pumping to promote water use efficiency and sustainable groundwater use.

While water levels have declined below minimum thresholds in some representative wells, the number of wells falling below the minimum thresholds has not resulted in the undesirable results that are described in the Plan. Group 1 management actions (as outlined in Section 6 of GSI, 2022 and summarized in the above bulleted list) are being planned and it is hoped that these actions will result in improved conditions. If they do not and it is determined that groundwater pumping is contributing to undesirable results, additional management actions described in the Plan (e.g., Group 2 and 3) may be warranted. The effect of the management actions will be reviewed periodically, and additional Group 2 management actions and Group 3 projects may be considered and implemented as necessary to avoid undesirable results.

The EMA GSA is not charged with managing groundwater quality unless it can be shown that water quality degradation is caused by groundwater pumping in the EMA, or the EMA GSA implements a project that degrades water quality. As described in the Plan, groundwater quality in the EMA is generally suitable for both drinking water and agricultural purposes (GSI, 2022). Potential degradation of groundwater quality caused by groundwater pumping or implementation of projects and management actions will be monitored as part of the EMA's water quality monitoring network.

Land subsidence caused by groundwater extraction will be monitored as part of the Plan. Subsidence can be estimated using Interferometric Synthetic Aperture Radar (InSAR) data provided by DWR. Minor subsidence has been observed in the EMA for the period between June 2015 and October 2020. These data show that an average subsidence of approximately 0.018 feet per year has occurred in certain parts of the Basin over the period of record. This is a minor rate of subsidence that does not exceed the minimum threshold value and is likely a result of tectonic activity and not pumping. This is therefore relatively insignificant and not a major concern for the EMA. The EMA GSA will continue to monitor and report annual subsidence as more data become available.

Potential GDEs associated with one of the principal aquifers were identified on the downstream ends of Alamo Pintado Creek and Zanja de Cota Creek where there is evidence that groundwater is interconnected with surface water. As described in the Plan, the EMA GSA has proposed to install piezometers in the GDE areas to assess whether depletion of interconnected surface water is occurring and whether significant and unreasonable adverse impacts to GDEs or reductions in discharge of interconnected surface water to the Santa Ynez River may be occurring as a result of groundwater use. Planning for installation of the proposed piezometers is underway.

Due to the short period between the adoption of the Plan and the submittal of this Annual Report, additional time is necessary to implement projects and managements actions and to evaluate their effectiveness. However, it is anticipated that the projects and management actions will enable the EMA GSA to sustainably manage groundwater and achieve sustainability goals as defined in the Plan.

SECTION 1: **Introduction**

This first Annual Report (2019–2021) for the Santa Ynez River Valley Groundwater Basin (Basin) - Eastern Management Area (EMA) has been prepared for the EMA Groundwater Sustainability Agency (GSA) in accordance with Sustainable Groundwater Management Act (SGMA) regulations (§ 356.2. Annual Reports) (Appendix A). Following adoption and submittal of the Plan on January 19, 2022, the EMA GSA is required to submit an Annual Report for the preceding water year (October 1 through September 30) to the California Department of Water Resources (DWR) by April 1, 2022. Because this is the first Annual Report for the EMA, this report documents and updates the required elements for annual reporting for the 3-year period following that covered by the Plan for water years 2019, 2020, and 2021 (i.e., October 1, 2018 and September 31, 2021).

1.1 Setting and Background

The Plan was prepared by GSI Water Solutions, Inc. (GSI, 2022), on behalf of and in cooperation with the EMA GSA. The Plan, and this Annual Report, discuss the area known as the EMA (Figure 1). The Basin covers 319 square miles (204,000 acres) within the entire Bulletin 118 Basin Boundary, of which the easternmost 150 square miles make up the EMA, including the Santa Ynez Uplands and Santa Ynez River areas (DWR, 2018a). The Santa Ynez Uplands area includes the groundwater system that is subject to regulation under SGMA. The Santa Ynez River area, including the river and associated underflow that constitutes a surface water system, is managed under the jurisdiction of the California State Water Resources Control Board (SWRCB), and is not regulated under SGMA.

The EMA is bounded on the north and east by impermeable rocks of the San Rafael Mountains and on the northwest by the adjacent San Antonio Creek Valley Groundwater Basin (San Antonio Groundwater Basin). The entire Basin is bounded on the south by the Santa Ynez Mountains (Figure 1). Average precipitation ranges from 15 inches per year in the southern and central areas to about 24 inches per year in the higher elevations (Santa Barbara County, 2012). Several tributaries flow from the San Rafael Mountains and Santa Ynez mountains into the Santa Ynez River along the southern edge of the EMA. The Santa Ynez River flows west of Highway 154, past the communities of Solvang and Santa Ynez.

The Plan was developed by the EMA GSA, which consists of four member agencies:

- Santa Ynez River Water Conservation District
- Santa Barbara County Water Agency
- City of Solvang
- Santa Ynez River Water Conservation District, Improvement District No. 1 (ID No. 1)

1.2 Organization of This Report

The required contents of an Annual Report are provided in the SGMA regulations (§ 356.2) (Appendix A). Organization of the report is meant to follow the regulations, where possible, to assist in the review of the document. This Annual Report is organized as follows:

- **Section 1: Introduction.** A brief background of the formation and activities of the EMA GSA and development and submittal of the Plan.
- **Section 2: Basin Setting and Monitoring Networks.** A summary of the basin setting, basin 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 seasonal high and low groundwater elevations and representative hydrographs.
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- **Section 8: Progress toward Basin Sustainability (§ 356.2[c]).** A summary of management actions taken under the EMA Plan.
- **Section 9: References**.

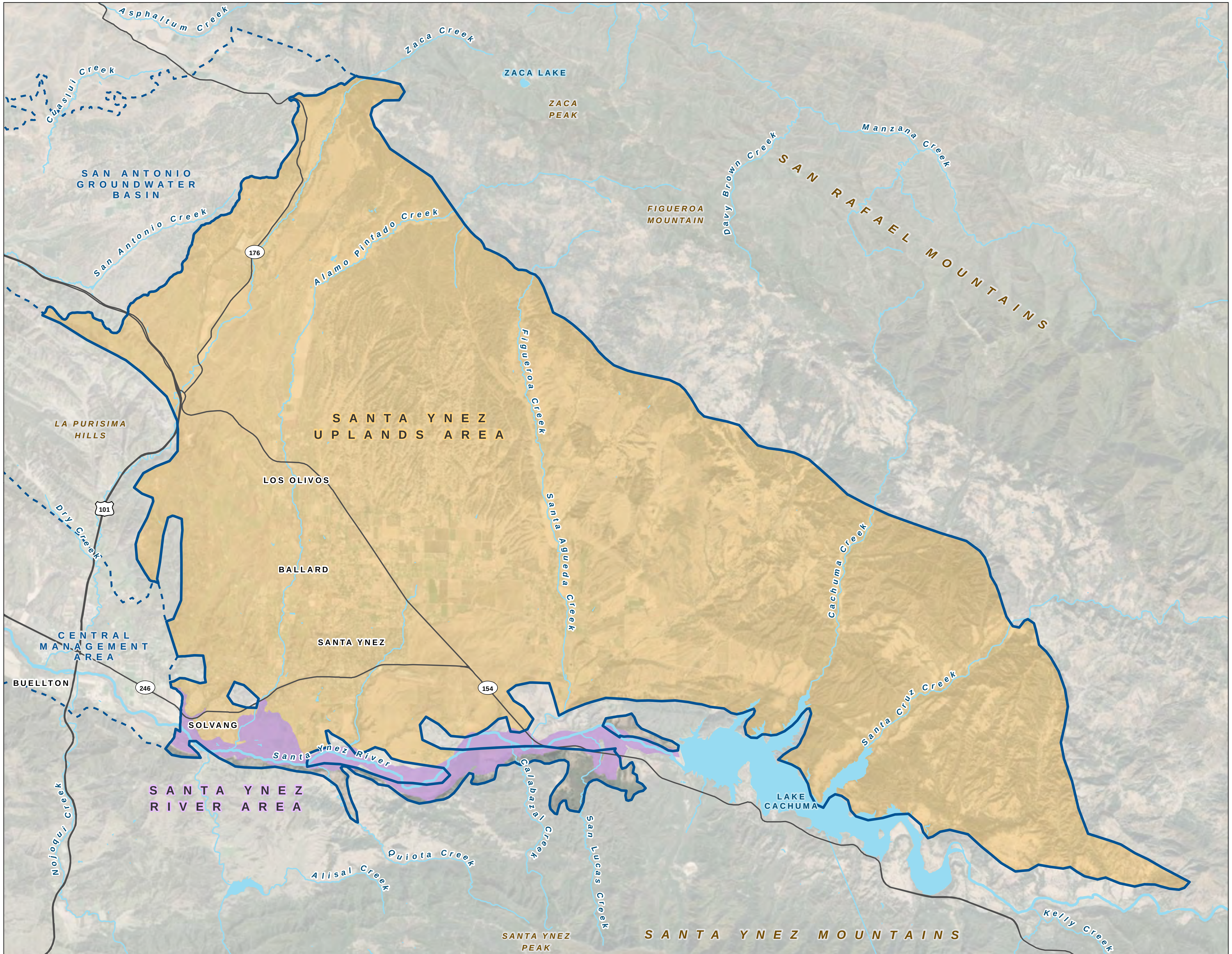

FIGURE 1

Santa Ynez River Valley Groundwater Basin Eastern Management Area

Santa Ynez River Valley Groundwater Basin – Eastern Management Area First Annual Report (2019 - 2021)

LEGEND

- Santa Ynez Uplands Area (area covered by GSP)
- Santa Ynez River

All Other Features

- Eastern Management Area Bulletin 118 Boundary
- Other Bulletin 118 Groundwater Basin Boundary
- Major Road
- Watercourse
- Waterbody

NOTE

GSP: Groundwater Sustainability Plan

N

0 5,000 10,000 15,000

Feet

Date: February 25, 2022
Data Sources: ESRI, USGS, Maxar 2019

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SECTION 2: Basin Setting and Monitoring Networks

2.1 Introduction

This section provides a summary of the basin setting and the groundwater monitoring programs described in detail in the Plan, as well as any notable events affecting monitoring activities or the quality of monitoring results in the reported water years 2019 to 2021. Much of the information in this Annual Report was taken from the Plan prepared by GSI (2022).

2.2 Basin Setting

The Basin is located within the Santa Ynez River watershed in Santa Barbara County on California's central coast. The entire Basin is about 50 miles long and varies in width from about 4 to 7 miles. The Basin covers 319 square miles (204,000 acres) within the entire Bulletin 118 Basin Boundary, of which the easternmost 150 square miles make up the EMA, including the Santa Ynez Uplands and Santa Ynez River areas (DWR, 2018a). The Santa Ynez Uplands area includes the groundwater system that is subject to regulation under SGMA, as presented on Figure 1. The Santa Ynez River area, including the river and associated underflow that constitutes a surface water system, is managed under the jurisdiction of the SWRCB and is not regulated under SGMA.

In the Santa Ynez Uplands, the principal aquifers are the Paso Robles Formation and Careaga Sand. The base of these water-bearing formations is an irregular surface formed as the result of folding, faulting, and erosion, which extends to a maximum depth of approximately 3,500 feet in some areas.

The groundwater basin is generally bound by the mountains rimming the EMA as follows and presented on Figure 2:

- The northern and eastern boundary of the EMA is defined by outcropping of impermeable bedrock of the San Rafael Mountains.
- The Santa Ynez Upland is separated from the Santa Ynez River area to the south by a ridge of impermeable bedrock. The Santa Ynez Mountains form the southern boundary of the entire EMA south of the Santa Ynez River.
- The boundary to the northwest is defined as the shared border with the San Antonio Groundwater Basin, which is a topographic watershed divide west of Zaca Creek Canyon, but not necessarily a geologic barrier to groundwater flow.
- The boundary to the west is formed in the Purisima Hills by impermeable consolidated bedrock underlying the Careaga Sand.

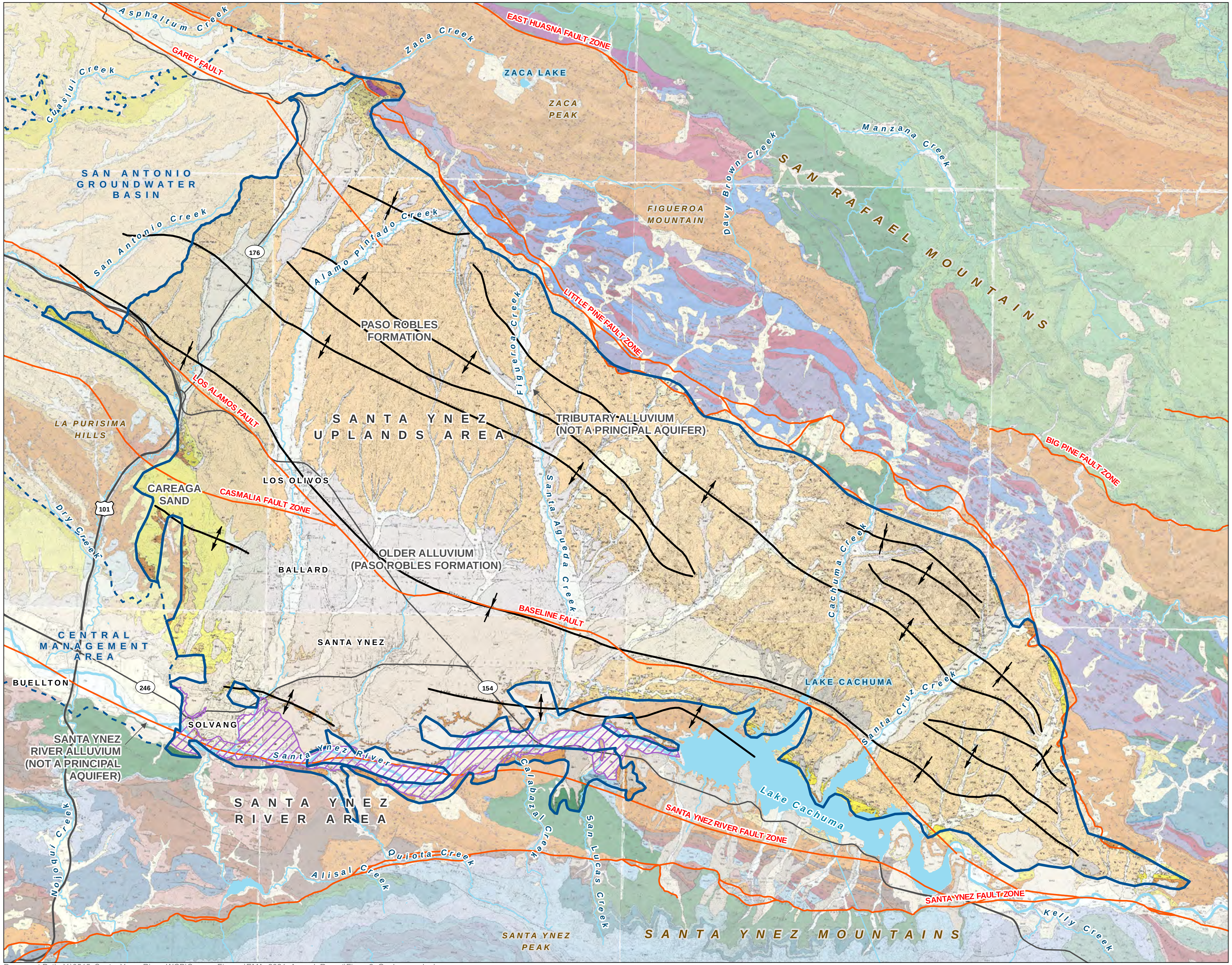

FIGURE 2

Geologic Map

Santa Ynez River Valley Groundwater Basin – Eastern Management Area First Annual Report (2019 - 2021)

LEGEND

- Santa Ynez River Area

Geology

- Tributary Alluvium, Qa
- Santa Ynez River Alluvium, Qg
- Older Alluvium, Qoa
- Paso Robles Formation QTp
- Careaga Sand, Tcag
- Monterey Formation, Tm
- Fault

Fold Axes

- Anticline
- Syncline

All Other Features

- Eastern Management Area Bulletin 118 Boundary
- Other Bulletin 118 Groundwater Basin Boundary
- Major Road
- Watercourse
- Waterbody

N

0 5,000 10,000 15,000
Feet

Date: February 25, 2022
Data Sources: ESRI, USGS, Maxar 2019

GSI Water Solutions, Inc.

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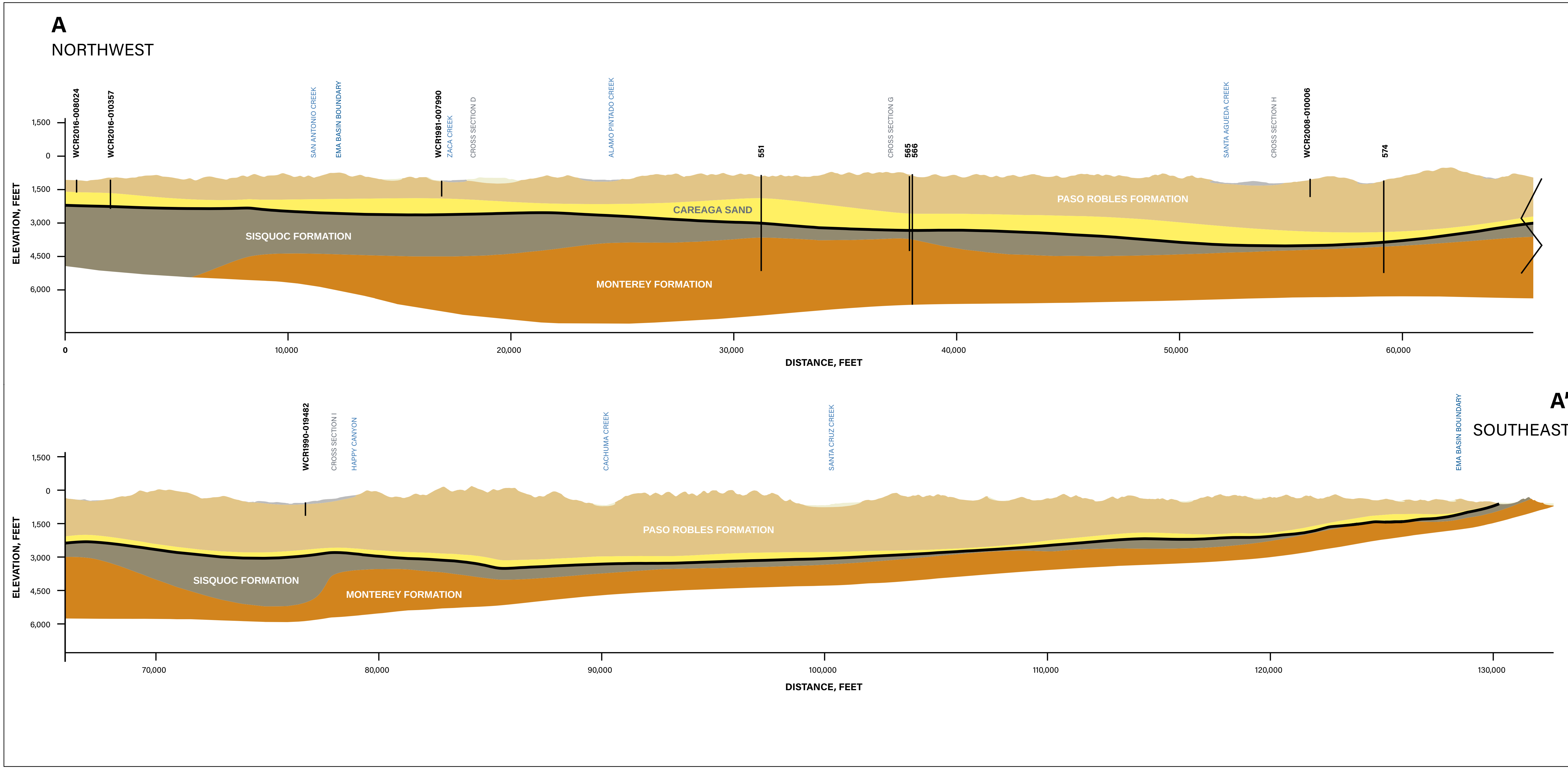
Two principal aquifers have been identified in the EMA: the Paso Robles Formation and the Careaga Sand, which are presented on Figure 3a and Figure 3b, respectively. The Paso Robles Formation and the Careaga Sand together extend to a depth of more than 1,500 feet below ground surface (bgs) on average in the EMA with a maximum thickness of up to 3,500 feet. Overlying these formations are the Quaternary-aged Older Alluvium (Qoa), which is derivative of the Paso Robles Formation, and is therefore composed of materials that are very similar to the Paso Robles Formation and extend to a thickness of as much as 150 feet. Because of this similarity, this Older Alluvium is managed as part of the Paso Robles Formation. Large exposures of the formation north and east of the valley receive direct infiltration of rainfall.

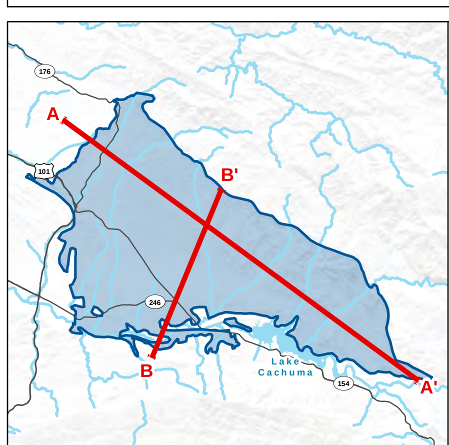
Vertical heterogeneity in the water-bearing properties of the Paso Robles Formation is the result of coarse-grained beds of sediments that yield water freely to wells alternating with fine-grained beds that do not, where higher well yields are typically attributed to the wells that penetrate the coarse-grained lenses. Production from wells completed in this formation can range between less than 100 gallons per minute (gpm) to as much as 1,500 gpm, depending largely on length of the aquifer perforated by individual wells. With that, considerable variability is known to exist within the formation throughout the EMA. Whereas the upper part consists of relatively coarse-grained materials typical of alluvial fan deposits, the lower part of the complexly folded Paso Robles Formation is finer-grained. The coarser-grained upper portions of the Paso Robles Formation yield groundwater to wells at higher flow rates than the underlying portions. Fine-grained zones act as local confining beds and are likely the cause of the localized artesian conditions that were historically reported in some wells screened within the Paso Robles Formation in Happy Canyon and along Alamo Pintado Creek.

In the Santa Ynez Uplands, the Careaga Sand is approximately 800 feet thick on average and varies between 200 and 900 feet. There are large exposures of the formation in the Purisima Hills along the western edge of the EMA. However, because the lateral extent of the Careaga Sand aquifer is limited relative to that of the Paso Robles Formation, fewer wells are completed in the Careaga Sand than in the overlying Paso Robles Formation. In the EMA, wells completed in the Careaga Sand produce between 12 and 325 gpm.

The primary components of groundwater recharge to the aquifers are mountain front recharge, streamflow percolation, deep percolation of direct precipitation, and agricultural irrigation return flow.

Natural groundwater discharge areas in the EMA include springs and seeps, some groundwater discharge to surface water, and evapotranspiration (ET) by phreatophytes. The largest component of groundwater discharge is pumping of groundwater from wells. The regional direction of groundwater flow in both principal aquifers is generally from the north to the south-southwest.





LEGEND

- Qa – Tributary Alluvium
- Qoa – Older Alluvium
- QTp – Paso Robles Formation
- Tca – Careaga Sand
- Basin Bottom
- Tsq – Sisquoc Formation
- Tm – Monterey Formation

FIGURE 3A

Cross Section A

Santa Ynez River Valley Groundwater Basin – Eastern Management Area First Annual Report (2019 - 2021)

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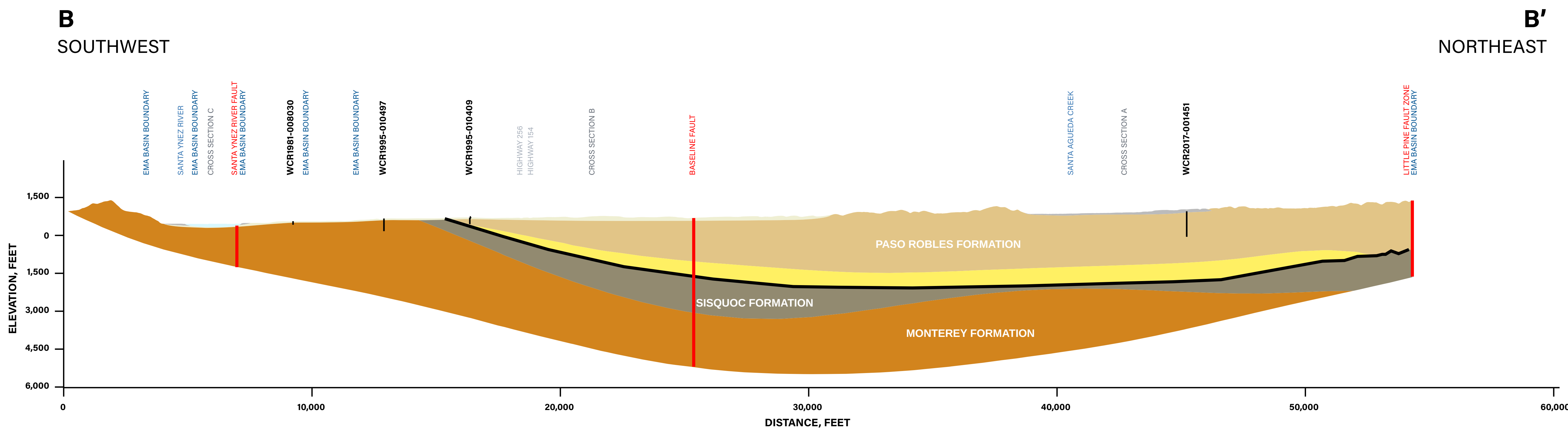

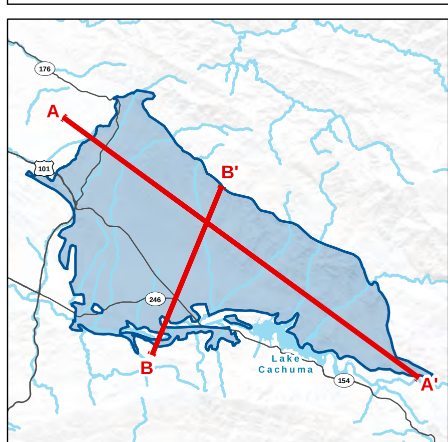

LEGEND

- Qa – Tributary Alluvium
- Qoa – Older Alluvium
- QTp – Paso Robles Formation
- Tca – Careaga Sand
- Basin Bottom
- Tsq – Sisquoc Formation
- Tm – Monterey Formation

FIGURE 3B

Cross Section B

Santa Ynez River Valley Groundwater Basin –
Eastern Management Area
First Annual Report (2019 - 2021)

GSI Water Solutions, Inc.

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2.3 Precipitation and Climatic Periods

Annual precipitation recorded at the Santa Ynez Fire Station #32 (Santa Barbara County Station No. 218 gauge), cumulative departure from average annual precipitation, and water year type are presented in Figure 4. The long-term average annual precipitation for 1951 through 2021 is 15.6 inches per water year. Water year types were identified using DWR guidance (DWR, 2021), which principally considers the rainfall that fell during the current water year, as well as the rainfall during the prior water year. The water year index presented on Table 1 is calculated in accordance with DWR's guidance, which is:

Index = (0.40 * Current Year's precipitation) + (0.60 * Previous Year's Precipitation).

The water years are categorized according to the following designations, which are determined in comparison to rank of each year to the preceding 29 years, as shown on Table 1:

- Wet (greater than 70 percent)
- Above normal (50 to 70 percent)
- Below normal (30 to 50 percent)
- Dry (15 to 30 percent)
- Critical (less than 15 percent)

Table 1. Santa Ynez River Valley Groundwater Basin Water Year Types

Water Year	Annual Precipitation (inches)	Water Year Index[1]	Water Year Type[1]	Climatic Condition[2]
1981	14.3	17.6	Wet	Wet
1982	14.8	14.6	Below Normal	Wet
1983	35.2	27.0	Wet	Wet
1984	7.5	18.6	Wet	Dry
1985	10.9	9.5	Critical	Dry
1986	17.1	14.6	Below Normal	Dry
1987	9.0	12.2	Dry	Dry
1988	16.9	13.7	Below Normal	Dry
1989	7.5	11.2	Dry	Dry
1990	6.5	6.9	Critical	Dry
1991	16.9	12.7	Below Normal	Wet
1992	25.0	21.7	Wet	Wet
1993	28.0	26.8	Wet	Wet
1994	13.6	19.4	Wet	Wet
1995	30.2	23.6	Wet	Wet
1996	12.2	19.4	Wet	Wet
1997	11.7	11.9	Dry	Wet
1998	36.4	26.5	Wet	Wet

Water Year	Annual Precipitation (inches)	Water Year Index[1]	Water Year Type[1]	Climatic Condition[2]
1999	12.2	21.8	Wet	Neutral/Variable
2000	15.3	14.0	Below Normal	Neutral/Variable
2001	25.6	21.5	Wet	Neutral/Variable
2002	7.9	15.0	Below Normal	Neutral/Variable
2003	16.5	13.1	Dry	Neutral/Variable
2004	10.3	12.8	Dry	Neutral/Variable
2005	35.2	25.3	Wet	Neutral/Variable
2006	17.5	24.6	Wet	Neutral/Variable
2007	6.7	11.0	Critical	Neutral/Variable
2008	15.7	12.1	Dry	Neutral/Variable
2009	13.1	14.2	Below Normal	Neutral/Variable
2010	21.2	18.0	Above Normal	Neutral/Variable
2011	26.3	24.3	Wet	Neutral/Variable
2012	12.0	17.7	Above Normal	Dry
2013	6.8	8.9	Critical	Dry
2014	7.9	7.5	Critical	Dry
2015	8.3	8.2	Critical	Dry
2016	10.0	9.3	Critical	Dry
2017	21.0	16.6	Above Normal	Dry
2018	7.9	13.1	Below Normal	Dry
2019	20.1	15.2	Above Normal	Dry
2020	15.1	17.1	Above Normal	Dry
2021	8.3	11.1	Dry	Dry

Notes

The water years are shaded according to the following designations, which are determined in comparison to rank of each year to the preceding 29 years.

(light blue)	Wet
(light green)	Above Normal
(light yellow)	Below Normal
(beige)	Dry
(salmon)	Critical

[1] Defined in DWR, 2021.

[2] Defined using the cumulative departure from mean annual precipitation measured at the Santa Ynez Fire Station #32 (Santa Barbara County Station No. 218 gauge) (see Section 3.3 of GSI, 2022).

In addition to the year-by-year water year type, the longer-term climatic conditions, which consist of historical wet-dry cycles, were also identified by GSI and presented in Table 1 by evaluating trends in the cumulative departure from mean annual precipitation measured at the Santa Ynez Fire Station #32 (Santa Barbara County Station No. 218 gauge).

Since the Plan only included data up to the end of water year 2018, the 3 water years of 2019 through 2021 have included 2 above normal years during 2019 and 2020 and 1 dry year in 2021 according to DWR water year calculations. The water year types identified by GSI methods show that the overall climactic trend has been dry, beginning in 2012.

