San Antonio Creek Valley Groundwater Basin Groundwater Sustainability Plan

December 16, 2021

Prepared for:

San Antonio Basin
Groundwater Sustainability Agency

Prepared by:

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San Antonio Basin Groundwater Sustainability Agency

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December 16, 2021

Prepared for:
Board of Directors
San Antonio Basin Groundwater Sustainability Agency
920 East Stowell Rd
Santa Maria, CA 93454

GSI Water Solutions, Inc.

GSI Water Solutions, Inc. is pleased to submit this Groundwater Sustainability Plan (GSP) prepared in accordance with California Code of Regulations, Title 23. Water, Division 2. Department of Water Resources, Chapter 1.5. Groundwater Management, Subchapter 2. Groundwater Sustainability Plans.

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Abbreviations and Acronyms

AB	Assembly Bill
AF	acre-feet
AFY	acre-feet per year
amsl	above mean sea level
Basin Plan	Water Quality Control Plan for the Central Coast Basin
Basin	San Antonio Creek Valley Groundwater Basin
BMP	best management practice
Board	SABGSA Board of Directors
BOD	biochemical oxygen demand
BPA	Base Pumping Allocation
CARB	California Air Resources Board
CASGEM	California Statewide Groundwater Elevation Monitoring
CCI	California Climate Investments
CCR	California Code of Regulations
CDFW	California Department of Fish and Wildlife
CEQA	California Environmental Quality Act
CGPS	Continuous Global Positioning System
COGG	California Oil, Gas, and Groundwater
CRCD	Cachuma Resource Conservation District
DAC	Disadvantaged Community
DDW	Division of Drinking Water
DEHP	di(2-ethylhexyl)phthalate
DMS	Data Management System
DQO	data quality objective
DSW-MAR	Distributed Storm Water Managed Aquifer Recharge
DWR	California Department of Water Resources
EPA	U.S. Environmental Protection Agency
ET	evapotranspiration
EVI	Enhanced Vegetation Index
ft	foot or feet
ft^2/day	square feet per day
GAMA	Groundwater Ambient Monitoring and Assessment
GDE	groundwater-dependent ecosystem
GEC	Groundwater Extraction Credit
GIS	geographic information system
gpcd	gallons per capita per day
gpd	gallons per day
gpm	gallons per minute

gpm/ft	gallons per minute per foot
GPS	Global Positioning System
Groundwater Report	Santa Barbara County 2019 Groundwater Basins Status Report
GSA	Groundwater Sustainability Agency
GSI	GSI Water Solutions, Inc.
GSP	Groundwater Sustainability Plan
HCM	hydrogeologic conceptual model
ILRP	Irrigated Lands Regulatory Program
InSAR	Interferometric Synthetic Aperture Radar
IRWMP	Integrated Regional Water Management Plan
JPA	Joint Exercise of Powers Agreement
JPL	Jet Propulsion Laboratory
LACSD	Los Alamos Community Services District
LAFD	Los Alamos Fire Department
MAR	Managed Aquifer Recharge
MCL	maximum contaminant level
MO	measurable objective
MT	minimum threshold
NASA	National Aeronautics and Space Administration
NAVD 88	North American Vertical Datum of 1988
NCCAG	Natural Communities Commonly Associated with Groundwater
NHD	National Hydrography Dataset
NWIS	National Water Information System
OSWCR	Online System for Well Completion Reports
QA/QC	quality assurance and quality control
RMS	representative monitoring site
RP	reference point
RWQCB	Regional Water Quality Control Board
SABGSA	San Antonio Basin Groundwater Sustainability Agency
SABWD	San Antonio Basin Water District
SAC	Stakeholder Advisory Committee
SB	Senate Bill
SCADA	Supervisory Control and Data Acquisition
SERS	streambed electrical resistance sensors
SGMA	Sustainable Groundwater Management Act
Slough	Barka Slough
SMC	sustainable management criteria
SMCL	secondary maximum contaminant level
SSURGO	Soil Survey Geographic Database
SWAMP	Surface Water Ambient Monitoring Program

SWP	State Water Project
SWRCB	State Water Resources Control Board
TDS	total dissolved solids
TMDL	Total Maximum Daily Load
TNC	The Nature Conservancy
UC	University of California
UNAVCO	University NAVSTAR Consortium
USAF	U.S. Air Force
USDA	U.S. Department of Agriculture
USGS	U.S. Geological Survey
UTS	unarmored three-spine stickleback
VAFB	Vandenberg Air Force Base
VOC	volatile organic compound
VSFB	Vandenberg Space Force Base
WCR	well completion report
WQO	water quality objective
WWTF	Wastewater Treatment Facility

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Executive Summary

ES-1 Introduction

The Sustainable Groundwater Management Act (SGMA), effective as of January of 2015, created a new statewide framework for managing California's groundwater at the local level through the formation of Groundwater Sustainability Agencies (GSAs). SGMA requires the development and implementation of a Groundwater Sustainability Plan (GSP) for each groundwater basin in the state that has been designated as high or medium priority. A GSP presents strategies for maintaining or bringing a groundwater basin into a sustainable condition within the next 20 years. SGMA exempts de minimus pumpers (e.g., individual domestic well owners who extract up to 2 acre-feet per year [AFY]) from most of the SGMA requirements and does not require metering.

The San Antonio Basin Groundwater Sustainability Agency (SABGSA) was formed in 2017 for the purpose of sustainably managing groundwater and developing this GSP for the San Antonio Creek Valley Groundwater Basin (Basin). The SABGSA member agencies are the San Antonio Basin Water District and Los Alamos Community Services District. The Basin occupies approximately 123 square miles in western Santa Barbara County (see Figure ES-1). It is bounded on the north by the Casmalia Hills and Solomon Hills, on the east by the San Rafael Mountains and a watershed divide separating the adjoining Santa Ynez River Valley groundwater basin, on the south by the Purisima Hills and Burton Mesa, and the west by the approximate western boundary of Barka Slough.

This GSP describes the physical setting of the Basin; quantifies historical, present, and future water budgets; develops quantifiable management objectives that account for the interests of the Basin's beneficial groundwater uses and users and identifies a group of projects and management actions that will allow the Basin to achieve sustainability within 20 years of plan adoption. This document also includes the list of references and technical studies, documentation of the stakeholder engagement process undertaken in the development of this plan, and several supporting appendices.

The SABGSA has provided multiple venues for stakeholder engagement and public comment. A Stakeholder Advisory Committee was formed to represent basin water user groups. Members of the Advisory Committee reviewed draft sections of this GSP, provided feedback, and solicited input from their respective stakeholders as the plan was developed. Opportunities for public comment are provided at all SABGSA Board meetings, Advisory Committee meetings, and two workshops. Comments were also received through a Groundwater Communication Portal, letters, and email.

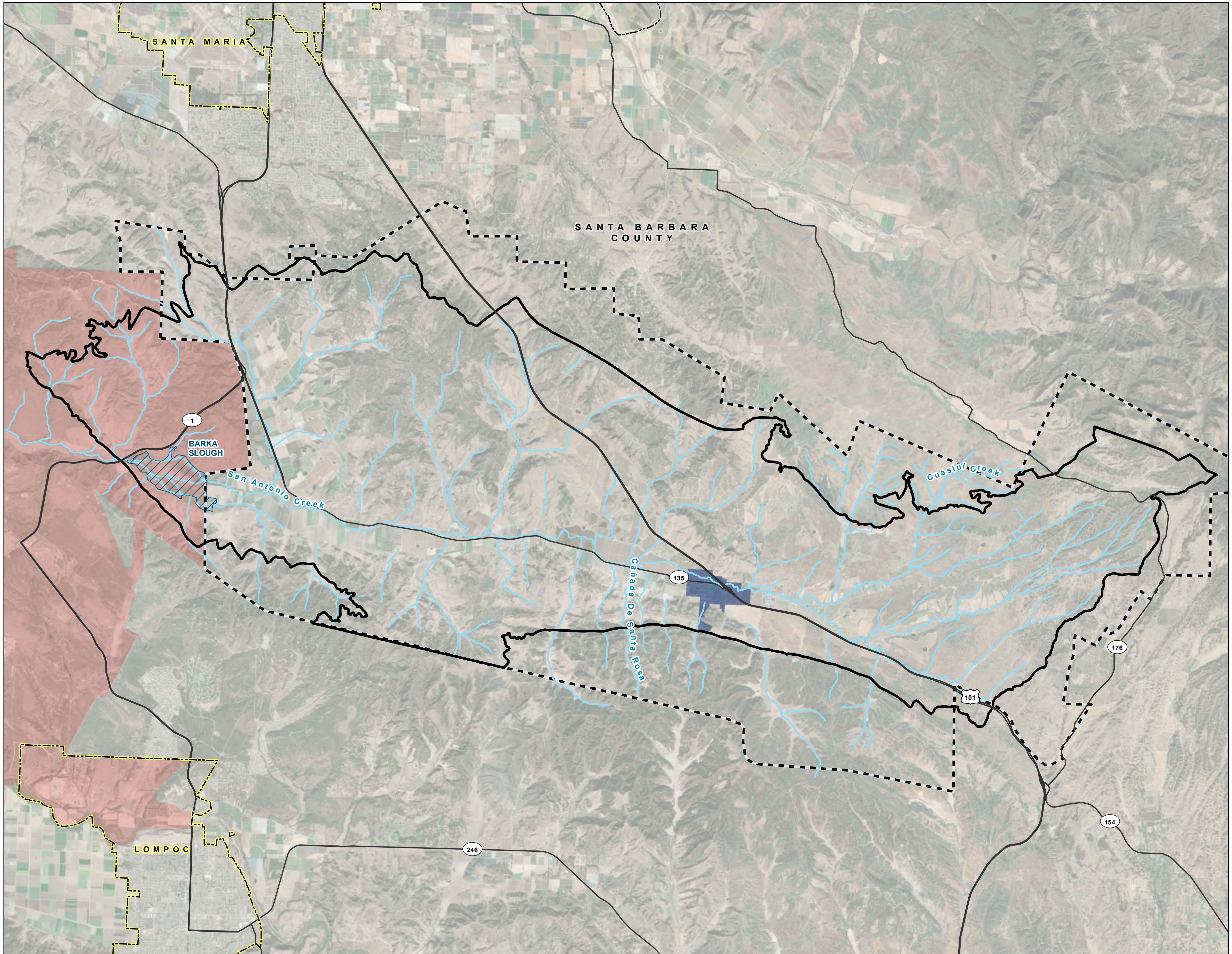

FIGURE ES-1

San Antonio Creek Valley Groundwater Basin Plan Area

Groundwater Sustainability Plan
San Antonio Creek Valley
Groundwater Basin

LEGEND

- Los Alamos Community Services District
- Vandenberg Space Force Base

All Other Features

- San Antonio Creek Valley Groundwater Basin
- Barka Slough
- San Antonio Basin Water District
- County Boundary
- City Boundary
- Major Road
- San Antonio Creek or Adjacent Tributary

N

0 5,000 10,000 15,000
Feet

Date: November 18, 2021
Data Sources: USGS (2020b), ESRI, DWR (2018a), Maxar imagery (2020)

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The organization of this plan is as follows:

- **Section 1 – Introduction to Plan Contents:** An introduction to the GSP, including a description of its purpose and a brief description of the Basin.
- **Section 2 – Administrative Information:** Includes the following:
  - Information on the SABGSA as an organization and a brief description of the agencies participating in the GSA, including information on the legal authority of the GSA to plan and coordinate groundwater sustainability for the Basin.
  - An overview description of the Basin, including land use and agencies with jurisdiction, a description of the existing groundwater management plans and regulatory programs, and land use programs that might have an effect on, or be affected by, this GSP.
  - The SABGSA's communications and engagement planning and implementation, public feedback and stakeholder comments on the plan, how feedback was incorporated into the GSP, and responses to comments received.
- **Section 3 – Basin Setting:** Includes the following:
  - An explanation of the hydrogeologic conceptual model developed for the Basin that includes descriptions of the regional hydrology and geology, principal aquifers and aquitards, and a description of the data gaps in the current model.
  - A detailed description of the groundwater conditions, including groundwater elevations and changes in storage, groundwater quality distribution and trends over time, an evaluation of land subsidence, locations where surface water and groundwater are interconnected, and the identification and distribution of groundwater-dependent ecosystems (GDEs).
  - A presentation of the historical, current, and projected future water budget for the Basin; how the water budgets were developed; and the effects of climate change (using DWR climate change factors).
- **Section 4 – Sustainable Management Criteria:** Defines the sustainability goal for the Basin; describes the process through which sustainable management criteria (SMCs) were established; describes significant and unreasonable effects that could lead to undesirable results as a result of groundwater use; describes and defines SMCs regarding chronic lowering of groundwater levels, reduction of groundwater in storage, seawater intrusion, degraded groundwater quality, land subsidence, and depletion of interconnected surface water; and describes the minimum thresholds, measurable objectives, and interim milestones to avoid undesirable results.
- **Section 5 – Monitoring Networks:** A detailed description of the monitoring network objectives and monitoring protocols in the Basin for groundwater levels, groundwater storage, water quality, land subsidence, interconnected surface water, representative monitoring sites, and a description of how monitoring data will be reported.
- **Section 6 – Projects and Management Actions:** Provides a description of the tiered implementation plan and a description of each project and management action that is planned to be implemented by the SABGSA to avoid undesirable results and ensure sustainability within 20 years of GSP adoption.
- **Section 7 – Groundwater Sustainability Plan Implementation:** Describes the implementation approach and timing for projects and management actions, overall schedule, estimated implementation costs, and sources of funding.

Summaries of the key technical sections of this GSP are presented below.

ES-2 Basin Setting (GSP Section 3)

Section 3 of the GSP describes the hydrogeologic conceptual model (HCM) of the Basin, including the basin boundaries, geologic formations and structures, and principal aquifer units. The section also summarizes general basin water quality, the conceptual interaction between groundwater and surface water, and generalized groundwater recharge and discharge areas. The HCM is a summary of aspects of the basin hydrogeology that influence groundwater sustainability. The HCM is based on the available body of data and prior studies of regional geology, hydrology, and water quality. In this GSP, the HCM provides a framework for subsequent sections describing the basin setting, including groundwater conditions and water budgets. Ongoing studies of the Basin will help the SABGSA better understand the Basin's hydrogeology in the future. The USGS is in the process of conducting a hydrogeological study and developing a calibrated groundwater model of the Basin. This study was not complete at the time this GSP was prepared; however, some preliminary information developed by the USGS was used in the development of the GSP. Once the USGS study is completed, the GSA expects to update the basin setting information and utilize the groundwater flow model for basin management purposes.

ES-2.1 Principal Aquifers

The Basin consists of an elongated bowl-shaped structure that is oriented east-west and was formed by compressional forces. Two relatively thick geologic units fill the Basin; the Paso Robles Formation and the Careaga Sand. Both have been identified as principal aquifers (see Figure ES-2). The alluvium in the Basin may be water bearing, particularly in the lower reaches of San Antonio Creek, because it receives recharge from San Antonio Creek; however, it is not considered a principal aquifer because there are no known wells completed in this unit and it does not produce sufficient quantities of water to support agricultural operations.

The Paso Robles Formation is approximately 2,000 feet (ft) thick, and much of it is saturated. It underlies the San Antonio Creek Valley and outcrops in large areas along the valley flanks and in the adjacent Solomon Hills, Casmalia Hills, and Zaca Canyon. The Paso Robles Formation consists of stream-deposited lenticular beds of gravel, sand, silt, and clay. Generally, the sand is silty and includes stringers of coarse sand and small pebbles. Coarse-grained beds in the formation yield water freely to wells, while fine-grained zones act as confining beds and are the cause of the artesian conditions that were historically reported in some wells screened within the Paso Robles Formation. The lower part of the Paso Robles Formation contains occasional beds of limestone, ranging in thickness from approximately 1 to 30 ft, that may restrict the vertical movement of groundwater.

The Careaga Sand outcrops extensively in the Purisima Hills and in large areas in the Solomon and Casmalia Hills and underlies the Paso Robles Formation in the Basin. The exposed Careaga Sand dips northward in the Purisima Hills and passes under the San Antonio Creek Valley at a depth of several thousand feet. The Careaga Sand is approximately 1,500 ft thick, and much of the formation is saturated. It consists of fine- to medium-grained sand with some silt and abundant pebbles. The upper member of the Careaga Sand is coarse-grained and uniformly graded. The Careaga Sand has a large storage capacity and transmits water readily to wells and to the overlying younger formations.