The water year types are calculated differently by the three management agencies within the Basin. The Western Management Area and Central Management Area CMA are currently using a method similar to the 2019 SWRCB Water Rights Order 2019-0148 for the Cachuma Project, which is based on surface flows. The EMA is using the SGMA Water Year Type Dataset method based on precipitation data (DWR, 2021). The water year types from the two methods exhibit a reasonably robust match, though, during some years, slight differences in water year type designation exist. Both methods were selected in coordination with the entire Basin and were chosen based on the management needs of each management area. Both methods are focused on the same basin-wide sustainability goal.

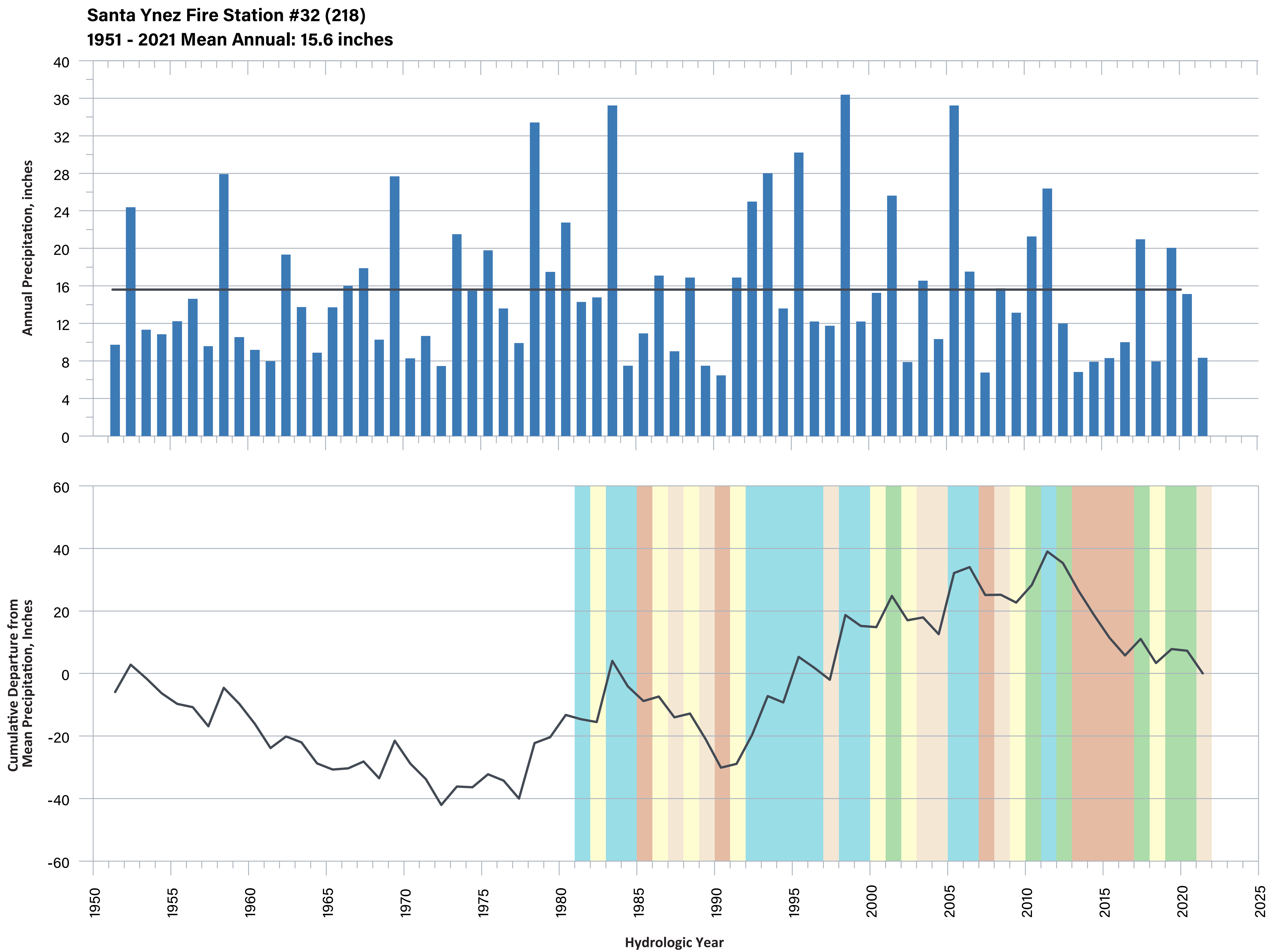

FIGURE 4

Precipitation and Climatic Periods, Santa Ynez Fire Station #32

Santa Ynez River Valley
Groundwater Basin –
Eastern Management Area
First Annual Report (2019 - 2021)

LEGEND

Cumulative Departure

Water Year Type

- Wet
- Above Normal
- Below Normal
- Dry
- Critical

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2.4 Groundwater Elevation Monitoring (§ 356.2[b])

This section provides a brief description of the groundwater monitoring programs and monitoring results.

2.4.1 Groundwater Elevation Monitoring Locations

The Plan summarized the existing groundwater monitoring network and protocol for including a subset of these wells into the Representative Monitoring Network. Under SGMA, the monitoring networks are required to be developed to provide sufficient data quality, frequency, and spatial distribution to characterize groundwater and interconnected surface water, and to evaluate changing aquifer conditions in response to implementation of the Plan. The monitoring networks developed in the Plan support efforts to:

- Monitor changes in groundwater conditions and demonstrate progress toward achieving measurable objectives and avoiding undesirable results as defined in the Plan.
- Quantify annual changes in water use.
- Monitor status of the beneficial uses and users of groundwater.

Monitoring networks have been developed for each of the five sustainability indicators applicable to the EMA in relation to groundwater pumping and implementation of the Plan:

- 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 being implemented using the same representative monitoring sites (wells). The Plan identifies an existing network of 24 representative wells for water level monitoring (GSI, 2022). Of these, 15 wells are screened solely in the Paso Robles Formation, and 9 wells are screened solely in the Careaga Sand. Figure 5 displays the representative monitoring wells, and Appendix B includes a summary of information for each of the wells.

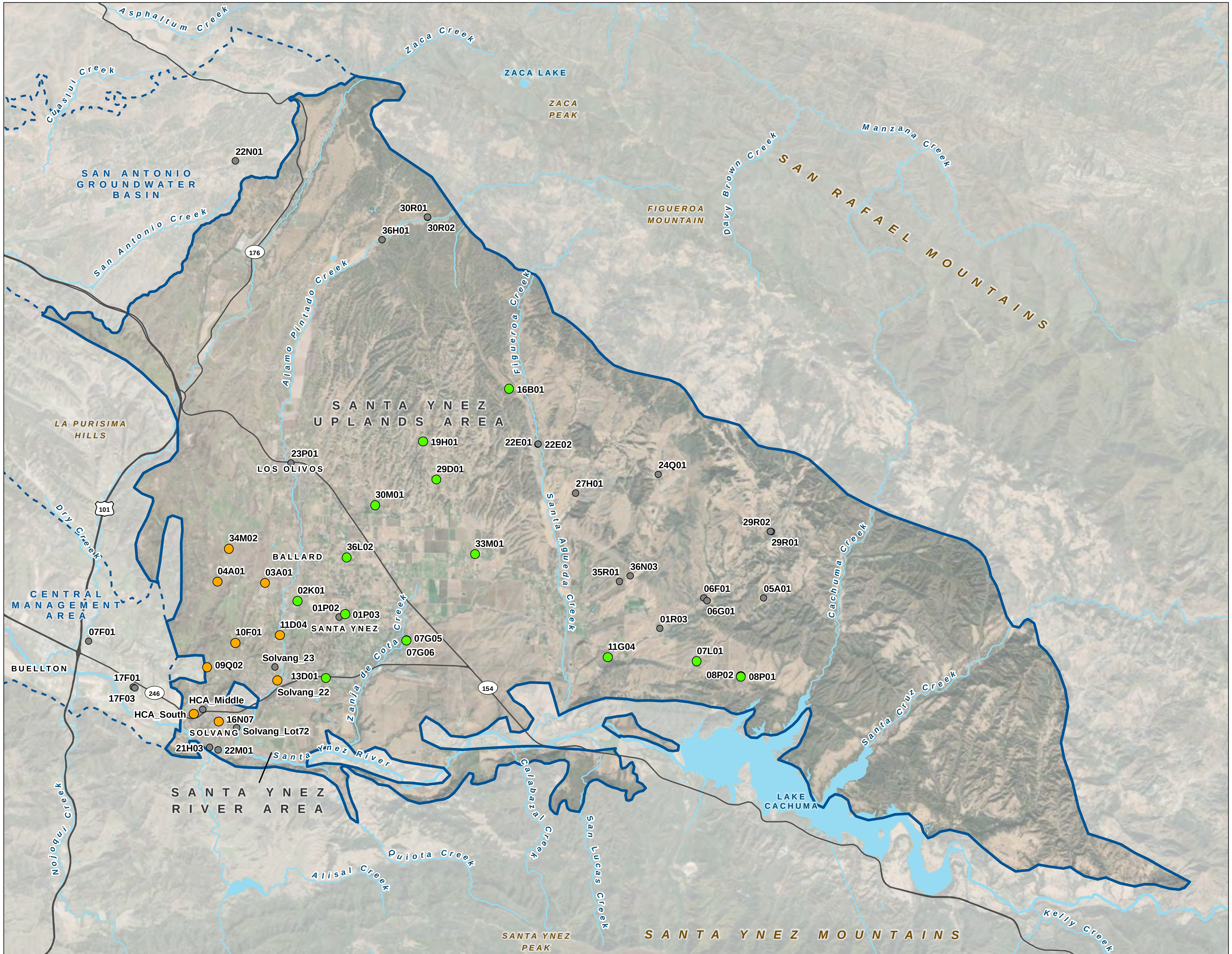

FIGURE 5

Groundwater Level Monitoring Network

Santa Ynez River Valley Groundwater Basin – Eastern Management Area First Annual Report (2019 - 2021)

LEGEND

Representative Well (by screened aquifer)

- Careaga Sand
- Paso Robles Formation
- Monitored by Santa Barbara County Water Agency

All Other Features

- Eastern Management Area Basin Boundary
- Major Road
- Watercourse
- Waterbody

N

0 5,000 10,000 15,000
Feet

Date: March 18, 2022
Data Sources: ESRI, USGS, Maxar 2020

GSI Water Solutions, Inc.

Document Path: Y:\0515_Santa_Ynez_River_WCD\Source_Figures\EMA_2021_Annual_Report\Figure5_Groundwater_Level_Monitoring_Network.mxd, wkimmon

2.4.2 Monitoring Data Gaps

Although the existing groundwater level monitoring network satisfies the well density guidelines cited in the DWR best management practice guidance for monitoring networks (DWR, 2016a and 2016b), two low-density areas have been identified within the EMA where the addition of monitoring wells would improve the understanding of groundwater conditions discussed in this section (see Figure 4-2 in GSI, 2022). The first area includes northwestern portions of the Santa Ynez Uplands from Los Olivos to the northern boundary of the Basin and EMA, including the northern reaches of Zaca Creek and Alamo Pintado Creek. The second area is in the Paso Robles Formation in the central portion of the EMA, generally between Santa Agueda Creek and Happy Canyon.

An effort will be made to contact owners of wells in these areas to determine whether the wells can be included in the monitoring program. Including these additional wells in the groundwater level monitoring network would increase the accuracy of groundwater elevation trends and enhance efforts to sustainably manage the EMA.

2.5 Additional Monitoring

Evaluation of the water quality sustainability indicator will be achieved through existing groundwater quality monitoring networks, including the SWRCB Division of Drinking Water (DDW) public supply well water quality program and the SWRCB Irrigated Lands Regulatory Program (ILRP). As noted above, the EMA GSA is not charged with managing groundwater quality unless it can be shown that water quality degradation is caused by groundwater pumping in the EMA, or the EMA GSA implements a project that degrades water quality. Constituents of concern (COCs) identified in the Plan are based on regulatory standards (i.e., maximum contaminant levels [MCLs] and secondary MCLs [SMCLs]) for drinking water established by the SWRCB DDW and the U.S. Environmental Protection Agency.[1] For agricultural uses, COCs are based on basin water quality objectives presented in the *Water Quality Control Plan for the Central Coastal Basin* (RWQCB, 2019).

There are 56 wells from the existing monitoring programs within the groundwater quality monitoring network, of which 26 are municipal and public water system drinking water supply wells from the SWRCB's Groundwater Ambient Monitoring and Assessment database. The remainder of the wells were either agricultural and/or domestic wells from the ILRP database. Well construction information is unknown for the ILRP wells.

According to the California Department of Conservation, Geologic Energy Management Division's online Well Finder, or WellSTAR, tool, the Zaca Oil Field is the only oil and gas field located within or adjacent to the EMA. The U.S. Geological Survey, in cooperation with the SWRCB, initiated the California Oil, Gas, and Groundwater (COGG) Program in 2015.[2] The objective of the COGG Program is to determine where and to what extent groundwater quality may be adversely impacted by proximal oil and gas development activities (Davis et al., 2018). When results from the COGG Program are available for review, the EMA GSA will consider these findings, if available, as part of the overall groundwater quality monitoring program.

[1] The list of MCLs and SMCLs is available at https://www.waterboards.ca.gov/drinking_water/certlic/drinkingwater/Chemicalcontaminants.html. (Accessed January 12, 2022.)
[2] Description available at https://webapps.usgs.gov/cogg/. (Accessed January 12, 2022.)

Land subsidence in the EMA is estimated using Interferometric Synthetic Aperture Radar (InSAR) data provided by DWR and by the University NAVSTAR Consortium (UNAVCO) Continuous Global Positioning System (CGPS) Station near the Santa Ynez Airport. InSAR measures ground elevation using microwave satellite imagery data. The Plan documents minor subsidence in the EMA using data provided by DWR depicting the difference in InSAR measured ground surface elevations between June 2015 and October 2020, which is likely a result of tectonic activity and not pumping.

Available data to date indicate that (1) land subsidence rates have not exceeded rates observed from 2000 through 2020 at the UNAVCO CGPS station near Santa Ynez and thus, the minimum threshold has not been exceeded; and (2) land subsidence that causes significant and unreasonable damage to groundwater supply has not been documented, land uses (including agricultural, residential, rural residential, and town buildings), or infrastructure, and property interests. The EMA will annually assess subsidence using the UNAVCO CGPS and InSAR data provided by DWR. UNAVCO CGPS and InSAR data are included in Appendix D.

The interconnected surface water monitoring network will consist of yet to be installed piezometers in the groundwater-dependent ecosystem (GDE) areas identified in the Plan within the distal ends of Alamo Pintado Creek and Zanja de Cota Creek. These piezometers will be used to assess whether depletion of interconnected surface water is occurring and whether significant and unreasonable adverse impacts to GDEs or reductions in discharge of interconnected surface water may be occurring as a result of groundwater use. As described in the Plan, the EMA GSA will use groundwater levels within these forthcoming monitoring wells as a proxy for evaluating the minimum threshold in the Plan for depletion of interconnected surface waters.

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

3.1 Introduction

This section describes groundwater elevations in the EMA since the fall of 2018, which marked the end of the analyses completed for the Plan. In future years, the Annual Reports will present groundwater elevation updates for only the preceding water year. Because of the 3-year gap between the end of the historical period of water year 2018 presented in the Plan and this Annual Report, which presents the period through water year 2021, eight groundwater elevation maps have been prepared—one for each principal aquifer during the spring periods of 2019, 2020, and 2021, and the fall of 2020.

These maps present the most up-to-date seasonal conditions in the Paso Robles Formation and the Careaga Sand. The monitoring data has been reviewed for quality and an appropriate timeframe has been chosen to provide the highest consistency in the wells used for each reporting period. While well construction information is incomplete or unavailable for a number of the monitoring wells, these data represent the best available groundwater elevation data for the two principal aquifers. Consequently, a careful review of the data was conducted prior to uploading this data to the DWR's Monitoring Network Module, which replaces the California Statewide Groundwater Elevation Monitoring program. The monitoring data presented herein are stored in the data management system developed for the Plan.

The groundwater elevation contour maps were generated from data collected by Santa Barbara County Water Agency, ID No. 1, and City of Solvang staff. Notably, the number of wells in the Representative Monitoring Network for both principal aquifers has decreased since the 2018 period. Monitoring of several wells completed within the Careaga Sand in the northwestern portion of the EMA adjacent to the San Antonio Groundwater Basin has not been conducted since 2018 due to a denial of access by the well owners. Likewise, several wells completed within the Paso Robles Formation that were monitored through 2018 as presented in the Plan are no longer available for monitoring. The reduction in the number of wells monitored in each of the principal aquifers in recent years has decreased the accuracy of our understanding of groundwater conditions, which in turn affects the estimation of the change in groundwater in storage. The EMA GSA will undertake efforts to add additional monitoring wells to address these identified data gaps.

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

To maintain consistency with the Plan and represent conditions that can be easily compared from year to year, this Annual Report attempts to use the same set of wells included in the monitoring network described in the Plan. Groundwater elevation data from all available wells completed in the principal aquifers were used to create the groundwater elevation contour maps. Of these wells, a total of 15 within the Paso Robles Formation and 9 within the Careaga Sand have been identified as representative monitoring sites (RMSs) for the purpose of monitoring sustainability indicators.

As of 2019, approximately 45 wells were measured by Santa Barbara County Water Agency staff in the spring months and only 3 wells were monitored in the fall months. However, in 2020, the fall groundwater monitoring effort was expanded to include more complete groundwater monitoring such that in October 2020, Santa Barbara County staff measured groundwater levels in 20 wells within the EMA. As implementation of the Plan progresses, additional wells will be added considering accessibility, location, well construction, and representative hydrograph signatures.

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

- Groundwater elevation contour maps for the seasonal high and seasonal low groundwater conditions for the previous water year are provided. Because groundwater conditions were described in the Plan through the fall of 2018, groundwater elevation contour maps are presented in this report for the remaining years depending on data (i.e., for spring 2019, spring 2019, spring 2020, fall 2020, and spring 2021). The fall 2021 water level measurements were collected in October 2021, which is after the end of the 2021 water year; therefore, they are not presented in this Annual Report.
- A map depicting the change in groundwater elevation for the preceding water year is provided. Change in groundwater elevation maps are presented in this report for the most recent period of spring 2020 through spring of 2021.
- A description of the seasonal variability in groundwater conditions is provided in the groundwater elevation maps between the fall of 2020 and following spring of 2021 is provided.
- Hydrographs for wells with publicly available data are presented in Appendix C.

3.2.1 Paso Robles Formation Groundwater Elevation Contours

Groundwater elevation contour maps provide information about the spatial variations, yearly fluctuations, trends in groundwater conditions, groundwater flow directions, and horizontal groundwater gradients. The contour maps were prepared principally for the spring period, when most data are historically available, which represents the seasonal high groundwater levels. The seasonal low groundwater elevations typically occur in the fall. In general, the spring groundwater data are representative of March through April of each year and the fall groundwater data since 2020 are representative of October. For consistency with the Plan, best attempts were made to use the same well data sets for contouring as available.

Overall, groundwater in the Paso Robles Formation continues to flow in the same direction as documented in the Plan towards the south and southwest from the San Rafael Mountains as presented on Figure 6 through Figure 9. The horizontal groundwater gradients during these periods are relatively unchanged from year to year and range between 0.02 feet per foot (ft/ft) throughout most of the Santa Ynez Uplands to approximately 0.05 ft/ft in limited areas.

During the reporting period, the groundwater elevations in individual wells have varied in response to precipitation and pumping. Generally, groundwater levels have declined somewhat from the spring 2018 levels presented in the Plan. The groundwater elevations in the Paso Robles Formation have declined modestly during the reporting period: groundwater elevations have declined an average of 5 feet in the representative Paso Robles Formation Wells between the spring of 2019 and 2020 and an additional 2 feet in the spring of 2021.

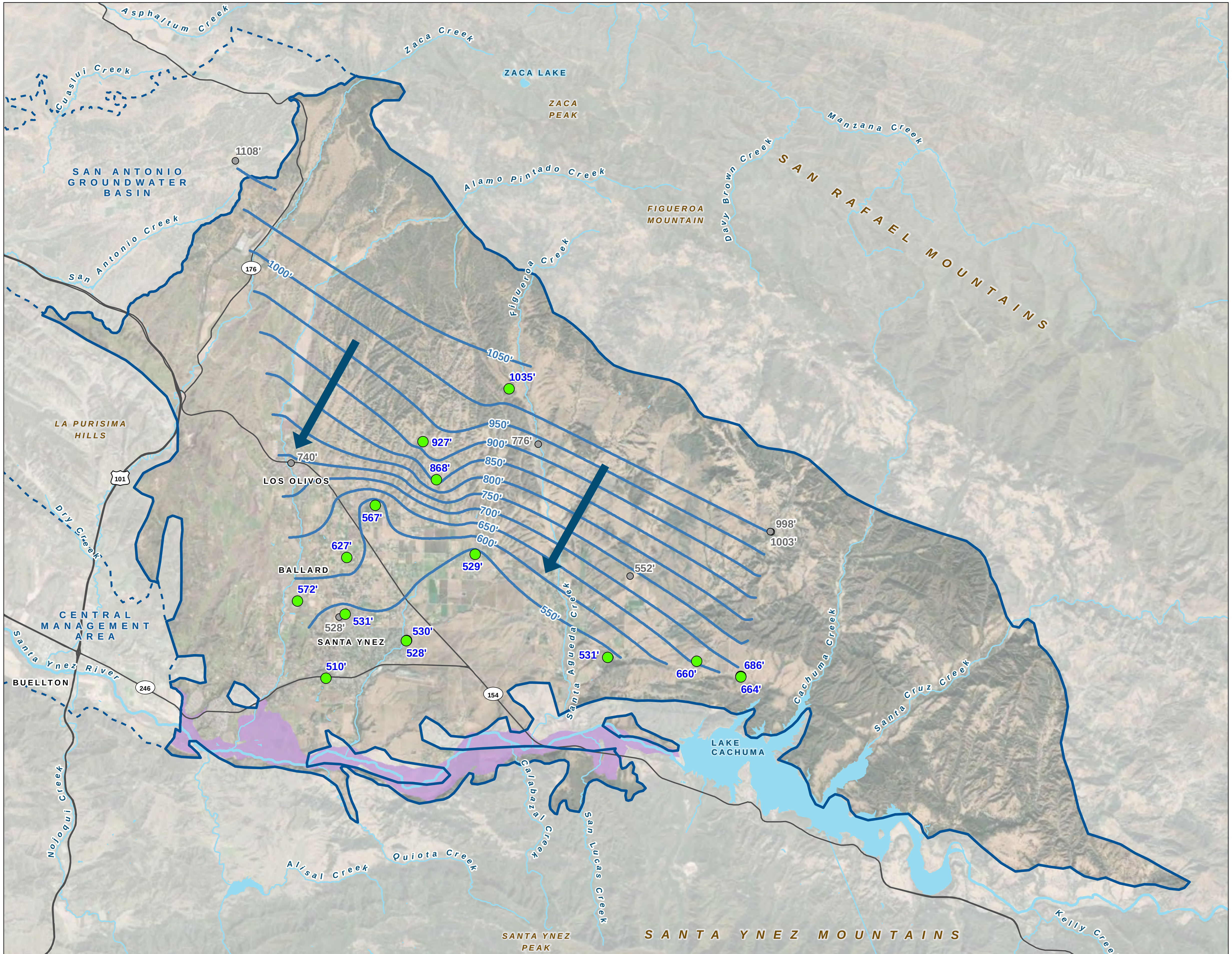

FIGURE 6

Paso Robles Formation Groundwater Elevation Contours, Spring 2019

Santa Ynez River Valley Groundwater Basin –
Eastern Management Area
First Annual Report (2019 - 2021)

LEGEND

- Paso Formation Groundwater Elevation, Spring 2019
- Groundwater Flow Direction
- Santa Ynez River Area

Paso Formation Wells

- Representative Well
  Water Level Elevaton (feet)
- Other Well
  Water Level Elevaton (feet)

All Other Features

- Eastern Management Area Bulletin 118 Boundary
- Other Bulletin 118 Groundwater Basin Boundary
- Major Road
- Watercourse
- Waterbody

Date: February 25, 2022
Data Sources: ESRI, USGS, Maxar Imagery (2020)

GSI Water Solutions, Inc.

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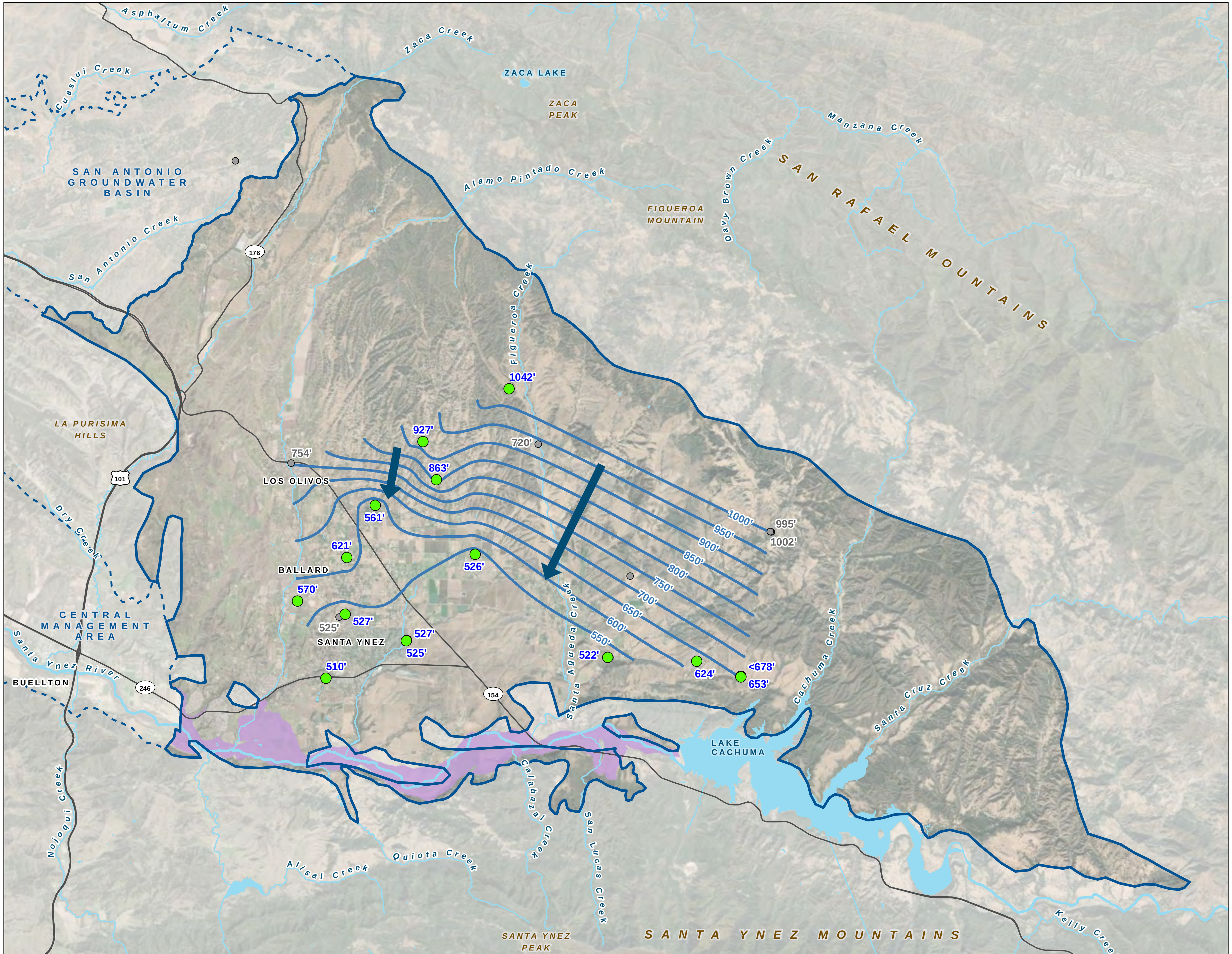

FIGURE 7

Paso Robles Formation Groundwater Elevation Contours, Spring 2020

Santa Ynez River Valley Groundwater Basin –
Eastern Management Area
First Annual Report (2019 - 2021)

LEGEND

- Paso Formation Groundwater Elevation, Spring 2020
- Groundwater Flow Direction
- Santa Ynez River Area

Paso Formation Wells

- Representative Well
  Water Level Elevaton (feet)
- Other Well
  Water Level Elevaton (feet)

All Other Features

- Eastern Management Area Bulletin 118 Boundary
- Other Bulletin 118 Groundwater Basin Boundary
- Major Road
- Watercourse
- Waterbody

N

0 5,000 10,000 15,000
Feet

Date: February 25, 2022
Data Sources: ESRI, USGS, Maxar Imagery (2020)

GSI Water Solutions, Inc.

Document Path: Y:\0515_Santa_Ynez_River_WCD\Source_Figures\EMA_2021_Annual_Report\Figure7_Paso_GW_Contours_Spring2020.mxd, abarry

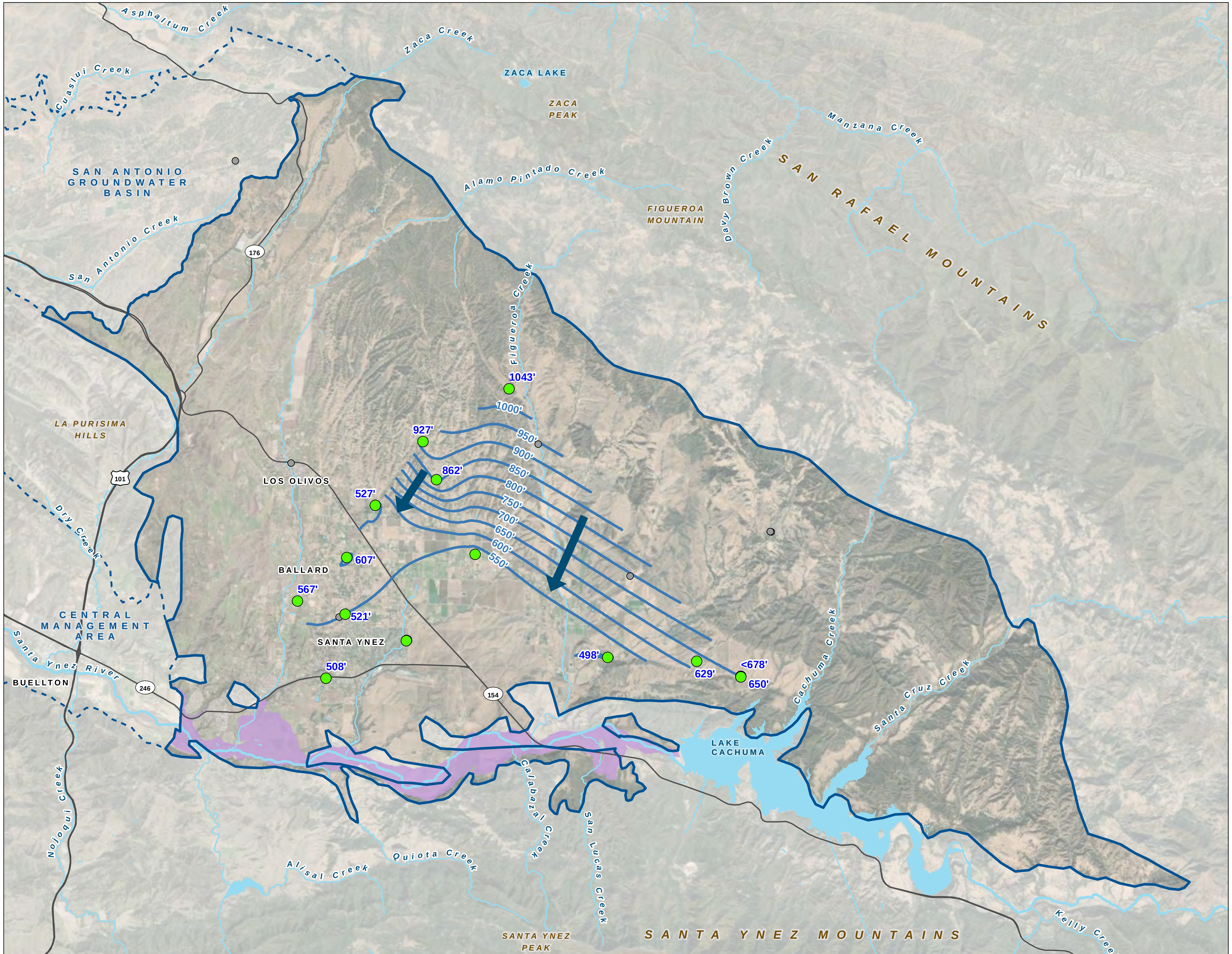

FIGURE 8

Paso Robles Formation Groundwater Elevation Contours, Fall 2020

Santa Ynez River Valley Groundwater Basin – Eastern Management Area First Annual Report (2019 - 2021)

LEGEND

- Paso Formation Groundwater Elevation, Fall 2020
- Groundwater Flow Direction
- Santa Ynez River Area

Paso Formation Wells

- Representative Well
  Water Level Elevaton (feet)
- Other Well
  Water Level Elevaton (feet)

All Other Features

- Eastern Management Area Bulletin 118 Boundary
- Other Bulletin 118 Groundwater Basin Boundary
- Major Road
- Watercourse
- Waterbody

N

0 5,000 10,000 15,000
Feet

GSI Water Solutions, Inc.

Date: February 25, 2022
Data Sources: ESRI, USGS, Maxar Imagery (2020)

Document Path: Y:\0515_Santa_Ynez_River_WCD\Source_Figures\EMA_2021_Annual_Report\Figure8_Paso_GW_Contours_Fall2020.mxd, abarry

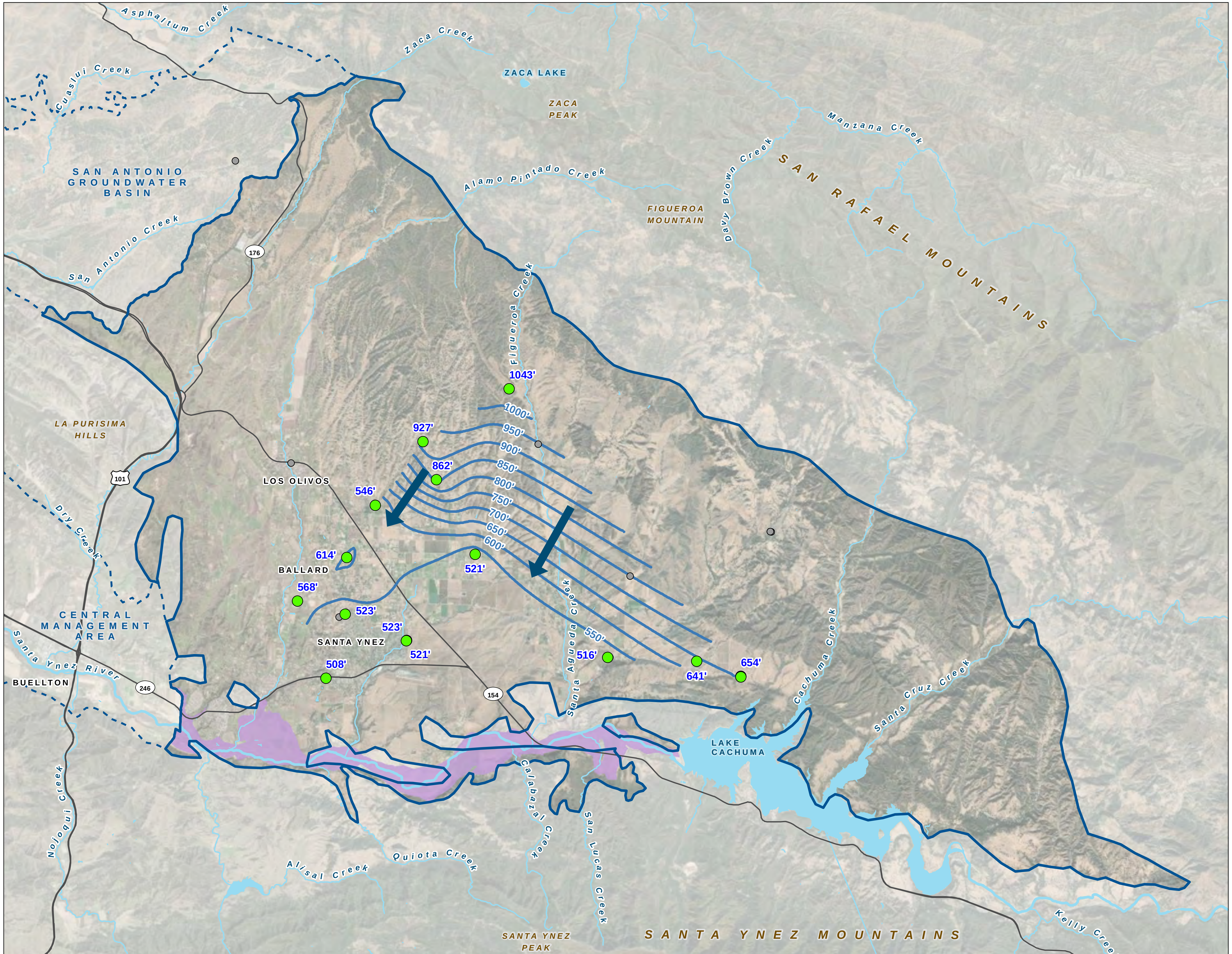

FIGURE 9

Paso Robles Formation Groundwater Elevation Contours, Spring 2021

Santa Ynez River Valley Groundwater Basin –
Eastern Management Area
First Annual Report (2019 - 2021)

LEGEND

- Paso Formation Groundwater Elevation, Spring 2021
- Groundwater Flow Direction
- Santa Ynez River Area

Paso Formation Wells

- Representative Well
  Water Level Elevaton (feet)
- Other Well
  Water Level Elevaton (feet)

All Other Features

- Eastern Management Area Bulletin 118 Boundary
- Other Bulletin 118 Groundwater Basin Boundary
- Major Road
- Watercourse
- Waterbody

N

0 5,000 10,000 15,000
Feet

Date: February 25, 2022
Data Sources: ESRI, USGS, Maxar Imagery (2020)

GSI Water Solutions, Inc.

Document Path: Y:\0515_Santa_Ynez_River_WCD\Source_Figures\EMA_2021_Annual_Report\Figure9_Paso_GW_Contours_Spring2021.mxd, abarry

Groundwater conditions in the EMA in the spring and fall are generally somewhat similar. Groundwater elevations in the fall are usually lower than in the spring in response to lower rainfall and increased pumping needed to satisfy irrigation demand in the warmer summer and early fall months. Groundwater elevations in the spring and fall of 2020 are presented as Figure 7 and Figure 8, respectively. A comparison of these maps, along with consideration of the groundwater elevation hydrographs included in Appendix C, indicate that groundwater levels in wells measured in both periods tended to be lower in the fall than in the spring, with the magnitude of the decrease ranging between near zero to as much as 34 feet with an average seasonal change in the representative wells of 7 feet. This seasonal change is similar to the overall change that has occurred during this 3-year reporting period since 2018 when groundwater levels have declined an average of 5 feet between the spring of 2019 and 2020 and an additional 2 feet in the spring of 2021.

3.2.2 Careaga Sand Aquifer Groundwater Elevation Contours

Contour maps were prepared for the groundwater elevations within the Careaga Sand principally for the spring period, which is when most data are historically available. These contour maps from the spring period represent the seasonal high groundwater levels. As in the Paso Robles Formation, the seasonal low groundwater elevations within the Careaga Sand aquifer typically occur in the fall, though to a lesser degree than within the Paso Robles Formation. In general, the spring groundwater data are representative of March through April of each year and the fall groundwater data (since 2020) represent October conditions. For consistency with the Plan, the same well data sets were used for contouring when available. Notably, many wells used to characterize groundwater conditions presented in the Plan are no longer available to be monitored in the northwestern portion of the EMA and therefore the area of the groundwater contours is limited to the area with water elevation data as presented on the figures.

Overall, groundwater in the Careaga Sand continue to flow in the same direction as documented in the Plan towards the southwest in the area below the communities of Ballard, Santa Ynez, and Solvang as presented on Figure 10 through Figure 13. The horizontal groundwater gradients during these periods are relatively unchanged from those presented in the Plan and range between 0.01 and 0.02 ft/ft.

The groundwater elevations in individual wells have varied annually in response to precipitation and pumping. Generally, groundwater levels have declined from the spring 2018 levels presented in the Plan. The groundwater elevations in the representative Careaga Sand wells have declined modestly during the reporting period by an average of 2 feet between spring 2019 and spring 2020 and an additional 4 feet on average by the spring of 2021.

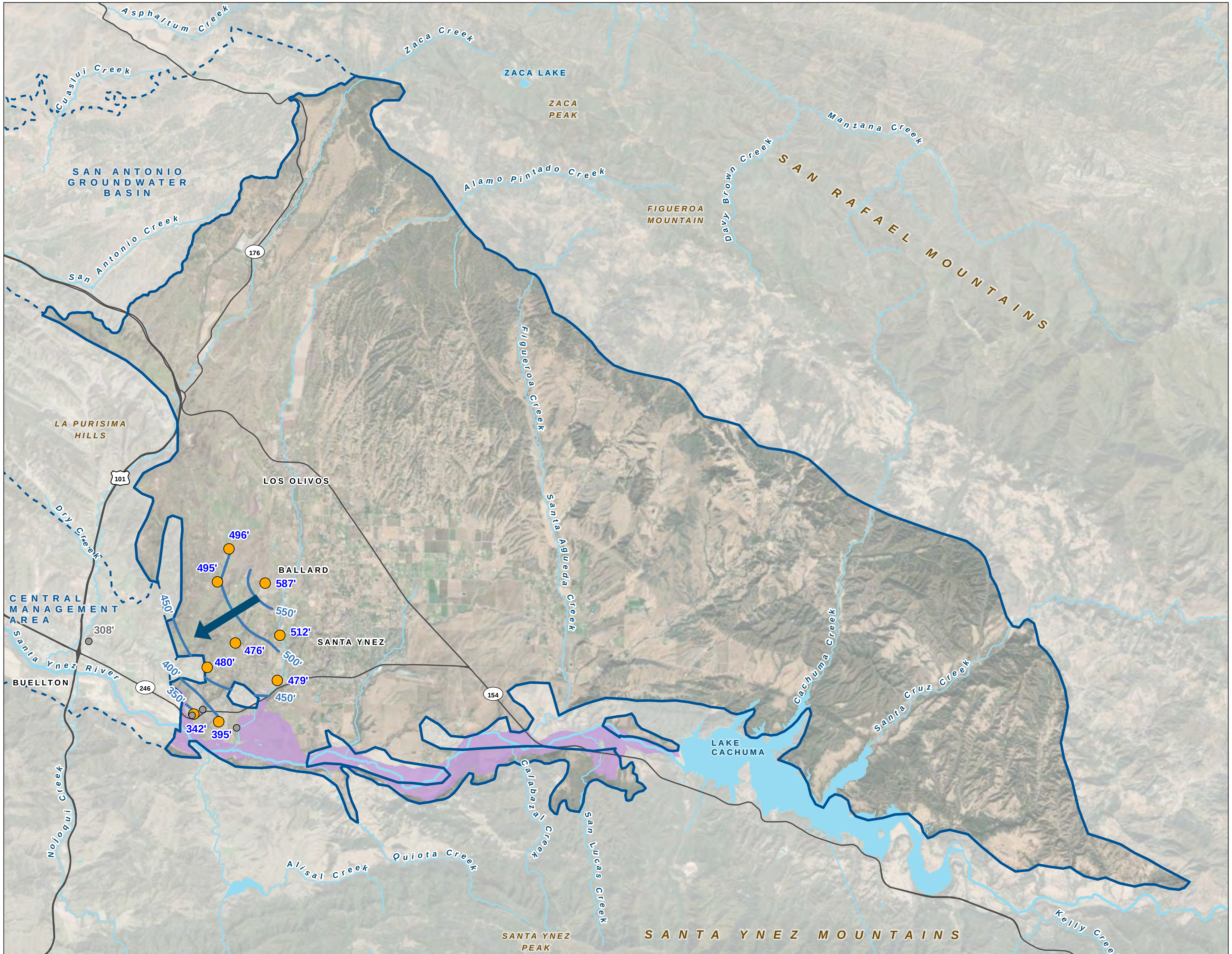

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FIGURE 10

Careaga Sand Groundwater Elevation Contours, Spring 2019

Santa Ynez River Valley Groundwater Basin – Eastern Management Area First Annual Report (2019 - 2021)

LEGEND

- Careaga Sand Groundwater Elevation, Spring 2019
- Groundwater Flow Direction
- Santa Ynez River Area

Careaga Sand Formation Wells

- Representative Well Water Level Elevaton (feet)
- Other Well Water Level Elevaton (feet)

All Other Features

- Eastern Management Area Bulletin 118 Boundary
- Other Bulletin 118 Groundwater Basin Boundary
- Major Road
- Watercourse
- Waterbody

N

0 5,000 10,000 15,000
Feet

Date: March 21, 2022
Data Sources: ESRI, USGS, Maxar Imagery (2020)

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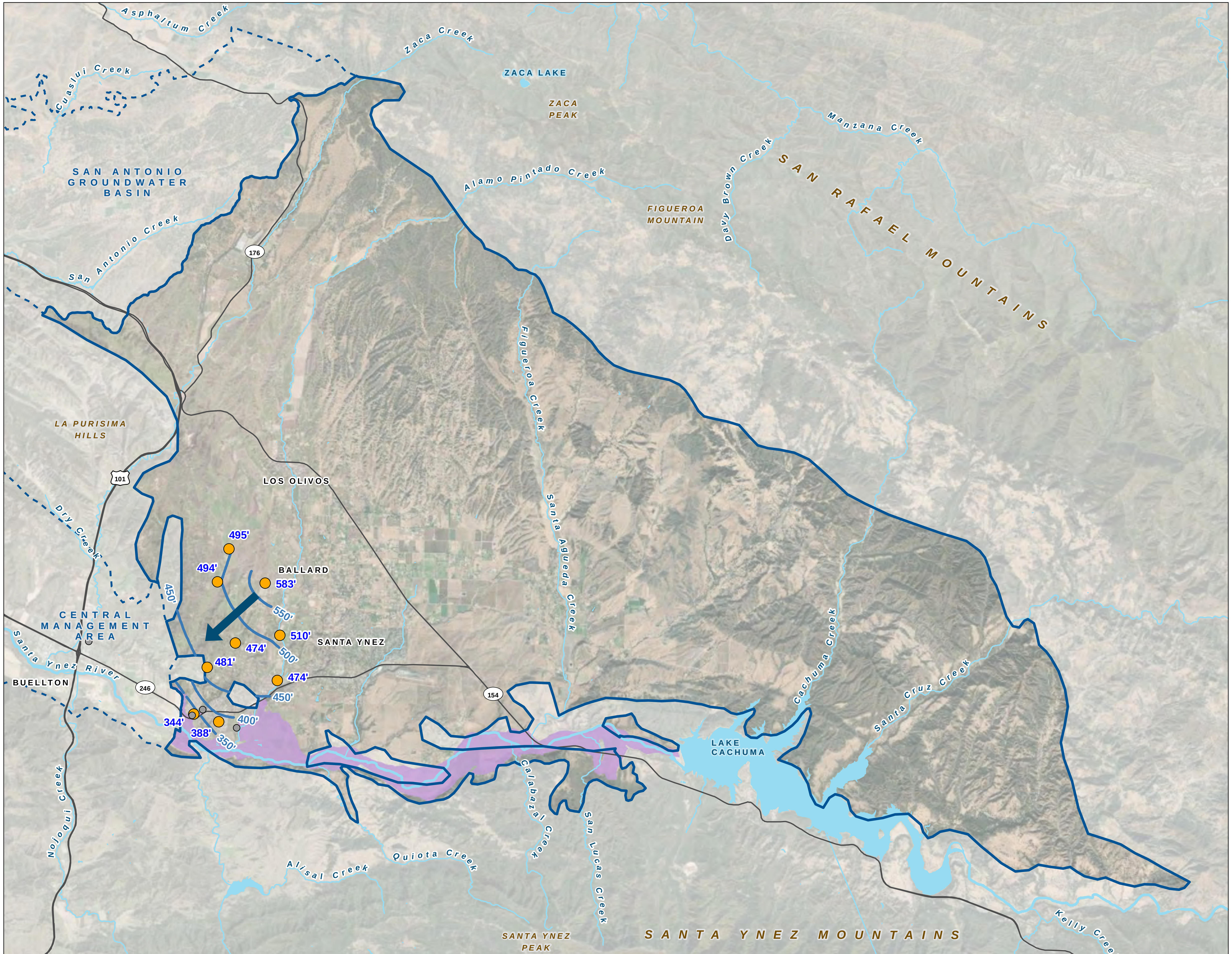


FIGURE 11

Careaga Sand Groundwater Elevation Contours, Spring 2020

Santa Ynez River Valley Groundwater Basin – Eastern Management Area First Annual Report (2019 - 2021)

LEGEND

- Careaga Sand Groundwater Elevation, Spring 2020
- Groundwater Flow Direction
- Santa Ynez River Area

Careaga Sand Formation Wells

- Representative Well Water Level Elevaton (feet)
- Other Well Water Level Elevaton (feet)

All Other Features

- Eastern Management Area Bulletin 118 Boundary
- Other Bulletin 118 Groundwater Basin Boundary
- Major Road
- Watercourse
- Waterbody

N

0 5,000 10,000 15,000
Feet

Date: February 25, 2022
Data Sources: ESRI, USGS, Maxar Imagery (2020)

GSI Water Solutions, Inc.

Document Path: Y:\0515_Santa_Ynez_River_WCD\Source_Figures\EMA_2021_Annual_Report\Figure11_Careaga_GW_Contours_Spring2020.mxd, abarry

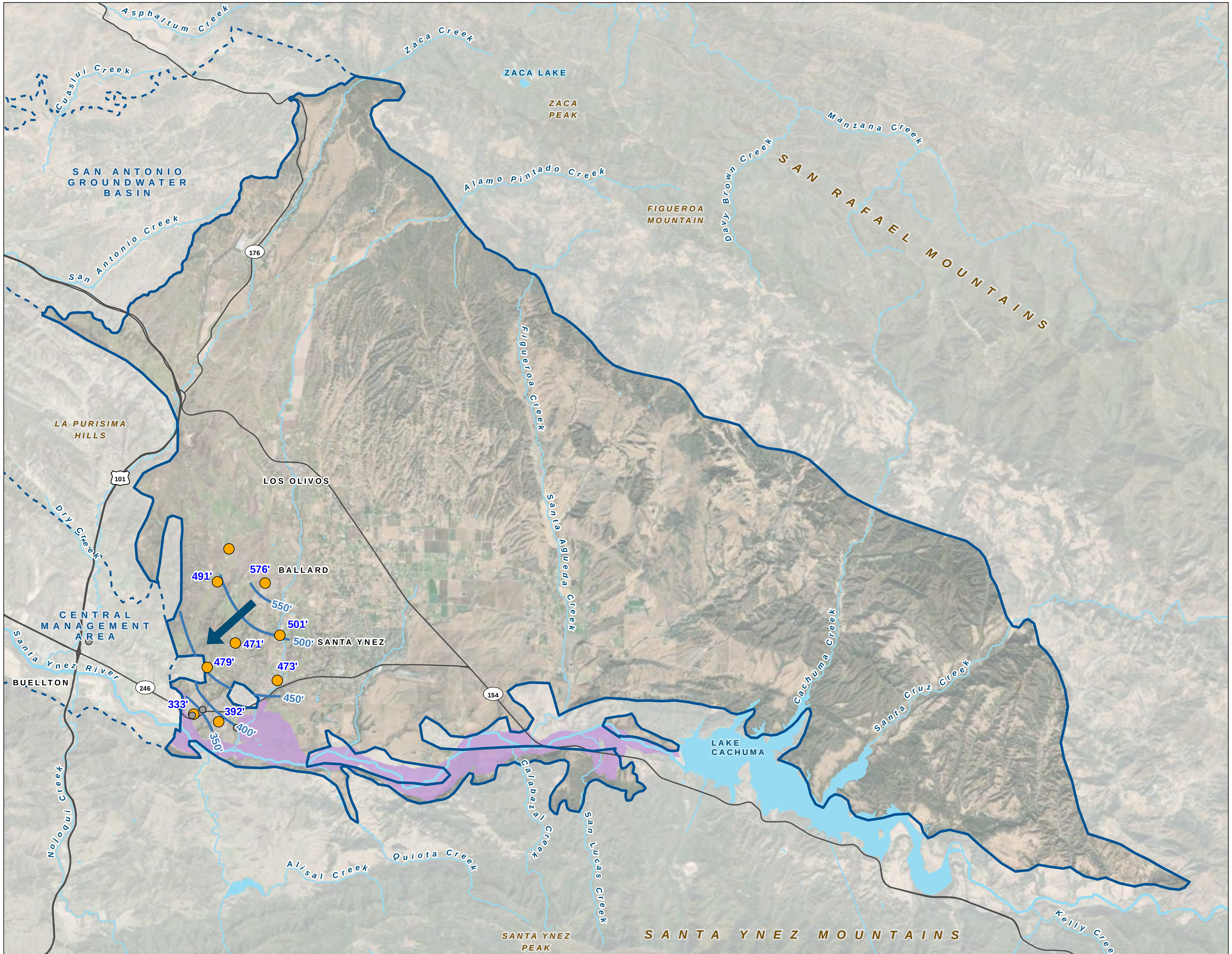


FIGURE 12

Careaga Sand Groundwater Elevation Contours, Fall 2020

Santa Ynez River Valley Groundwater Basin – Eastern Management Area First Annual Report (2019 - 2021)

LEGEND

- Careaga Sand Groundwater Elevation, Fall 2020
- Groundwater Flow Direction
- Santa Ynez River Area

Careaga Sand Formation Wells

- Representative Well
  Water Level Elevaton (feet)
- Other Well
  Water Level Elevaton (feet)

All Other Features

- Eastern Management Area Bulletin 118 Boundary
- Other Bulletin 118 Groundwater Basin Boundary
- Major Road
- Watercourse
- Waterbody

N

0 5,000 10,000 15,000
Feet

Date: February 25, 2022
Data Sources: ESRI, USGS, Maxar Imagery (2020)

GSI Water Solutions, Inc.

Document Path: Y:\0515_Santa_Ynez_River_WCD\Source_Figures\EMA_2021_Annual_Report\Figure12_Careaga_GW_Contours_Fall2020.mxd, abarry

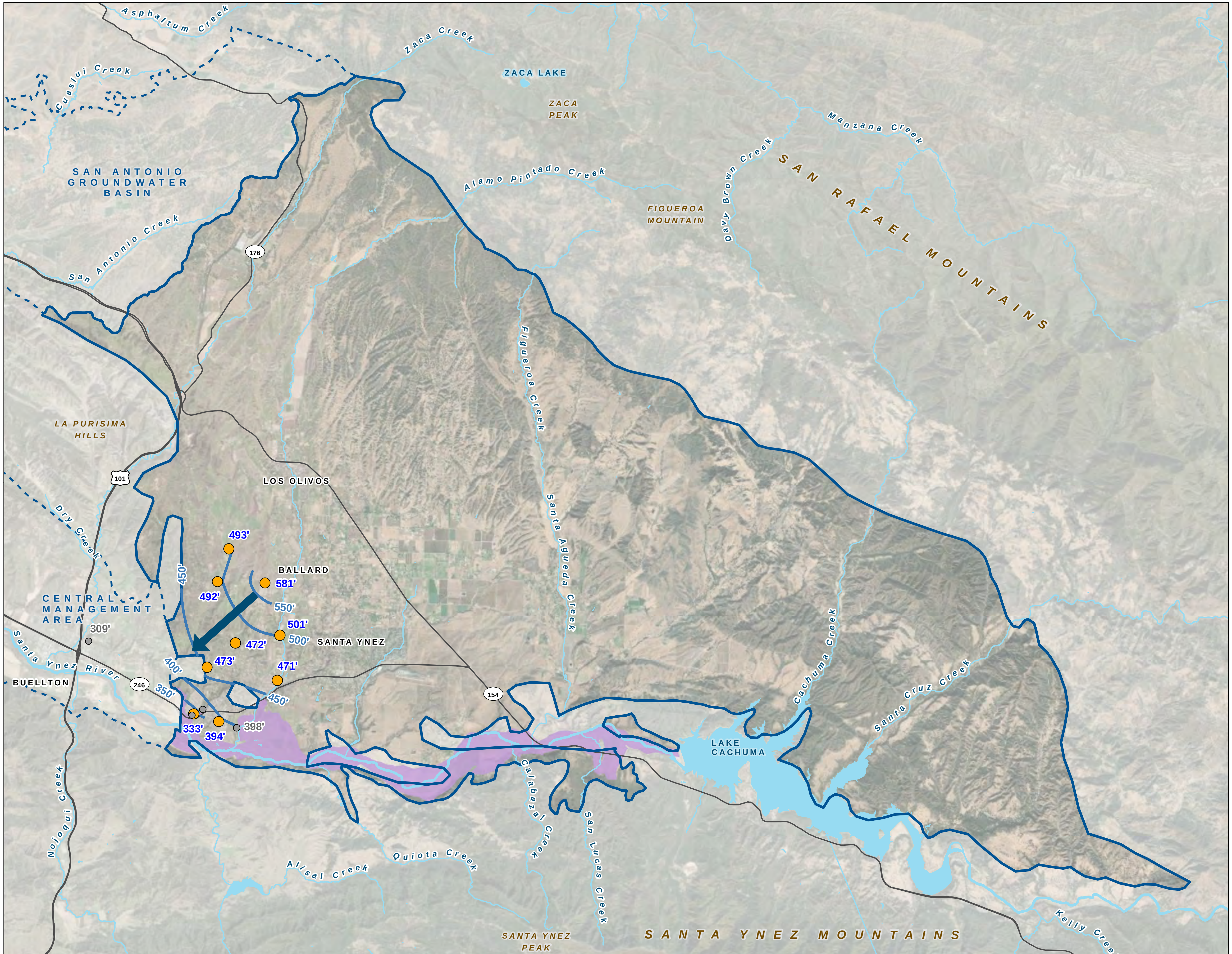


FIGURE 13

Careaga Sand Groundwater Elevation Contours, Spring 2021

Santa Ynez River Valley Groundwater Basin –
Eastern Management Area
First Annual Report (2019 - 2021)

LEGEND

- Careaga Sand Groundwater Elevation, Spring 2021
- Groundwater Flow Direction
- Santa Ynez River Area

Careaga Sand Formation Wells

- Representative Well
  Water Level Elevaton (feet)
- Other Well
  Water Level Elevaton (feet)

All Other Features

- Eastern Management Area Bulletin 118 Boundary
- Other Bulletin 118 Groundwater Basin Boundary
- Major Road
- Watercourse
- Waterbody

N

0 5,000 10,000 15,000
Feet

Date: March 18, 2022
Data Sources: ESRI, USGS, Maxar Imagery (2020)

GSI Water Solutions, Inc.

Seasonally, the groundwater conditions in the spring and fall are somewhat similar, with groundwater elevations in the fall generally slightly lower than in the spring in response to reduced rainfall recharge and increased pumping to satisfy irrigation demand in the warmer summer and early fall months. Groundwater elevations in the spring and fall of 2020 are presented as Figure 11 and Figure 12, respectively. A comparison of these maps, along with consideration of the groundwater elevation hydrographs included in Appendix C, suggest that groundwater levels in wells measured in both periods tended to be lower in the fall than in the spring, with the magnitude of the change ranging between a rise of 4 feet and decline of 9 feet, with an average seasonal change in the representative wells of 4 feet.

3.3 Hydrographs (§ 356.2[b][1][B])

Groundwater elevation hydrographs are used to evaluate groundwater behavior in each principal aquifer. Changes in groundwater elevation in the EMA can result from many influencing factors, which may include changing hydrologic trends, seasonal variations in precipitation, varying groundwater extractions, changing inflows and outflows, and influence from localized pumping. Climatic variation can be one of the most significant factors affecting groundwater elevations over time. For this reason, the hydrographs also display water year type categorized as wet, above normal, below normal, dry, or critical (Figure 4).

3.3.1 Hydrographs

Groundwater elevation hydrographs and an associated location map for the 15 representative wells completed in the Paso Robles Formation and 9 wells completed within the Careaga Sand are presented in Appendix C. Figure C-1 at the beginning of Appendix C includes the other wells that are monitored by Santa Barbara County Water Agency but are not considered to be representative of a single principal aquifer. The hydrographs include available well construction data and measurable objectives and minimum thresholds for each RMS that were developed during the preparation of the Plan.

As described in the Plan, the groundwater levels measured during the spring of 2012 at the RMSs were selected as the measurable objectives, and minimum thresholds were set relative to these elevations.

According to DWR methods for defining water year types, the water year types for water years 2019 and 2020 were both “above normal” while water year 2021 was “dry”. Although 2 of the 3 water years included above normal precipitation, groundwater elevations in some of the representative wells are continuing to trend downward. Of the 15 representative wells in the Paso Robles Formation hydrographs presented in Appendix C, only 4 of the wells exhibit groundwater elevations below the minimum threshold as of the spring of 2021. Likewise, only 1 of the 9 wells completed in the Careaga Sand exhibits groundwater elevations below the minimum threshold in the spring of 2021.

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

4.1 Introduction

This section presents the metered and estimated groundwater extractions from the EMA for water years 2019, 2020, and 2021. The metered and estimated groundwater extractions from the EMA for the water year 2018 are included in the tables for comparison. The types of groundwater extraction described in this section include municipal (Table 2), agricultural (Table 3), and rural domestic (Table 5). Each of following subsections 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 6.

4.2 Municipal Metered and Other Self-Reported Well Production Data

Metered groundwater pumping extraction data are from the City of Solvang and ID No. 1. Table 2 presents these metered data, the self-reported data provided by pumpers within the SYRWCD, and estimated extraction data for mutual water companies. The accuracy rating of the metered production data from Solvang and ID No. 1 is high, while the accuracy rating of the self-reported production data from pumpers within SYRWCD and from mutual water companies is considered medium due to the lack of quantified production data (meters).