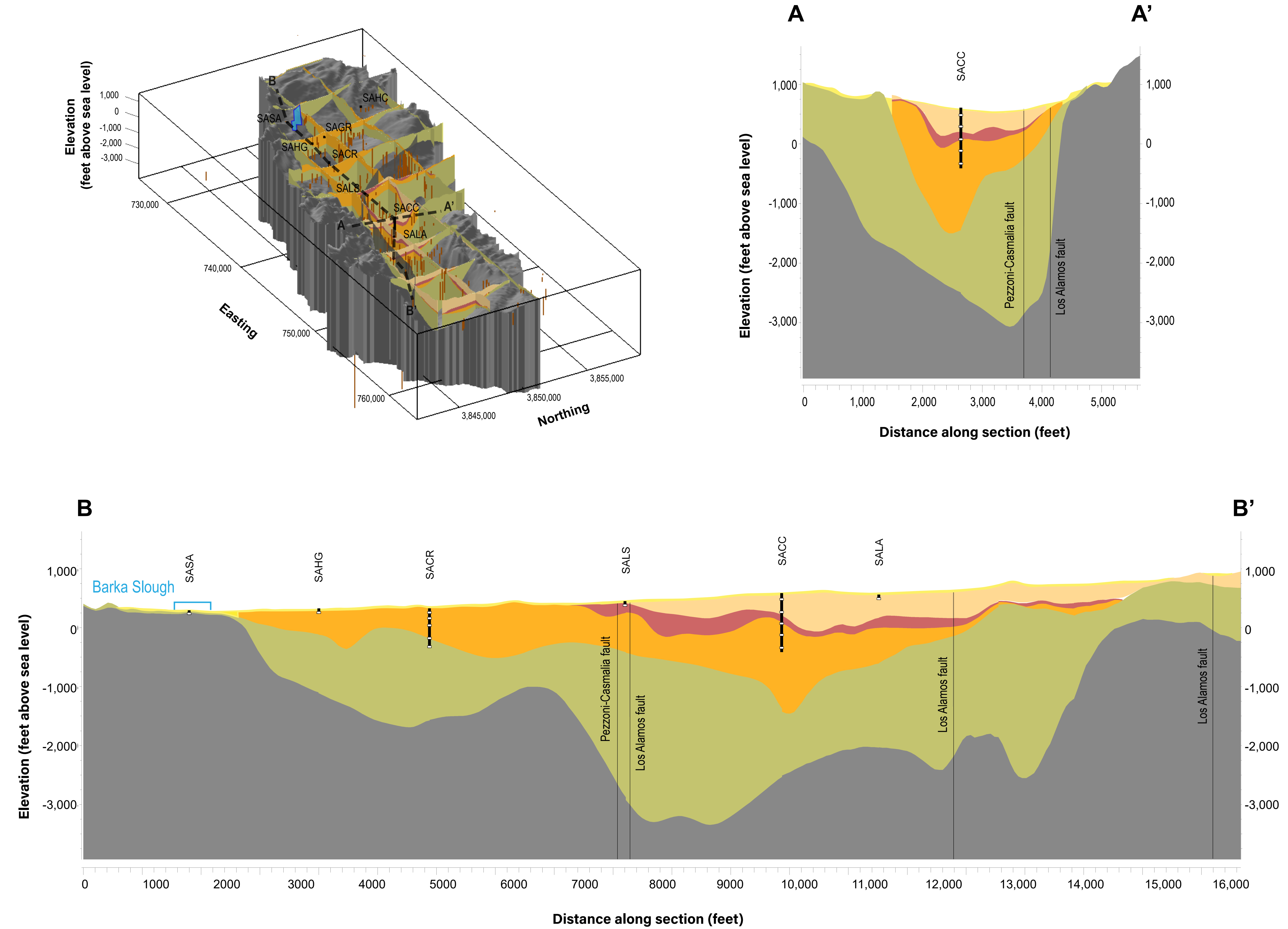

FIGURE ES-2

Geologic Cross Sections, San Antonio Creek Valley Groundwater Basin

Groundwater Sustainability Plan
San Antonio Creek Valley
Groundwater Basin

LEGEND

- Channel Alluvium
- Upper member - Paso Robles Formation
- Middle member - Paso Robles Formation
- Lower member - Paso Robles Formation
- Careaga Sand
- Consolidated bedrock

WELL LEGEND

← Screen

NOTE
Geologic cross section locations shown on Figure 3-4.

Date: September 16, 2021
Data Sources: USGS (2020c)

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ES-2.2 Recharge and Discharge in the Basin

Natural areal recharge in the Basin occurs through distributed areal infiltration of precipitation and through infiltration of surface water from San Antonio Creek and tributary drainages. Recharge to the Paso Robles Formation and Careaga Sand also occurs through direct infiltration of precipitation and infiltration in creek beds in the higher elevations where these units crop out at the surface.

Natural groundwater discharge areas in the Basin include springs and seeps, groundwater discharge to the lower end of San Antonio Creek and Barka Slough, and evapotranspiration (ET) by phreatophytes. Phreatophytes are plants whose roots tap into groundwater present in the alluvium along creeks and streams. Springs tend to be located in the uplands of the Solomon Hills and San Rafael Mountains ranges. Groundwater discharge also likely occurs in the vicinity of Barka Slough on the west end of the Basin.

ES-2.3 Groundwater Conditions

This section of the GSP describes the current and historical groundwater conditions in the Paso Robles Formation and Careaga Sand in the Basin. Groundwater flow direction is generally to the west across most of the Basin, except in the northwest area of the Basin, where groundwater flow is to the south in the Paso Robles Formation and to the south-southwest in the Careaga Sand. In general, groundwater flow in the Basin tends to converge toward the lower groundwater levels in the San Antonio Creek and Barka Slough.

Long-term groundwater elevation declines are evident on the hydrographs of wells completed in the Paso Robles Formation, shown in Appendix D. The magnitude of measured declines for Paso Robles Formation wells with a period of record of at least 10 years ranges from approximately 26 to 143 ft. The most significant water level declines occurred during the current drought (2012 to the present). Since 2017, observed water levels in some Paso Robles Formation wells indicate stabilization, while the trend is unclear in others. Long-term groundwater elevation declines are evident in virtually all of the hydrographs for wells completed in the Careaga Sand, also shown in Appendix D. The magnitude of measured declines for Careaga Sand wells with a period of record of at least 10 years ranges from approximately 1 to 70 ft. Although some recovery has occurred in groundwater levels in Careaga Sand wells during periods of above-average rainfall, the overall trend shows sharply declining water levels.

Groundwater in the Basin is of widely varying quality and generally decreases in quality from east to west coincident with the groundwater flow direction. Overall, groundwater in the Basin is of sufficient quality to be suitable for drinking water and agricultural purposes. Concentrations of total dissolved solids (TDS) generally increase from east to west along San Antonio Creek and are greatest near the Barka Slough, along western San Antonio Creek, and in Harris Canyon. Concentrations of boron, sodium, nitrate, and chloride are also elevated in the Barka Slough area, along western San Antonio Creek and in Harris Canyon. While there are some wells that have concentrations of TDS, sodium, chloride, and boron that exceed regulatory standards, it is possible that these exceedances are a result of natural conditions and not caused by land use activities. Elevated concentrations of TDS, sodium, and chloride are often associated with the rocks of marine origin that are present in the Basin, and elevated boron concentrations are naturally occurring in many central coast basins.

ES-2.4 Interconnected Groundwater and Surface Water

All the streams in the Basin are classified as intermittent and are likely to be losing streams, meaning that surface water flows down through the streambed into the groundwater. The stream channels located in Barka Slough are classified as perennial and likely to be gaining streams, meaning that groundwater flowing in through the streambed feeds the surface water system. Ephemeral surface water flows in the Basin make it difficult to assess the interconnectivity of surface water and groundwater and to quantify the degree to which surface water depletion has occurred. Interconnected surface water and groundwater within the Paso Robles Formation and Careaga Sand is present in Barka Slough and contributes to the classification of perennial streams in that area.

ES-2.5 Groundwater-Dependent Ecosystems

GDEs are defined under SGMA as “ecological communities of species that depend on groundwater emerging from aquifers or on groundwater occurring near the ground surface.” GDE types include terrestrial vegetation that is supported by shallow groundwater that discharges to seeps, springs, wetlands, streams, and estuaries. The locations of potential GDEs in the Basin were identified through screening methods developed by The Nature Conservancy and with local hydrologic data. A complete biological survey of Barka Slough has not been completed. The presence of potential GDEs associated with springs and seeps will be verified during GSP implementation.

Several wetland features, three mapped springs, and four types of groundwater dependent vegetation communities are present in the Basin. The four Natural Communities vegetation types are the following:

- Coast Live Oak
- Valley Oak
- Riparian Mixed Harwood
- Willow

Wetland classifications present in the Basin include the following:

- Palustrine, Emergent, Persistent, Seasonally Flooded
- Palustrine, Emergent, Persistent, Semipermanently Flooded
- Palustrine, Forested, Seasonally Flooded
- Palustrine, Scrub-Shrub, Seasonally Flooded
- Palustrine, Unconsolidated Bottom, Permanently Flooded
- Riverine, Lower Perennial, Unconsolidated Bottom, Permanently Flooded
- Riverine, Unknown Perennial, Unconsolidated Bottom, Semipermanently Flooded

Generally, wetlands were recorded along the San Antonio Creek tributary channels as well as Barka Slough. There are a few small areas outside of these locations that may be associated with springs. The locations of the groundwater dependent vegetation classifications and wetland classifications are presented in Figure ES-3.

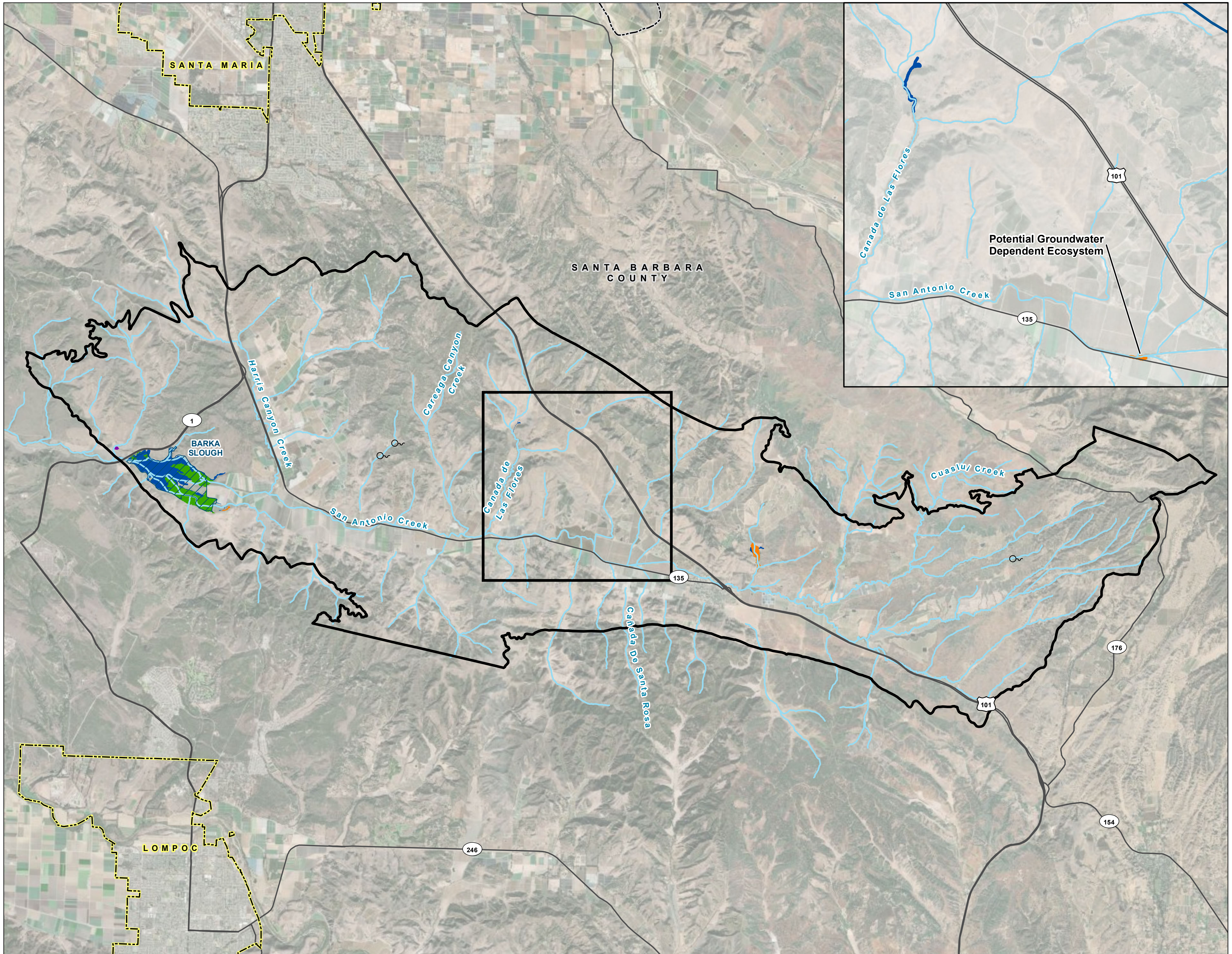

FIGURE ES-3

Groundwater-Dependent Ecosystems

Groundwater Sustainability Plan
San Antonio Creek Valley
Groundwater Basin

LEGEND

Natural Communities Commonly Associated with Groundwater (NCCAG)

- Wetland Area

VEGETATION

- Coast Live Oak
- Riparian Mixed Hardwood
- Willow

All Other Features

- San Antonio Creek Valley Groundwater Basin
- Barka Slough
- Major Road
- City Boundary
- USGS Spring

NOTE

San Antonio Creek Valley Groundwater Basin Boundary as defined in the California Department of Water Resources Bulletin 118.

N

0 5,000 10,000 15,000
Feet

Date: September 17, 2021
Data Sources: USGS (2020b, 2020h), ESRI, DWR (2018a, 2020b), Maxar imagery (2020)

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Document Path: Y:\0748_San_Antonio_GSP\Source_Figures\001_SanAntonio_Basin_GSA\GW_Sustainability_Plan\ES\FigureES-3_GDEs.mxd, abarry

ES-2.6 Water Budget Development

The water budgets presented in the GSP provide an accounting and assessment of the total annual volume of surface water and groundwater entering and leaving the Basin, including historical, current, and projected water budget conditions, and the change in the volume of groundwater in storage.

The water budget includes the following elements:

Surface Water Inflows:

- Runoff of precipitation into streams and rivers within the watershed

Surface Water Outflows:

- Streamflow exiting the Basin from Barka Slough
- Percolation of streamflow to the groundwater system

Groundwater Inflows:

- Recharge from precipitation, including mountain front recharge
- Irrigation return flow (water not consumed by crops/landscaping)
- Percolation of streamflow to groundwater
- Percolation of treated wastewater from septic systems and Los Alamos Community Services District Wastewater Treatment Plant spray irrigation

Groundwater Outflows:

- ET from crops, unirrigated land, and riparian areas
- Groundwater pumping
- Groundwater discharge to surface water

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

Groundwater from the Basin's two identified principal aquifers, the Paso Robles Formation and the Careaga Sand, supplied all the groundwater pumped and used in the Basin over the historical water budget period (water years [WYs] 1981–2018) or historical period. The historical groundwater budget includes a summary of the estimated groundwater inflows, groundwater outflows, and change in groundwater in storage. The results of the water budget indicate that average annual outflows from the Basin (28,100 AFY) has exceeded average annual inflows to the Basin (17,500 AFY) throughout the historical period, resulting in a deficit of groundwater in storage of approximately 10,600 AFY from year to year. Figure ES-4 depicts the Basin's average groundwater inflows and outflows during the historical period by groundwater budget component.

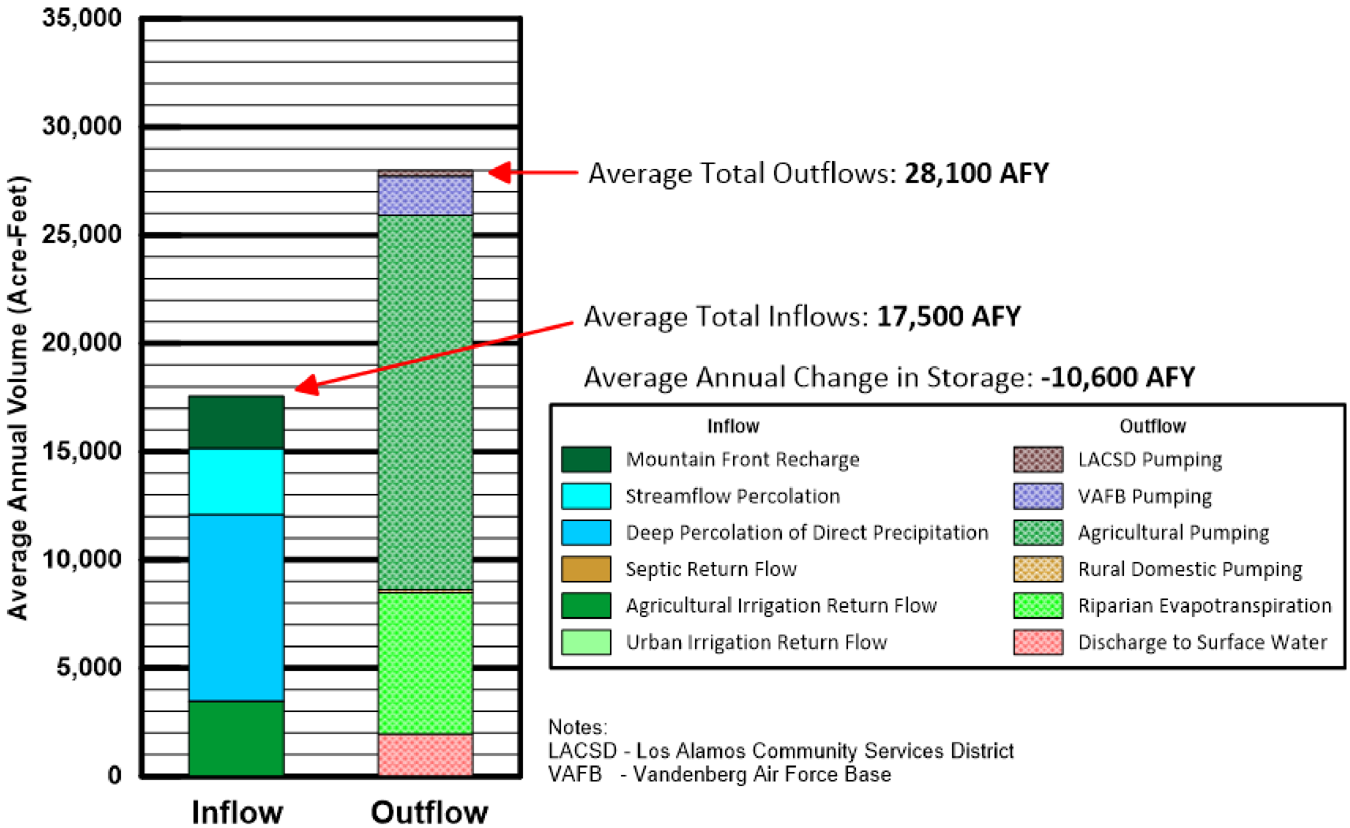

Figure ES-4. Average Groundwater Budget Volumes, Historical Period

Basin yield, or safe yield, of a groundwater basin is defined by SGMA as the maximum quantity of water that can be continuously withdrawn from a groundwater basin without adverse effect (e.g., chronic and continued lowering of groundwater levels and the volume of groundwater in storage). Basin yield is not a fixed constant value but a dynamic value that fluctuates over time as the balance of the groundwater inputs and outputs change; thus, the calculated basin yield of the Basin will be estimated and likely modified with each future update of this GSP. Basin yield is not the same as sustainable yield. Sustainable yield is defined in SGMA as "the maximum quantity of water, calculated over a period representative of long-term conditions in the basin and including any temporary surplus that can be withdrawn annually from a groundwater supply *without causing an undesirable result*" (emphasis added). Calculating the basin yield (see Section 3.3) provides a starting point for later establishing sustainable yield by considering the sustainability indicators described in greater detail in Section 4 of the GSP.

The historical basin yield was calculated by summing the average annual groundwater in storage decrease of 10,600 AFY with the estimated total average annual amount of groundwater pumping, of 19,500 AFY, for the historical period. This results in a historical basin yield for the Basin of about 8,900 AFY. This estimated value reflects historical climate, hydrologic, and pumping conditions and provides insight into the amount of groundwater pumping that could be sustained in the Basin to maintain a balance between groundwater inflows and outflows. It is anticipated that this value may fluctuate in the future as conditions change or as more data are obtained.

ES-2.7 Projected Water Budget

The surface water and groundwater inflow and outflow components of the projected water budget (WYs 2018–2072) in the Basin were estimated using estimated future land uses, cropping patterns, related pumping volumes, and repeating factors associated with the observed historical climatic conditions forward in time through 2042 and 2072. The effects of climate change were also evaluated using DWR-provided climate change factors.

The DWR-provided climate change data are based on the California Water Commission's Water Storage Investment Program climate change analysis results, which used global climate models and radiative forcing scenarios recommended for hydrologic studies in California by the Climate Change Technical Advisory Group. Climate data from the recommended General Circulation Model models and scenarios have also been downscaled and aggregated to generate an ensemble time series of change factors that describe the projected change in precipitation and ET values for climate conditions that are expected to prevail at midcentury and late century, centered around 2030 and 2070, respectively.

The seasonal timing and amount of precipitation in the Basin is projected to change. Decreases are projected in the summer, mid-fall, and late winter. Increases are projected in mid-winter, early spring, and late summer to early fall. The Basin is projected to experience minimal changes in total annual precipitation. In a warmer climate such as may occur in the Basin, crops require more water to sustain growth, and this increased water requirement is characterized in climate models using the rate of ET. Under 2030 conditions, the Basin is projected to experience average annual ET increases of approximately 3.6 percent relative to the baseline period (see Section 3.3.5), while under 2070 conditions, annual ET is projected to increase by approximately 8 percent relative to the baseline period. The Basin is projected to experience average annual increases in streamflow of approximately 2 percent and 6 percent under 2030 and 2070 conditions, respectively.

Consistent with the historical period, the projected water budget is dominated by groundwater pumping for agricultural irrigation. Consequently, on the inflow side of the water budget, there is an increase in agricultural irrigation return flow due to the increase in the volume of groundwater used for irrigation. The other inflow component, streamflow percolation, shows a notable increase even though a decrease in mountain front recharge and deep percolation of direct precipitation is projected. The average annual groundwater inflow for the Basin is projected to increase by approximately 13 percent and 11 percent during the 2042 and 2072 projected periods, respectively, compared to the historical period. The average annual groundwater outflow is projected to increase by approximately 25 percent and 27 percent during the 2042 and 2072 projected periods, respectively, compared to the historical period. The average annual change in storage for the Basin is projected to decrease by approximately 44 percent and 53 percent during the 2042 and 2072 project periods, respectively, compared to the historical period.

The projected water budget for year 2042 conditions is presented in Figure ES-5, which breaks out the inflow and outflow components of the water budget. Table ES-1 summarizes the Basin's historical, current (WYs 2011–2018), and projected water budgets.

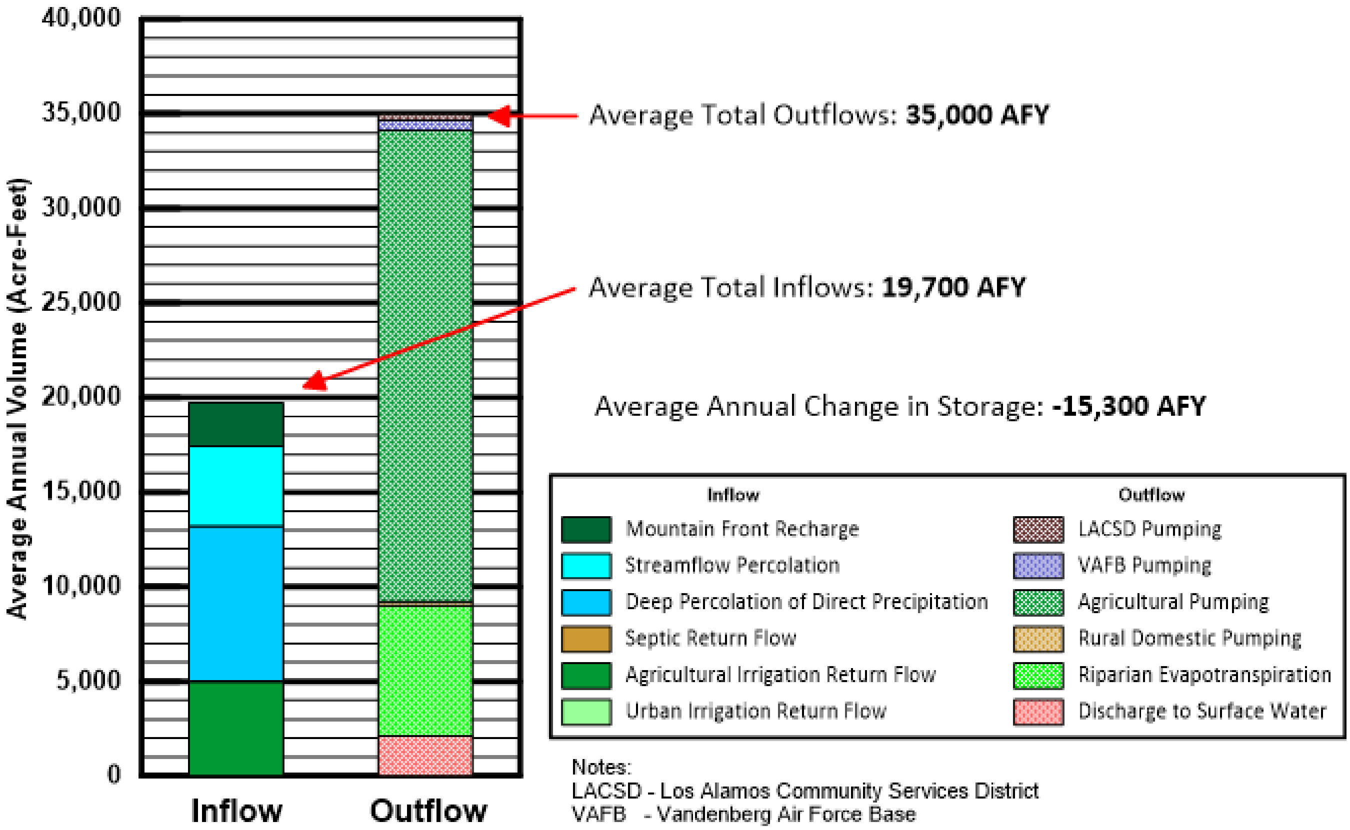

Table ES-1. Summarized Historical, Current, and Projected Water Budgets

Water Budget Period	Annual Average					
	Total Inflows	Total Pumping	Total Outflows	Change of Groundwater in Storage	Cumulative Change of Groundwater in Storage	Basin Yield[1]
Historical Period	17,500	19,500	28,100	-10,600	-400,100	8,900
Current Period	13,500	23,200	30,500	-17,000	-135.500	6,200
Projected Period (2042)[2]	19,700	26,000	35,000	-15,300	—	10,700
Projected Period (2072)[2]	19,500	26,600	35,700	-16,200	—	10,400

Notes

All values are in units of acre-feet.
[1] Basin yield is calculated by subtracting average annual total groundwater pumping from the sum of the average annual total inflows and average annual change in storage.
[2] 2042 and 2072 volumes are annual averages calculated using the 50-year base period described in Section 3.3.5.1.
— = Not applicable

ES-3 Sustainable Management Criteria (GSP Section 4)

Section 4 of the GSP defines the conditions that constitute sustainable groundwater management and discusses the process by which the SABGSA will characterize undesirable results and establish minimum thresholds and measurable objectives for each sustainability indicator in the Basin. Section 4 presents the data and methods used to develop SMCs and demonstrates how these criteria influence beneficial uses and users. The SMCs are considered initial criteria and will be reevaluated and potentially modified in the future as new data become available.

Sustainability indicators are defined in SGMA to mean the conditions in a basin that, when significant, unreasonable, and caused by groundwater use, become undesirable results and impact sustainability of the basin. The following five sustainability indicators are applicable in the Basin:

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

The sixth SMC designated in SGMA, seawater intrusion, is not applicable in the Basin because of the distance from the Pacific Ocean and the presence of a bedrock high on the west end of the Basin that creates a barrier to groundwater flow.

A wide variety of information was used to define minimum thresholds and measurable objectives for each sustainability indicator, which are measured at representative wells. Minimum thresholds and measurable objectives are generally defined as follows:

- **Minimum Threshold** - A minimum threshold is the numeric value for each sustainability indicator that is used to define undesirable results. For example, a particular groundwater level might be a minimum threshold if lower groundwater levels would result in a significant and unreasonable reduction of groundwater in storage or depletion of supply.
- **Measurable Objective** - Measurable objectives are specific, quantifiable goals or targets that reflect the SABGSA's desired groundwater conditions and allow the SABGSA to achieve the sustainability goal within 20 years.

ES-3.1 Sustainability Goal

The goal of this GSP is to sustainably manage the groundwater resources of the Basin for current and future beneficial uses of groundwater, including Barka Slough (Slough), through an adaptive management approach that builds on best available science and monitoring and considers economic, social, and other objectives of Basin stakeholders. This goal was developed with input from Basin stakeholders. It takes into consideration the need to maintain a vibrant agricultural community while ensuring that domestic and environmental water uses are protected. As discussed in Section 3 of the GSP, the GSA recognizes that the observed water level declines and chronic storage deficit are undesirable. The GSA is committed to implementing a number of projects and management actions, including a pumping allocation program, after the GSP is adopted (see Section 6) that will result in basin pumping within the sustainable yield and avoidance of undesirable results within the next 20 years. The GSP includes plans to fill critical data gaps and an extensive monitoring program (see Section 5) that addresses each of the applicable sustainability indicators. Minimum thresholds, measurable objectives, and interim milestones have been established to measure sustainability and to assess progress toward meeting the sustainability goal over the next 20 years.

This GSP is intended to be an adaptive plan that allows for consideration of observed basin conditions and adaptive management actions through the planning horizon.

ES-3.2 Qualitative Objectives for Meeting Sustainability Goals

Qualitative objectives are designed to help stakeholders understand the overall purpose for sustainably managing groundwater resources (e.g., avoid chronic lowering of groundwater levels) and reflect the local economic, social, and environmental values within the Basin. A qualitative objective is often compared to a mission statement. The qualitative objectives for the Basin are the following:

- **Avoid Chronic Lowering of Groundwater Levels**
  - Maintain groundwater levels that continue to support current and future groundwater uses and sustain the health of Barka Slough in the Basin.
- **Avoid Chronic Reduction of Groundwater in Storage**
  - Maintain sufficient groundwater volumes in storage to sustain current and planned groundwater use in prolonged drought conditions while avoiding impacts to Barka Slough resulting from groundwater pumping.
- **Avoid Degraded Groundwater Quality**
  - Maintain access to drinking water supplies.
  - Maintain access to agricultural water supplies.
  - Maintain quality consistent with current ecosystem uses.
- **Avoid Land Subsidence**
  - Prevent land subsidence that causes significant and unreasonable effects to groundwater supply, land uses, infrastructure, and property interests.
- **Avoid Depletion of Interconnected Surface Water**
  - Avoid significant and unreasonable effects to beneficial uses, including GDEs, caused by groundwater extraction.
  - Maintain sufficient groundwater levels to maintain areas of interconnected surface water as of January 2015 when SGMA became effective.

ES-3.3 Process for Establishing Sustainable Management Criteria

This section presents the process that was used to develop the SMCs for the Basin, including input obtained from Basin stakeholders, the criteria used to define undesirable results, and the information used to establish minimum thresholds and measurable objectives.

ES-3.3.1 Public Input

The public input process was developed in conjunction with the SABGSA member agency's continued engagement of local stakeholders and interested parties on water issues. This included the formation of the Stakeholder Advisory Committee, whose members were selected by the SABGSA Board because members have an interest in maintaining a healthy agricultural and business community, good water quality, and a healthy environment. The SMCs and beneficial uses presented in this section were developed using a combination of information from public input, public meetings, comment forms, hydrogeologic analysis, and meetings with Advisory Committee members.

ES-3.3.2 Define Undesirable Results

Defining what is considered undesirable is one of the first steps in the SMC development process. The qualitative objectives for meeting sustainability goals are presented as ways of avoiding undesirable results for each of the sustainability indicators. The absence of undesirable results defines sustainability. The following are the general criteria used to define undesirable results in the Basin:

- There must be significant and unreasonable effects caused by pumping
- A minimum threshold is exceeded in a specified number of representative wells over a prescribed period
- Impacts to beneficial uses—including to GDEs and/or threatened or endangered species— occur

These criteria may be refined periodically during the 20-year GSP implementation period based on monitoring data and analysis.

ES-3.4 Summary of Sustainable Management Criteria

Table ES-2 summarizes the SMCs for the six groundwater sustainability indicators. The table first describes the type(s) of potential undesirable results associated with each sustainability indicator, then describes the minimum thresholds and measurable objectives for each indicator. Detailed discussions of the SMCs for each groundwater sustainability indicator are provided in Sections 4.5 through 4.10 of this GSP.

Table ES-2. Summary of Sustainable Management Criteria

Potential Undesirable Results	Minimum Threshold	Measurable Objective	Other Notes
Chronic Lowering of Groundwater Levels			
Groundwater levels in the Paso Robles Formation or Careaga Sand drop below the minimum threshold after periods of average and above-average precipitation in 50 percent of representative wells for 2 consecutive years An acute or chronic measurable impact to GDEs associated with interconnected surface water, specifically Barka Slough, caused by groundwater pumping in the Basin (during periods of average or above-average precipitation measured at the Los Alamos Fire Station gage) Reduction of groundwater in storage results in an inability to produce the estimated annual volume of groundwater equal to the sustainable yield for the Basin determined using the water budget method described in this GSP.	Paso Robles Formation and Careaga Sand groundwater levels: 25 feet below the fall 2018 groundwater levels measured at representative monitoring sites.	Groundwater levels measured at each representative monitoring site in spring 2015	Extended drought or high rates of pumping (exceeding the long-term rate of recharge) in the Paso Robles Formation or Careaga Sand could lead to significant and unreasonable effects on groundwater levels.
Reduction of Groundwater in Storage			
Groundwater levels in the Paso Robles Formation or Careaga Sand drop below the minimum threshold after periods of average and above-average precipitation in 50 percent of representative wells for 2 consecutive years. Reduction of groundwater in storage results in an inability to produce the estimated annual volume of groundwater equal to the sustainable yield for the Basin determined using the water budget method described in this GSP.	Same as for chronic lowering of groundwater levels.	Same as for chronic lowering of groundwater levels.	Extended drought or high rates of pumping (exceeding the long-term rate of recharge) in the Paso Robles Formation or Careaga Sand could lead to significant and unreasonable effects on groundwater levels.
Seawater Intrusion			
Not applicable to this Basin	N/A	N/A	N/A
Degraded Groundwater Quality			
Concentrations of regulated contaminants in untreated groundwater from private domestic wells, agricultural wells, or municipal wells exceed regulatory thresholds as a result of pumping or GSA activities. Groundwater pumping or GSA activities cause concentrations of TDS, chloride, sulfate, boron, sodium, and nitrate to increase and exceed WQOs since SGMA was enacted in January 2015.	Minimum thresholds presented in Table 4-3 for TDS, chloride, sulfate, boron, sodium, and nitrate as measured by SWRCB ILRP and Division of Drinking Water programs in 20 percent of wells monitored. In cases where the ambient (prior to January 2015) water quality exceeds the WQO, the minimum threshold concentration is 110 percent of the ambient water quality in 20 percent of the wells.	Maintain groundwater quality related to contaminants equal to, or below, regulatory standards or, equal to or below concentrations present in groundwater in January 2015. Maintain groundwater quality related to salts and nutrients equal to or below WQOs in the Basin Plan, or equal to or below concentrations in January 2015.	SABGSA has no responsibility to manage groundwater quality unless it can be shown that water quality degradation is caused by pumping in the Basin, or the SABGSA implements a project that degrades water quality.

Potential Undesirable Results	Minimum Threshold	Measurable Objective	Other Notes
Significant and Unreasonable Land Subsidence that Substantially Interferes with Surface Land Uses			
Groundwater extraction results in subsidence that substantially interferes with surface land uses (including agricultural, residential, rural residential, and town buildings) and property interests. Groundwater extraction results in subsidence that causes land surface deformation that impacts the use of critical infrastructure (including LACSD wells, WWTP, and associated infrastructure) and roads. Groundwater extraction results in land subsidence greater than minimum thresholds at the UNAVCO CGPS Station ORES.	The rate of subsidence does not exceed 0.05 feet (0.6 inches) per year for 3 consecutive years measured at the UNAVCO CGPS Station ORES.	Maintenance of current conditions and average rate of subsidence from 2000 to 2020 (0.5 inches per year).	Based on measured subsidence at UNAVCO CGPS stations.
Depletion of Interconnected Surface Water that Causes Significant and Unreasonable Results to Beneficial Uses of Surface Water			
Groundwater level declines caused by groundwater pumping in the Basin could reduce the amount of groundwater discharging to interconnected surface water and Barka Slough, resulting in an impact to GDEs. Severe drought that reduces mountain front recharge, streamflow percolation, percolation of direction precipitation, and recharge to the Paso Robles Formation and Careaga Sand; thus, lowering groundwater levels and reducing surface water flow into the Slough, resulting in an impact to GDEs. Short-term impacts due to drought are anticipated in the SGMA regulations with recognition that management actions need sufficient flexibility to accommodate drought periods and ensure short-term impacts can be offset by increases in groundwater levels or storage during normal or wet periods. Permanent loss or significant degradation of existing native riparian or aquatic habitat due to lowered groundwater levels and reduced surface water flow into Barka Slough caused by groundwater pumping.	0.15 cfs of surface water flow measured at the Casmalia stream gage west of Barka Slough.	Surface water flow measured at the Casmalia stream gage equal to the geometric mean flow (0.5 cfs) between 2015 and 2018.	Groundwater and surface water exit the Basin as surface water flow from Barka Slough. Consequently, if surface water flow can be measured exiting the Basin, it is inferred that there is sufficient water available to GDEs in the Slough. If surface flow exiting Barka Slough ceased, there is a potential that there is no longer enough water, whether entering the Slough as groundwater or surface water, available to GDEs located in the Slough.