Table 2. Municipal and Other Self-Reported Groundwater Extractions

(Values in acre-feet)

Water Year	Water Year Type	ID No. 1	Self-Reported to SYRWCD	City of Solvang	Mutual Water Companies	Total
2018	Below Normal	753	938	369	945	3,005
2019	Above Normal	298	948	186	951	2,382
2020	Above Normal	621	970	289	957	2,837
2021	Dry	795	1,069	456	963	3,284

Notes

[shaded box] = Water year included in the historical period

ID No. 1 = Santa Ynez River Water Conservation District, Improvement District No. 1

SYRWCD = Santa Ynez River Water Conservation District

4.3 Estimate of Agricultural Extraction

During water years 2019 to 2021, approximately 80 percent of the total groundwater extraction was used to supply agriculture in the EMA. Agricultural water demand within the SYRWCD was estimated based on self-reported pumping volumes, which are estimated based on planted acreages and crop-specific water duty factors specified in SYRWCD's Groundwater Production Information and Instructions pamphlet (SYRWCD, 2010).

While the accuracy of the land use mapping of irrigated crops for 2018 is high, uncertainty remains in the estimates of water use from these irrigated lands and, hence, the estimated volumes of pumping needed to meet the crop water requirement. The accuracy of these calculations is considered medium.

Outside of the SYRWCD boundaries, the method for estimating agricultural pumping has changed for the annual reporting period compared to the method used and presented in the Plan. Previously, the agricultural water use was based on California Natural Resource Agency (CNRA) 2018 land use data (DWR, 2018b) and the same crop-specific water use factors as those used within the SYRWCD. These land use data provided crop categories, which were grouped into six crop groups, including vineyard, field crops, truck and berry crops, tree crops, pasture, and cannabis/hemp, each with a respective set of crop water use factors.

However, because the spatial land use data were last available in 2018 from the CNRA, a different method of estimation was required for the period of water years 2019 through 2021. Of the alternative methods available for estimating ET, OpenET was selected and used to estimate crop water uses for water years 2019 through 2021. The OpenET method is a National Aeronautics and Space Administration collaboration with the Desert Research Institute and the Environmental Defense Fund running atop a Google Earth Engine, which provides monthly crop water use for a defined area (here the field scale). The OpenET data is being used throughout the state as part of an open-source groundwater accounting platform, freely available, to help GSAs manage the transition to sustainable supplies. The accuracy of these OpenET data are considered to be medium.

This method estimates the Potential and Actual ET values from the planted crops directly from remote sensing methods at the field scale, and may help address concerns about potential errors in agricultural water use estimation that could occur based on rough estimations of pumping from Water Use factors, including the variability of actual water use during variable hydrology (water year type), and any water applied outside of the typical crop need or for frost control.

This OpenET data was available for the entire Santa Ynez Uplands, both within and outside of the SYRWCD; however, it was only used in this Annual Report for the areas outside of the SYRWCD for consistency with previous estimates within the SYRWCD. Based on these methods both inside and outside estimated agricultural groundwater demands for water years 2018 through 2021 are included in Table 3. Water year 2018, the final year presented in the Plan, is included for comparison.

Table 3. Agricultural Irrigation Groundwater Extractions

Water Year	Water Year Type	Agricultural Demand (acre-feet)
2018 [1]	Below Normal	11,876
2019	Above Normal	12,278
2020	Above Normal	11,812
2021	Dry	13,379

Notes

[shaded box] = Water year included in the historical period

[1] Water year's historical water budget pumping volume was revised based on updated data.

Notably, the groundwater extraction in the Santa Ynez Uplands for agricultural use was relatively unchanged during water years 2019 and 2020 but increased by approximately 13 percent in 2021. This increase was due to an expansion of vineyard acreage outside of the SYRWCD in the area south of the Santa Ynez Airport and west of the Zanja de Cota of approximately 890 acres of vineyards in 2021. Meters would substantially improve the accuracy of these estimates.

4.4 Rural Domestic and Small Public Water System Extraction

Rural domestic groundwater extractions in the EMA were estimated using the methods described below.

4.4.1 Rural Domestic Demand

Rural domestic pumping is defined as all domestic pumping occurring outside of SYRWCD's jurisdiction not associated with a small public water system. Rural domestic pumping was calculated by conducting an aerial survey to identify land parcels with home sites in the area outside the SYRWCD in 2018. The 2018 domestic demand for each of these parcels was estimated using variable demand factors based on parcel acreage, as specified in Tetra Tech 2010 (Table 4). The calculated 2018 rural domestic demand was then adjusted through 2021 using a compilation of census data for nearby communities.

Table 4. Rural Domestic Demand Factors Based on Lot Size

Lot Size (acres)	Annual Water Use (acre-feet per year per lot)
0.16	0.14
0.5	0.52
1	0.82
5	0.98
10	1.15

Note

Source: Tetra Tech, 2010

These groundwater extraction components were estimated based on an aerial survey and published estimated water demand based on parcel size. Consequently, the accuracy of this groundwater budget component is considered medium. Table 5 includes the calculated rural domestic groundwater demand for water years 2018 to 2021.

Table 5. Rural Domestic Groundwater Extractions

Water Year	Water Year Type	Rural Domestic (acre-feet)
2018	Below Normal	303
2019	Above Normal	305
2020	Above Normal	307
2021	Dry	309

Note

[shaded box] = Water year included in the historical period

4.5 Total Groundwater Extraction Summary

The total annual volume of groundwater extracted in the EMA for water years 2019, 2020, and 2021 was between 14,900 and 17,000 acre-feet (AF), as shown on Table 6. As required, the table presents the total metered and estimated water use by sector and indicates the method of measure and associated level of accuracy.

Table 6. Groundwater Extractions by Water Use Sector

(Values in acre-feet)

Water Year	Water Year Type	Municipal and Self-Reported Domestic	Mutual Water Companies	Rural Domestic	Agriculture	Total
2018	Below Normal	2,060	945	303	11,876	15,184
2019	Above Normal	1,431	951	305	12,278	14,965
2020	Above Normal	1,880	957	307	11,812	14,956
2021	Dry	2,320	963	309	13,379	16,972
Method of Measure	NA	Provided by ID No. 1 (metered), City of Solvang (metered), and SYRWCD (user reported)	Estimated based on population data	Estimated based on population data	Within District: User Reported Outside District: Estimated based on land use surveys, crop duty factors, and OpenET	NA
Level of Accuracy	NA	High (metered) / Low (user reported)	Medium	Medium	Medium (OpenET) / Low (user reported) / Medium (land use surveys)	NA

Notes

[shaded box] = Water year included in the historical period

ID No. 1 = Santa Ynez River Water Conservation District, Improvement District No. 1

NA = not applicable

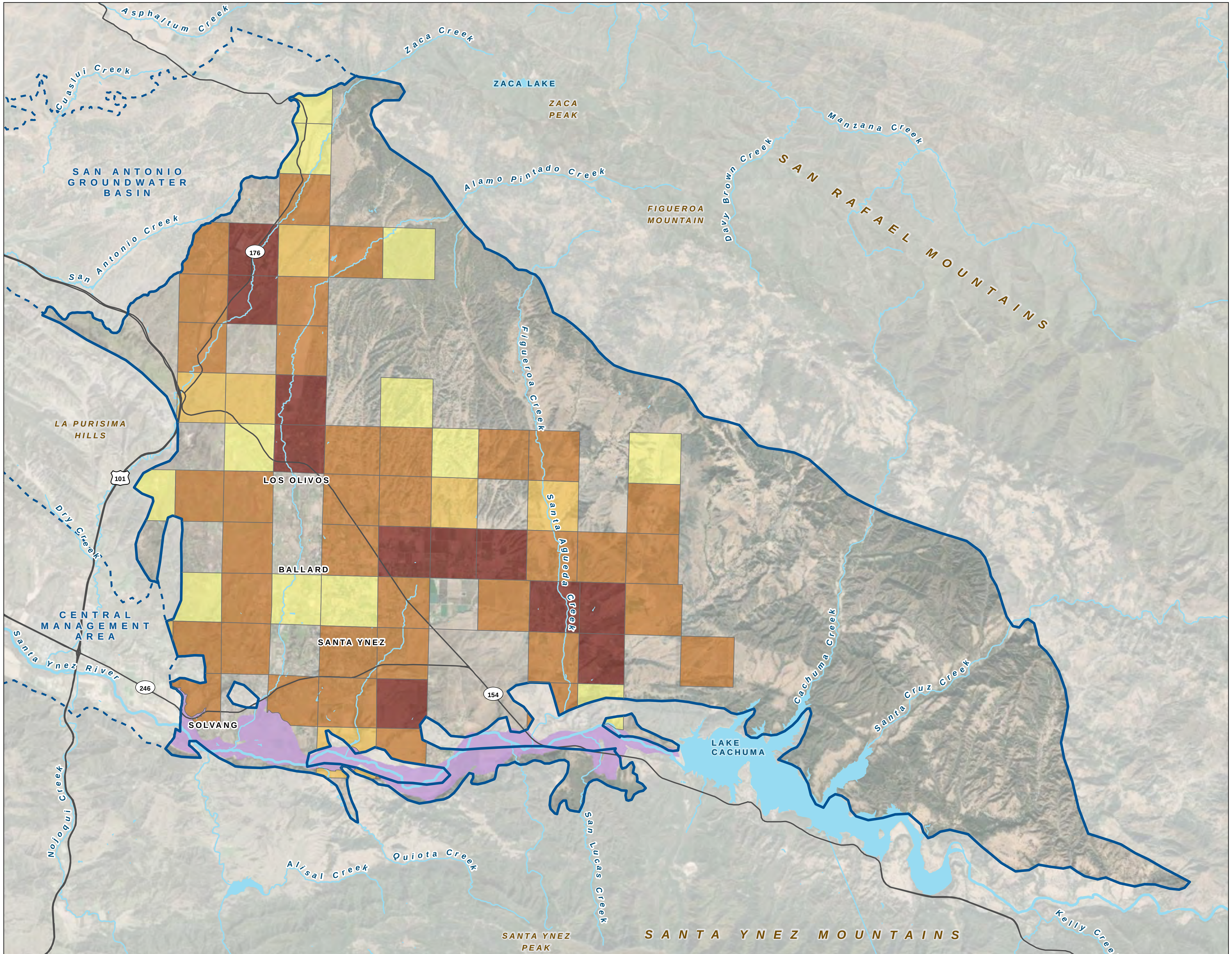
SYRWCD = Santa Ynez River Water Conservation District

The locations of these extractions were based on the known locations of metered pumping from the municipal users, estimates of pumping from rural domestic users, and agricultural land use spatial data. Together, the spatial distribution of these extractions during the most recent water year in 2021 are presented on Figure 14 in terms of AF per square mile.

FIGURE 14

Location and Volume of Groundwater Extractions, Water Year 2021

Santa Ynez River Valley Groundwater Basin –
Eastern Management Area
First Annual Report (2019 - 2021)



LEGEND

Santa Ynez River Area

Groundwater Extraction by Section

Acre Feet

- 25 - 50
- 50 - 100
- 100 - 500
- 500 - 1555

All Other Features

- Eastern Management Area Bulletin 118 Boundary
- Other Bulletin 118 Groundwater Basin Boundary
- Major Road
- Watercourse
- Waterbody

N

0 5,000 10,000 15,000
Feet

GSI Water Solutions, Inc.

Date: March 1, 2022
Data Sources: ESRI, USGS, Maxar Imagery (2020)

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

This section provides a summary of the surface water supplies used within the EMA during water years 2018 through 2021. ID No. 1 imports water into the EMA via the Cachuma Project and the State Water Project (SWP). ID No. 1 does not receive its Cachuma Project water directly; instead, in addition to its own entitlement of SWP supplies, it also receives an amount of SWP water through an Exchange Agreement with the South Coast members of the Cachuma Project, whereby ID No.1 provides its Cachuma Project water to the South Coast in exchange for an equivalent amount of SWP water from the South Coast agencies. ID No.1 also produces water from the Santa Ynez River underflow pursuant to licenses issued by the State Water Resources Control Board for use in the Santa Ynez Uplands. As a member agency of the Central Coast Water Authority (CCWA), ID No. 1 has a Table A allocation of 2,000 acre-feet per year (AFY) and a 200 AF drought buffer of imported SWP water. Of that amount, 1,500 AFY are contractually committed for use by the City of Solvang. The drought buffer effectively increases the amount of water to be delivered in the event that overall deliveries are reduced by a given percentage.

In addition to imported water sources, users within the EMA extract water from the Santa Ynez River Alluvium for municipal, domestic, industrial, and agricultural uses, including water used for urban landscape irrigation. Pumping data from this area of the EMA are provided by the City of Solvang, ID No. 1, and from SYRWCD as “self-reported” pumping data from well owners within SYRWCD. The river well production data from ID No. 1, Solvang, and the other self-reported pumping records aggregate uses together into the SYRWCD categories of (1) agricultural; (2) “other” water, which includes municipal, industrial, small public water systems, and domestic use; and (3) “special” irrigation water, which refers to urban landscape and golf course irrigation. These pumping volumes have been compiled on a water year basis and are reported annually on a July-through-June fiscal year basis in SYRWCD’s annual reports, which have been prepared for 42 years.

Pumping volumes provided by the City of Solvang and ID No. 1 are from metered pumping and are considered highly reliable and accurate. Likewise, some of the self-reported pumping data provided by SYRWCD annual reports are also from metered pumping records and are similarly accurate. A large portion of the self-reported SYRWCD pumping data outside of the municipal providers is estimated from self-reported records using crop-specific water duty factors provided by SYRWCD for its water use estimates and annual reports. These pumping estimates based on self-reported records are of medium accuracy, due to the uncertainty of standardized crop water duty factors and reliability of self-reporting. Table 7 presents the volume of surface water supply that was used in the EMA.

Table 7. Surface Water Use

(Values in acre-feet)

Water Year	City of Solvang	ID No. 1 Table A	ID No. 1 Exchange	Solvang River Wells	ID No. 1 River Wells	Other Reported River Wells[1]	Total Reported River Wells	Total
2018	484	274	1,012	263	1,159	1,675	3,097	4,867
2019	759	50	2,213	160	739	1,658	2,557	5,579
2020	745	315	1,740	148	567	1,566	2,281	5,081
2021	612	0	1,439	240	1,142	1,775	3,157	5,208
Method of Measure	Metered	Metered	Metered	Metered	Metered	User Reported	Metered/Reported	NA
Level of Accuracy	High	High	High	High	High	Medium	High/Medium	NA

Notes

[shaded box] = Water year included in the historical period

[1] Includes wells within Santa Ynez River Water Conservation District Zone A

ID No. 1 = Santa Ynez River Water Conservation District, Improvement District No. 1

NA = not applicable

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 domestic demands within the EMA. For the period of water years 2019 through 2021, the quantification of total water use was completed from reported metered municipal water production and metered surface water delivery, SYRWCD reported groundwater and river well pumping within its boundaries, and estimates of agricultural and rural water demand outside of SYRWCD. Table 8 presents the total metered and estimated water use in the EMA by source and water use sector. The method of measurement and a qualitative level of accuracy for each estimate is rated on a scale of low, medium, and high.

Table 8. Total Water Use

(Values in acre-feet)

Water Year	Water Year Type	Groundwater Use	Surface Water Use	Total
2018	Below Normal	15,184	4,867	20,051
2019	Above Normal	14,965	5,579	20,544
2020	Above Normal	14,956	5,081	20,037
2021	Dry	16,972	5,208	22,180
Method of Measure	NA	Metered, User Reported, and Estimated	Metered/User Reported	NA
Level of Accuracy	NA	High (metered) to Low (user reported)	High to Medium	NA

Notes

[shaded box] = Water year included in the historical period

NA = not applicable

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

7.1 Introduction

This section presents an overview of the change in groundwater in storage within the two principal aquifers in the EMA. The annual changes in groundwater in storage have been estimated using two methods based on the availability of data. Where groundwater elevation data are sufficient and spatially distributed from year to year, the change in storage estimate used these data. However, where these data are lacking in the Santa Ynez Uplands, the change in storage was estimated using the inflow and outflow components from the water budget described in the Plan.

7.2 Annual Changes in Groundwater in Storage (§ 356.2[b][5][A])

The current groundwater monitoring network for the Paso Robles Formation does not have sufficient spatial distribution to adequately represent groundwater conditions for the entire aquifer throughout the Santa Ynez Uplands. While the groundwater elevation monitoring network used for contouring groundwater elevations for water year 2018 for both principal aquifers provided sufficient spatial coverage of the EMA in 2018, the monitoring network was not sufficient for this in the Paso Robles Formation during water years 2019 through 2021. This is in part due to the loss of access to several groundwater wells in the adjacent San Antonio Groundwater Basin in 2018 and 2019, and the loss of access to wells within the EMA during water years 2020 and 2021. The wells in the San Antonio Groundwater Basin, which is in hydraulic communication with the EMA, have historically been used to define groundwater conditions in that area in both basins.

The groundwater elevation changes depicted on the maps presented in section are used, along with the storage coefficient, to calculate the proportion of that change that is due to groundwater in storage. The portion of void space in the aquifer that can be utilized for groundwater storage is represented by the aquifer storage coefficient, which similar to porosity and is a unitless factor that is multiplied by the total volume change between water years to derive the change in groundwater in storage.

7.2.1 Paso Robles Formation

The relatively limited extent of the groundwater elevation contours within the Paso Robles Formation is evident in the spring of 2020 (Figure 7) and more so during the spring of 2021 (Figure 9). Although the existing groundwater level monitoring network satisfies the DWR's well density guidance, there are two areas identified within the EMA both in the northwest and the eastern portion of the EMA, where the addition of monitoring wells would improve the hydrogeologic conceptual model (HCM) as discussed in the Plan. Because the accuracy of using this method is dependent on the lateral extent of the water level data, the accuracy associated with using this method for the Paso Robles Formation is considered low. Since 2018, the understanding of water level conditions in the Paso Robles Formation has been hindered by the loss of at least one well in the adjacent San Antonio Groundwater Basin, one within Los Olivos and one near Happy Canyon. The EMA GSA is working to address these identified data gaps.

Nonetheless, the change in storage can be inferred for a portion of the Paso Formation using the change in groundwater elevation map between the spring of 2020 and 2021 presented on Figure 15. The red and orange areas with the greatest change in groundwater elevation are the areas where the change in groundwater in storage was the greatest. The change in storage map generated by this method is not considered representative of groundwater conditions throughout the EMA and therefore was not used to calculate the change in groundwater in storage. Instead, the change in storage within the Paso Robles Formation was estimated based on the overall water budget (for both aquifers) and the change in storage in the Careaga Sand, described below. The remainder of the change in storage, which did not occur in the Careaga Sand, occurred in the Paso Robles Formation.

7.2.2 Careaga Sand

Changes in groundwater in storage within the Careaga Sand for water years 2019, 2020, and 2021 were derived by comparing spring groundwater elevation contour maps from one year to the next. For example, the spring 2021 groundwater elevations for the Careaga Sand (Figure 13) were subtracted from the spring 2020 groundwater elevations (Figure 11), resulting in a map depicting the changes in groundwater elevations that occurred during the 2020 water year (Figure 16). Similar calculations were made for water years 2019 and 2020. The red and orange areas with the greatest change in groundwater elevation are the areas where the change in groundwater in storage was the greatest.

The change in groundwater elevation map for water year 2021 within the Careaga Sand (Figure 16), a dry precipitation year, shows a combination of declines in groundwater elevation of between 5 and 10 feet in most of the area, with limited areas of greater decline of up to 15 feet and a slight rise along the southern border of the area adjacent the Santa Ynez River. Again, areas with the greatest declines in water levels reflect the areas with the greatest reduction of groundwater in storage.

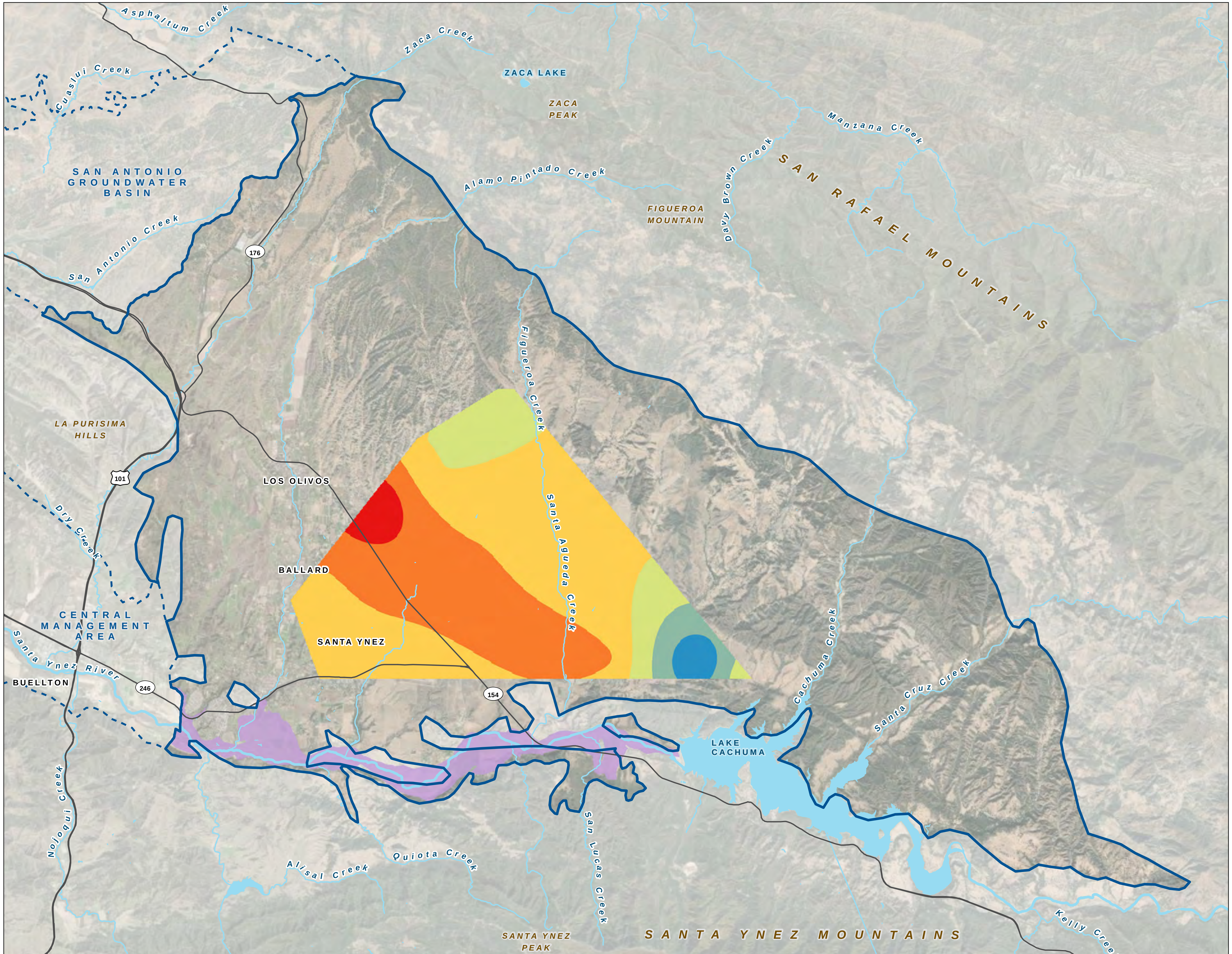

FIGURE 15

Paso Robles Formation Change of Groundwater Elevation, Spring 2020 to Spring 2021

Santa Ynez River Valley Groundwater Basin –
Eastern Management Area
First Annual Report (2019 - 2021)

LEGEND

Santa Ynez River Area

Change in Groundwater Elevation (feet NAVD88)[1]

- -15.7 - -10
- -10 - -5
- -5 - 0
- 0 - 5
- 5 - 10
- 10 - 16.2

All Other Features

- Eastern Management Area Bulletin 118 Boundary
- Other Bulletin 118 Groundwater Basin Boundary
- Major Road
- Watercourse
- Waterbody

NOTE

[1]NAVD88: North American Datum of 1988

N

0 5,000 10,000 15,000
Feet

Date: March 1, 2022
Data Sources: ESRI, USGS, Maxar Imagery (2020)

GSI Water Solutions, Inc.

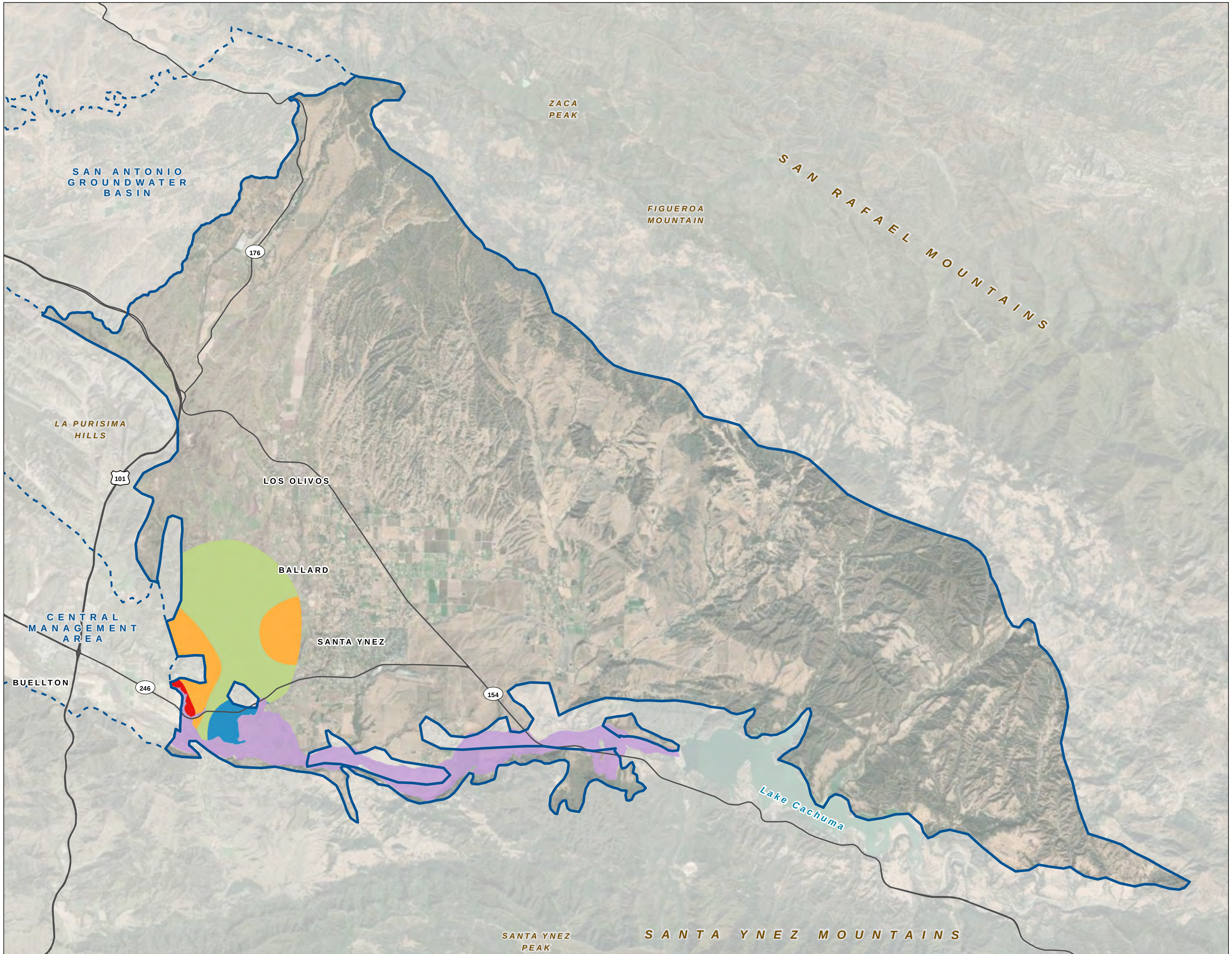

FIGURE 16

Careaga Sand Change of Groundwater Elevation, Spring 2020 to Spring 2021

Santa Ynez River Valley Groundwater Basin –
Eastern Management Area
First Annual Report (2019 - 2021)

LEGEND

Santa Ynez River Area

Change in Groundwater Elevation (feet NAVD88)[1]

- -15 - -10
- -10 - -5
- -5 - 0
- 0 - 6

All Other Features

- Eastern Management Area Bulletin 118 Boundary
- Other Bulletin 118 Groundwater Basin Boundary
- Major Road
- Watercourse
- Waterbody

NOTE

[1]NAVD88: North American Datum of 1988

N

0 5,000 10,000 15,000
Feet

Date: March 1, 2022
Data Sources: ESRI, USGS, Maxar Imagery (2020)

GSI Water Solutions, Inc.

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

Together with the change in storage for the Paso Robles Formation calculated by the water budget method, the EMA-wide annual change of groundwater in storage for both principal aquifers for water years 2019, 2020, and 2021 are presented in Table 9. The annual and cumulative change in groundwater in storage since 1981 are presented on Figure 17, which includes the period since January of 2015.

The volume of groundwater in storage rose by 4,000 AF in water year 2019, when a total of 20 inches of rain fell during the above normal year. In 2020, when 15 inches of rain fell, the volume of groundwater in storage declined by 2,100 AF. Lastly, when a dry year occurred during 2021 and only half of the normal rain fell, the groundwater in storage declined by 13,600 AFY. This annual storage decline in 2021 is similar to the annual change in storage that was experienced in the EMA during each of the peak drought years of 2013 through 2016. Overall, since 2018, when the historical period presented in the Plan ended, a net decrease of 11,700 AFY of groundwater has occurred.