Notes

Basin Plan = Water Quality Control Plan for the Central Coast Basin
cfs = cubic feet per second
CGPS = Continuous Global Positioning System
GDE = groundwater-dependent ecosystem
GSA = groundwater sustainability agency
GSP = Groundwater Sustainability Plan
ILRP = Irrigated Lands Regulatory Program
N/A = not applicable
SABGSA = San Antonio Basin Groundwater Sustainability Agency
SGMA = Sustainable Groundwater Management Act
Slough = Barka Slough
SWRCB = State Water Resources Control Board
TDS = total dissolved solids
UNAVCO = University NAVSTAR Consortium
WQO = water quality objective

ES-4 Monitoring Networks (GSP Section 5)

This section of the GSP describes existing monitoring networks and improvements to the monitoring networks that will be developed for the Basin. The monitoring networks presented in this section are based on existing monitoring sites. During the 20-year GSP implementation period, it may be necessary to expand the existing monitoring networks and identify or install more monitoring sites to fully demonstrate sustainability and improve the GSP model.

The groundwater monitoring network section of this GSP is largely based on historical groundwater data compiled by the United States Geological Survey (USGS) National Water Information System (NWIS) program, the USGS Groundwater Ambient Monitoring and Assessment (GAMA) Program, the California Statewide Groundwater Elevation Monitoring (CASGEM), and quarterly groundwater monitoring completed by the SABGSA beginning the fourth quarter of 2019 to the present.

ES-4.1 Monitoring Plan for Water Levels, Change in Storage, Water Quality

The 50 wells included in the groundwater level monitoring network are listed in Table 5-1 and shown on Figure 3-11. The groundwater level monitoring network will be used as a proxy for the groundwater storage monitoring network. All but six wells in the groundwater level monitoring network are monitored by the GSA. Four of the six wells are monitored by the Los Alamos Community Services District (LACSD). Static water levels are provided to the GSA on a quarterly basis in association with the GSA's quarterly monitoring events. The remaining two wells are monitored by Santa Barbara County, and data are provided semiannually. A subset of wells from the monitoring network has been selected as representative monitoring sites (RMSs). RMSs are defined in the SGMA regulations as a subset of monitoring sites that are representative of conditions in the Basin. The monitoring network will enable the collection of data to assess sustainability indicators, evaluate the effectiveness of management actions and projects that are designed to achieve sustainability, and evaluate adherence to minimum thresholds and measurable objectives for each applicable sustainability indicator. There may be opportunities to optimize the groundwater level monitoring network in the Basin. The number of wells included in the groundwater level monitoring network will be evaluated during each 5-year GSP interim period.

The 89 wells included in the groundwater quality monitoring network are listed in Table 5-3 and shown on Figure 5-4. All the wells from the GSP groundwater water quality monitoring network are RMS wells. The groundwater quality monitoring network includes eight municipal drinking water supply wells and 81 wells monitored as part of the state Irrigated Lands Regulatory Program (ILRP). Of the ILRP wells, 21 were determined to be domestic supply wells, and 60 wells were determined to be agricultural supply wells. Groundwater quality data do not indicate a need for additional monitoring locations. Current programs provide adequate spatial and temporal coverage for the purposes for the GSP. There is adequate spatial coverage in the groundwater quality monitoring network to assess impacts, if any, to beneficial uses and users.

ES-4.2 Monitoring Plan for Land Subsidence

Locally defined significant and unreasonable conditions for land subsidence are (1) land subsidence rates exceeding rates observed from 2000 through 2020 at the University NAVSTAR Consortium (UNAVCO) Continuous Global Positioning System (CGPS) Station ORES in the town of Los Alamos, near Los Alamos Park; and (2) land subsidence that causes damage to groundwater supply, land uses, infrastructure, and property interests. Since the beginning of data collection in 2000, the land surface elevation has by 0.82 ft. The Basin is located near the intersection of the Coastal Ranges and Transverse Ranges California Geomorphic Provinces. Consequently, the Basin is in a very tectonically active region. The 0.82 ft of vertical displacement measured at the UNAVCO station could be due to tectonic activity, groundwater extraction, oil and gas extraction, or a combination of the three. In addition, Interferometric Synthetic Aperture Radar (InSAR) data provided by DWR shows that significant land subsidence did not occur during the period between June 2015 and June 2019 (the available InSAR data period of record) in the Basin. If subsidence is observed, approaches the minimum threshold, causes undesirable results, and appears to be related to groundwater pumping, the SABGSA will undertake a program to install land surface elevation benchmarks at critical infrastructure locations, and monitor subsidence with measured land surface elevations on an annual basis.

ES-4.3 Monitoring Plan for Depletion of Interconnected Surface Water

The SABGSA plans to install two surface water gages on San Antonio Creek; one upstream and one downstream of Barka Slough to measure surface water inflow and outflow to the Slough and assess surface water depletion and potential for impacts to Barka Slough. Until those gages are installed, the Casmalia stream gage, located 2.5 miles downstream of Barka Slough, will be used to assess surface water depletion and impacts to Barka Slough. Monitoring of groundwater levels in monitoring wells completed in the Careaga Sand surrounding the Barka Slough area will also continue to be conducted by the SABGSA as part of the groundwater level monitoring network. The SABGSA plans to assess the feasibility of installing shallow piezometers within the sediments underlying Barka Slough if access can be achieved and maintained through the dense vegetation and if the California Department of Fish and Wildlife will permit the piezometer installation and monitoring within the Slough. If achievable, the piezometers would provide important data regarding the elevation of the water table relative to the plant rooting depths in the Slough. It is anticipated that these data will be used to better define the water budget at the Slough and to determine whether the SMC for this indicator should be adjusted.

ES-5 Projects and Management Actions (GSP Section 6)

Section 6 of the GSP describes the projects and management actions that will allow the Basin to attain sustainability in a phased manner. In this GSP, groundwater management actions generally refer to activities that support groundwater sustainability through policy and regulations without infrastructure; projects are defined as activities supporting groundwater sustainability that require infrastructure.[1] The identified management actions and potential future projects are classified using a tiered system, with the implementation of Tier 1 management actions to be initiated within 1 year of GSP adoption by the SABGSA. Because the SABGSA desires to begin addressing the observed water level declines and the storage deficit soon after adoption of the GSP, Tier 2 management actions will also be initiated. Tier 3 and 4 management actions and priority projects will be considered for implementation in the future as conditions in the Basin dictate, and as the effectiveness of the lower-tiered initiatives are assessed.

[1] Per SGMA, de minimis groundwater extractors are exempt, and not anticipated to be adversely impacted, from certain projects and management actions managed by the local GSA. Domestic well users generally fall within the SGMA definition of a de minimis extractor. SGMA defines a de minimis extractor as “a person who extracts, for domestic purposes, two acre-feet or less (of groundwater) per year.”

Management Actions

- Address Data Gaps
- Groundwater Pumping Fee Program
- Well Registration Program and Well Meter Installation Program
- Water Use Efficiency Programs
- Groundwater Base Pumping Allocation (BPA) Program
- Groundwater Extraction Credit (GEC) Marketing and Trading Program
- Voluntary Agricultural Crop Fallowing Programs

Projects

- Non-Native/Invasive Species Eradication
- Barka Slough Augmentation Project with Groundwater Supplies
- Watershed Management Projects, Including Controlled Burns
- Distributed Storm Water Managed Aquifer Recharge (DSW-MAR) Basins (In-Channel and Off-Stream Basins)
- LACSD Wastewater Treatment Facility Recycled Water and Reuse In Lieu of Groundwater Pumping or Indirect Potable Reuse
- SABGSA to Become Funding Partner to Santa Barbara County Precipitation Enhancement Program
- Vandenberg Space Force Base, previously Vandenberg Air Force Base, Groundwater Pumping Reduction Capital Project Participation (Desalination and/or Recharge and Recovery)
- Barka Slough Augmentation Project with State Water Project or Banked Supplemental Water Supplies
- In Lieu Recharge Projects to Deliver Unused and Surplus Imported Water to Offset Groundwater Extractions from LACSD and Agricultural Pumpers
- SABGSA to provide Technical Assistance and Financial Incentives for High Tunnel (“Hoop Houses”) Rainwater Harvesting Projects for Supplemental Irrigation Water Supplies and/or Groundwater Recharge
- Additional Projects for Potential Future Consideration by SABGSA
    - Development of Water Supply Wells in Bedrock Formations
    - Use of Treated Oilfield Produced Water for Irrigation
    - Water Exchanges to Secure Other Agency State Water Project Allocations

The SABGSA member agencies will initiate work on Tier 1 management actions within 1 year of GSP adoption. These management actions are focused primarily on filling identified data gaps, developing funding for SABGSA operations and future Basin monitoring, registering and metering wells, and developing new and expanding existing water use efficiency programs for implementation within the Basin. As a critical element of GSP implementation, the Groundwater Pumping Fee Program is included as a Tier 1 management action to provide the SABGSA with a source of funding for operation and the continued monitoring of conditions in the Basin.

Tier 2 management actions are planned to be initiated within approximately 3 years of GSP adoption because accurate flow monitoring is necessary, and time is needed for the Tier 1 well metering program to be fully implemented. Activities in Tier 3 include priority projects on which the SABGSA member agencies may initiate work within 3 to 5 years of GSP adoption. All non-priority projects that were identified and evaluated are classified as Tier 4. The SABGSA does not plan to initiate the construction of any Tier 4 project infrastructure, for the specific goal of achieving Basin sustainability, until evidence exists that the effects of the implemented management actions are proving insufficient. However, the GSA may choose to implement a Tier 3 or 4 project if funding becomes available and the SABGSA determines that there would be substantial benefit to the Basin.

The effect of the management actions will be reviewed annually, and additional higher-tiered management actions and priority projects will be implemented as necessary to avoid undesirable results. A graphical depiction of the implementation sequence is presented in Figure ES-6.

Management actions included in the GSP are summarized below and are described in more detail in Sections 6.3 through 6.11.

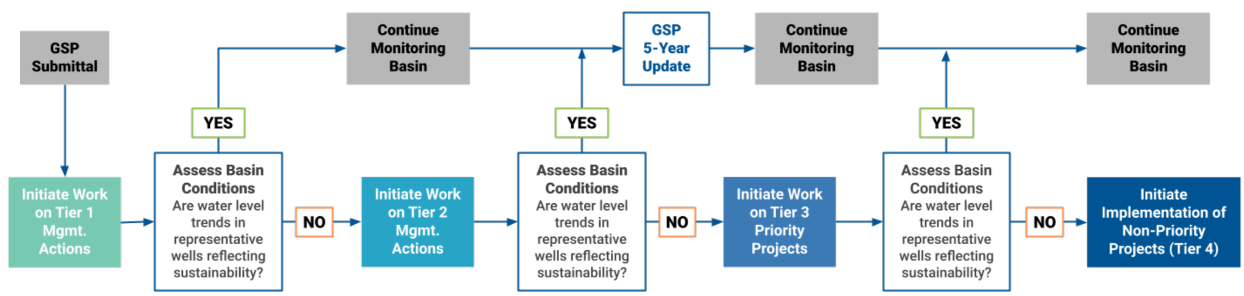

Figure ES-6. Adaptive Implementation Strategy for Projects and Management Actions

ES-5.1 Tier 1 Management Action 1 – Address Data Gaps

Data gaps have been identified that require additional information because they are important for management of the Basin in the future. The following management actions will help fill these data gaps:

- Expand Monitoring Well Network in the Basin to Increase Spatial Coverage and Well Density
- Perform Reference Point Elevation and Video Surveys in Representative Wells That Currently Do Not Have Adequate Construction Records to Confirm Well Construction
- Install Stream Gages at Barka Slough
- Implement LACSD Wellfield Pumping Coordination/Offsite Well Impact Mitigation
- Review/Update Water Usage Factors and Crop Acreages and Update Water Budget
- Survey and Investigate Potential GDEs in the Basin and Further Characterize Barka Slough
- Review USGS Groundwater Model/Update HCM and Develop Water Budget for Barka Slough

ES-5.1.1 Expand Monitoring Well Network in the Basin to Increase Spatial Coverage and Well Density

The areas where additional monitoring well data is needed are depicted in Figure 5-3. Two low-density areas in both principal aquifers were identified in the Basin: the eastern uplands and the central-to-northwestern uplands. The proposed strategy for adding monitoring wells to the monitoring network will be to first incorporate existing wells to the extent possible. If an existing well in a particular area cannot be identified or permission to use data from an existing well cannot be secured to fill a data gap, then a new monitoring well may be considered.

ES-5.1.2 Perform Reference Point Elevation and Video Surveys in Representative Wells That Currently Do Not Have Adequate Construction Records to Confirm Well Construction

There are wells in the GSP Monitoring Well Network that do not have adequate documentation regarding the reference point elevation, depth, geologic formations intersected, casing characteristics, screened intervals, pump setting, and/or well construction details. To address this data gap, the SABGSA will identify the wells lacking this information, obtain permission from well owners, and perform reference point surveys and video logging to ascertain well construction details and the location of well production zones.

ES-5.1.3 Install Stream Gages at Barka Slough

Two locations have been identified for installation of stream gages to supplement characterization of spatial and temporal exchanges between surface water and groundwater relative to Barka Slough. A stream gage downstream of the confluence of San Antonio Creek and Harris Canyon Creek and upstream of the Slough would enable direct quantification of surface water entering the Slough. A stream gage at the west end of Barka Slough (where surface water discharges from the Basin), near California State Highway 1, would provide a more direct quantification of surface water discharge exiting the Slough. The addition of a stream gage at this location would inform the water budget for the Slough and improve the ability to assess the interconnected surface water SMCs. If it is determined that access can be obtained and maintained and California Department of Fish and Wildlife is willing to permit this activity, then the SABGSA is considering the installation of shallow piezometers within the Barka Slough sediments to allow monitoring of groundwater levels within the root zone of the plants in the Slough.

ES-5.1.4 LACSD Wellfield Pumping Coordination/Offsite Well Impact Mitigation

Based on the review of available well location data, it appears that the LACSD municipal wells are in an area that coincides with the presence of numerous agricultural irrigation wells. Pumping from this area of concentrated wells appears to be resulting in a localized and lower groundwater levels in the aquifer. The LACSD has been reviewing its pumping schedules and initiated discussions with the surrounding agricultural pumpers to explore the potential for implementing a coordinated pumping schedule program to assess the feasibility of distributing pumping from all wells in the affected area to address this localized issue and raise static and pumping levels at LACSD wells. The SABGSA plans to initiate a study to evaluate the localized impacts in the Basin that are occurring from the existing pumping operations and explore strategies for implementing a groundwater pumping management program to improve the conditions in the Basin and mitigate the impacts to the LACSD water supply system.

ES-5.1.5 Review/Update Water Usage Factors and Crop Acreages and Update Water Budget

Uncertainty remains in the estimates of water use from irrigated lands in the Basin and hence the assumed amount of pumping needed to meet the crop water requirement. To address this uncertainty and increase the accuracy of the annual groundwater pumping estimates and Basin water budget calculations in future years until a metering program is fully implemented, the SABGSA plans to review and update water usage factors and crop acreages.

ES-5.1.6 Survey and Investigate Potential GDEs and Further Characterize Barka Slough

At present there are insufficient data available to confirm the nature and spatial extent of GDEs within Barka Slough and elsewhere as well as the degree to which GDEs are supported by surface water and/or groundwater. To address this uncertainty, the SABGSA plans to perform a habitat survey in Barka Slough and further investigate potential GDEs elsewhere in the Basin. This information will be used to further identify GDEs that may be affected by pumping and groundwater management activities and to understand groundwater and surface water conditions in Barka Slough so that SMCs can be updated to avoid impacts to GDEs.

ES-5.1.7 Review USGS Groundwater Model/Update HCM, Develop Water Budget for Barka Slough

A groundwater model developed by the USGS is being calibrated as part of a multi-year groundwater basin study. When the model is made available by the USGS, the SABGSA plans to review and use the model to improve the accuracy of the annual groundwater pumping estimates and Basin water budget calculations in future years, and to assess the water budget for Barka Slough.

ES-5.2 Tier 1 Management Action 2 – Groundwater Pumping Fee Program

As part of the GSP implementation process, the SABGSA will explore various financing options to cover its operational costs and to generate funding for monitoring of the Basin and the implementation of management actions and potential future projects. Based on the results of these efforts, the SABGSA may adopt a management action to levy groundwater pumping fees for the purposes of (1) generating funding for the SABGSA operations, (2) ongoing monitoring of the condition of the Basin, and (3) development and implementation of the identified management actions and potential projects.

The initial phase of the program will be focused on program design, policy and regulatory development, compliance with the California Environmental Quality Act, and stakeholder outreach. The SABGSA will consider an investigative study to determine the most effective and equitable fee and incentive structure. In conjunction with the development of the Groundwater Pumping Fee Program, the SABGSA will ensure that any charges that the SABGSA plans to place on groundwater extraction will be carefully reviewed by legal counsel to determine whether those charges are appropriate, and what regulatory/statutory processes will be required for them. Potential charges on groundwater extraction will also be reviewed so that they take into consideration the fee structure that the San Antonio Basin Water District has in place. De minimus pumpers will not be metered and will not be required to pay an extraction-related pumping fee.

ES-5.3 Tier 1 Management Action 3 – Well Registration and Well Meter Installation Programs

Well registration is intended to establish a relatively accurate count of all the active wells in the Basin, including an accurate location of each well. All groundwater production wells, including wells used by de minimis pumpers, will be required to be registered with the SABGSA. Well metering is intended to improve estimates of the amount of groundwater extracted from the Basin. SGMA does not authorize GSAs to require metering of de minimis (and domestic) well users, and therefore well metering will be limited to non-de minimis wells. The information to be acquired through the well registration program can be used by the GSA for the purposes of potential risk and impact assessment with regard to the water supply adequacy and water quality for domestic and community drinking water wells within the Basin. If the information obtained through the well registration program indicates that there is a potential for adverse impacts to the future water supply adequacy or water quality of domestic and/or community drinking water supply wells then the GSA can elect to develop and implement a Drinking Water Well Impact Mitigation Program.