Table 9. Annual Change in Storage

(Values in acre-feet)

Water Year	Water Year Type	Change in Storage (Paso Robles Formation)	Change in Storage (Careaga Sand)	Total Annual Change in Storage
2018	Below Normal	NA	NA	-5,147
2019	Above Normal	3,047	996	4,043
2020	Above Normal	-1,662	-477	-2,139
2021	Dry	-12,737	-825	-13,562

Notes

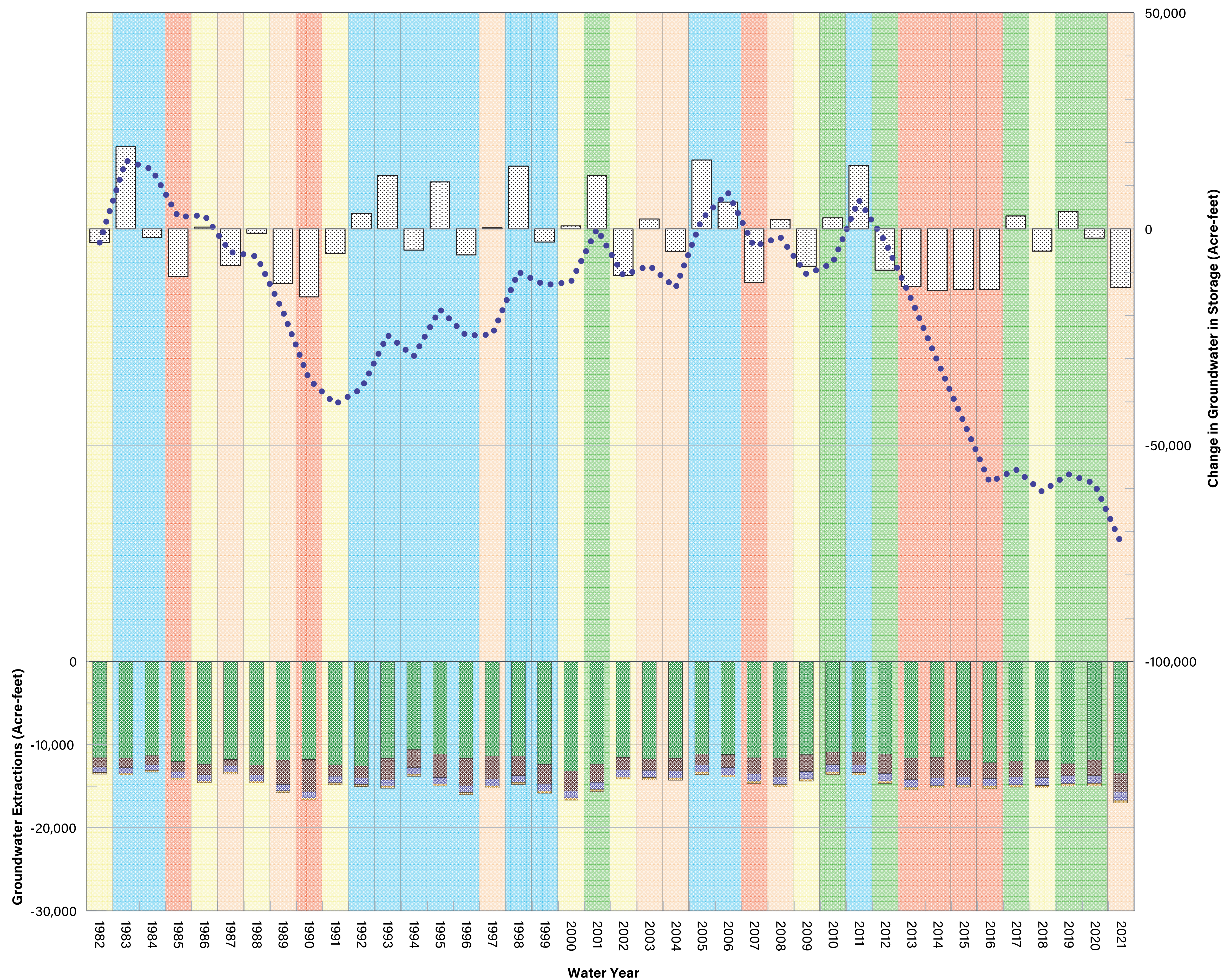
[shaded box] = Water year included in the historical period

NA = not applicable

FIGURE 17

Cumulative Change in Groundwater in Storage

Santa Ynez River Valley
Groundwater Basin –
Eastern Management Area
First Annual Report (2019 - 2021)



LEGEND

- Cumulative Change of Groundwater in Storage
- Annual Change of Groundwater in Storage
- Agricultural Pumping
- Municipal Pumping
- Mutual Water Companies
- Rural Domestic

Water Year Type

- Wet
- Above Normal
- Below Normal
- Dry
- Critical

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

8.1 Introduction

This section summarizes several management actions that are being implemented in the EMA to avoid undesirable results and to attain sustainability. These management actions are focused primarily on filling identified data gaps, developing funding for EMA GSA operations and future EMA monitoring, registering and metering wells, implementing a pumping fee program, and developing new and expanding existing water use efficiency programs for implementation within the EMA.

As described in the Plan (GSI, 2022), the need for projects and management actions is based on groundwater conditions, including the following:

- The amount of groundwater pumping in the EMA is greater than the estimated sustainable yield, and declining groundwater levels have been documented.
- Water budgets indicate that the amount of groundwater in storage is in decline and will continue to decline in the future as a result of pumping in the EMA during dry and critical conditions.

To mitigate continued declines in groundwater levels in the EMA, achieve the sustainability goal before 2040, and avoid undesirable results as required by SGMA regulations, increased rainfall, improved water use efficiency, an overall reduction of new groundwater pumping followed by overall reduction in groundwater pumping, or an increase in supply may be required. The following section describes the actions that are being initiated now that the Plan has been adopted and submitted to DWR.

Potential management actions and potential future projects are categorized into three groups:

- The management actions included in Group 1 will be initiated within 1 year of GSP adoption by the EMA GSA.
- The Group 2 management actions and Group 3 projects may be considered for implementation in the future as conditions in the Basin dictate and the effectiveness of the other management actions are assessed.

8.2 Group 1 Management Actions and Group 3 Projects under Development

Group 1 management actions that are in the planning stages include the following:

1. Address Data Gaps
    - Expand Monitoring Well Network in the EMA to Increase Spatial Coverage and Well Density
2. Groundwater Pumping Fee Program
3. Well Registration Program and Well Meter Installation Program

8.3 Summary of Progress toward Meeting Basin Sustainability

Relative to the most current conditions as reported in the Plan, this First Annual Report (2019–2021) indicates continued modest declines in groundwater levels. Groundwater elevations have declined in most of the representative monitoring wells, resulting in a decrease in total groundwater in storage. It is not clear how much of this is driven by reduced rainfall or by pumping; however, based on the rainfall conditions over the last 20 years, drought is the predominant factor leading to groundwater declines. Group 1 management actions are planned to address data gaps through improvement of the monitoring and data-collection networks, as well program implementation for better measurement of groundwater pumping and to promote water use efficiency and sustainable groundwater use.

While water levels have declined below minimum thresholds in some representative wells, the number of wells with water levels falling below the minimum thresholds has not resulted in the undesirable results that are described in the Plan. Group 1 management actions (as outlined in Section 6 of GSI, 2022 and summarized in the above bulleted list) are being planned and it is hoped that these actions will result in improved conditions. If they do not and it is determined that groundwater pumping is contributing to undesirable results, additional management actions described in the Plan (e.g., Group 2 and 3) may be warranted. The effect of the management actions will be reviewed periodically, and additional Group 2 management actions and Group 3 projects may be considered and implemented as necessary to avoid undesirable results.

The EMA GSA is not charged with managing groundwater quality unless it can be shown that water quality degradation is caused by groundwater pumping in the EMA, or the EMA GSA implements a project that degrades water quality. As described in the Plan, groundwater quality in the EMA is generally suitable for both drinking water and agricultural purposes (GSI, 2022). Potential degradation of groundwater quality caused by groundwater pumping or implementation of projects and management actions will be monitored as part of the EMA's water quality monitoring network.

Land subsidence caused by groundwater extraction will be monitored as part of the Plan. Subsidence can be estimated using InSAR data provided by DWR. Minor subsidence has been observed in the EMA using InSAR data provided by DWR for June 2015 through October 2020. These data show that an average subsidence of approximately 0.018 feet per year has occurred in certain parts of the Basin over the period of record. This is a minor rate of subsidence that does not exceed the minimum threshold value and is relatively insignificant and not a major concern for the EMA. The EMA GSA will continue to monitor and report annual subsidence as more data become available.

Potential GDEs associated with one of the principal aquifers were identified on the downstream ends of Alamo Pintado Creek and Zanja de Cota Creek where there is evidence that groundwater is interconnected with surface water. As described in the Plan, the EMA GSA has proposed to install piezometers in the GDE areas to assess whether depletion of interconnected surface water is occurring and whether significant and unreasonable adverse impacts to GDEs or reductions in discharge of interconnected surface water to the Santa Ynez River may be occurring as a result of groundwater use. Planning for installation of the proposed piezometers is underway.

Due to the short period between the adoption of the Plan and the submittal of this Annual Report, additional time is necessary to implement projects and managements actions and to evaluate their effectiveness. However, it is anticipated that the projects and management actions will enable the EMA to sustainably manage groundwater and achieve sustainability goals as defined in the Plan.

SECTION 9: **References**

Davis, T., M. Landon, and G. Bennett. 2018. *Prioritization of Oil and Gas Fields for Regional Groundwater Monitoring Based on Preliminary Assessment of Petroleum Resource Development and Proximity to California's Groundwater Resources.* Scientific Investigation Report 2018-5065.

DWR. 2016a. *BMP 1 Monitoring Protocols Standards and Sites*. Prepared by California Department of Water Resources (DWR).

DWR. 2016b. *BMP 2 Monitoring Networks and Identification of Data Gaps*. Prepared by California Department of Water Resources (DWR).

DWR. 2018a. Bulletin 118 Basin Boundary Description 3-015, Santa Ynez River Valley. Prepared by the California Department of Water Resources (DWR). Available at https://water.ca.gov/-/media/DWR-Website/Web-Pages/Programs/Groundwater-Management/Bulletin-118/Files/2016-Basin-Boundary-Descriptions/3_015_SantaYnezRiverValley.pdf. (Accessed January 12, 2022.)

DWR. 2018b. Layer: i15_Crop_Mapping_2018 (ID: 0). California Department of Water Resources. Available at: https://www.arcgis.com/home/webmap/viewer.html?url=https%3A%2F%2Fgis.water.ca.gov%2Farcgis%2Frest%2Fservices%2FPlanning%2Fi15_Crop_Mapping_2018%2FFeatureServer&source=sd. (Accessed January 12, 2022.)

DWR. 2021. *Sustainable Groundwater Management Act Water Year Type Dataset Development Report*. California Department of Water Resources (DWR) Sustainable Groundwater Management Office. January 2021.

GSI. 2022. *Santa Ynez River Valley Groundwater Basin – Eastern Management Area Groundwater Sustainability Plan*. Prepared for the Eastern Management Area Groundwater Sustainability Agency. Prepared by GSI Water Solutions, Inc. January 2022.

RWQCB. 2019. *Water Quality Control Plan for the Central Coastal Basin, June 2019 Edition*. California Environmental Protection Agency. Central Coast Regional Water Quality Control Board.

Santa Barbara County. 2012. *Santa Barbara County 2011 Groundwater Report*. Prepared by Dennis Gibbs for Santa Barbara County Public Works Department, Water Resources Division.

SYRWCD. 2010. Groundwater Production Information and Instructions Pamphlet. Prepared by the Sant Ynez River Water Conservation District. June 2010.

Tetra Tech. 2010. *Assessment of Groundwater Availability on the Santa Ynez Chumash Reservation*. March.

APPENDIX A

Sustainable Groundwater Management Act Groundwater Sustainability Plan Regulations for Annual Reports

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ARTICLE 7. Annual Reports and Periodic Evaluations by the Agency

§ 356. Introduction to Annual Reports and Periodic Evaluations by the Agency

This Article describes the procedural and substantive requirements for the annual reports and periodic evaluation of Plans prepared by an Agency.

Note: Authority cited: Section 10733.2, Water Code.

Reference: Section 10733.2, Water Code.

§ 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

Summary of Representative Well Data

Table B-1. Representative Groundwater Level Monitoring Network – Paso Robles Formation Wells

Representative Well ID	Well Use	Well Depth (ft)	Screen Interval(s) (ft bgs)	Ground Elevation (ft NAVD 88)	Reference Point Elevation (ft NAVD 88)	First Date Measured	Last Date Measured	Years
6N/29W-07L01	Agricultural	—	—	868.9	870.7	1960	2021	62
6N/29W-08P01	Domestic	—	210 to ?	915.2	915.4	1934	2021	88
6N/29W-08P02	Domestic	—	—	896.0	897.0	1966	2021	56
6N/30W-07G05	Municipal	166	—	604.3	606.7	1962	2021	60
6N/30W-07G06	Municipal	566	305 to 410	602.3	604.3	1962	2021	60
6N/30W-11G04	Agricultural	400	130 to 390	681.1	683.1	2010	2021	12
6N/31W-01P03	Municipal	505	195 to 490	633.1	634.7	1967	2021	55
6N/31W-02K01	Domestic	—	—	619.6	620.8	1942	2021	80
6N/31W-13D01	Domestic	152	—	625.1	626.6	1941	2021	81
7N/30W-16B01	Agricultural	—	—	1,066.4	1,069.3	1950	2021	72
7N/30W-19H01	Agricultural	—	—	1,090.1	1,105.9	1954	2021	68
7N/30W-29D01	Agricultural	—	—	917.8	919.3	1905	2021	117
7N/30W-30M01	Agricultural	—	—	806.5	807.5	1905	2021	117
7N/30W-33M01	Agricultural	349	150 to 340	764.3	764.7	1954	2021	68
7N/31W-36L02	Domestic	—	—	722.6	723.6	1942	2021	80

Notes

— = no data available

? = Unknown

bgs = below ground surface

ft = foot or feet

NAVD 88 = North American Vertical Datum of 1988

Table B-2. Representative Groundwater Level Monitoring Network – Careaga Sand Wells

Representative Well ID	Well Use	Well Depth (ft)	Screen Interval(s) (ft bgs)	Ground Elevation (ft NAVD 88)	Reference Point Elevation (ft NAVD 88)	First Date Measured	Last Date Measured	Years
7N/31W-34M02	Agricultural	—	—	671.1	673.1	2014	2021	8
6N/31W-03A01	Domestic	—	—	738.5	740.0	1963	2021	59
6N/31W-04A01	Domestic	259	—	601.1	603.1	1956	2021	66
6N/31W-09Q02	Municipal	550	250 to 540	756.9	754.0	2011	2021	11
6N/31W-10F01	Agricultural	265	—	555.6	556.7	1966	2021	56
6N/31W-11D04	Agricultural	447	93 to ?	565.3	560.6	1955	2021	67
6N/31W-16N07	Municipal	145	99 to 127	479.3	478.2	2011	2021	11
6N/31W-xxxx[1]	Municipal	329	190 to 325	503.2	500.9	2011	2021	11
Solvang HCA[1]	Municipal	490	180 to 470	398.0	402.8	2011	2021	11

Notes

[1] The State Well Number for these wells is not known at this time.

— = no data available

? = Unknown

bgs = below ground surface

ft = foot or feet

NAVD 88 = North American Vertical Datum of 1988

Table B-3. Representative Well Water Elevations – Paso Robles Formation Wells

(All elevations are in feet NAVD 88)

Representative Well ID	Minimum Threshold	Fall 2018	Spring 2019	Fall 2019	Spring 2020	Fall 2020	Spring 2021
6N/29W-07L01	639	—	660	—	**624**	**629**	641
6N/29W-08P01	676	—	686	—	**<678**	**Dry**	—
6N/29W-08P02	654	—	664	—	**653**	**650**	654
6N/30W-07G05	515	—	530	—	527	—	523
6N/30W-07G06	513	—	528	—	525	—	521
6N/30W-11G04	512	—	531	—	522	**498**	516
6N/31W-01P03	516	—	531	—	527	—	523
6N/31W-02K01	557	—	572	—	570	567	568
6N/31W-13D01	495	—	510	—	510	508	508
7N/30W-16B01	1,021	1,035	1,035	1,038	1,042	1,043	1,043
7N/30W-19H01	912	—	927	—	927	927	927
7N/30W-29D01	850	—	868	—	863	862	862
7N/30W-30M01	559	—	567	—	561	**527**	**546**
7N/30W-33M01	514	—	529	—	526	—	521
7N/31W-36L02	616	—	627	—	621	**607**	**614**

Notes

Bolded values are below the minimum threshold value.

— = no data available

NAVD 88 = North American Vertical Datum of 1988

Table B-4. Representative Well Water Elevations – Careaga Sand Wells

(All elevations are in feet NAVD 88)

Representative Well ID	Minimum Threshold	Fall 2018	Spring 2019	Fall 2019	Spring 2020	Fall 2020	Spring 2021
7N/31W-34M02	484	—	496	—	495	Pumping	493
6N/31W-03A01	573	—	587	—	583	576	581
6N/31W-04A01	483	—	495	—	494	491	492
6N/31W-09Q02	446	474	480	478	481	479	473
6N/31W-10F01	464	—	476	—	474	471	472
6N/31W-11D04	502	—	512	—	510	**501**	**501**
6N/31W-16N07	377	389	395	394	388	392	394
6N/31W-xxxx	467	479	479	478	474	473	471
Solvang HCA	320	335	342	346	344	333	333

Notes

Bolded values are below the minimum threshold value.

— = no data available

NAVD 88 = North American Vertical Datum of 1988

Table B-5. Other County Water Agency-Monitored Well Water Elevations

(All elevations are in feet NAVD 88)

Well ID	Aquifer	Fall 2018	Spring 2019	Fall 2019	Spring 2020	Fall 2020	Spring 2021
6N/29W-05A01	Tributary Alluvium	Dry	Dry	—	Dry	—	Dry
6N/29W-06F01	Tributary Alluvium	—	833	—	832	829	830
6N/29W-06G01	Tributary Alluvium	—	831	—	831	829	829
7N/30W-22E01	Tributary Alluvium	—	909	—	911	910	911
8N/31W-36H01	Tributary Alluvium	—	1,161	—	1,141	1,128	1,130
6N/31W-17F01[1]	Santa Ynez River Alluvium	Pumping	327	—	Dry	Dry	326
6N/31W-17F03[1]	Santa Ynez River Alluvium	—	327	—	326	324	Pumping
6N/31W-21H03[1]	Santa Ynez River Alluvium	355	361	357	361	361	359
6N/31W-22M01[1]	Santa Ynez River Alluvium	356	361	358	361	361	359
6N/30W-01R03	Tributary Alluvium / Paso Robles Formation	—	739	—	Pumping	Pumping	Pumping
7N/30W-24Q01	Tributary Alluvium / Paso Robles Formation	—	1,156	—	1,159	1,160	1,161
7N/30W-27H01	Tributary Alluvium / Paso Robles Formation	—	843	—	—	835	837
8N/30W-30R01	Tributary Alluvium / Paso Robles Formation	—	Pumping	—	Pumping	1,185	1,226
8N/30W-30R02	Tributary Alluvium / Paso Robles Formation	—	1,199	—	Pumping	Pumping	Pumping
6N/31W-01P02	Paso Robles Formation	—	528	—	525	521	Discontinued
7N/29W-29R01	Paso Robles Formation	—	998	—	995	—	Discontinued
7N/29W-29R02	Paso Robles Formation	—	1,003	—	1,002	—	Discontinued
7N/30W-22E02	Paso Robles Formation	—	776	—	720	Obstructed	Pumping
7N/30W-35R01	Paso Robles Formation	—	Dry	—	—	—	Obstructed
7N/30W-36N03	Paso Robles Formation	—	552	—	—	Obstructed	Obstructed

Well ID	Aquifer	Fall 2018	Spring 2019	Fall 2019	Spring 2020	Fall 2020	Spring 2021
7N/31W-23P01	Paso Robles Formation	—	740	737	754	Destroyed	Destroyed
8N/31W-22N01	Paso Robles Formation	—	1,108	—	—	—	—
Solvang_23	Paso Robles Formation / Careaga Sand	—	—	—	—	—	474
6N/31W-07F01	Careaga Sand	—	308	—	310	Pumping	309
HCA_Middle	Careaga Sand	—	—	—	—	—	409
Solvang_Lot72	Careaga Sand	—	—	—	—	—	398

Notes

[1] These wells are in the Santa Ynez EMA, but are in the Santa Ynez River area not managed under the auspices of SGMA

— = no data available

NAVD 88 = North American Vertical Datum of 1988

APPENDIX C

Representative Monitoring Site Hydrographs

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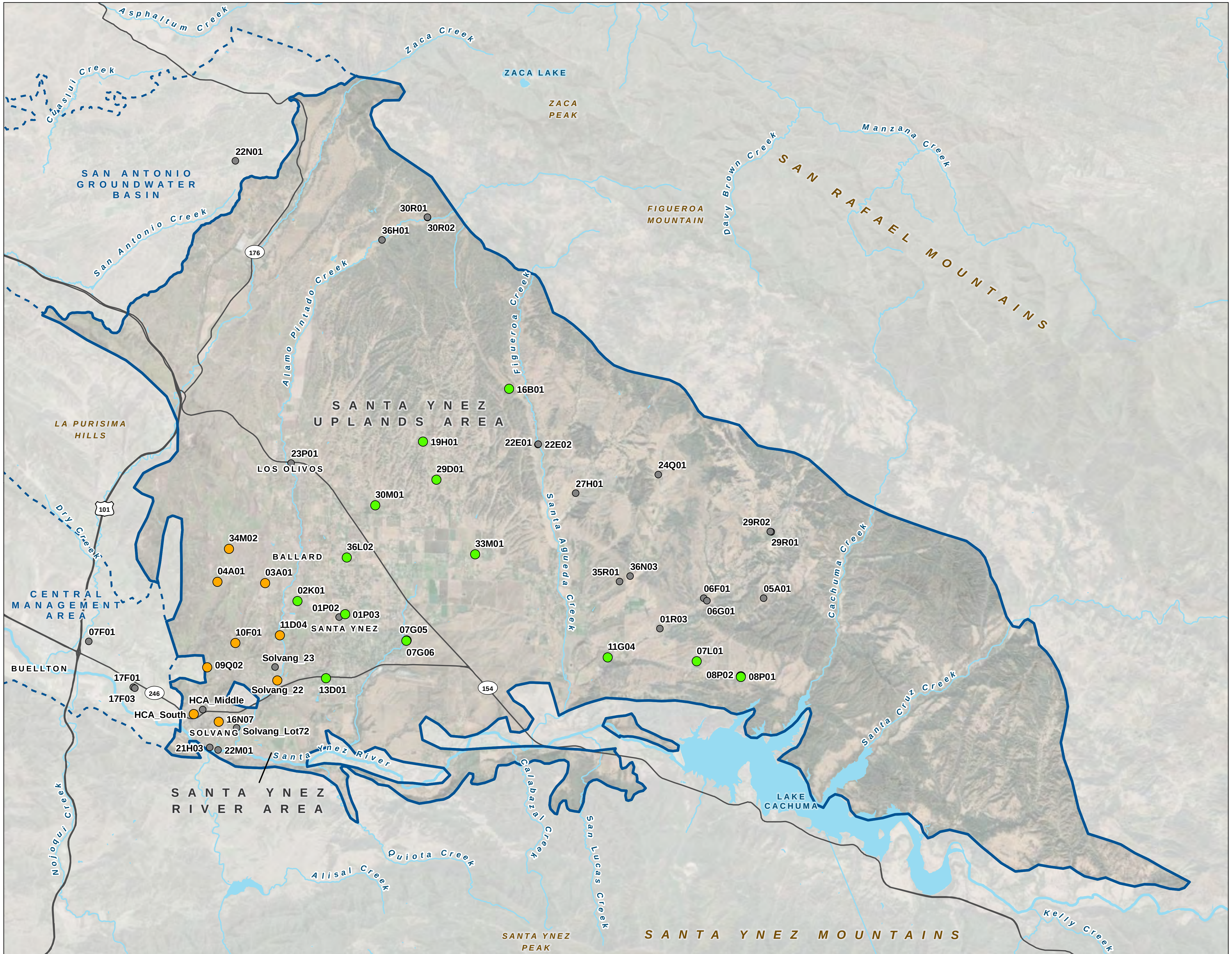

FIGURE C-1

Groundwater Level Monitoring Network

Santa Ynez River Valley Groundwater Basin – Eastern Management Area 2021 Annual Report

LEGEND

Representative Well (by screened aquifer)

- Careaga Sand
- Paso Robles Formation

Other Wells

- Monitored by Santa Barbara County

All Other Features

- Eastern Management Area Basin Boundary
- Major Road
- Watercourse
- Waterbody

N

0 5,000 10,000 15,000

Feet

Date: February 9, 2022
Data Sources: ESRI, USGS, Maxar 2020

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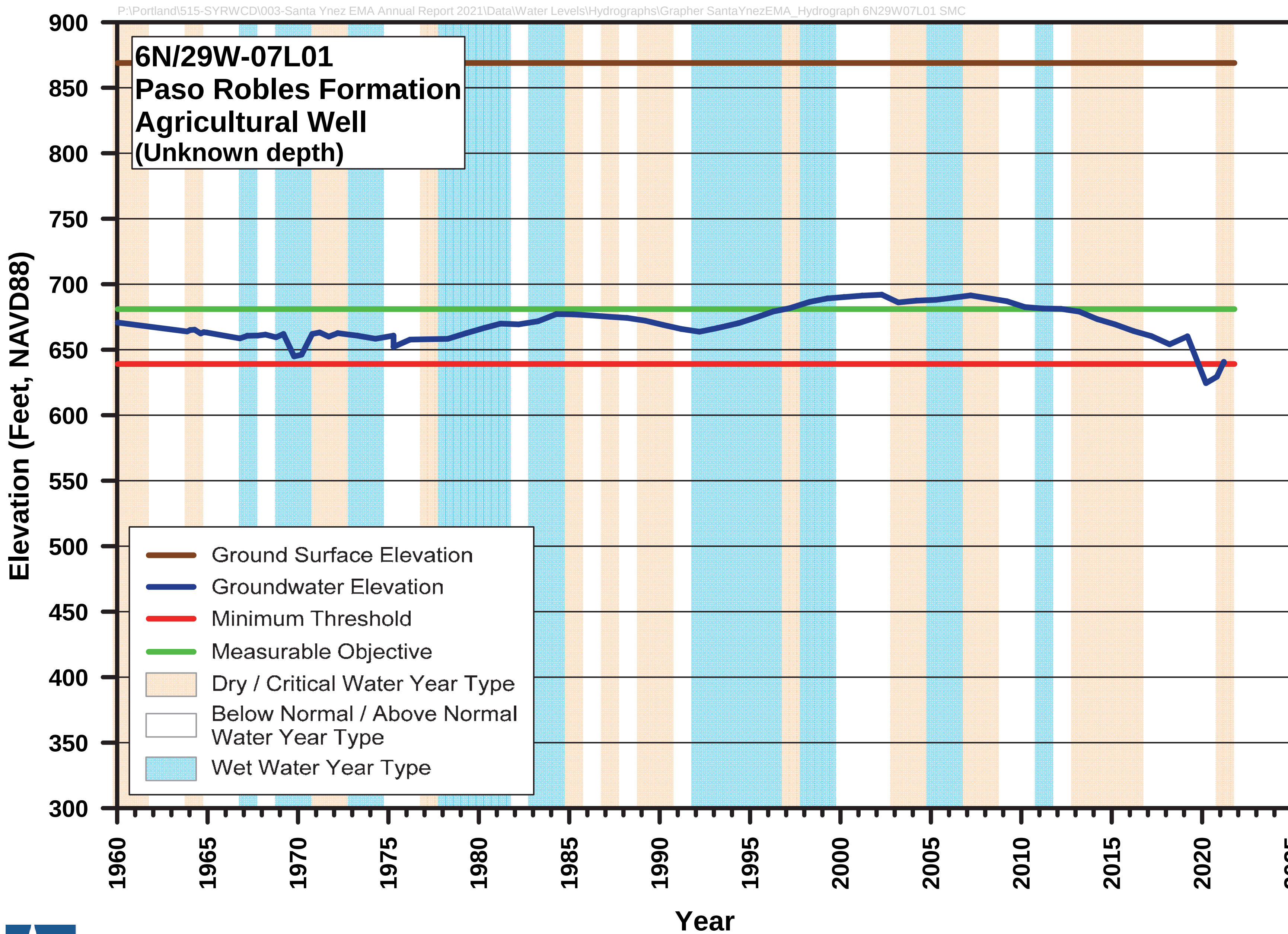
Document Path: Y:\0515_Santa_Ynez_RWD\Source_Figures\EMA_2022_Annual_Report\Figure5_Groundwater_Level_Monitoring_Network.mxd, npalmer



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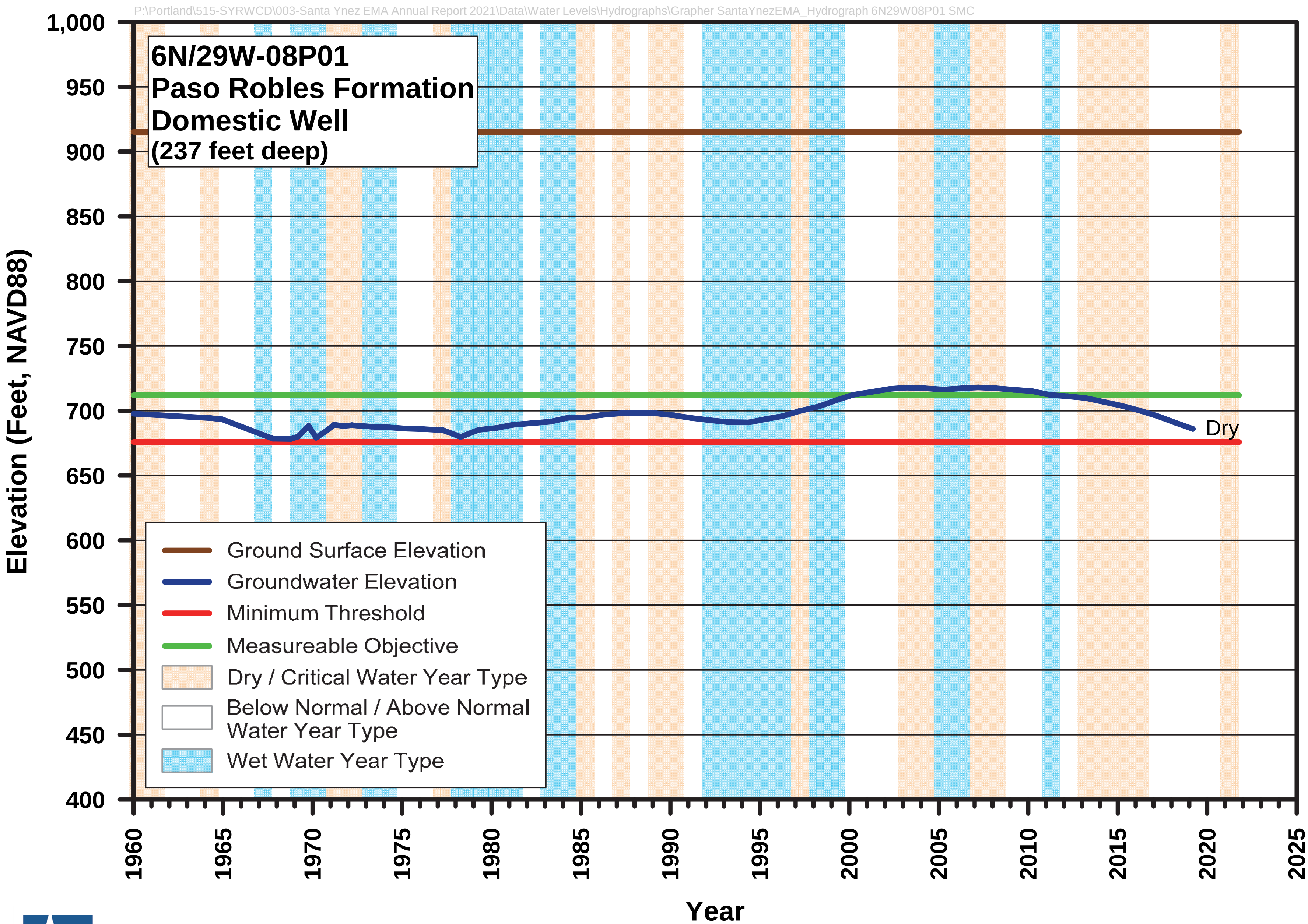
Groundwater Elevation Hydrograph
Santa Ynez River Valley Groundwater Basin - Eastern Management Area First Annual Report (2019 - 2021)