The SABGSA will require all non-de minimis groundwater pumpers to report extractions annually and use a water-measuring method satisfactory to the SABGSA. Guidelines and a regulatory framework will be developed to implement this program, which may also include a system for reporting and accounting for water conservation initiatives, voluntary irrigated land fallowing (temporary and permanent), stormwater capture projects, or other activities that individual pumpers may elect to implement.

As a Tier 1 management action, the SABGSA plans to initiate a pilot program to determine the most feasible means of complying with SGMA's measurement provision within 1 year of GSP adoption. The measurement alternatives and data processing methods to be evaluated may include the following:

- Use of power records to correlate energy usage with volume of water pumped
- Conventional mechanical or magnetic flow meters
- Automated meter infrastructure systems

ES-5.4 Tier 1 Management Action 4 – Water Use Efficiency Programs

Urban and agricultural water use efficiency has been practiced in the Basin for more than two decades and have been effective in significantly reducing water use within the region. Existing programs promote responsible design of landscapes and appropriate choices of appliances, irrigation equipment, and other water-using devices to enhance the wise use of water. The water use efficiency management actions to be developed for implementation by municipal, agricultural, and domestic pumpers will promote expansion and supplementation of the water use efficiency programs that currently exist.

The Water Use Efficiency Programs proposed include the following:

- **Urban Water Use Efficiency Programs:** Initiatives that promote increasing water use efficiency by achieving reductions in the amount of water used for municipal, commercial, industrial, landscape irrigation, and aesthetic purposes. These programs can include incentives, public education, technical support, and other efficiency-enhancing programs.
- **Agricultural Water Use Efficiency Programs:** Initiatives that promote increasing water use and irrigation efficiency and achieving reductions in the amount of water used for agricultural irrigation. These programs can include incentives, public education, technical support, training, implementation of best water use practices, and other efficiency-enhancing programs.

ES-5.5 Tier 2 Management Action 5 – Groundwater Base Pumping Allocation (BPA) Program

The volume of groundwater that is pumped from the Basin in recent years is more than the estimated Basin yield of about 8,900 AFY. The SABGSA has determined that the volume of groundwater being pumped must be reduced to the sustainable yield of the Basin. To achieve this goal, the SABGSA may develop and implement a regulatory program to equitably allocate a groundwater BPA volume of water to be pumped from the Basin annually. Once the program is implemented, individual non-de minimis pumpers will be provided an annual groundwater BPA that will start at historically used quantities of water and ramp down over time to bring pumping in the Basin within its sustainable yield by 2042. The amount of needed pumping reduction in the future is uncertain and will depend on several factors, including climate conditions, the effectiveness and timeliness of voluntary actions by pumpers, and the success of other management actions described in this GSP.

After GSP adoption, developing the Groundwater BPA Program would likely require the following steps:

- Establishing a methodology for determining baseline pumping, considering the following:
  - Historical pumping
  - Sustainable yield of the Basin
  - Groundwater level trends
  - Land uses and corresponding irrigation requirements
- Establishing a methodology to determine individual annual allocations considering documented historical water use, opportunities for improved efficiency, and evaluation of anticipated benefits from other relevant actions that individual pumpers may take. Alternatively, the SABGSA may define the allocations based on acreage and crop type.
- A timeline for implementing limitations on pumping (“ramp down”) within the Basin as required to avoid undesirable results and reduce the impact on local growers.
- Approving a formal regulation to enact the program.

The SABGSA realizes certain landowners will need or elect to periodically use an amount of groundwater in excess of their annual allocation. It is anticipated that the pumping fee policy will include provisions that will allow landowners, under special circumstances, to pump groundwater beyond the current groundwater allocation, but at considerably higher cost. In addition, the SABGSA may incorporate supplemental conditions to be placed on new wells and new production from existing wells in the Basin in conjunction with the development of the Groundwater BPA Program.

ES-5.6 Tier 2 Management Action 6 – Groundwater Extraction Credit (GEC) Marketing and Trading Program

As previously described, the SABGSA will develop and implement a regulatory program to equitably allocate a pre-determined groundwater BPA to be extracted from the Basin annually. As necessary, the allocations of individual non-de minimis pumpers will be ramped down over time to bring pumping in the Basin to within its sustainable yield by within 20 years of the adoption of the GSP. In conjunction with the Groundwater BPA Program, the SABGSA will pursue the development and implementation of a GEC Marketing and Trading Program to provide non-de minimis users with increased flexibility in using their annual allocations. The program will enable voluntary permanent transfer of allocations between parties, through an exchange of GECs. In addition, the program will provide options for potentially long-term or short-term temporary transfer of GECs, including credits derived from voluntary fallowing or conversion to lower water use crops (see Section 6.9). The program is intended to allow groundwater users or new development to acquire needed groundwater allocations, in the form of GECs, from other pumpers to maintain economic activities in the Basin, encourage and incentivize water conservation, encourage and incentivize temporary and permanent fallowing of agricultural lands, encourage conversion to lower water use crops, and facilitate a ramp-down of pumping allocations as water demands and Basin conditions fluctuate during the 20-year GSP implementation period. The SABGSA may adopt a policy to define groundwater extraction carryover provisions year-to-year and/or allow multi-year pumping averages to provide groundwater pumpers with more flexibility in using their groundwater allocation year to year.

ES-5.7 Tier 2 Management Action 7 – Voluntary Agricultural Crop Fallowing Programs

The SABGSA has identified voluntary agricultural crop fallowing as a necessary management action to achieve sustainability. The SABGSA will develop and implement a voluntary fallowing program that will facilitate the conversion of high water use irrigated agriculture to low water use agriculture use or open space, public land, or other land uses on a voluntary basis. The SABGSA will develop programs that will permit both voluntary temporary and long-term or permanent fallowing and conversion to other land uses. An important consideration in developing the voluntary fallowing program will be to include protections of water rights for the overlying landowners that choose to temporarily fallow ground. As part of this management action, the SABGSA will develop a Basin-wide accounting system that tracks landowners who decide to voluntarily fallow their land and cease groundwater pumping or otherwise refrain from using groundwater. The Voluntary Agricultural Crop Fallowing Programs will be developed in parallel to the Groundwater BPA and the GEC Marketing and Trading Programs. It is also noted that the Voluntary Fallowing Program may potentially be enhanced, or a separate program could be implemented, which may provide for GSA to lease or purchase agricultural land for fallowing. The GSA could use fees generated through the Groundwater Pumping Fee Program to lease/purchase the lands to be fallowed, if necessary or deemed desirable by the GSA. Additionally, the GSA may also consider purchasing groundwater extraction credits.

ES-5.8 Tier 3 Priority Projects

The SABGSA has concluded that the Basin sustainability goals are likely to be achieved through the implementation of the Tier 1 and 2 management actions and will annually assess the effectiveness that the implemented management actions have achieved in stabilizing groundwater levels. If the implemented management actions are proving insufficient to meet sustainability goals, then the SABGSA may decide to implement selected projects from the portfolio of identified priority projects in the future.

The priority projects listed below and described in more detail in Section 6.10 were identified by the SABGSA for future consideration:

- Non-Native/Invasive Species Eradication
- Barka Slough Augmentation Project with Groundwater Supplies
- Watershed Management Projects, Including Controlled Burns
- Distributed Storm Water Managed Aquifer Recharge (DWR-MAR) Basins (In-Channel and Off-Stream Basins)

ES-5.9 Tier 4 Non-Priority Projects

Although the SABGSA has no near-term plans to initiate construction of any specific non-priority projects, for the purposes of achieving Basin sustainability, there may be interest in proceeding with the study, planning, preliminary design/engineering, and permitting phases for any number of projects that were identified by the SABGSA for potential future consideration. The following projects listed below, and described in more detail in Section 6.11, were identified by the SABGSA for future consideration:

- LACSD Wastewater Treatment Facility Recycled Water and Reuse In Lieu of Groundwater Pumping or Indirect Potable Reuse
- SABGSA to Become Funding Partner to Santa Barbara County Precipitation Enhancement Program
- Vandenberg Space Force Base Groundwater Pumping Reduction Capital Project Participation (Desalination and/or Recharge and Recovery)
- Barka Slough Augmentation Project with State Water Project or Banked Supplemental Water Supplies
- In Lieu Recharge Projects to Deliver Unused and Surplus Imported Water to Offset Groundwater Extractions from LACSD and Agricultural Pumpers
- SABGSA to provide Technical Assistance and Financial Incentives for High Tunnel (“Hoop Houses”) Rainwater Harvesting Projects for Supplemental Irrigation Water Supplies and/or Groundwater Recharge Projects
- Additional Projects for Potential Future Consideration by SABGSA
  - Development of Water Supply Wells in Bedrock Formations
  - Use of Treated Oilfield Produced Water for Irrigation
  - Water Exchanges to Secure Other Agency State Water Project Allocations

ES-6 Groundwater Sustainability Plan Implementation (GSP Section 7)

Section 7 provides a conceptual road map for the SABGSA's efforts to implement the GSP during the first 5 years after adoption and discusses implementation effects in accordance with SGMA regulations. This implementation plan is based on the SABGSA's current understanding of conditions and anticipated administrative considerations in the Basin that affect the management actions described in Section 6. Understanding of the conditions and administrative considerations in the Basin will evolve over time, based on future refinement of the hydrogeologic setting, groundwater flow conditions, and input from basin stakeholders. The SABGSA will evaluate the GSP at least every 5 years.

The SABGSA has developed a portfolio of management actions and projects that can be implemented in phases as the conditions in the Basin dictate. The management actions and potential future projects are classified with a tiered system, with the implementation of Tier 1 elements to be initiated within 1 year of GSP adoption by SABGSA and implementation of Tier 2 elements within 3 years of GSP adoption. Tier 3 and 4 projects will be considered for implementation in the future as conditions in the Basin dictate and as the effectiveness of the lower tier initiatives (Tier 1 and Tier 2) are assessed. Conceptual planning-level cost estimates for implementing the Tier 1 and Tier 2 management actions are presented in Table 7-1, and an estimate of the planning-level costs associated with Tier 3 priority projects and Tier 4 non-priority projects are summarized in Table 7-2. Potential funding sources are described in Section 7.7.

SECTION 1: **Introduction to Plan Contents [Article 5 § 354]**

§ 354 Introduction to Plan Contents. This Article describes the required contents of Plans submitted to the Department for evaluation, including administrative information, a description of the basin setting, sustainable management criteria, description of the monitoring network, and projects and management actions.

This section includes a brief description of Sustainable Groundwater Management Act (SGMA), the purpose of the Groundwater Sustainability Plan (GSP), and the sustainability.

1.1 Purpose of the Groundwater Sustainability Plan

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

1. Forming a Groundwater Sustainability Agency (GSA) to fully cover the basin
2. Developing a GSP that fully covers the basin
3. Implementing the GSP and managing to achieve quantifiable objectives
4. Regular reporting to the California Department of Water Resources (DWR)

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

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

This GSP is a planning document and does not define or change water rights.

1.2 Description of the San Antonio Creek Valley Groundwater Basin

The Basin encompasses an area of approximately 123 square miles (USGS, 2020). Long and narrow, the watershed is approximately 30 miles long and 7 miles wide. The Casmalia Hills and Solomon Hills to the north and the Purisima Hills and Burton Mesa to the south are the primary Basin boundaries. The valley floor is relatively flat and narrow with a slope from east to west, terminating at the western edge of Barka Slough (Hutchinson, 1980). Section 2.2 of this GSP provides a more detailed description of the area using the description from the California Department of Water Resources Bulletin 118.

1.3 References and Technical Studies [§ 354.4(b)]

§ 354.4 General Information.

(b) Each Plan shall include the following general information: A list of references and technical studies relied upon by the Agency in developing the Plan. Each Agency shall provide to the Department electronic copies of reports and other documents and materials cited as references that are not generally available to the public.

Hutchinson, C. B. 1980. *Appraisal of Ground-Water Resources in the San Antonio Creek Valley, Santa Barbara County, California*. U.S. Geological Survey Open-File Report 80-750.

USGS. 2020. *StreamStats: Streamflow Statistics and Spatial Analysis Tools for Water-Resources Applications.* Available at https://www.usgs.gov/mission-areas/water-resources/science/streamstats-streamflow-statistics-and-spatial-analysis-tools?qt-science_center_objects=0#qt-science_center_objects. (Accessed June 9, 2021.)

SECTION 2: **Administrative Information [Article 5, SubArticle 1]**

§ 354.2 Introduction to Administrative Information. This Subarticle describes information in the Plan relating to administrative and other general information about the Agency that has adopted the Plan and the area covered by the Plan.

2.1 Agency Information [§ 354.6]

2.1.1 Development of the Groundwater Sustainability Agency

In 2017, the Cachuma Resource Conservation District (CRCD) and the Los Alamos Community Services District (LACSD) entered into a Joint Exercise of Powers Agreement (JPA) to form the San Antonio Basin Groundwater Sustainability Agency (SABGSA) with the purpose of sustainably managing groundwater and developing this Groundwater Sustainability Plan (GSP) for the San Antonio Creek Valley Groundwater Basin (Basin).

Subsequent to the execution of the May 2017 JPA between the CRCD and LACSD, SABGSA notified the California Department of Water Resources (DWR) of a non-material change. In May 2020, the Santa Barbara County Local Agency Formation Commission approved the formation of the San Antonio Basin Water District (SABWD) as a California Water District formed pursuant to California Water Code § 34000 et seq. The formation of the SABWD meets the requirements set forth in the JPA to substitute the membership of CRCD with the membership of the SABWD (see Article 6 of the JPA in Appendix A) (SABGSA, 2020).

2.1.2 Member Agencies

2.1.2.1 San Antonio Basin Water District

The SABWD comprises approximately 86,484 acres in Santa Barbara County. The purpose of the SABWD is to sustainably manage, protect, and enhance the groundwater resource as an adjunct to each property within the SABWD, while preserving the ability of agricultural lands to remain productive. The SABWD focuses its water management responsibilities primarily on use of groundwater for agricultural purposes and has provided funding through its members for development of the GSP. The SABWD has a five-member board of directors that meets monthly.

2.1.2.2 Los Alamos Community Services District

Los Alamos is an unincorporated community approximately 15 miles south of Santa Maria and 15 miles north of Buellton. U.S. Highway 101 passes through the community in a northwest to southeast direction and provides the principal connection between Los Alamos and Santa Maria to the north and the Santa Ynez Valley, Goleta, and Santa Barbara to the south.

The LACSD was formed in 1956 to provide water treatment and distribution services to the community of Los Alamos. Since that time, LACSD has expanded its charter to operate and maintain water, wastewater, and recreational facilities for the community of Los Alamos. The LACSD has a five-member board of directors that meets monthly. Board members are elected to 4-year terms.

Although not a member agency, Santa Barbara County has land use planning authority in the Basin and participates in SGMA implementation through its representation on the Groundwater Sustainability Plan Committee.

2.1.3 Name and Mailing Address [§ 354.6(a)]

§ 354.6 Agency Information. When submitting an adopted Plan to the Department, the Agency shall include a copy of the information provided pursuant to Water Code Section 10723.8, with any updates, if necessary, along with the following information:

(a) The name and mailing address of the Agency.

San Antonio Basin GSA
920 East Stowell Road | Santa Maria, CA 93454
805 868 4013 | sanantoniobasingsa.org

2.1.4 Organization and Management Structure [§ 354.6(b)]

§ 354.6 Agency Information. When submitting an adopted Plan to the Department, the Agency shall include a copy of the information provided pursuant to Water Code Section 10723.8, with any updates, if necessary, along with the following information:

(b) The organization and management structure of the Agency, identifying persons with management authority for implementation of the Plan.

The SABGSA adopted its bylaws on June 14, 2017. The bylaws establish the JPA provisions as the basis for SABGSA's day-to-day operations and a structure for governance of the SABGSA as follows:

- A board of directors that votes to establish a principal office; a chair, vice chair, secretary, and treasurer with specific duties as outlined; regular monthly meetings and a provision for special meetings
- The responsibility for debts and liabilities as well as establishing indemnity of the officers and members

The bylaws are included in Appendix A.

2.1.5 Plan Manager and Contact Information [§ 354.6(c)]

§ 354.6 Agency Information. When submitting an adopted Plan to the Department, the Agency shall include a copy of the information provided pursuant to Water Code Section 10723.8, with any updates, if necessary, along with the following information:

(c) The name and contact information, including the phone number, mailing address and electronic mail address, of the plan manager.

Anna Olsen, Executive Director
San Antonio Basin GSA
920 East Stowell Road | Santa Maria, CA 93454
805 868 4013 | aolsen@sanantoniobasingsa.org
sanantoniobasingsa.org

2.1.6 Legal Authority [§ 354.6(d)]

§ 354.6 Agency Information. When submitting an adopted Plan to the Department, the Agency shall include a copy of the information provided pursuant to Water Code Section 10723.8, with any updates, if necessary, along with the following information:

(d) The legal authority of the Agency, with specific reference to citations setting forth the duties, powers, and responsibilities of the Agency, demonstrating that the Agency has the legal authority to implement the Plan.

2.1.6.1 Agency Information

The SABGSA developing this coordinated GSP is formed in accordance with the requirements of California Water Code § 10723 et seq. The May 2017 JPA outlines the specific authorities of the SABGSA in developing and implementing the GSP and is included, along with the resolution to form the SABGSA, in Appendix A. The SABGSA is not an exclusive agency. Therefore, the SABGSA has the legal authority to implement this GSP throughout the plan area. No authority is needed from any other GSA or agency to implement this plan.

Figure 2-1 shows the extent of the GSP plan area with the jurisdictional boundary of the SABWD and LACSD.