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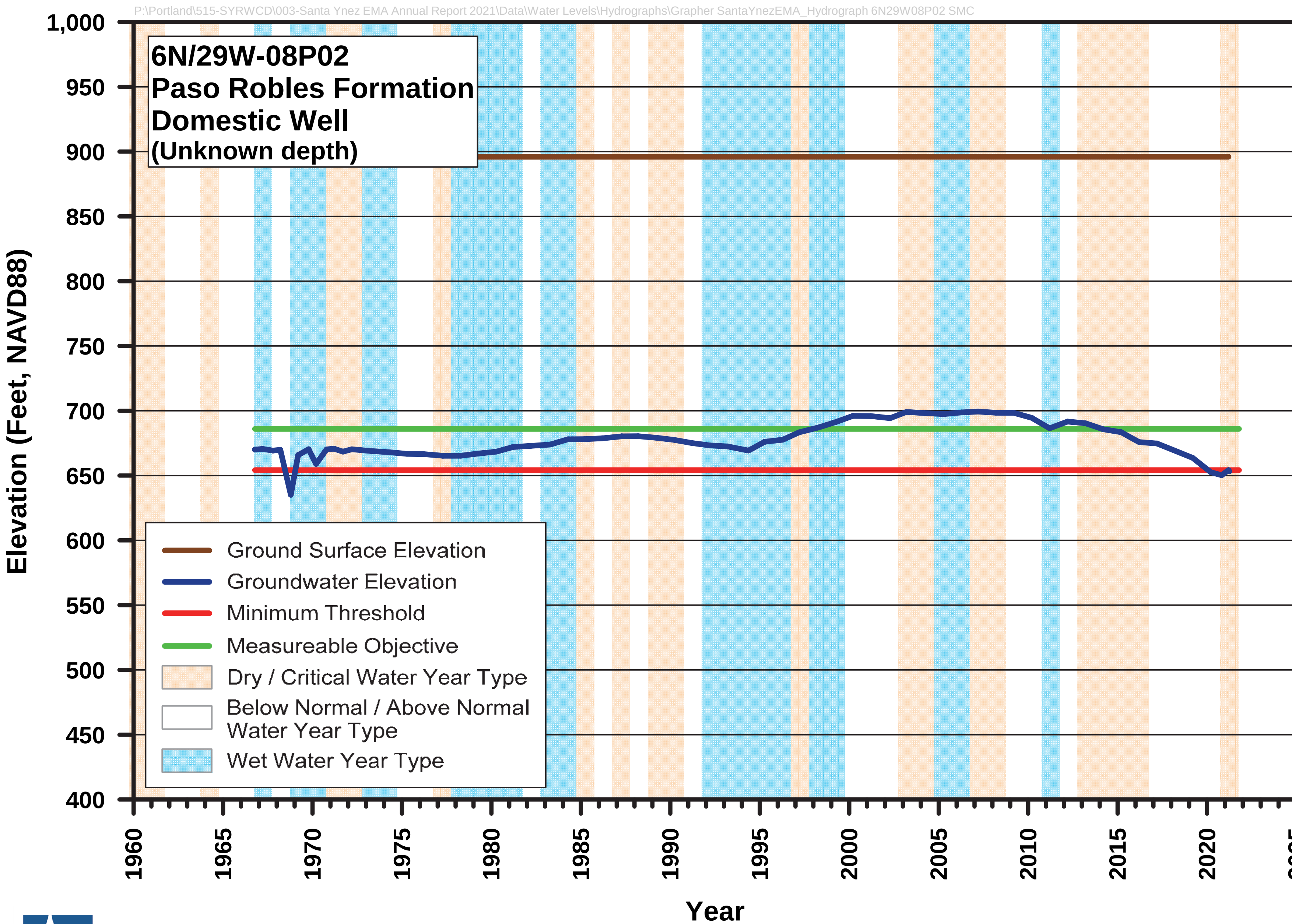
Groundwater Elevation Hydrograph
Santa Ynez River Valley Groundwater Basin - Eastern Management Area First Annual Report (2019 - 2021)



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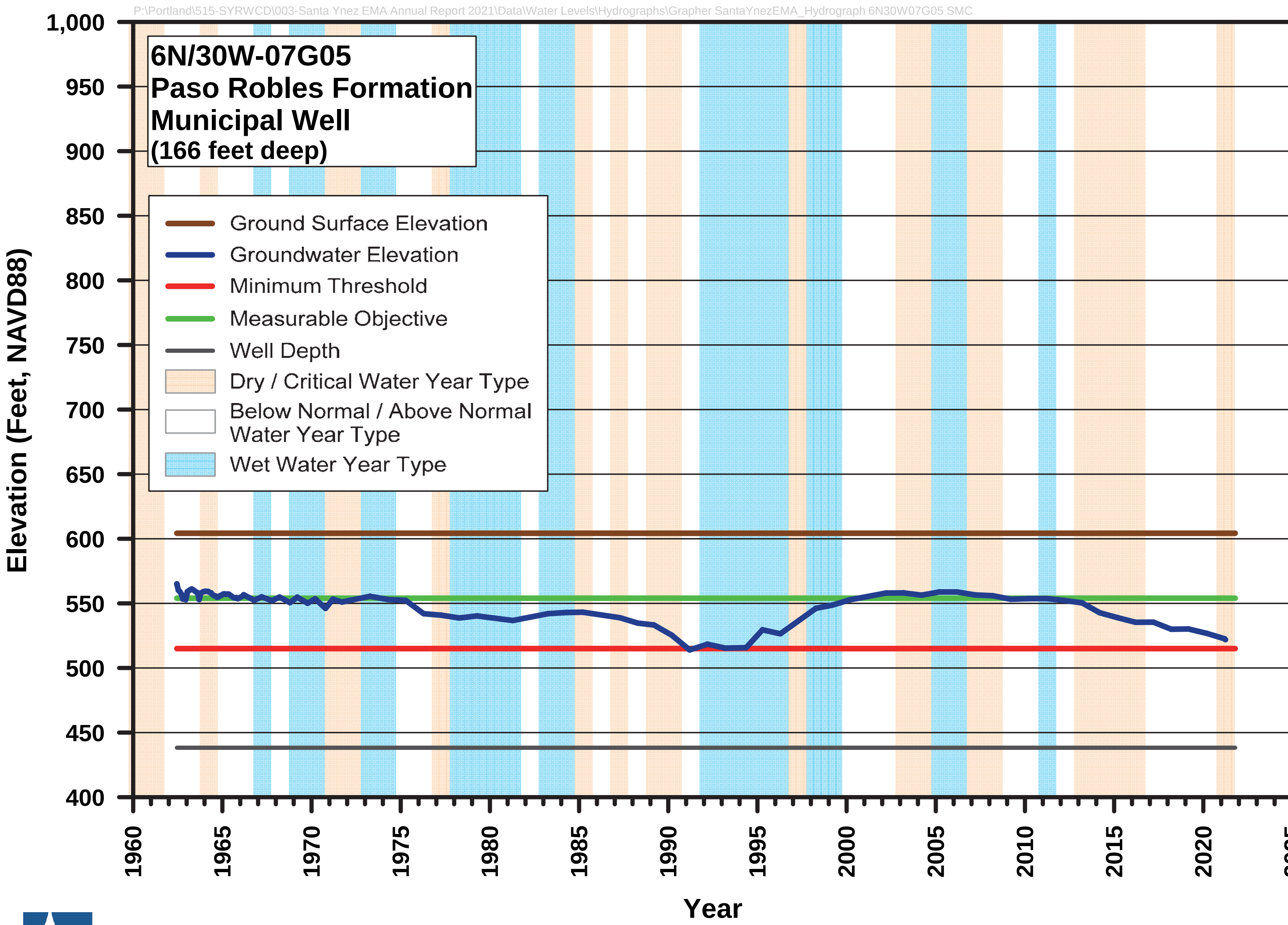
Groundwater Elevation Hydrograph

Santa Ynez River Valley Groundwater Basin - Eastern Management Area First Annual Report (2019 - 2021)



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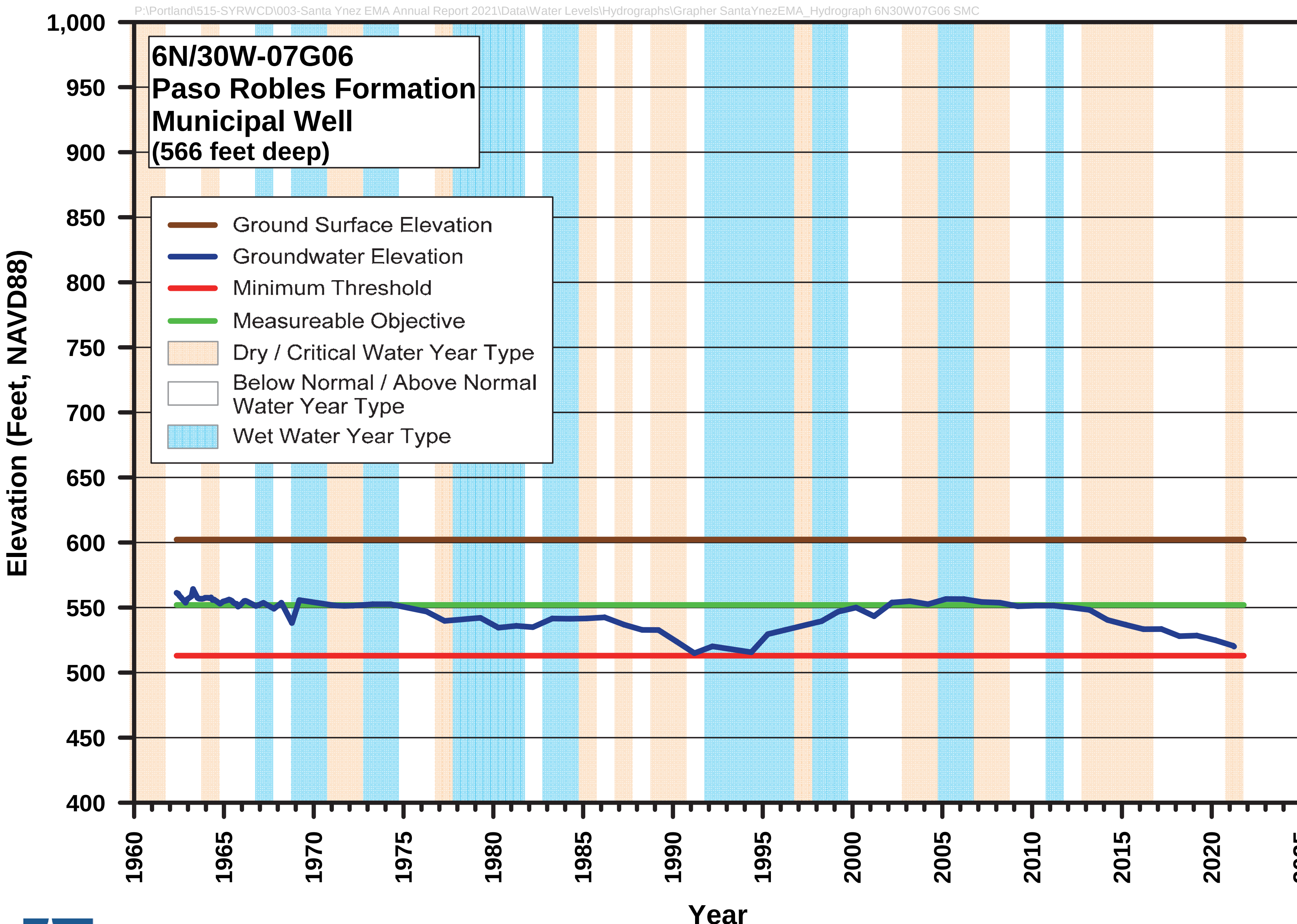
Groundwater Elevation Hydrograph
Santa Ynez River Valley Groundwater Basin - Eastern Management Area First Annual Report (2019 - 2021)



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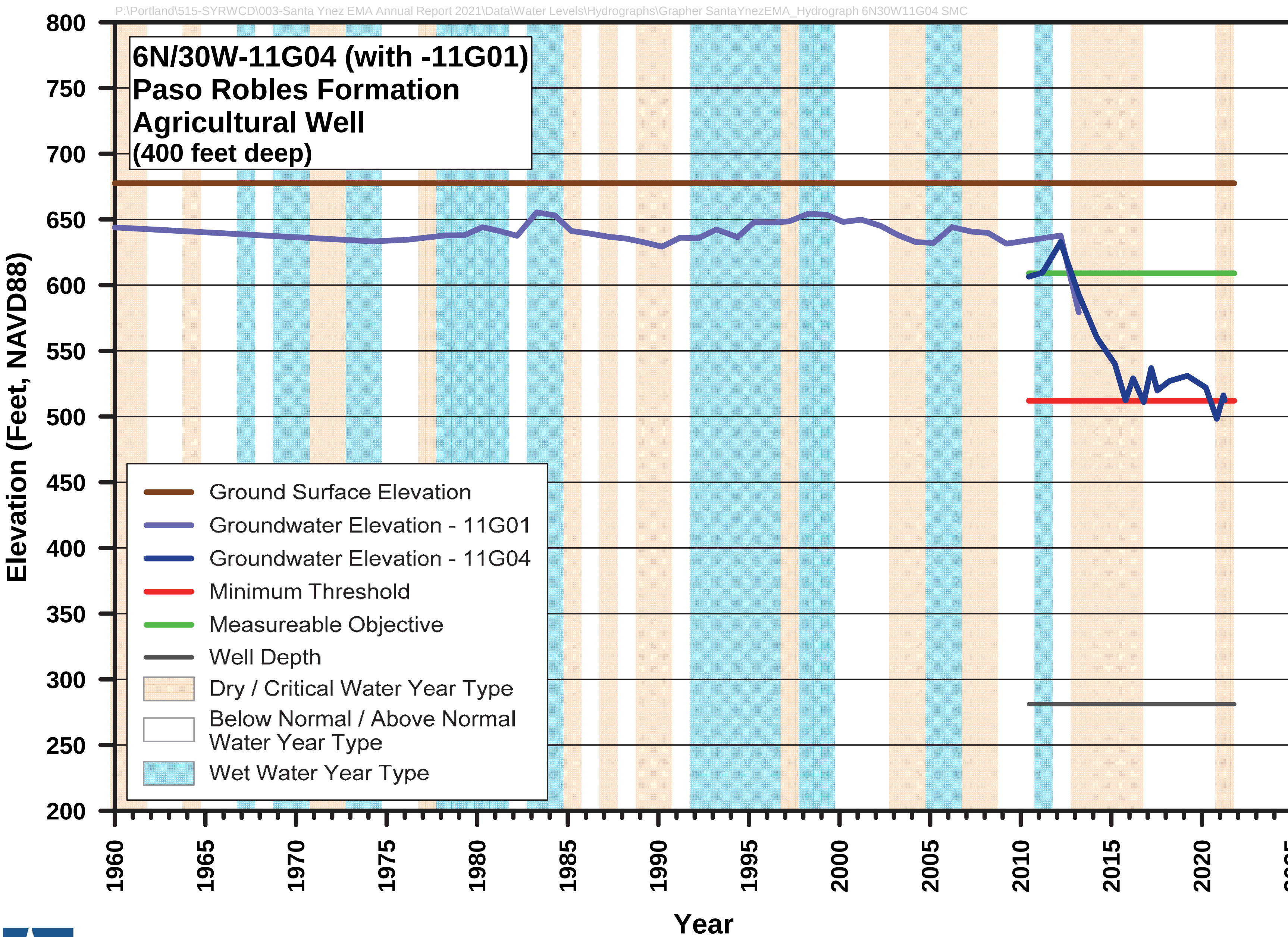
Groundwater Elevation Hydrograph
Santa Ynez River Valley Groundwater Basin - Eastern Management Area First Annual Report (2019 - 2021)



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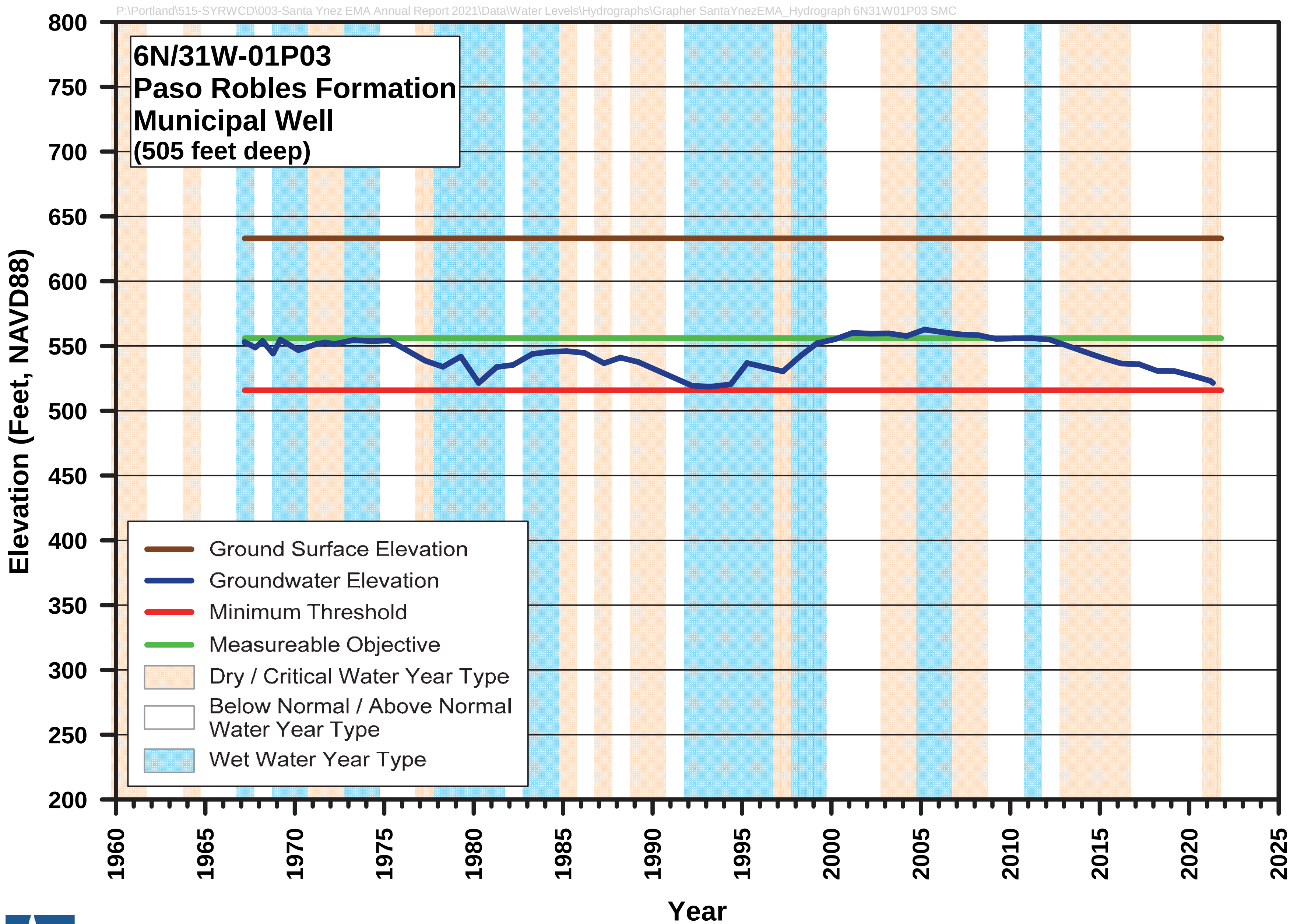
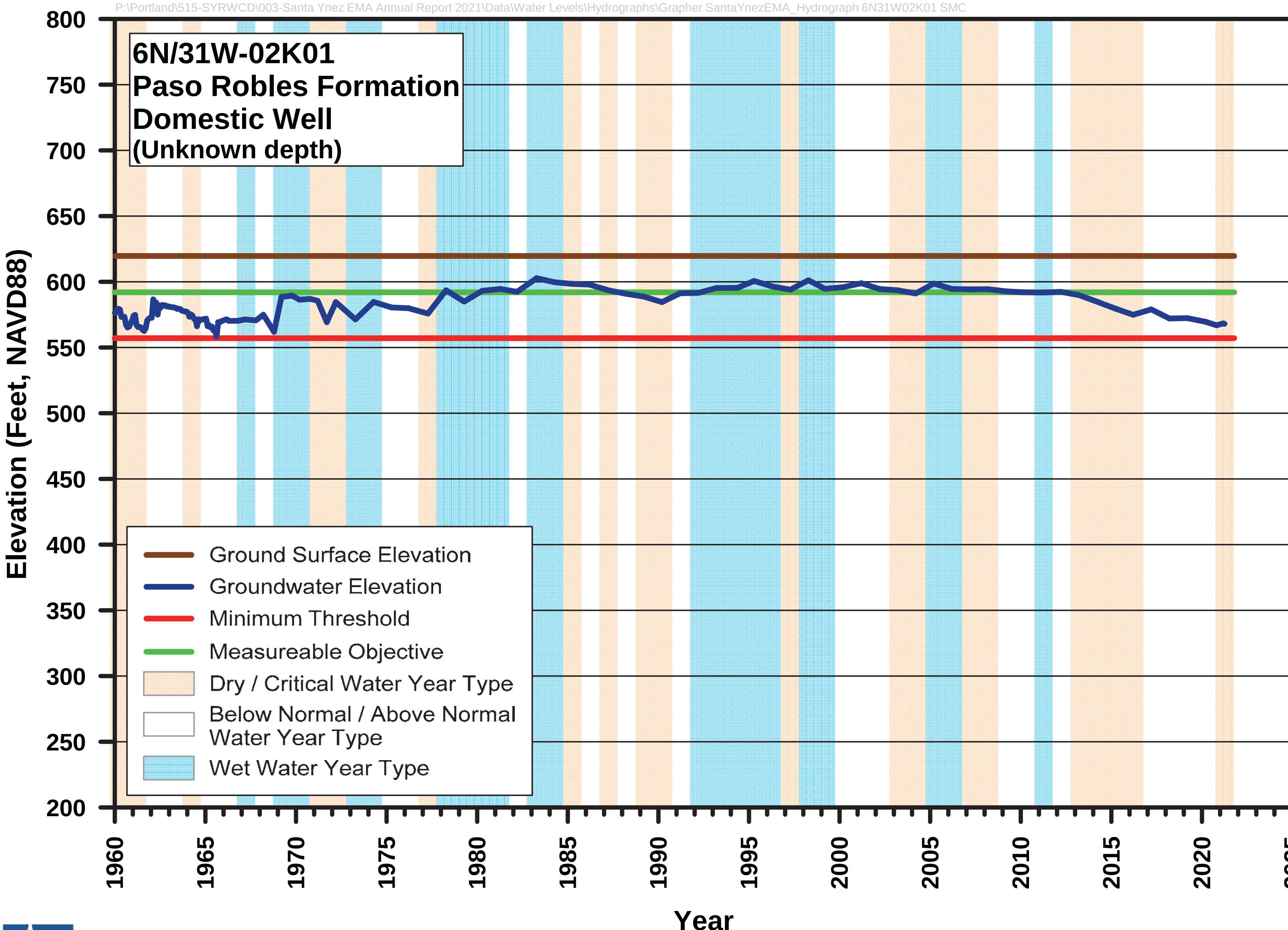
Groundwater Elevation Hydrograph

Santa Ynez River Valley Groundwater Basin - Eastern Management Area First Annual Report (2019 - 2021)


P:\Portland\515-SYRWCD\003-Santa Ynez EMA Annual Report 2021\Data\Water Levels\Hydrographs\Grapher SantaYnezEMA_Hydrograph 6N31W01P03 SMC
6N/31W-01P03
Paso Robles Formation
Municipal Well
(505 feet deep)
Elevation (Feet, NAVD88)
800
750
700
650
600
550
500
450
400
350
300
250
200
Ground Surface Elevation
Groundwater Elevation
Minimum Threshold
Measureable Objective
Dry / Critical Water Year Type
Below Normal / Above Normal Water Year Type
Wet Water Year Type
1960
1965
1970
1975
1980
1985
1990
1995
2000
2005
2010
2015
2020
2025
Year



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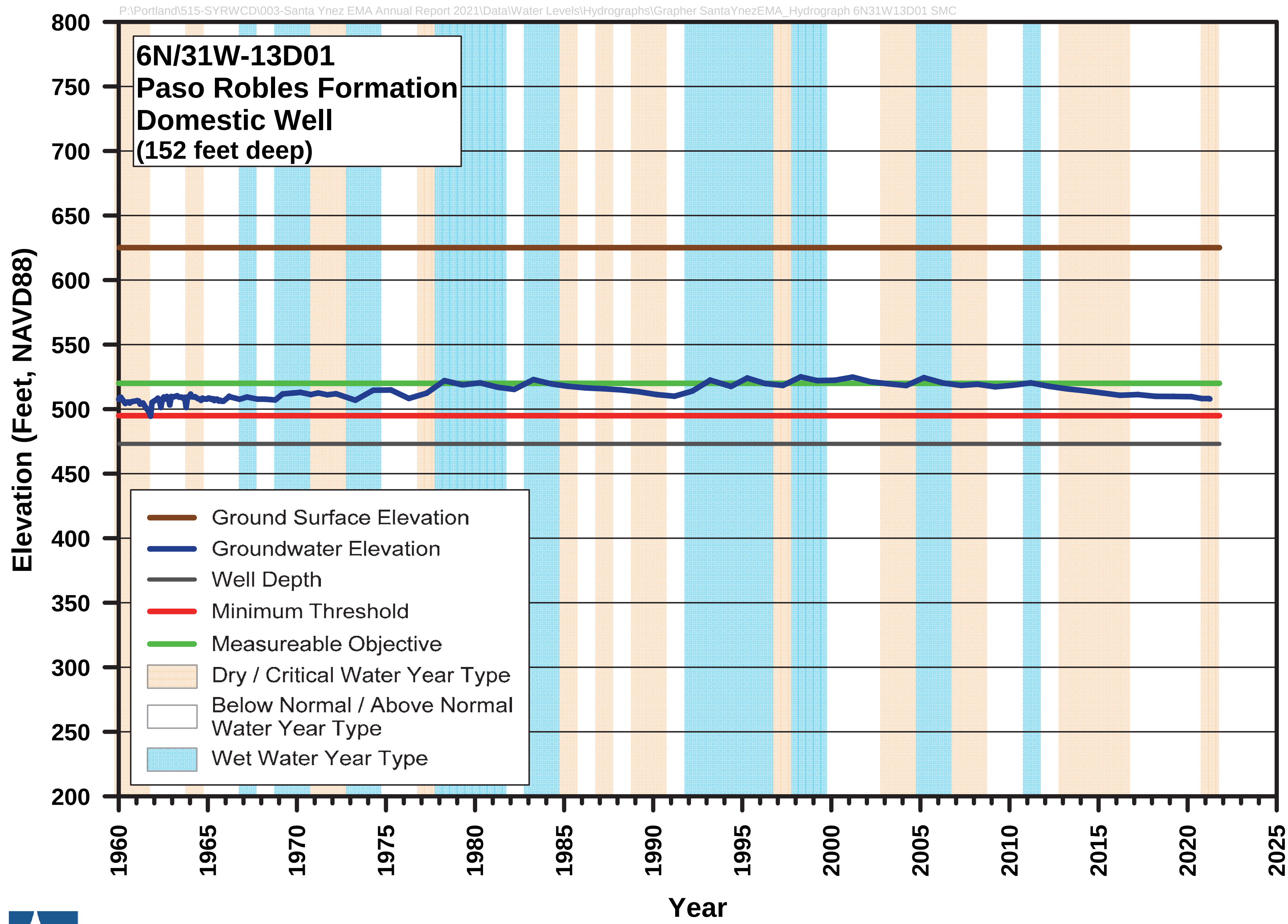
Groundwater Elevation Hydrograph
Santa Ynez River Valley Groundwater Basin - Eastern Management Area First Annual Report (2019 - 2021)



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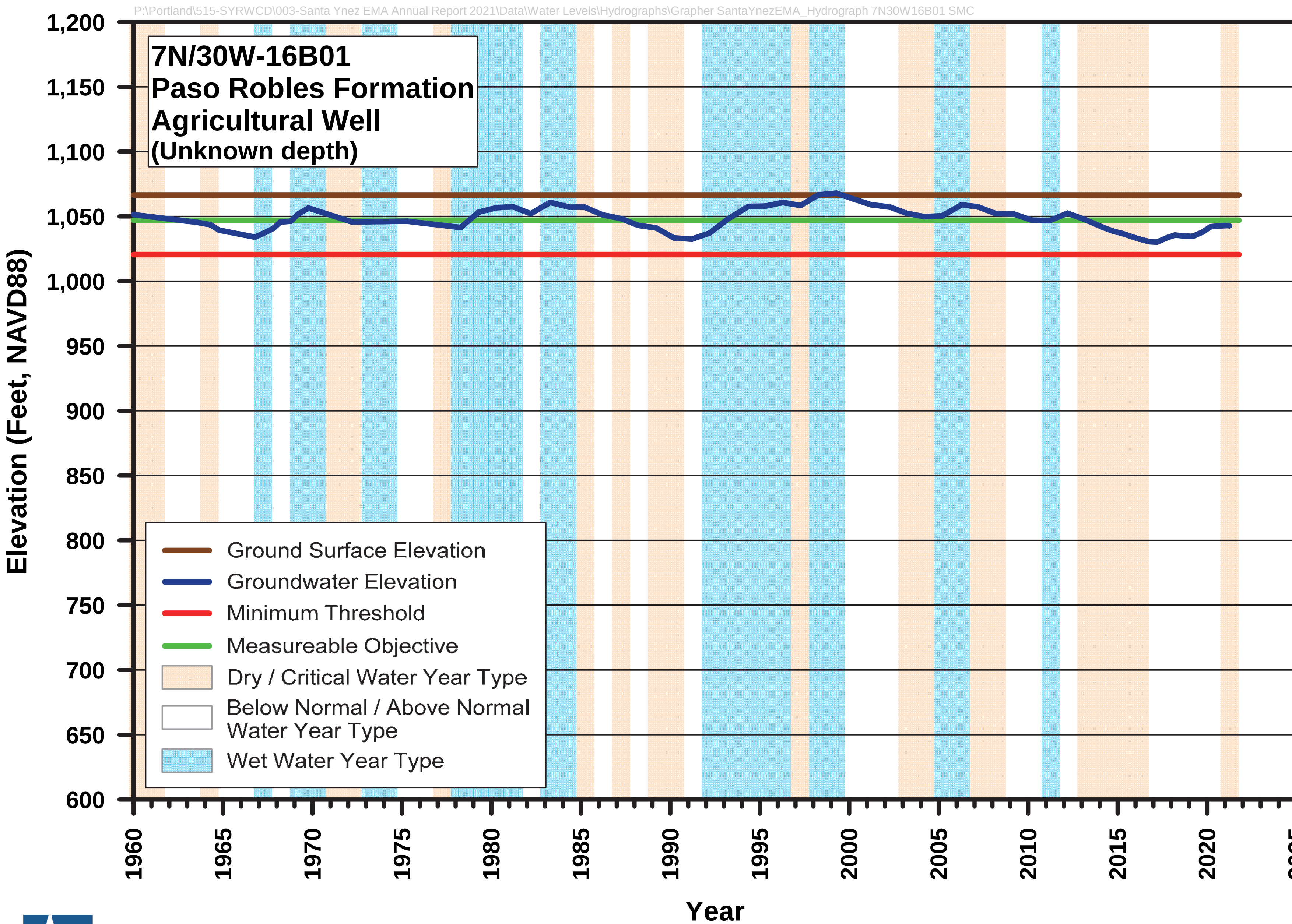
Groundwater Elevation Hydrograph

Santa Ynez River Valley Groundwater Basin - Eastern Management Area First Annual Report (2019 - 2021)