2.1.6.2 Authority under the Joint Exercise of Powers Agreement

The purpose of the 2017 JPA is to establish the SABGSA. The JPA stipulates that the purpose of the SABGSA is to implement and comply with SGMA in the Basin; key provisions for SABGSA in the JPA include the following:

- Serve as the GSP for the Basin
- Develop, adopt, and implement a GSP that achieves the goals and objectives outlined in SGMA
- Adopt rules, regulations, policies, bylaws and procedures governing the operation of the Agency and adoption and implementation of the GSP in accordance with applicable law
- Obtain rights, permits and other authorizations for or pertaining to implementation of the GSP
- Make and enter into all contracts necessary to the full exercise of the GSA's powers
- Act cooperatively with other entities in exercising the powers of the GSA

The full list of activities that SABGSA is authorized to undertake are enumerated in Article 5 of the JPA, which is Appendix A of this GSP.

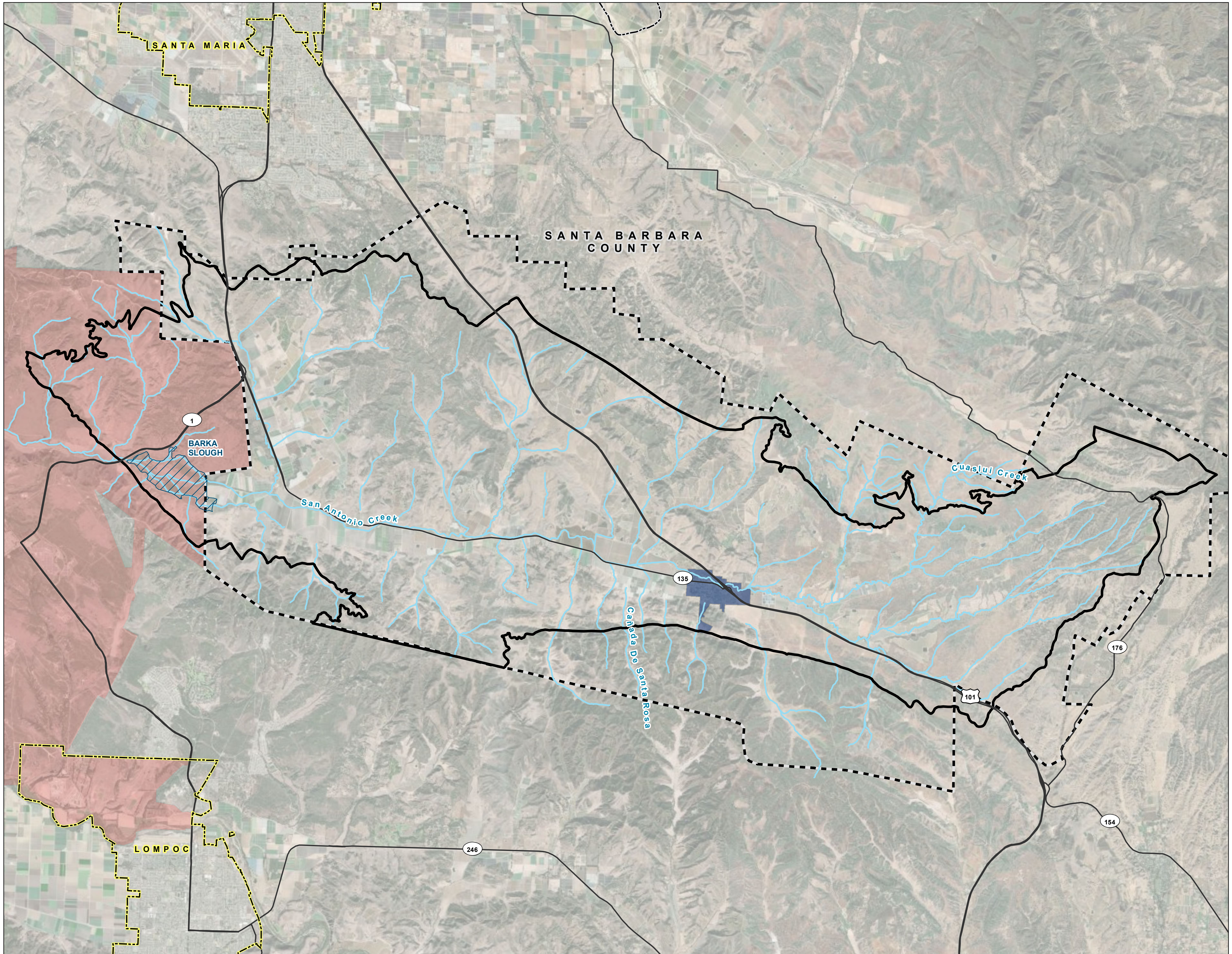

FIGURE 2-1

San Antonio Creek Valley Groundwater Basin Plan Area

Groundwater Sustainability Plan
San Antonio Creek Valley
Groundwater Basin

LEGEND

- Los Alamos Community Service
- Vandenberg Space Force Base
- Barka Slough
- San Antonio Creek Valley Groundwater Basin
- San Antonio Basin Water
- County Boundary
- City Boundary
- Major Road
- San Antonio Creek or Adjacent

N

0 5,000 10,000 15,000
Feet

Date: November 3, 2021
Data Sources: USGS (2020b), ESRI, DWR (2018a), Maxar imagery (2020)

GSI Water Solutions, Inc.

Document Path: Y:\0748_San_Antonio_GSP\Source_Figures\001_SanAntonio_Basin_GSA\GW_Sustainability_Plan\Section2\Figure2_1_San_Antonio_Creek_Valley_GW_Basin_Plan_Area.mxd, abarry

2.1.7 Cost and Funding of Plan Implementation [§ 354.6(e)]

§ 354.6 Agency Information. When submitting an adopted Plan to the Department, the Agency shall include a copy of the information provided pursuant to Water Code Section 10723.8, with any updates, if necessary, along with the following information:

(e) An estimate of the cost of implementing the Plan and a general description of how the Agency plans to meet those costs.

The GSP Implementation Plan, including the estimated cost for implementing the plan, is presented in Section 7 of the GSP.

2.2 Description of Plan Area [§ 354.8]

2.2.1 Summary of Jurisdictional Areas and Other Features [§ 354.8(a)(1),(a)(2),(a)(3),(a)(4),(a)(5), and (b)]

§ 354.8 Description of Plan Area. Each Plan shall include a description of the geographic areas covered, including the following information:

(a) One or more maps of the basin that depict the following, as applicable:

(1) The area covered by the Plan, delineating areas managed by the Agency as an exclusive Agency and any areas for which the Agency is not an exclusive Agency, and the name and location of any adjacent basins.

(2) Adjudicated areas, other Agencies within the basin, and areas covered by an Alternative.

(3) Jurisdictional boundaries of federal or state land (including the identity of the agency with jurisdiction over that land), tribal land, cities, counties, agencies with water management responsibilities, and areas covered by relevant general plans.

(4) Existing land use designations and the identification of water use sector and water source type.

(5) The density of wells per square mile, by dasymetric or similar mapping techniques, showing the general distribution of agricultural, industrial, and domestic water supply wells in the basin, including de minimis extractors, and the location and extent of communities dependent upon groundwater, utilizing data provided by the Department, as specified in Section 353.2, or the best available information.

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

The San Antonio Creek Valley groundwater basin occupies approximately 130 square miles (DWR, 2003) in western Santa Barbara County. The basin is bound on the north by the Solomon-Casmalia Hills and the Santa Maria Valley groundwater adjudication boundary and on the east by the San Rafael Mountains and a watershed divide separating the adjoining Santa Ynez River Valley groundwater basin. Average annual precipitation ranges from 15 to 19 inches. There are no natural lakes or water supply reservoirs in the Basin. San Antonio Creek and its tributaries are the major waterbodies. San Antonio Creek discharges into Barka Slough (Slough), an unmanaged 660-acre wetland (Martin, 1985). The basin is bound on the south by the Purisima Hills and on the west by the approximate western boundary of the Slough. The valley is drained by San Antonio Creek (DWR, 2018; see Figure 2-1). The San Antonio Creek Basin has not been adjudicated.

2.2.1.1 Jurisdictional Areas

The majority of the Basin, including unincorporated Los Alamos, is under the jurisdiction of Santa Barbara County. At the west end of the Basin is Vandenberg Space Force Base (VSFB), which is under the jurisdiction of the U.S. Department of the Defense, Space Force Space Command (Santa Barbara County, 2019a).[2]

2.2.1.2 Land Use

Land use planning authority in the Basin is the responsibility of the Santa Barbara County. Santa Barbara County also coordinates on integrated regional water management, water planning, and land use issues with neighboring San Luis Obispo and Ventura counties. Land uses in the Basin are primarily agricultural. As of 2018, approximately 13,500 acres are in cultivation. As of 2021, the area of cultivation has reduced to approximately 12,900 acres. VSFB land surrounds Barka Slough to the west and draws a portion of its supply from wells completed in the Basin near the Slough. Several named oil and gas fields are located within or adjacent to the Basin (see Figure 3-47). The community plan area of Los Alamos is 1 square mile of residential, commercial, and recreational land uses in the central portion of the Basin (Santa Barbara County, 2011; Census Bureau, 2010; Dudek, 2019). Further details on land use planning are available in Section 2.2.4 of this GSP.

2.2.1.3 Water Use Sectors

By far, the largest water use sector in the Basin is agricultural, representing approximately 95 percent of all water use (see Table 2-1). VSFB represents the second-largest use, at just under 3 percent of all groundwater pumped. LACSD and rural domestic pumping account for approximately 1 percent and 1 percent, respectively, of total average annual pumping. Table 2-1 shows all the water uses in the Basin.

[2] Vandenberg Space Force Base was formerly called the Vandenberg Air Force Base until a renaming ceremony in May 2021 (Associated Press, 2021).

Table 2-1. Annual Groundwater Pumping by Water Use Sector, Current Period

Water Use Sector	Average	Minimum	Maximum
LACSD	290	250	320
VSFB	670	0	1,800
Agricultural	22,000	22,000	22,200
Rural Domestic	160	160	170
Total[1]	23,100	—	—

Notes

All values in acre-feet.

[1] Minimum and maximum values are not totaled because the values for each component may have occurred in different years.

LACSD = Los Alamos Community Services District

VSFB = Vandenberg Space Force Base

2.2.2 Water Resources Monitoring and Management Programs [§ 354.8(c) and (d)]

§ 354.8 Description of Plan Area. Each Plan shall include a description of the geographic areas covered, including the following information:

(c) Identification of existing water resource monitoring and management programs, and description of any such programs the Agency plans to incorporate in its monitoring network or in development of its Plan. The Agency may coordinate with existing water resource monitoring and management programs to incorporate and adopt that program as part of the Plan.

(d) A description of how existing water resource monitoring or management programs may limit operational flexibility in the basin, and how the Plan has been developed to adapt to those limits.

2.2.2.1 Groundwater Level Monitoring

Starting in 2018, the San Antonio Creek Groundwater Availability Project was implemented by the USGS to provide stakeholders with water quality and quantity data to help with effective use of available water resources and planning for the future. As part of this study, the USGS collected groundwater level data on a quarterly basis in over 30 wells in the Basin as part of the ongoing cooperative study that includes Santa Barbara County, and VSFB. In addition, since the fourth quarter of 2019, SABGSA took over the quarterly groundwater level monitoring in the Basin.

Groundwater level monitoring data are gathered from a combination of public and private wells in the Basin. The USGS National Water Information System (NWIS) program, USGS Groundwater Ambient Monitoring and Assessment (GAMA) Program, and the California Statewide Groundwater Elevation Monitoring (CASGEM) program compile the data.

The network of approximately 56 wells (the number may vary)[3] that provide the elevation data are shown on Figure 5-1. A set of representative monitoring sites (RMSs) has been developed for this GSP. These representative sites are depicted and discussed further in Sections 3 and 5.

2.2.2.2 Groundwater Quality Monitoring

Groundwater quality samples have been collected from selected wells in the Basin and analyzed for various studies and programs. The USGS conducts a broad survey of groundwater quality as part of its GAMA Program. For this GSP, historical groundwater quality data from USGS NWIS and the State Water Resources Control Board (SWRCB) GeoTracker GAMA databases were compiled. Groundwater quality data collected as part of the state Irrigated Lands Regulatory Program (ILRP) are stored in the GeoTracker database. According to the GAMA database,[4] drinking water supply wells in the Basin include the LACSD wells, VSFB wells, and a few wells located in Harris Canyon and off Batchelder Road. Water quality data was also obtained for the LACSD wells as part of its Division of Drinking Water (DDW) compliance monitoring program.

This GSP focuses on constituents that relate to beneficial uses of groundwater that might be impacted by groundwater management activities. Groundwater quality information is provided in Section 3.2.3.

2.2.2.3 Surface Water Streamflow Monitoring

The USGS currently measures streamflow at three locations along San Antonio Creek: one upstream of the town of Los Alamos (Los Alamos gage), one where San Antonio Creek leaves the basin (Casmalia gage), and one on a tributary to San Antonio Creek (Harris Canyon Creek gage). The Los Alamos gage has been in operation since 1970; the Casmalia gage was re-activated with funding from a USGS hydrology study in the Basin;[5] the Harris Canyon Creek gage was installed in December 2016.[6] This GSP relies on data from the USGS Basin Characterization Model calibrated to gage data to determine native streamflow for the water budget. More information is available in Section 3.3.

2.2.2.4 Surface Water Quality Monitoring

SWRCB's Surface Water Ambient Monitoring Program (SWAMP) is an ongoing program to assess the effectiveness of SWRCB's and the Central Coast Regional Water Quality Control Board's (RWQCB's) regulatory water quality programs, to provide a statewide picture of the status and trends in surface water quality, and to develop site-specific information in areas that are known or suspected to have water quality problems. The Central Coast Ambient Monitoring Program, underway since 1997, represents the Central Coast Region's participation in the statewide SWAMP. More detailed information on the SWAMP program can be found at the SWRCB website (www.swrcb.ca.gov).

2.2.2.5 Climate Monitoring

Precipitation data has been collected at the Los Alamos Fire station since 1910. Weather data is measured at the Clos Mullet station: ID # KCALOSAL252 located in Los Alamos.

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[3] Access to some wells are negotiated with land owners and can change.
[4] GAMA data are available here: https://www.waterboards.ca.gov/water_issues/programs/gama/online_tools.html. (Accessed April 7, 2021.)
[5] The San Antonio Creek Hydrology Studies are described on the USGS site: https://ca.water.usgs.gov/projects/san-antonio-creek/index.html. (Accessed April 7, 2021.)
[6] The USGS gages are the following: San Antonio Creek at Los Alamos (USGS 11135800 SAN ANTONIO C A LOS ALAMOS CA); San Antonio Creek near Casmalia (USGS 11136100 SAN ANTONIO C NR CASMALIA CA); and Harris Canyon Creek near Orcutt (USGS 11136040 HARRIS CANYON C NR ORCUTT CA).

2.2.2.6 Existing Groundwater Management Plans

Groundwater management planning in the region has historically been conducted by Santa Barbara County. The LACSD conducts infrastructure planning associated with serving the local community. The RWQCB has responsibility for maintaining surface water and groundwater quality in the region (see below).

Water Quality Control Plan for the Central Coast Basin – Planning Elements

The *Water Quality Control Plan for the Central Coast Basin* (Basin Plan) (RWQCB et al., 2017) provides management strategies to ensure that surface water and groundwater in the Central Coast Region are managed to provide the highest possible quality. The Basin Plan includes the following elements:

- The water quality standards that must be maintained for all the water uses in the region
- An implementation plan that describes the programs, projections and other action necessary to achieve the water quality standards
- The existing plans and policies of the SWRCB and the RWQCB that protect water quality
- A description of the monitoring and surveillance programs to support ensuring management of surface and groundwater

The Basin Plan includes recommended actions, requirements, and management principles, including salt source control, to ensure high-quality surface water and groundwater for all beneficial uses. The present and potential future beneficial uses for inland waters listed in the Basin Plan include surface water and groundwater as municipal supply (water for community, military, or individual water supplies); agricultural purposes; groundwater recharge; recreational water contact and non-contact; sport fishing; warm freshwater habitat; wildlife habitat; rare, threatened or endangered species; and spawning, reproduction, and/or early development of fish.

The Basin Plan also describes the existing regulatory monitoring and assessment of point sources of pollution and a program to control nonpoint sources of pollution; the GAMA Program to assess groundwater quality; the Central Coast Ambient Monitoring Program, and the available state, federal, and regional assessments of water quality (see Section 3.2 for a summary of the natural groundwater quality in the Basin).

Santa Barbara County 2019 Groundwater Basins Status Report

The *Santa Barbara County 2019 Groundwater Basins Status Report* (Groundwater Report) (Santa Barbara County, 2019b) describes the conditions of groundwater and status of groundwater basins in Santa Barbara County since the publication of the 2011 *Santa Barbara County Groundwater Report.* The 2019 Groundwater Report provides data and information from state and federal monitoring for water quantity and quality in the wake of the local drought emergency that lasted from 2014 to 2019. Specifically, for each basin in the county, the report discusses basin characteristics and status, provides groundwater levels and hydrographs for selected wells, and describes developments in supplemental supplies and basin management plans.

Santa Barbara County Integrated Regional Water Management Plan

The Santa Barbara County *Integrated Regional Water Management Plan* (IRWMP) (Dudek, 2019), updated in 2019, provides guidance for integrating water management across the region. The IRWMP was updated through a 2-year process that included a broad array of stakeholders and objectives, priorities, and resource management strategies were revisited to respond to the changing conditions in the Region, including increasing vulnerabilities from climate change, and in response to new state-mandated requirements, including SGMA regulations.

The IRWMP integrated 34 selected water management strategies and considered and included an additional eight strategies for the region. The strategies included in the IRWMP that have or will have a role in protecting the region's water supply reliability, water quality, ecosystems, groundwater, and flood management objectives. The integration of these strategies resulted in a list of action items (projects, programs, and studies) needed to implement the IRWMP over the 25-year planning horizon.

No disadvantaged communities (DACs) were identified within the Basin, based on several datasets (refer to the IRWMP (Dudek, 2019); California Air Resources Board's (CARB) California Climate Investments (CCI) Priority Populations online mapping tool[7]; California Office of Environmental Health Hazard Assessment's CalEnviroScreen online mapping tool of Senate Bill 535 DACs[8]; and DWR's DACs online mapping tool[9]).