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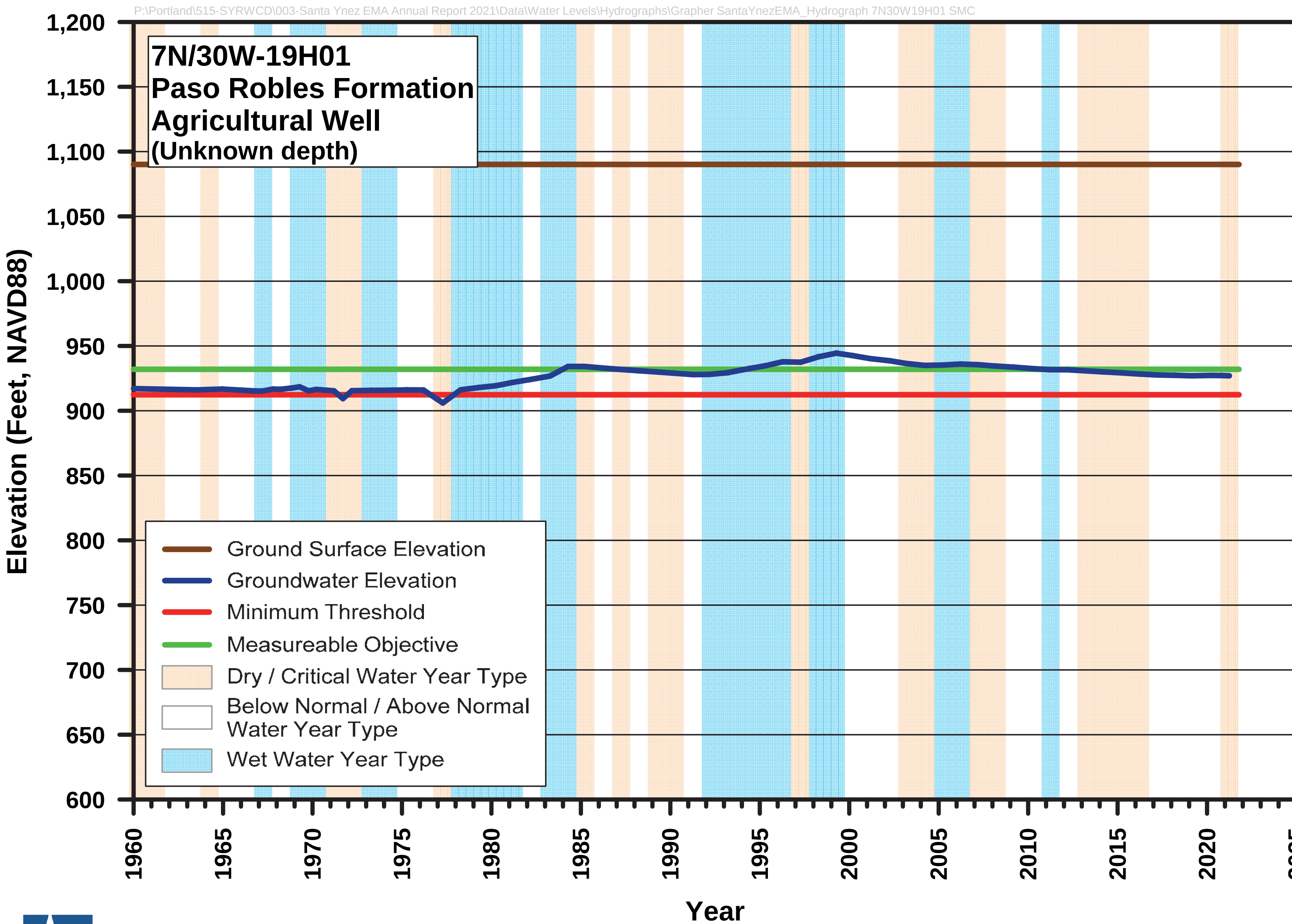
Groundwater Elevation Hydrograph
Santa Ynez River Valley Groundwater Basin - Eastern Management Area First Annual Report (2019 - 2021)



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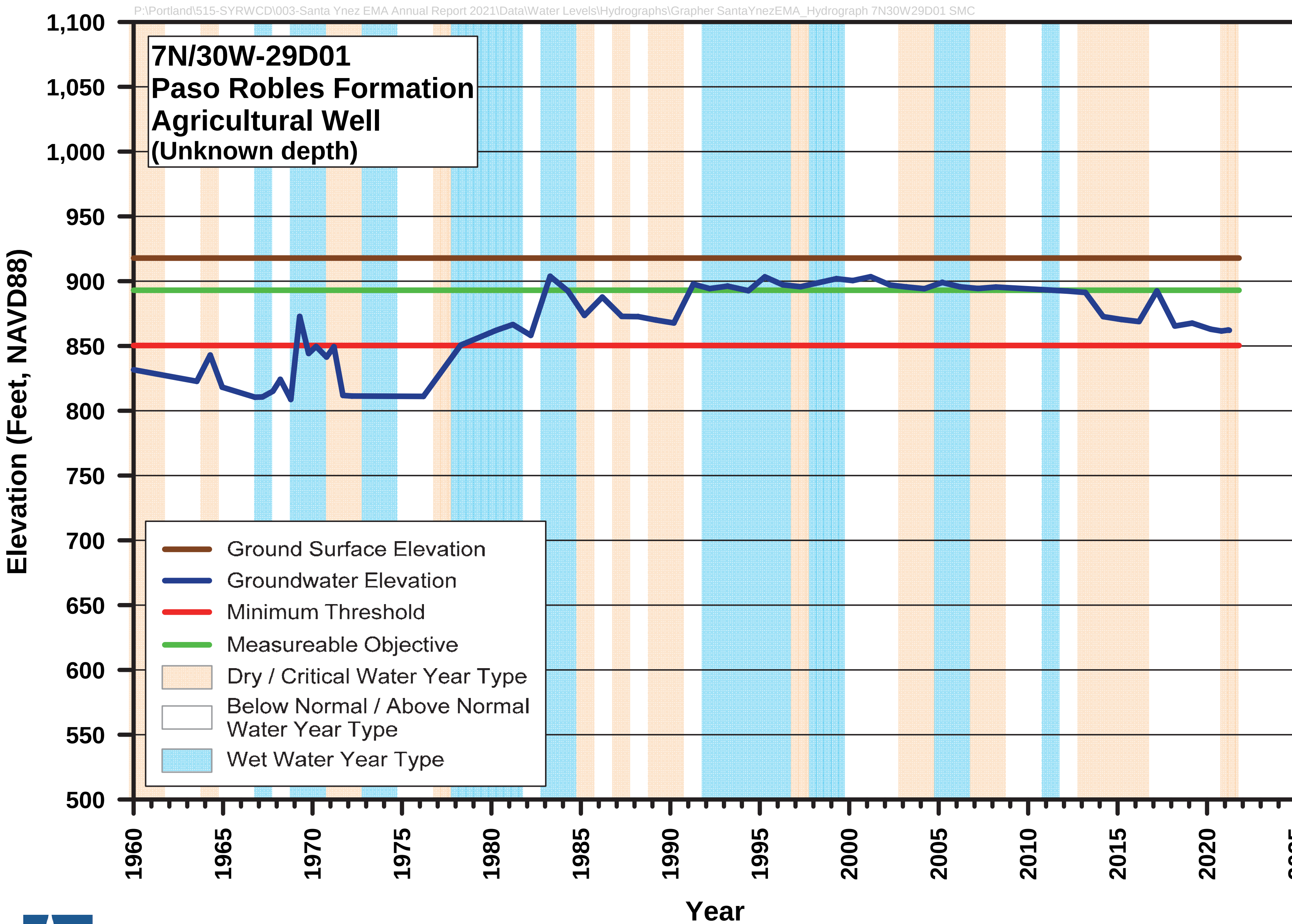
Groundwater Elevation Hydrograph
Santa Ynez River Valley Groundwater Basin - Eastern Management Area First Annual Report (2019 - 2021)



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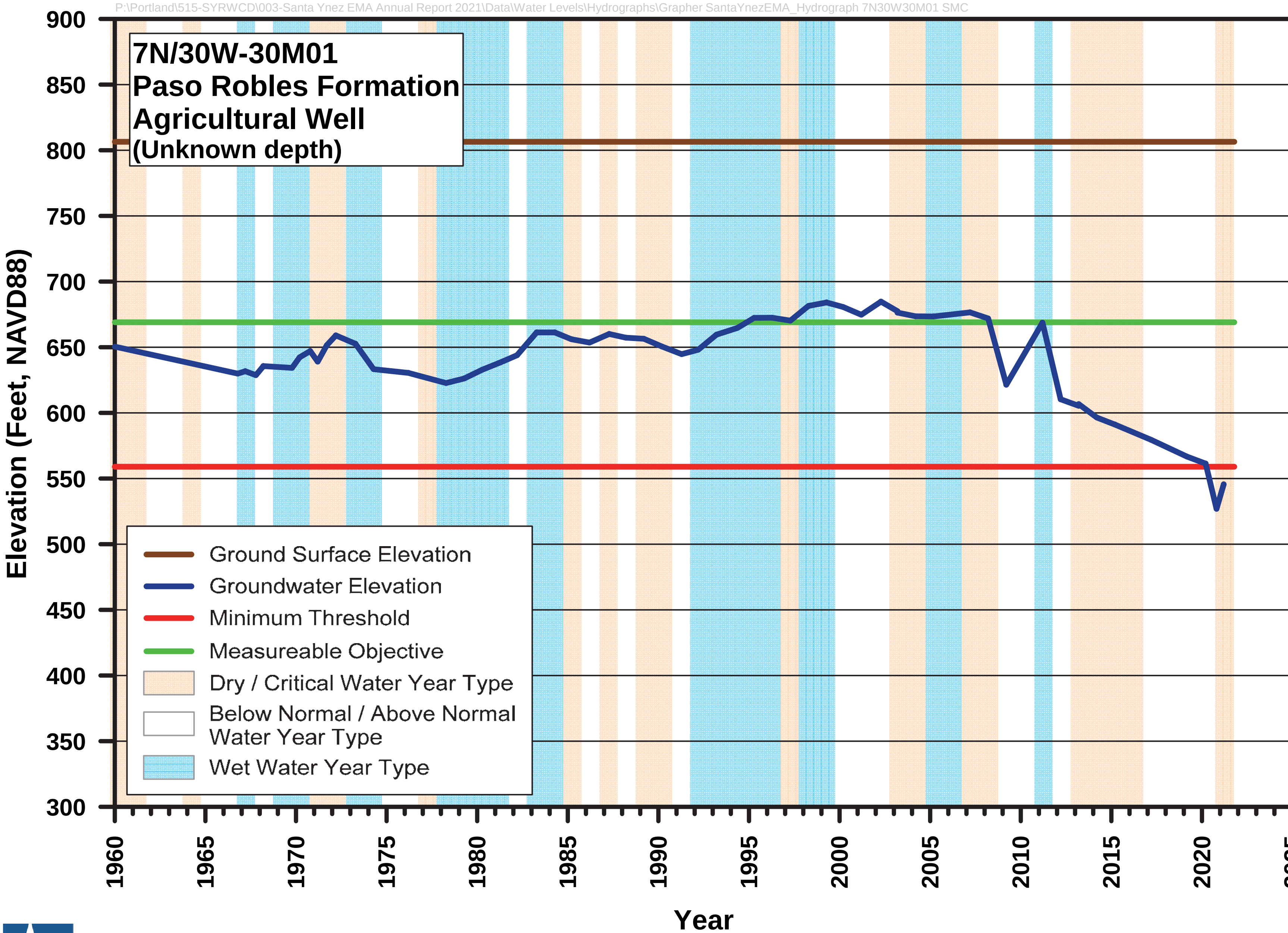
Groundwater Elevation Hydrograph

Santa Ynez River Valley Groundwater Basin - Eastern Management Area First Annual Report (2019 - 2021)



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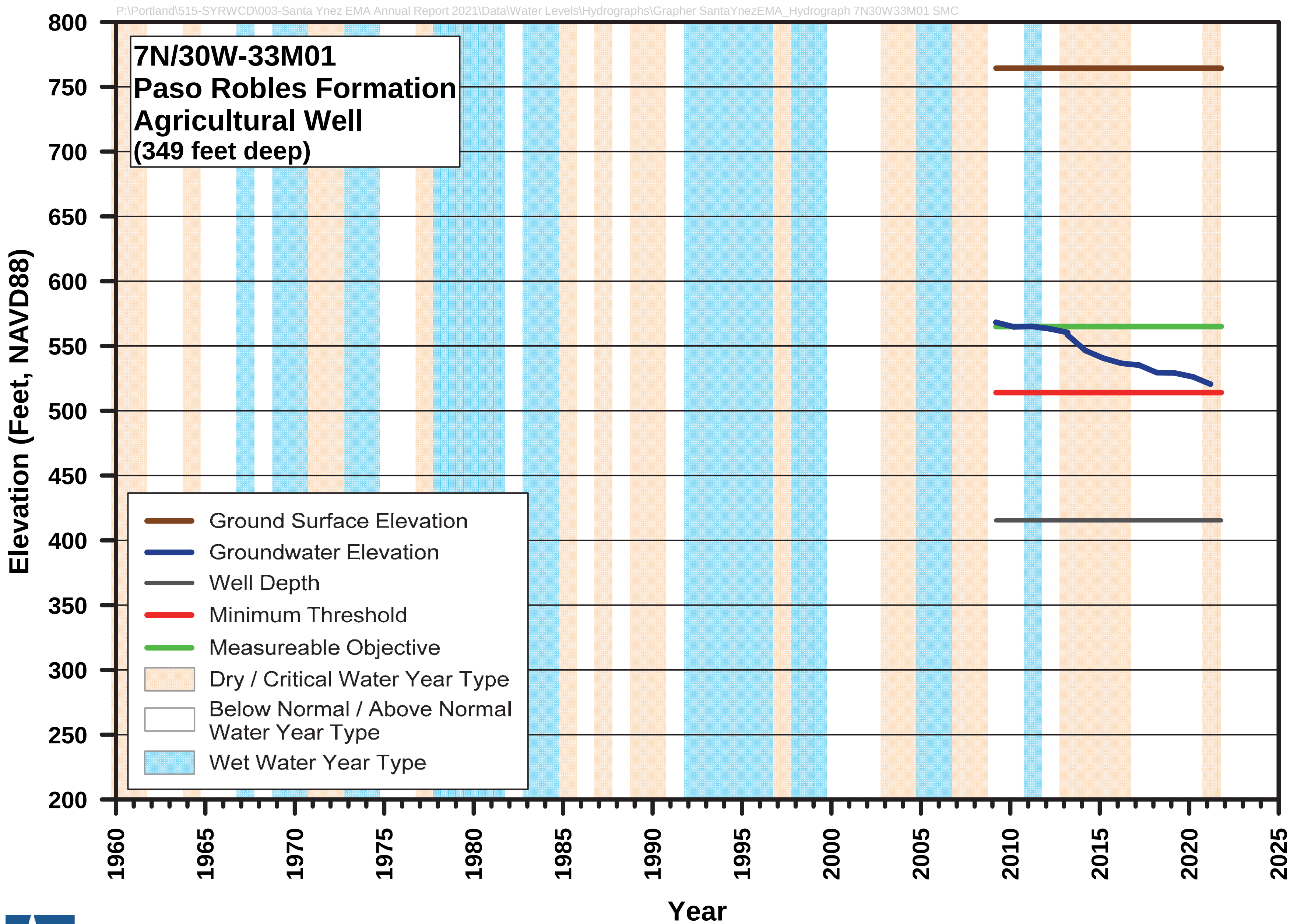

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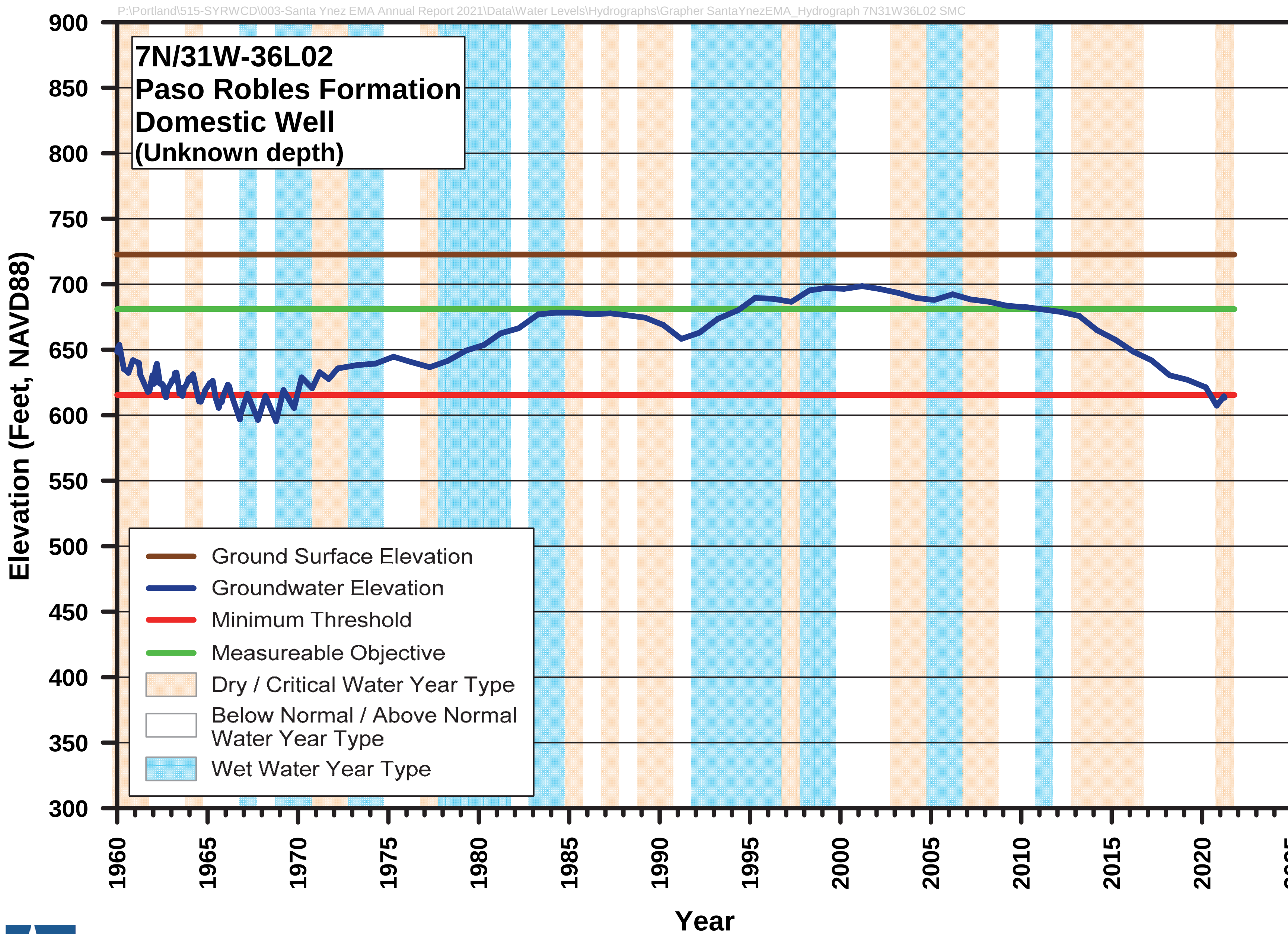
Groundwater Elevation Hydrograph

Santa Ynez River Valley Groundwater Basin - Eastern Management Area First Annual Report (2019 - 2021)



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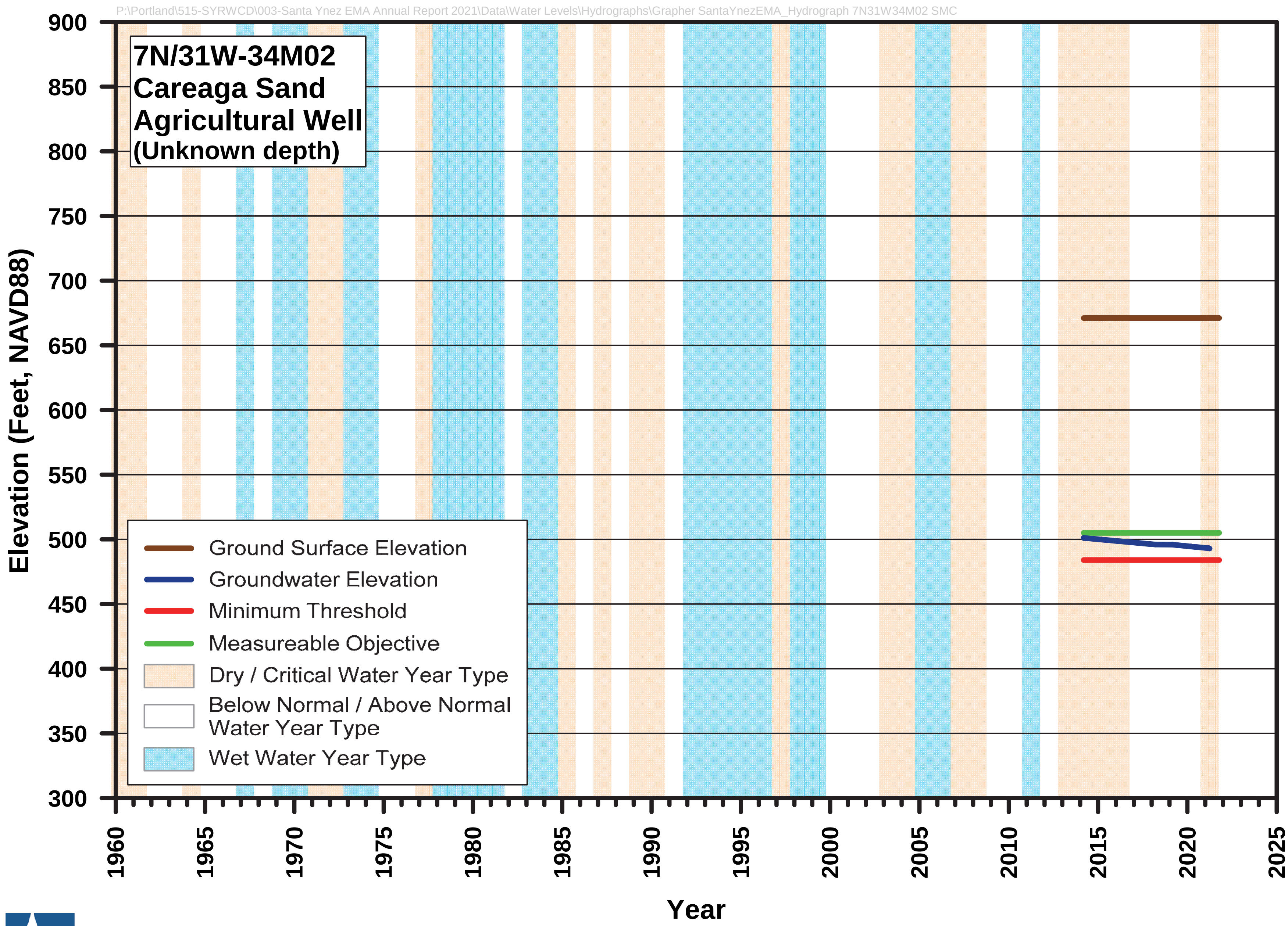
Groundwater Elevation Hydrograph
Santa Ynez River Valley Groundwater Basin - Eastern Management Area First Annual Report (2019 - 2021)



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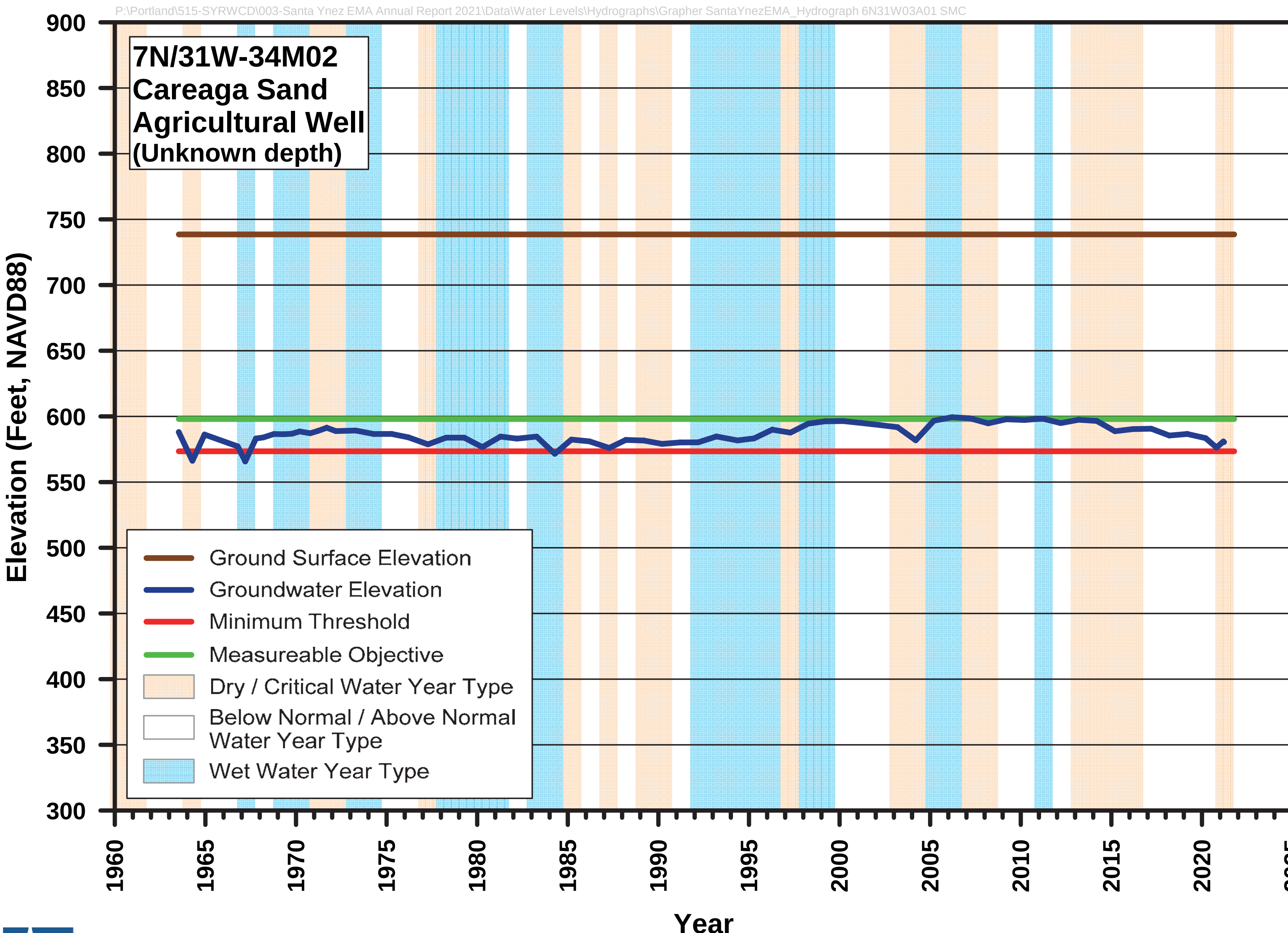
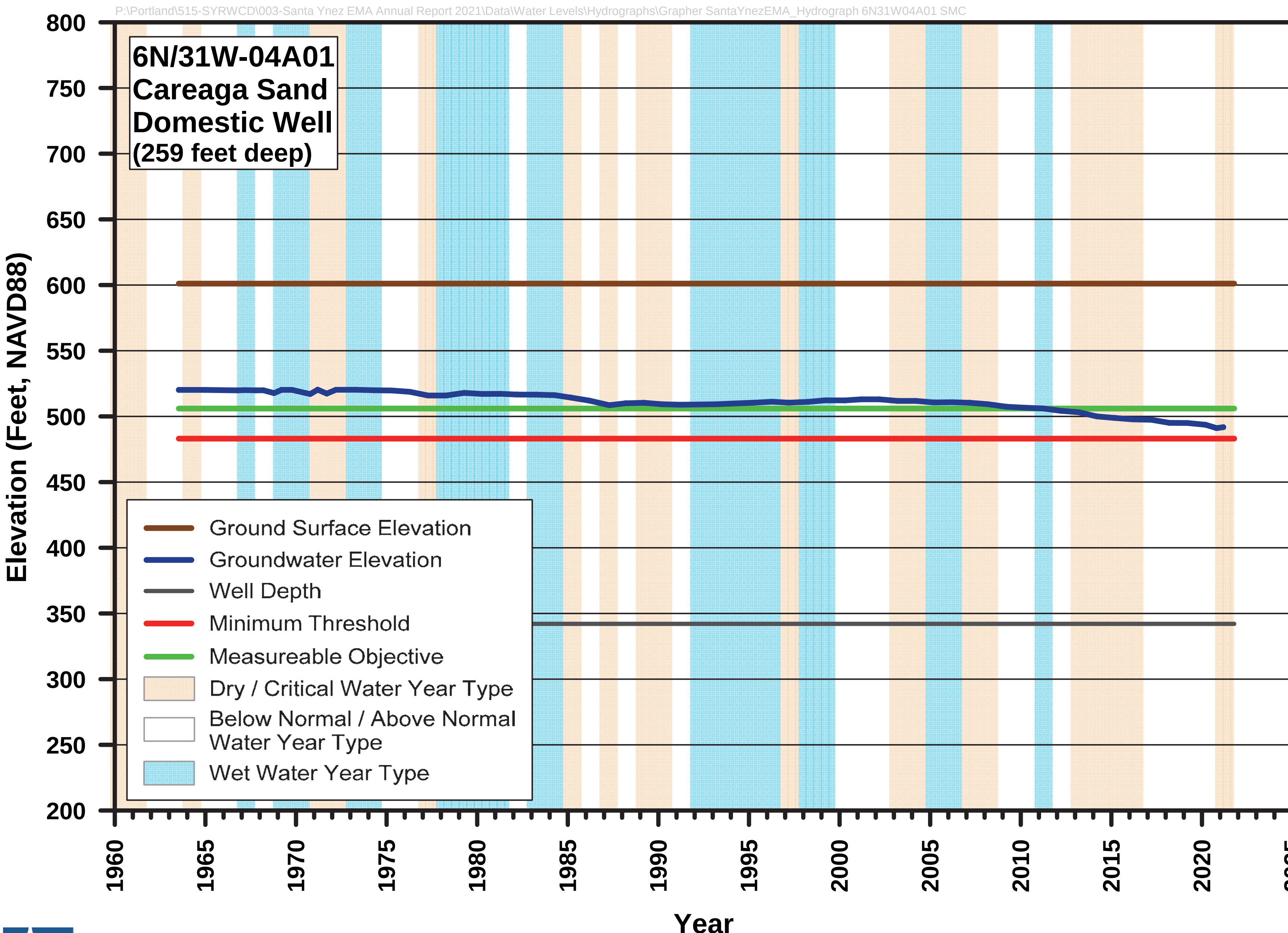
Groundwater Elevation Hydrograph
Santa Ynez River Valley Groundwater Basin - Eastern Management Area First Annual Report (2019 - 2021)



Groundwater Elevation Hydrograph

Santa Ynez River Valley Groundwater Basin - Eastern Management Area First Annual Report (2019 - 2021)