Los Alamos Community Services District Water Facilities Planning Study

The 2011 LACSD Water Facilities Planning Study describes the land uses and population at the time of publication and analyzes future water demand and infrastructure needs (Bethel, 2011).

2.2.2.7 Existing Groundwater Regulatory Programs

Agricultural Order

In 2017 the Central Coast RWQCB issued Agricultural Order No. R3-2017-0002, a Conditional Waiver of Waste Discharge Requirements for Discharges from Irrigated Lands (Agricultural Order) (RWQCB, 2017). The permit requires that growers implement practices to reduce nitrate leaching into groundwater and improve surface receiving water quality. Specific requirements for individual growers are structured into three tiers based on the relative risk their operations pose to water quality. Growers must enroll, pay fees, and meet various monitoring and reporting requirements according to the tier to which they are assigned. All growers are required to implement groundwater monitoring, either individually or as part of a cooperative regional monitoring program. Growers electing to implement individual monitoring (i.e., not participating in the regional monitoring program implemented by the Central Coast Groundwater Coalition or CCGC) are required to test all on-farm domestic wells and the primary irrigation supply well for nitrate or nitrate plus nitrite, and general minerals, including, but not limited to, total dissolved solids (TDS), sodium, chloride and sulfate.

Title 22 Drinking Water Program

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

The County of Santa Barbara has primacy and regulates state small water systems as defined in Chapter 34B Domestic Water Systems (Ordinance No. 12-4843) (Santa Barbara County, 2012). The SWRCB-DDW enforces the monitoring requirements established in Title 22 of the California Code of Regulations (CCR) for public water system wells, and all the data collected must be reported to the DDW. Title 22 also designates the regulatory limits (known as maximum contaminant levels [MCLs]) for various waterborne contaminants,

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[7] Available at https://webmaps.arb.ca.gov/PriorityPopulations/. (Accessed November 4, 2021.)
[8] Available at https://www.arcgis.com/apps/View/index.html?appid=c3e4e4e1d115468390cf61d9db83efc4. (Accessed November 4, 2021.)
[9] Available at https://gis.water.ca.gov/app/dacs/. Mapped DACs data included Places (2018) and Tracts (2018). (Accessed November 3, 2021.)

including volatile organic compounds, non-volatile synthetic organic compounds, inorganic chemicals, radionuclides, disinfection byproducts, general physical constituents, and other parameters.

Water Quality Control Plan for the Central Coast Basin – Water Quality Requirements

The pollution control actions required by, and best management practices recommended by, the SWRCB and the RWQCB are described in the Basin Plan (RWQCB et al., 2017). The plans and policies of the SWRCB for managing water quality are listed in Section 5 and included as appendices to the Basin Plan. Key policies that affect the management of surface water and groundwater in the Basin include the State Policy for Water Quality Control, Sources of Drinking Water Policy, and the Nonpoint Source Management Plan. Discharge prohibitions outlined in the Basin Plan include regulations for groundwaters, salt discharge, and other discharge requirements. Best management practices recommended in the Basin Plan include source controls that prevent a discharge or threatened discharge and treatment controls that remove pollutants from a discharge before it reaches surface water or groundwater.

The Basin Plan also lists the thresholds for Total Maximum Daily Loads (TMDLs) for waterbodies covered by the plan. A nitrate TMDL was developed for San Antonio Creek by the RWQCB because of exceedances of nitrate surface water Basin Plan standards. During the development of the TMDL, a subsurface discharge from an agricultural source was identified and eliminated and subsequent sampling and analysis indicated that San Antonio Creek was no longer impaired due to high nitrate concentrations. Development of the TMDL was continued in the event that other sources contribute to nitrate impairment (Central Coast RWQCB, 2015).[10]

2.2.2.8 Conjunctive Use Programs [§ 354.8(e)]

§ 354.8 Description of Plan Area. Each Plan shall include a description of the geographic areas covered, including the following information:

(e) A description of conjunctive use programs in the basin.

The Basin does not have a conjunctive use program.

[10] The TMDL also addresses exceedances of unionized ammonia and low dissolved oxygen levels, but the focus is nitrate.

2.2.3 Land Use and General Plans Summary [§ 354.8(f)(1),(f)(2), and (f)(3)]

§ 354.8 Description of Plan Area. Each Plan shall include a description of the geographic areas covered, including the following information:

(f) A plain language description of the land use elements or topic categories of applicable general plans that includes the following:

(1) A summary of general plans and other land use plans governing the basin.

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

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

Land use planning authority in the Basin is the responsibility of the Santa Barbara County. The *Santa Barbara County Comprehensive Plan* (2016) includes the following elements that have a bearing on water quantity or quality:

- A land use element that outlines the distribution of real estate, open space and agricultural land, mineral resources, recreational facilities, schools, and waste facilities
- A conservation element[11] that addresses the conservation, development, and use of natural resources including water, forests, soils, rivers, and mineral deposits
- Community and specific plans for municipalities and more urban areas to provide goals, policies, and standards to guide community development
- An open space element that details plans and measures for preserving open space for natural resources, outdoor recreation, public health and safety, and agriculture

Land uses in the Santa Barbara County Comprehensive Plan are designated by the Santa Barbara County Board of Supervisors and include the following:

- Agriculture
- Mineral Resource Industry
- Oil/Petroleum Resource Industry
- Mineral Resource Area
- Utility-Scale Solar Photovoltaic Facility
- Waste Disposal Facility
- Incorporated City

[11] Various studies indicate slight to moderate levels of overdraft in several groundwater basins within the County and substantial overdraft in one basin (Santa Barbara County, 2019b). The goals and policies in the Santa Barbara County Comprehensive Plan (2016), Conservation Element, Groundwater Resources Section were developed to protect local groundwater.

- Unincorporated Urban Area
- VSFB
- Los Padres National Forest

Land uses in the Basin are primarily agricultural (USGS, 2020e; Santa Barbara County, 2020). Of note, in 2019 the Santa Barbara County Board of Supervisors placed a limit on outdoor cannabis cultivation in the unincorporated areas of the County outside the Carpinteria Agricultural Overlay District County to no more than 1,575 acres (Santa Barbara County Code § 50-7) and requires a special land use permit. VSFB land surrounds Barka Slough to the west. There are some small areas of petroleum production (Dudek, 2019). In the central portion of the Basin, the Los Alamos Community Plan, developed by Santa Barbara County and last updated in 2011, governs community development for the 1 square mile of residential, commercial, and recreational land uses in the unincorporated community (Census Bureau, 2010; Santa Barbara County, 2011).

2.2.3.1 How Land Use Plans May Impact Water Demands and Sustainable Groundwater Management

As mentioned, agriculture is the overwhelmingly predominant land use in the Basin. The rate of growth of planted acreage in the Basin has slowed in the last two decades to approximately 0.2 percent annually. Total municipal demand in the Basin is expected to decrease slightly from the historical period due to State Water Project (SWP) deliveries being allocated to VSFB starting in 1997 through the Central Coast Water Authority. Rural domestic demand is expected to increase by approximately 57 percent compared to the historical period. Section 3.3.5 discusses the projected water budget in greater detail.

Santa Barbara County Public Health Department has authority to issue permits for new wells. This is a ministerial permit and does not require approval from SABGSA. Installation of new wells used to irrigate additional lands in the basin will likely become an issue because there presently is a substantial annual deficit of groundwater in storage that this GSP is focused on addressing. In addition, Santa Barbara County Land Use Planning Department has not placed limits on growth that would increase demand for water.

2.2.3.2 How Sustainable Groundwater Management May Affect Water Supply Assumptions

Historical, current, and projected groundwater budgets are presented in Section 3.3. Groundwater budget components include natural and anthropogenic sources of recharge and discharge from the Basin. Projects and management actions implemented by the SABGSA to mitigate water supply deficit or future drought conditions are discussed in Section 6.

2.2.3.3 Existing Well Types, Numbers, Density [§ 354.8(f)(4)]

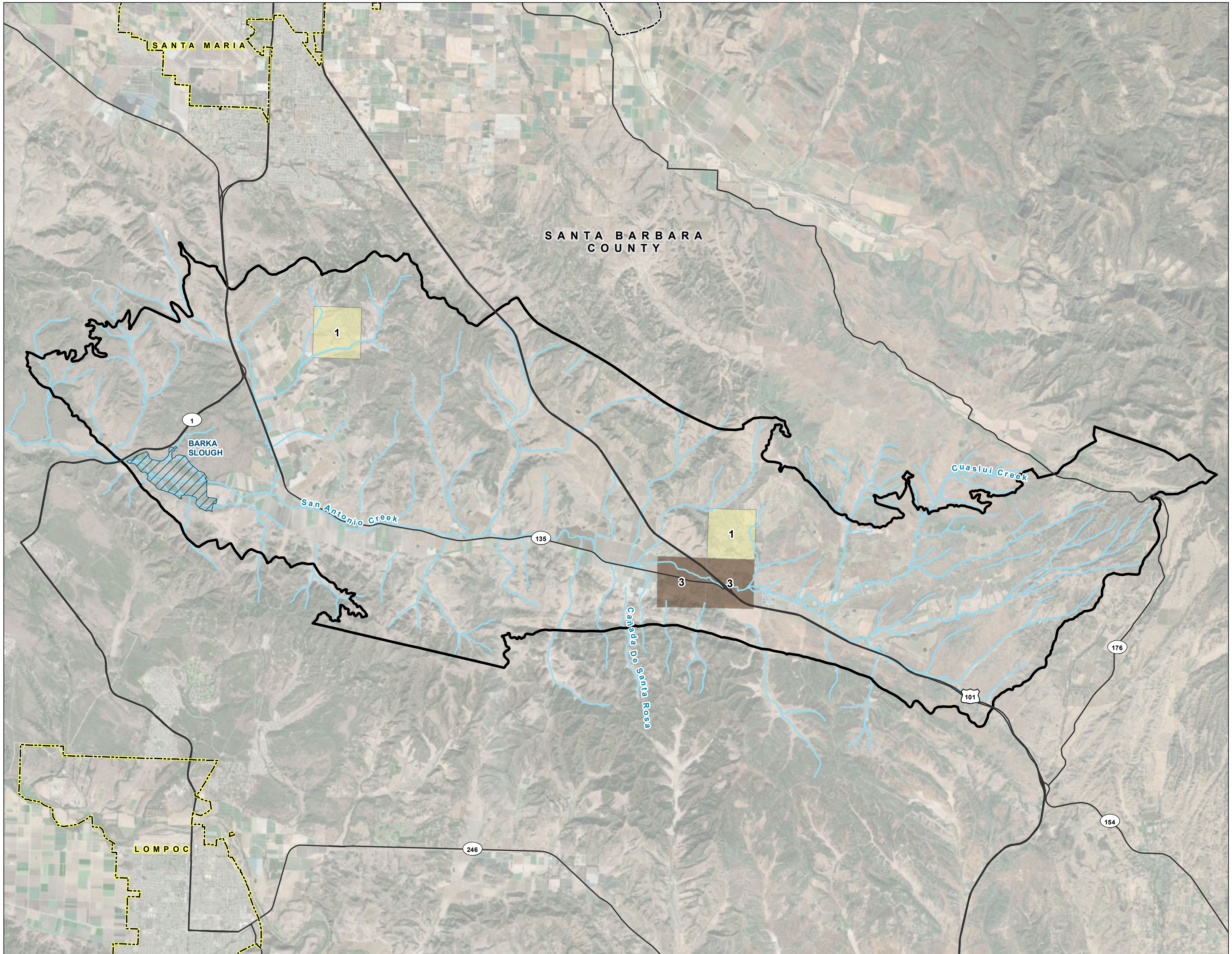
There are several different well types in the basin including agricultural, municipal, and domestic wells. Figures 2-2, 2-3, and 2-4 present the number and density of agricultural, municipal, and domestic wells in the Basin based on available data from DWR. The location and status (active, inactive, destroyed) of the wells shown on the maps have not been verified.

The Santa Barbara County Public Health Department's Environmental Health Services Division requires a Water Well Permit for all new and replacement wells and for modifications to wells, such as deepening, replacement or repairs. A permit application and map must be submitted describing the proposed location, construction, and intended use of the well. An Environmental Health Services representative reviews the application and conducts a site inspection before issuance of a permit can occur. Standards for well construction are set forth in Santa Barbara County Code § 34A-12. Once the well construction or replacement is completed, the property owner or well driller must provide a copy of the completed well log to Environmental Health Services.

FIGURE 2-2

San Antonio Creek Valley Groundwater Basin Well Density Map - Municipal Wells

Groundwater Sustainability Plan
San Antonio Creek Valley
Groundwater Basin



LEGEND

Municipal Well Count by Section

- 1
- 2 - 3

All Other Features

- Barka Slough
- San Antonio Creek Valley Groundwater Basin
- County Boundary
- City Boundary
- Major Road
- San Antonio Creek or Adjacent

N

0 5,000 10,000 15,000
Feet

Date: November 3, 2021
Data Sources: USGS (2020b), ESRI, DWR (2018a), Maxar imagery (2020)

GSI Water Solutions, Inc.

Document Path: Y:\0748_San_Antonio_GSP\Source_Figures\001_SanAntonio_Basin_GSA\GW_Sustainability_Plan\Section2\Figure2_2_San_Antonio_Creek_Valley_GW_Basin_Well_Density_Muni.mxd, abarry

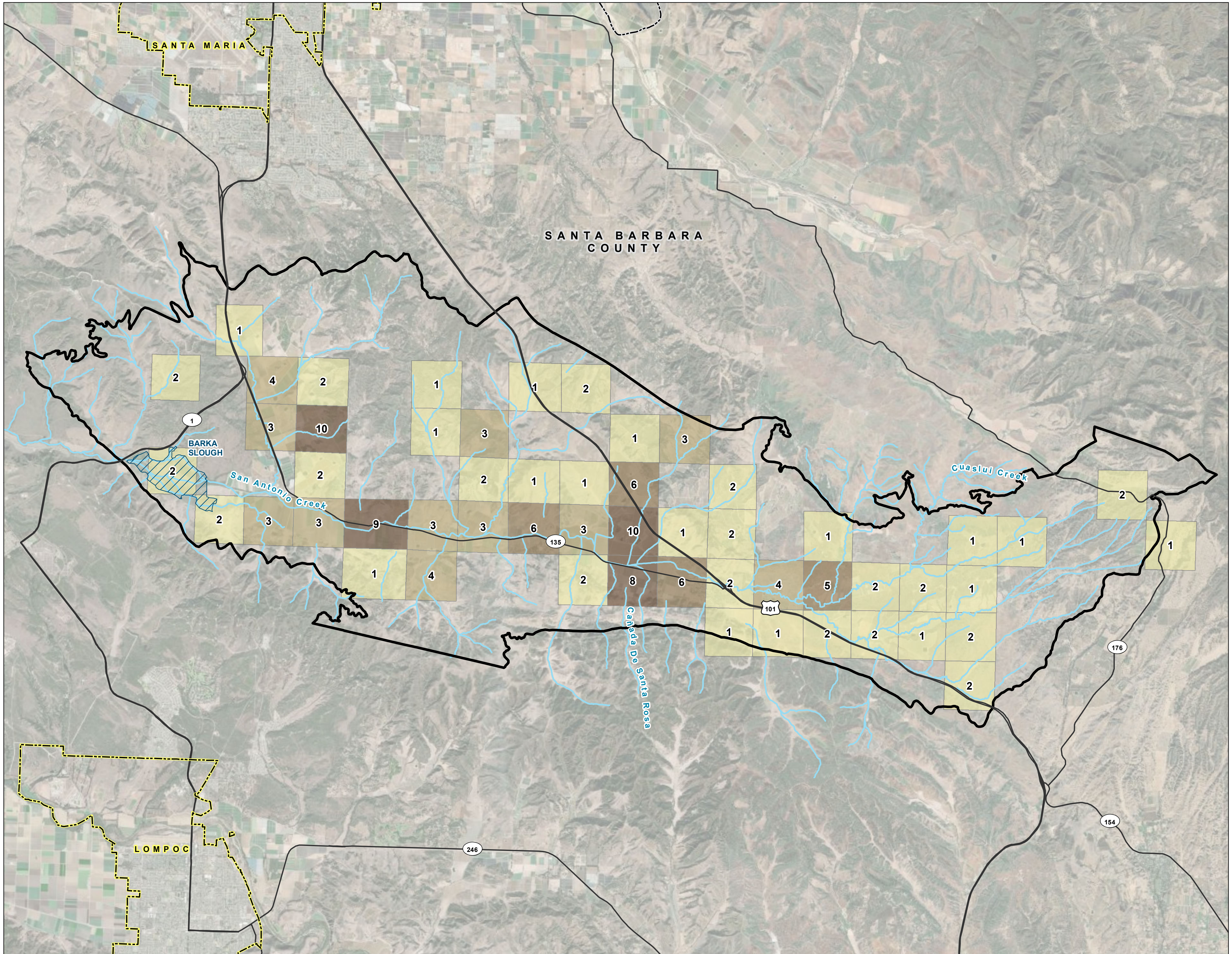


FIGURE 2-3

Well Density Map - Agricultural Wells

Groundwater Sustainability Plan
San Antonio Creek Valley
Groundwater Basin

LEGEND

Agricultural Well Count by Section

- 1 - 2
- 3 - 4
- 5 - 6
- 7 - 10

All Other Features

- Barka Slough
- San Antonio Creek Valley Groundwater Basin
- County Boundary
- City Boundary
- Major Road
- San Antonio Creek or Adjacent

N

0 5,000 10,000 15,000
Feet

Date: November 3, 2021
Data Sources: USGS (2020b), ESRI, DWR (2018a), Maxar imagery (2020)

GSI Water Solutions, Inc.