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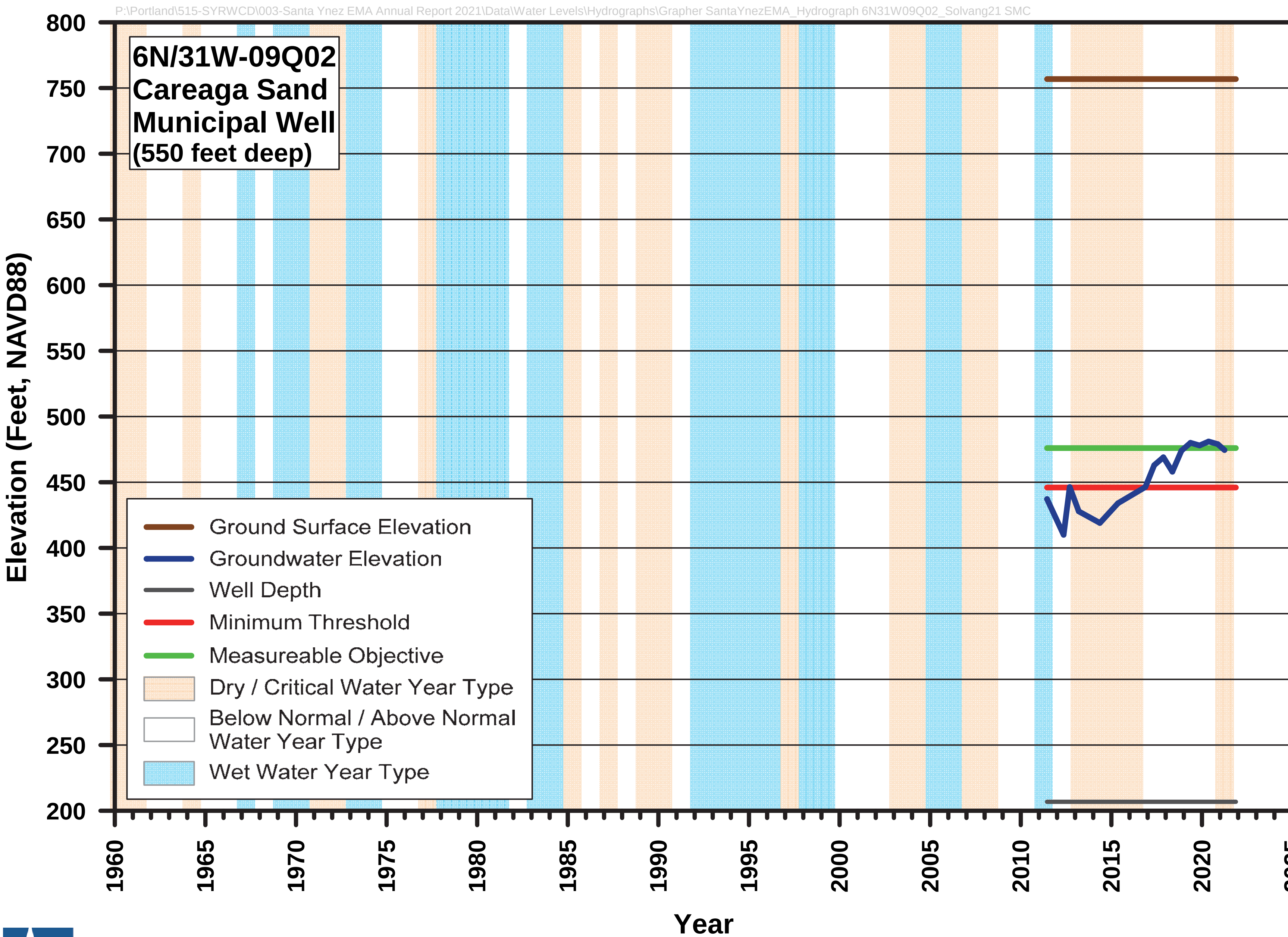
Groundwater Elevation Hydrograph

Santa Ynez River Valley Groundwater Basin - Eastern Management Area First Annual Report (2019 - 2021)



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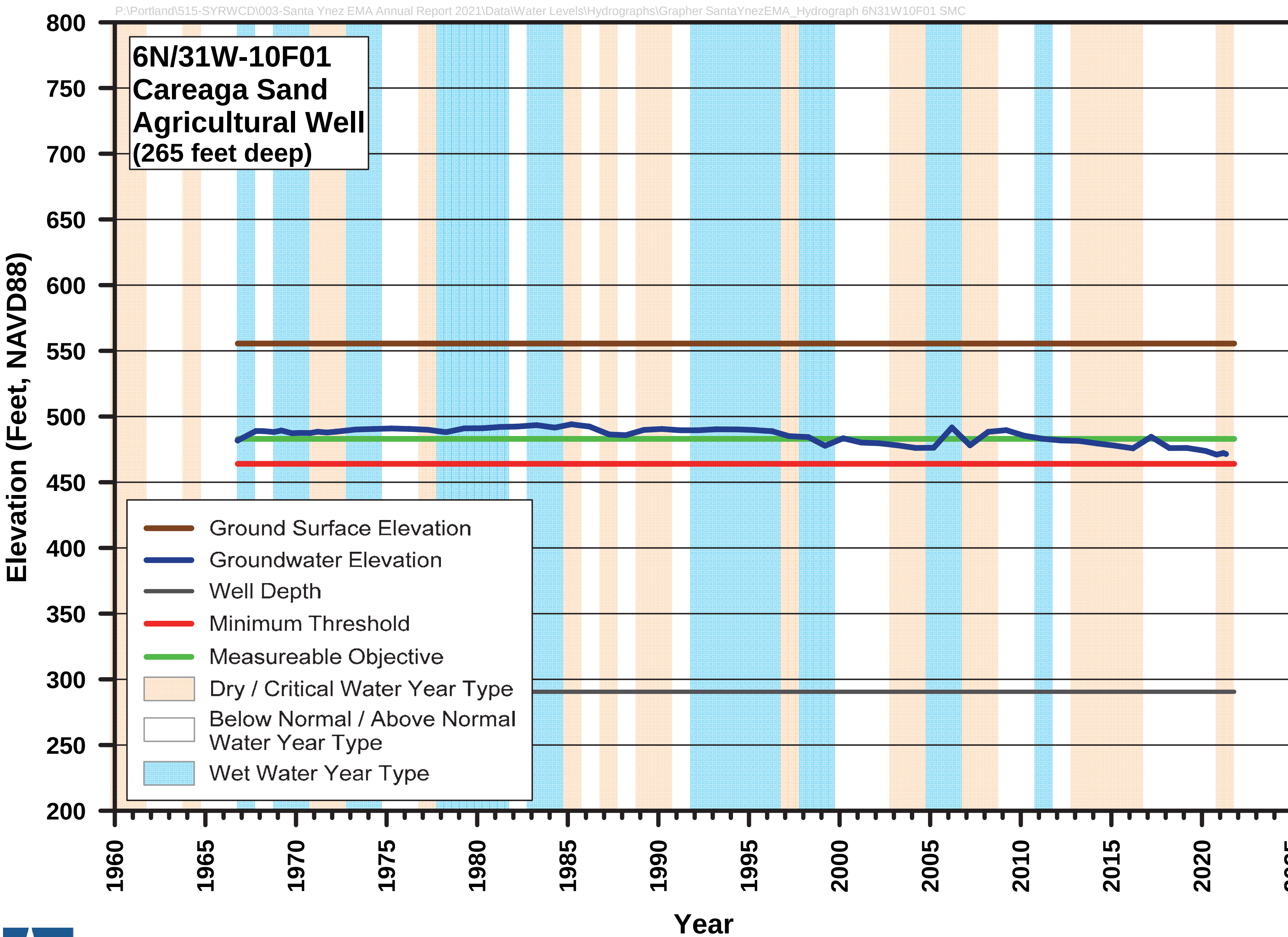
Groundwater Elevation Hydrograph
Santa Ynez River Valley Groundwater Basin - Eastern Management Area First Annual Report (2019 - 2021)



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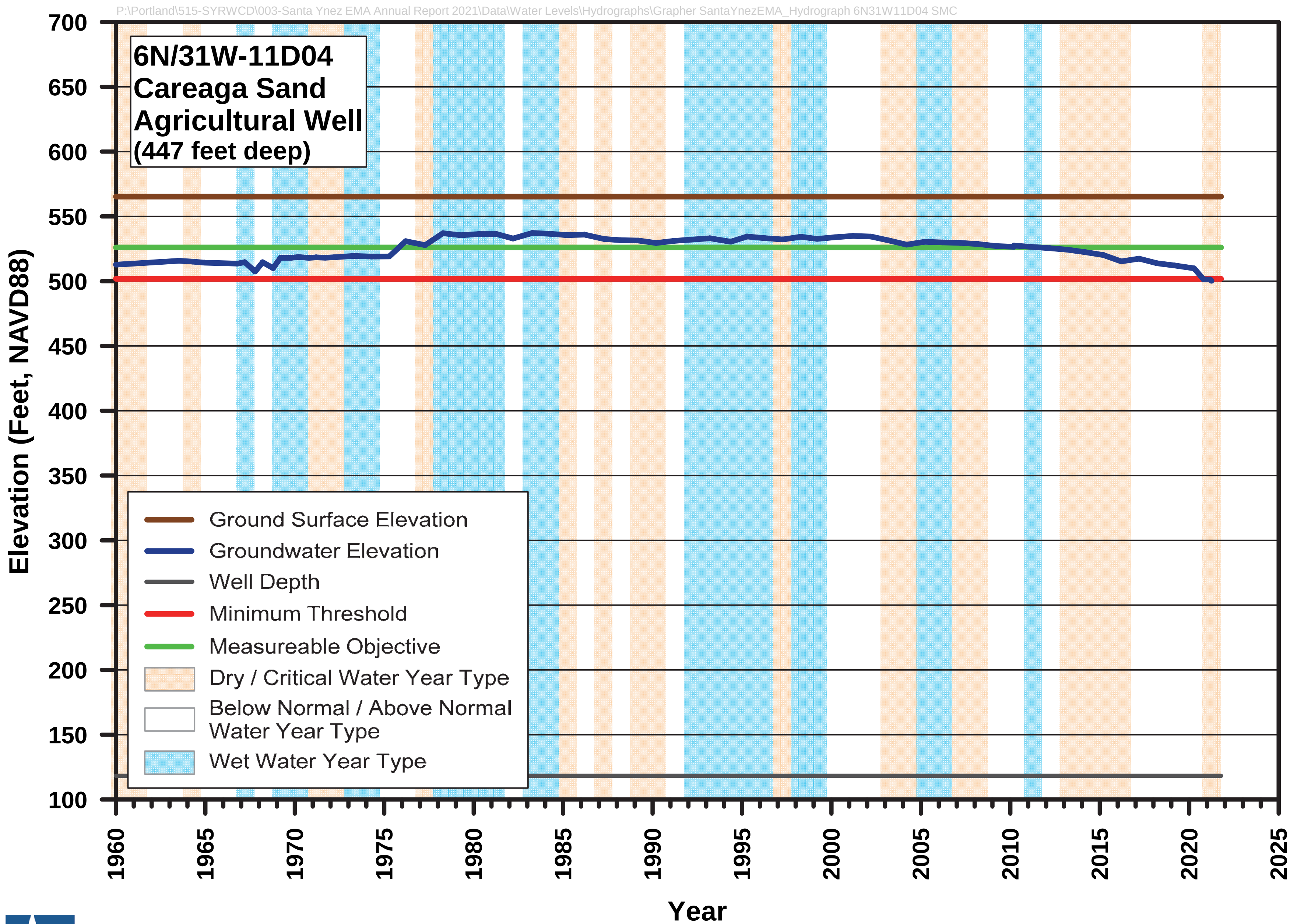
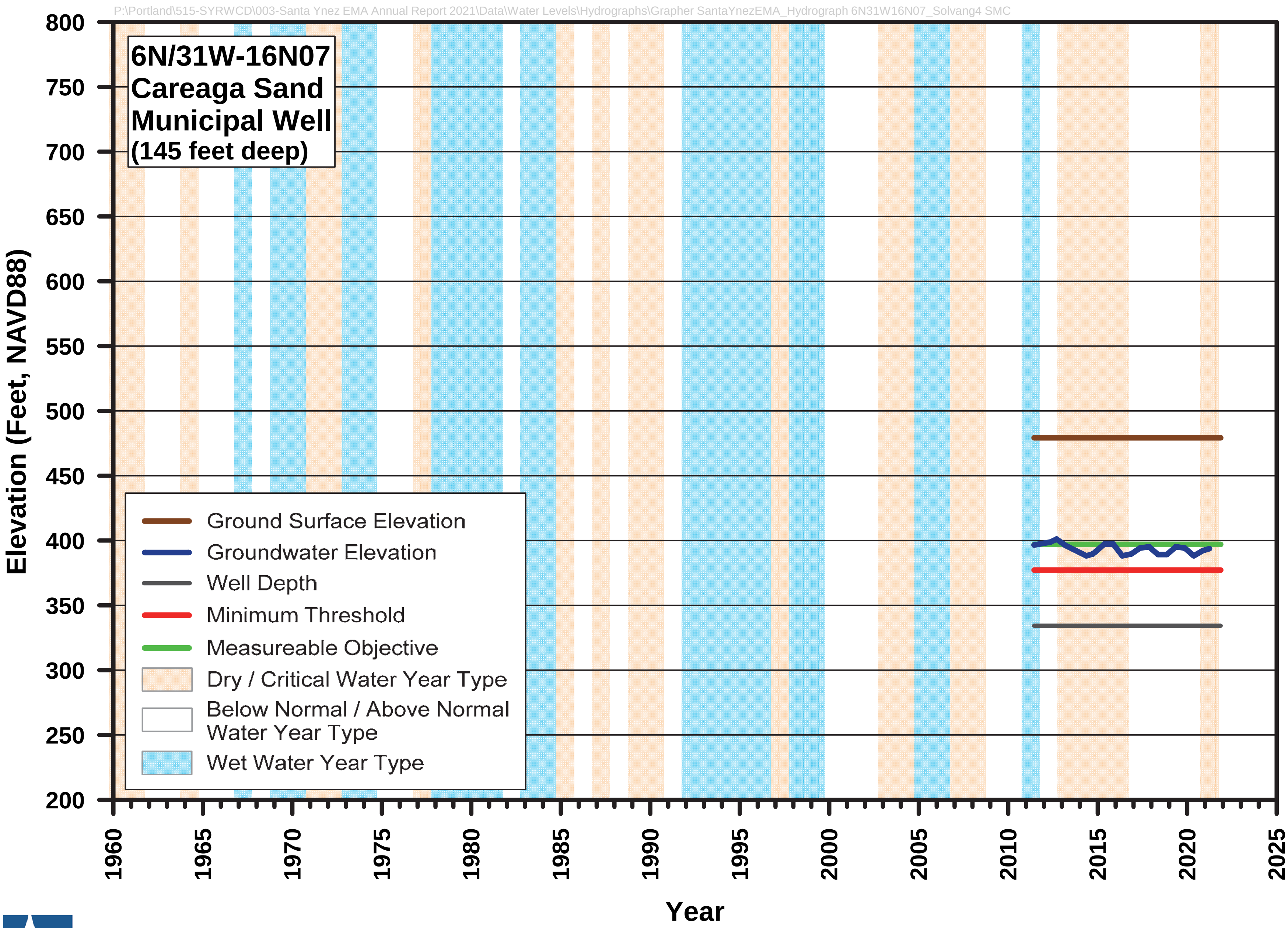
Groundwater Elevation Hydrograph

Santa Ynez River Valley Groundwater Basin - Eastern Management Area First Annual Report (2019 - 2021)

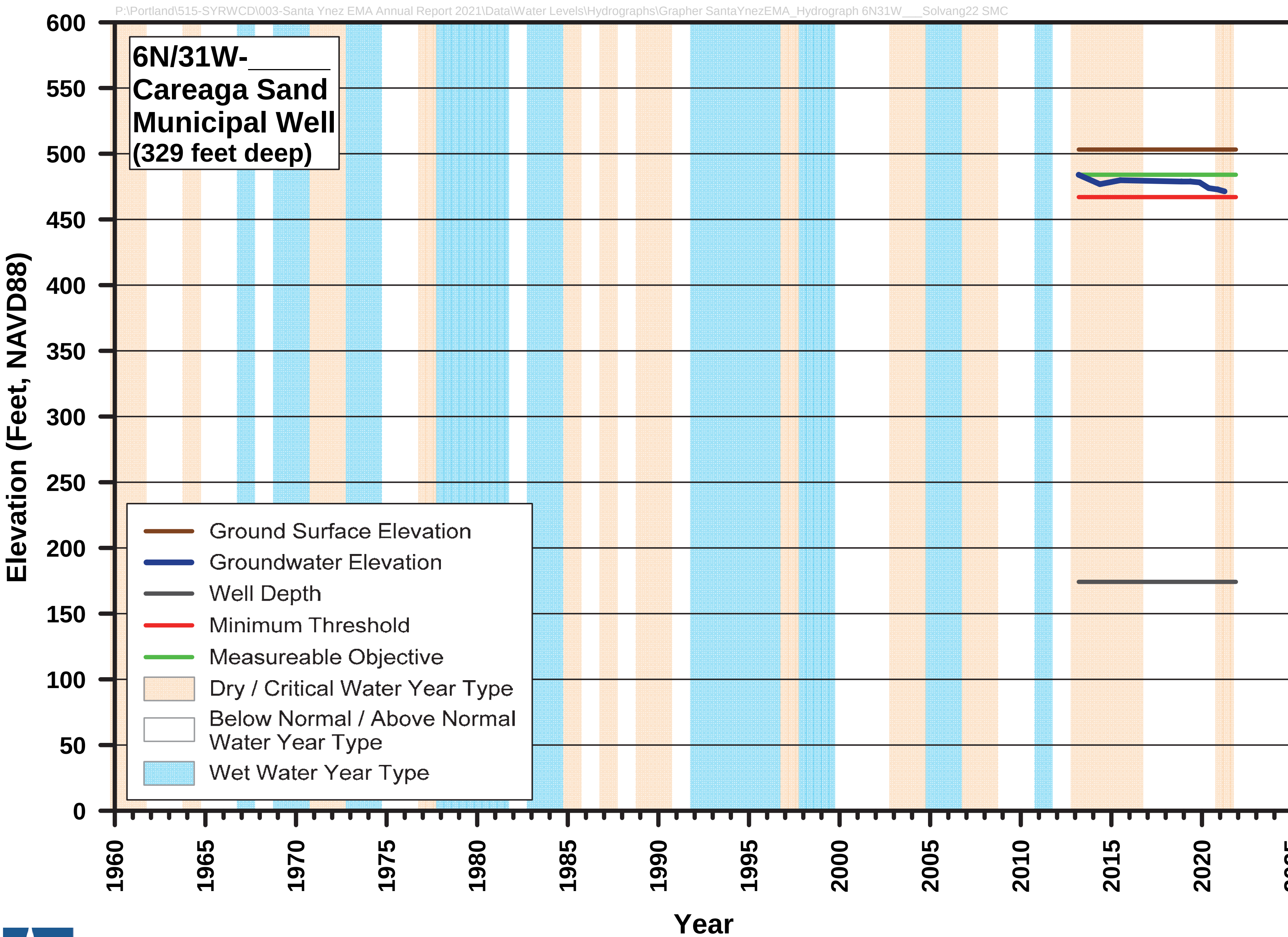


GSI Water Solutions, Inc.



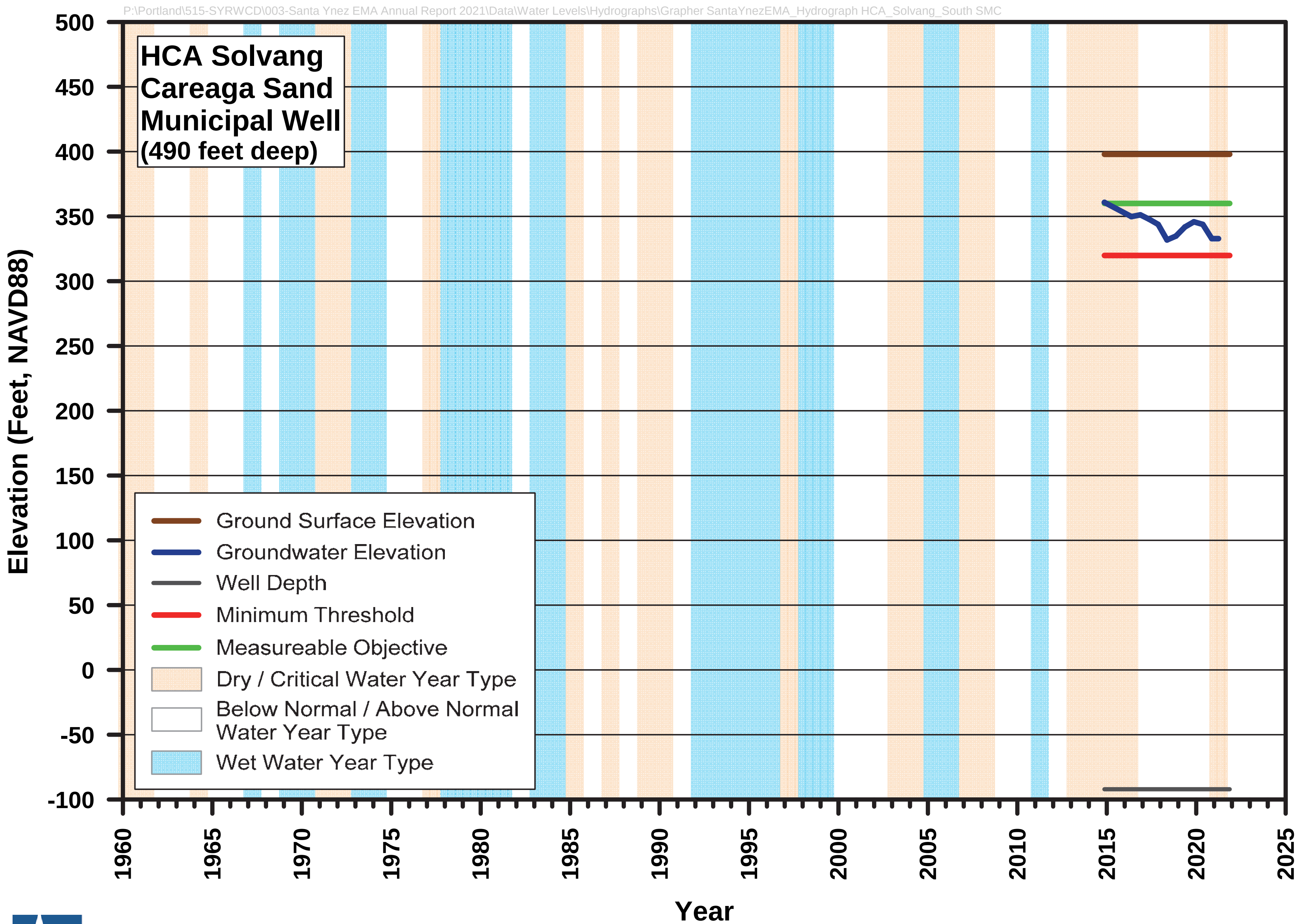
Groundwater Elevation Hydrograph

Santa Ynez River Valley Groundwater Basin - Eastern Management Area First Annual Report (2019 - 2021)



Groundwater Elevation Hydrograph

Santa Ynez River Valley Groundwater Basin - Eastern Management Area First Annual Report (2019 - 2021)



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APPENDIX D

Land Subsidence Data

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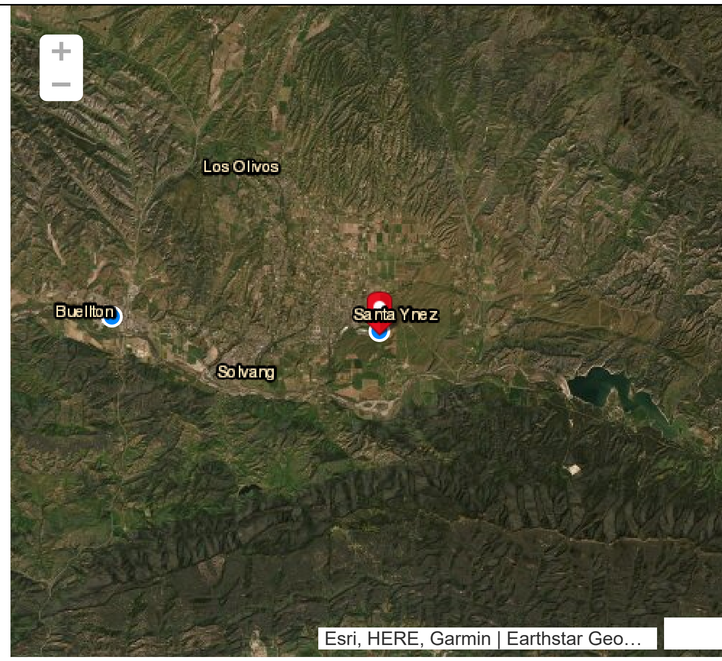
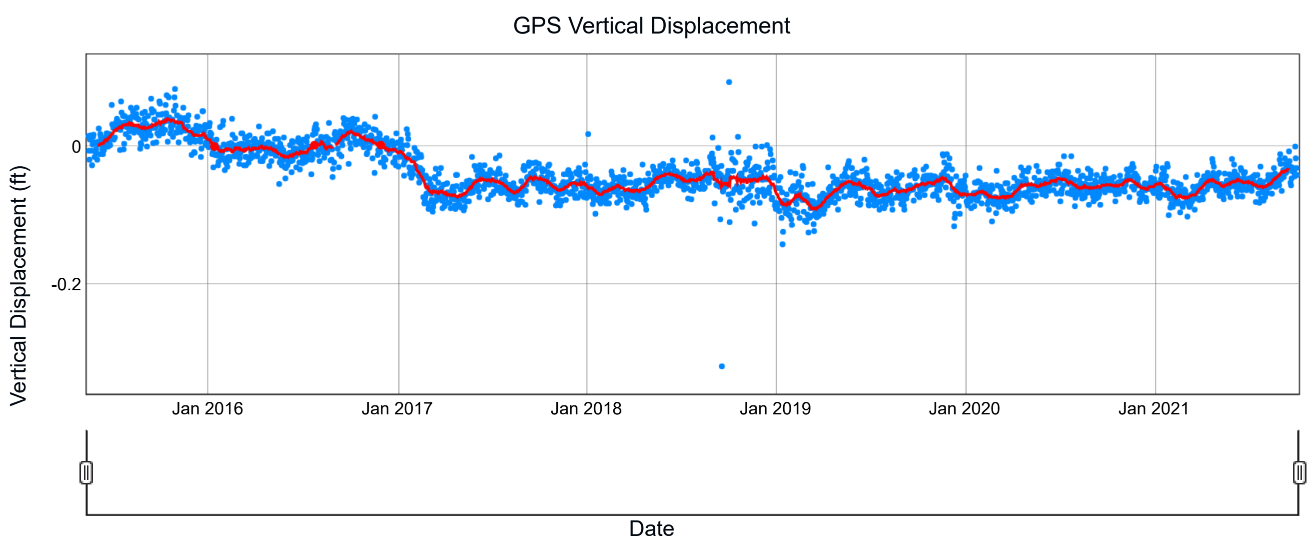
GPS Station ID: SYNG

Station ID: SYNG
Latitude: 34.60723222
Longitude: -120.0695593
HR Name: Central Coast
Basin: 3-015 SANTA YNEZ RIVER VALLEY
Sub Basin: 3-015 SANTA YNEZ RIVER VALLEY
Start Date: 31-May-2015
End Date: 08-Nov-2021
POR Vertical Displacement: 0.059 ft.



GPS Data

Date: (hover to see values)
— Vertical Displacement: — Vertical Displacement 31 Day Ave:

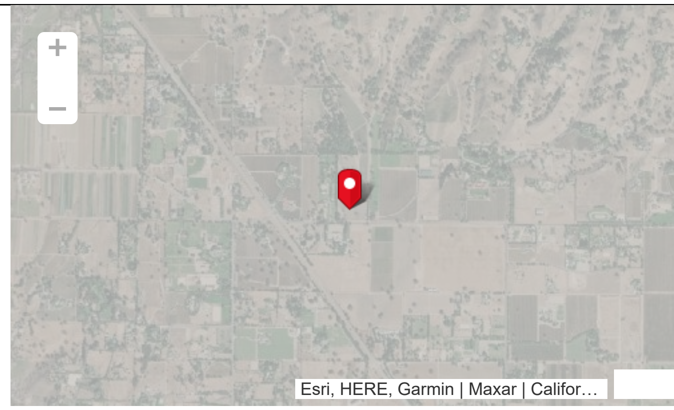


View Full Screen   Zoom Full Range   Fixed y-scale   Y-axis logscale   Show y=0   Show x-grid   Show y-grid

CSV   Excel   Search:

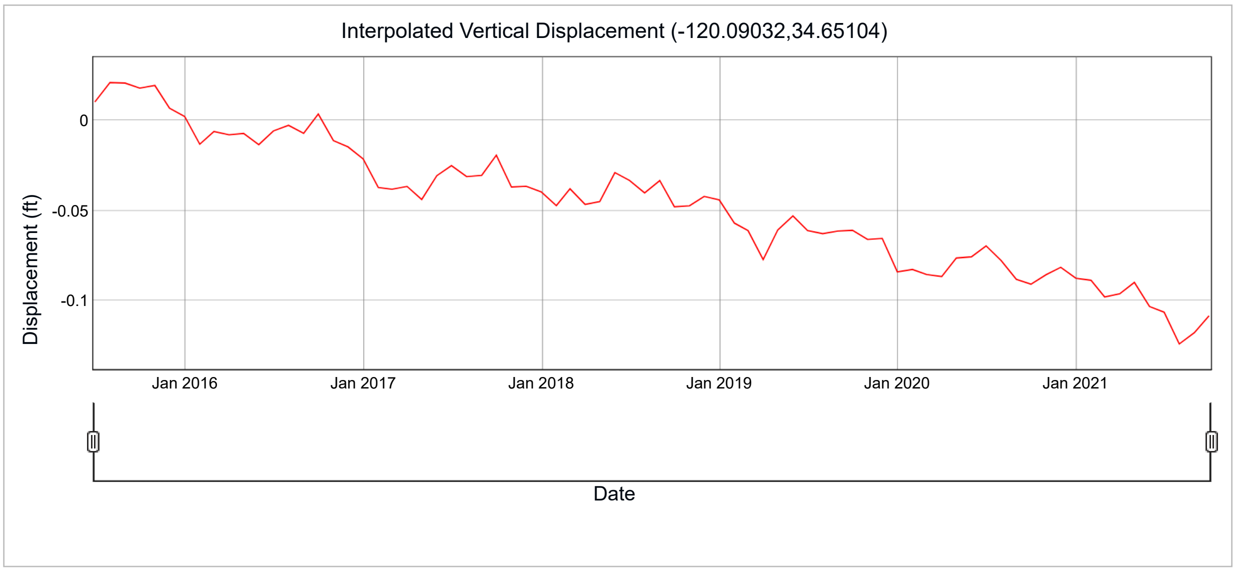
TRE ALTAMIRA Vertical Displacement at Latitude: 34.65104 **Longitude:** -120.09032

Interpolated Displacement (ft): -0.014
Latitude: 34.65104
Longitude: -120.09032



Vertical Displacement

Date: (hover to see values)
— **TRE Altamira Interpolated Vertical Displacement**



CSV Excel **Search:**