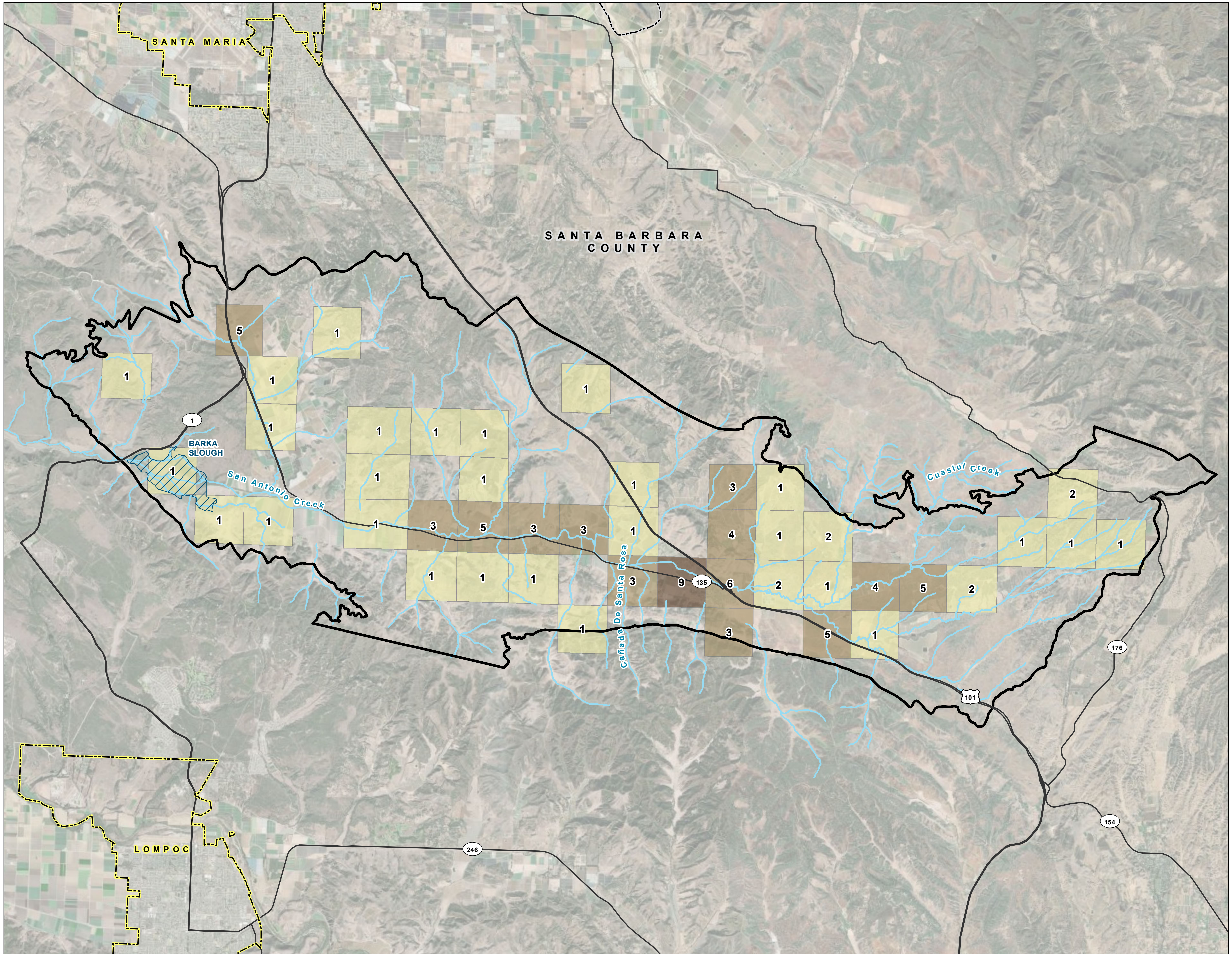


FIGURE 2-4

San Antonio Creek Valley Groundwater Basin Well Density Map - Domestic Wells

Groundwater Sustainability Plan
San Antonio Creek Valley
Groundwater Basin

LEGEND

Domestic Well Count by Section

- 1 - 2
- 3 - 6
- 7 - 9

All Other Features

- Barka Slough
- San Antonio Creek Valley Groundwater Basin
- County Boundary
- City Boundary
- Major Road
- San Antonio Creek or Adjacent

N

0 5,000 10,000 15,000
Feet

Date: November 15, 2021
Data Sources: USGS (2020b), ESRI, DWR (2018a), Maxar imagery (2020)

GSI Water Solutions, Inc.

Document Path: Y:\0748_San_Antonio_GSP\Source_Figures\001_SanAntonio_Basin_GSA\GW_Sustainability_Plan\Section2\Figure2_4_San_Antonio_Creek_Valley_GW_Basin_Well_Density_Dom.mxd, abarry

2.2.3.4 Impact of Land Use Plans Outside of Basin on Sustainable Groundwater Management [§ 354.8(f)(5)]

§ 354.8 Description of Plan Area. Each Plan shall include a description of the geographic areas covered, including the following information:

(f) A plain language description of the land use elements or topic categories of applicable general plans that includes the following:

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

There are no additional land use plans outside of the Basin that impact groundwater management other than those described in Section 2.2.4. VSFB is exempt from SGMA and operates wells within the Basin when its allocation of SWP water has been interrupted. VSFB has developed a plan that proposes pumping an additional 1,000 acre-feet per year of groundwater from the Basin to serve several proposed golf courses (AECOM, 2019). This plan is presently under review by the California Coastal Commission and is following the guidelines of the National Environmental Policy Act. SABGSA has been tracking this process and intends to provide comments when appropriate.

2.2.4 Additional Plan Elements [§ 354.8(g)]

§ 354.8 Description of Plan Area. Each Plan shall include a description of the geographic areas covered, including the following information:

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

Additional plan elements, appearing in the other sections of the GSP, discuss elements that have bearing on this GSP (see Section 4, Sustainable Management Criteria; Section 5, Monitoring Networks; and Section 6, Projects and Management Actions). These additional elements include the following:

- Migration of contaminated groundwater
- Well construction
- Measures addressing groundwater contamination, groundwater recharge, in lieu use, diversions to storage, conservation, and water recycling
- Efficient water management practices and water conservation methods to improve the efficiency of water use
- Efforts to develop relationships with state and federal regulatory agencies
- Efforts to coordinate with land use planning agencies to assess activities that potentially create risks to groundwater quality or quantity
- Impacts on groundwater-dependent ecosystems (GDEs)

2.3 Notice and Communication [§ 354.10]

2.3.1 Beneficial Uses and Users [§ 354.10(a)]

§ 354.10 Notice and Communication. Each Plan shall include a summary of information relating to notification and communication by the Agency with other agencies and interested parties including the following:

(a) A description of the beneficial uses and users of groundwater in the basin, including the land uses and property interests potentially affected by the use of groundwater in the basin, the types of parties representing those interests, and the nature of consultation with those parties.

The primary groundwater uses in the Basin include municipal, agricultural, and rural residential. Groundwater use also includes environmental use (such as GDEs). Municipal, domestic, and agricultural demands in the Basin currently rely entirely on groundwater. Agricultural and rural residential water demand is met from wells completed in both principal aquifers (the Paso Robles Formation and Careaga Sand). LACSD pumps exclusively from the Paso Robles Formation. The VSFB wellfield pumps exclusively from the Careaga Sand. There is reportedly no pumping from the shallow alluvial deposits that underlie San Antonio Creek. Refer to Section 3.1 for additional description of the principal aquifers. GDEs identified in the Basin are located in Barka Slough and are dependent on both surface water entering the Slough and groundwater upwelling into the Slough from the underlying Careaga Sand (see Section 3.2.6 for a description of GDE identification and Figure 3-31 for a conceptualized surface water and groundwater discharge into Barka Slough). No managed wetlands were identied in the Basin.

The SABGSA created an Advisory Committee representing many of the stakeholders and basin water users described above. Members of this group provide meaningful insight, support, and expertise from a variety of viewpoints for the SABGSA Board of Directors (the Board) to consider. The Advisory Committee is strictly advisory and does not vote on Board items, but members represent a number of social, cultural, and economic backgrounds to bring the widest possible perspective.

Potential committee members were identified through local outreach, word of mouth, and email to the stakeholder list. The qualifications of the candidates were reviewed, and the Stakeholder Advisory Committee (SAC) members were selected by the Board. The selected representatives reflect the interests of their group and are able to effectively communicate the group's opinions and feedback. The Advisory Committee is made up of the following committee representatives with up to 9 members each:

- County of Santa Barbara
- VSFB
- Environmental interests
- Agricultural interests
- Domestic water users

The members of the Advisory Committee were responsible for reviewing drafts of the various sections of the GSP, providing feedback on those drafts, reviewing presentations that were delivered during workshops and Board meetings, and soliciting input from their respective stakeholders as the plan was being developed.

The SABGSA Executive Director facilitated the Advisory Committee meetings; prepared agendas for the meetings; compiled questions, comments, and responses to comments made in the Advisory Committee meetings; prepared supporting materials; and maintained the SABGSA website.

2.3.2 Public Meetings [§ 354.10(b)]

§ 354.10 Notice and Communication. Each Plan shall include a summary of information relating to notification and communication by the Agency with other agencies and interested parties including the following:

(b) A list of public meetings at which the Plan was discussed or considered by the Agency.

Opportunities for public comment are provided at all SABGSA Board meetings, Advisory Committee meetings, and workshops. Meetings are also an opportunity for stakeholders to stay informed about what is happening with the SABGSA and the GSP process. For each public meeting at which sections of the GSP were discussed or considered, notices were distributed to member agencies, interested parties, and stakeholders via email communication and website postings. Additionally, prior to the COVID-19 pandemic, meeting notices were publicly posted at the LACSD office and the CRCD office at least 72 hours prior to each meeting. During the statewide stay-at-home order issued in March 2020 in response to the COVID-19 pandemic,[12] all postings were made online as offices were closed to the public. SABGSA also provided notices for all public meetings, including the agenda and presentations on its website. Email notifications of meetings were also sent to interested parties, the SABGSA Board, and the Advisory Committee. (See Section 2.3.4.2 for more information on public outreach.) The SABGSA Board met on the third Tuesday of each month at 6 p.m., unless otherwise noticed. During the COVID-19 pandemic, all Board meetings and Advisory Committee meetings were held virtually. In-person meetings, when conducted, took place at the LACSD office. All agendas and meeting minutes from past meetings are available on the SABGSA website.

[12] Information about the order and subsequent amendments is available at California COVID-19 information website: https://covid19.ca.gov/stay-home-except-for-essential-needs/. (Accessed June 9, 2020.)

As of this writing in early November 2021, the public meetings at which the GSP was discussed or considered include the following:

Advisory Committee Meetings	SABGSA Board of Directors Meetings
June 5, 2018	July 17, 2018
July 10, 2018	March 17, 2020
November 6, 2018	April 21, 2020
February 5, 2019	May 19, 2020
October 1, 2019	July 21, 2020
March 3, 2020	October 20, 2020
November 3, 2020	November 17, 2020
July 7, 2020	January 19, 2021
December 1, 2020	February 16, 2021
February 2, 2021	March 16, 2021
May 4, 2021	April 20, 2021
July 6, 2021	May 18, 2021
August 3, 2021	June 15, 2021
September 14, 2021	July 13, 2021
October 5, 2021	August 17, 2021
November 2, 2021	September 21, 2021
	October 19, 2021
	November 16, 2021

In addition, the following upcoming SABGSA Board of Directors meetings are anticipated to include discussions of GSP elements:

Upcoming SABGSA Board of Directors Meetings
December 21, 2021

One in-person public workshop was held during development of the GSP to update stakeholders on the GSP progress and to solicit input on the water budget, sustainability criteria, and minimum thresholds. Additional public workshops would have been held had there not been the COVID-19 pandemic. The public workshop was held to discuss elements of the GSP as follows:

Public Workshops
July 28, 2021 – SGMA and sustainable management criteria
October 14, 2021 – SGMA and Projects and Management Actions

2.3.3 Public Comments [§ 354.10(c)]

§ 354.10 Notice and Communication. Each Plan shall include a summary of information relating to notification and communication by the Agency with other agencies and interested parties including the following:

(c) Comments regarding the Plan received by the Agency and a summary of any responses by the Agency.

The SABGSA is committed to frequent and transparent communication with stakeholders and interested parties. During the Plan's development and after release of the public draft, public comments were received through the Groundwater Communication Portal, letters, and email. These comments were distributed to the SABGSA Board and consultant team for consideration as the GSP was developed. The comments were combined into a table and responses to the comments were also noted in the table with reference to where in the GSP the comment was addressed (see Appendix B). This information was formatted in a manner that could be included with the GSP document and uploaded to the DWR SGMA portal.

2.3.4 Communication [§ 354.10(d)]

2.3.4.1 Decision-Making Process [§ 354.10(d)(1)]

§ 354.10 Notice and Communication. Each Plan shall include a summary of information relating to notification and communication by the Agency with other agencies and interested parties including the following:

(d) A communication section of the Plan that includes the following:

(1) An explanation of the Agency's decision-making process.

Outreach Roles

SABGSA Board of Directors. The Board, which comprises eight appointed members, make the ultimate decisions regarding how the groundwater basin will be managed and how the management actions described in the GSP will be financed. The two member agencies are LACSD and the SABWD. The final GSP will be adopted by the Board of Directors. As required by the 2017 JPA that created the SABGSA, the Board will consider the recommendations of the Advisory Committee (described below). The Board typically meets on the third Tuesday of the month at the LACSD office at 6:00 p.m. The Board is responsible for the following outreach activities:

- Adopting and overseeing implementation of the Stakeholder Communication and Engagement Plan.
- Receiving public comments made in writing and verbally at Board meetings and public hearings.
- Considering the recommendations of the Advisory Committee.

GSP Advisory Committee. Advisory Committee meetings are typically the first Tuesday of the month at the LACSD office (or online during the COVID stay-at-home order) at 1:30 p.m. The GSP Advisory Committee, which is made up of members appointed by the Board, spent time becoming familiar with issues related to the GSP. The Advisory Committee is charged with developing recommendations on GSP-related issues and incorporating the community and stakeholder interests into these recommendations. This charge was carried out through various venues and a variety of activities, but generally included the following:

- Actively seeking input from the represented public and stakeholder groups on issues before the SABGSA.
- Sharing input and feedback with the full Advisory Committee at Advisory Committee meetings.
- Making recommendations to the Board.

Executive Director. The executive director is considered SABGSA staff and was available to provide information about GSA and the GSP status. The SABGSA's executive director is Anna Olsen, and she may be reached by email at aolsen@sanantoniobasingsa.org, or by telephone at 805-868-4013. The Board, the Advisory Committee, and staff are committed to keeping the public informed; providing balanced and objective information to assist the public in understanding SGMA and the available options and recommendations; and creating an open process for public input on the development and implementation of the GSP. When evaluating the options and making decisions, the Board, Advisory Committee, and staff solicited public input through a variety of methods, including public workshops, written and verbal comments, meetings with stakeholder organizations, and community events. Input was also received during public comment periods at Advisory Committee and Board meetings and in writing. As posted on all Board and Advisory Committee meeting agendas, comments made in writing were also submitted directly to the SABGSA's executive director at aolsen@sanantoniobasingsa.org.

2.3.4.2 Public Engagement [§ 354.10(d)(2) and (d)(3)]

§ 354.10 Notice and Communication. Each Plan shall include a summary of information relating to notification and communication by the Agency with other agencies and interested parties including the following:

(d) A communication section of the Plan that includes the following:

(2) Identification of opportunities for public engagement and a discussion of how public input and response will be used.

(3) A description of how the Agency encourages the active involvement of diverse social, cultural, and economic elements of the population within the basin.

Outreach Methods

The communication and engagement plan (see Appendix C) describes the approach that was taken for outreach. Outreach methods included facilitating the public's access to information and documents through the SABGSA's website and email distribution list, as well as making information available, where needed, in hard copy form. For instance, SABGSA used already-established outreach venues in the Basin's predominantly rural, agricultural community, such as community posting locations for placement and/or distribution of informational materials (e.g., flyers or posters). Locations for posting of materials included LACSD, CRCD, Los Alamos Public Library, and the Los Alamos Post Office. Public meetings and project information were disseminated through email or direct mail, as requested. This communication provided information for the Basin community, public agencies, and other interested persons/organizations about milestones, meetings, and the progress of GSP development. The SABGSA would have invited participation of federally recognized Indian tribes sharing the interest of sustainability of the groundwater agency, as required by SGMA, but there are no federally recognized tribes within the Basin. Some of the outreach methods employed for this project are described below.

1. Public Notices. To ensure that the general public is apprised of local activities and allow stakeholders to access information, SGMA specifies several public notice requirements for GSAs. All meetings, hearings, and workshops were noticed in compliance with the Ralph M. Brown Act.[13] As outlined below, there were a variety of opportunities for people to participate in the development and implementation of the GSP, including workshops, public hearings, providing comments at Board of Director and Advisory Committee meetings, and through written comments.

In addition to open meeting requirements, three sections of the California Water Code require public notice before establishing a GSA, adopting (or amending) a GSP, or imposing or increasing fees:

- Section 10723(b). "Before electing to be a groundwater sustainability agency, and after publication of notice pursuant to § 6066 of the Government Code, the local agency or agencies shall hold a public hearing in the county or counties overlying the basin." In accordance with California Water Code § 10723(b), the following occurred: on May 10 and May 16, 2017, at the duly noticed public meetings of the LACSD and the CRCD, respectively, the two agencies approved the JPA creating the GSA. On June 14, 2017, SABGSA held a noticed public hearing to consider becoming a GSA for the San Antonio Basin and voted to become such a GSA. The June 14, 2017, public hearing was noticed in the *Santa Maria Times* in accordance with Government Code § 6066.
- Section 10728.4. "A groundwater sustainability agency may adopt or amend a groundwater sustainability plan after a public hearing, held at least 90 days after providing notice to a city or county within the area of the proposed plan or amendment. …"
- Section 10730(b)(1). "Prior to imposing or increasing a fee, a groundwater sustainability agency shall hold at least one public meeting, at which oral or written presentations may be made as part of the meeting.…(3) At least 10 days prior to the meeting, the groundwater sustainability agency shall make available to the public data upon which the proposed fee is based."

2. Public Meetings/Hearings. Stakeholder involvement included regularly scheduled public meetings of the Board, Advisory Committee meetings, and workshops to provide input during development of the GSP. In addition to signing up to receive information about GSP development at the SABGSA webpage, interested parties participated in the development of the GSP by attending and participating in public meetings (Water Code § 10727.8[a]). Public meetings or hearings are formal opportunities for people to provide official comments on programs, plans, and proposals. During development of the GSP, topics associated with each chapter were presented at various Board meetings to keep the Board and public informed about the progress of the GSP and to obtain input as the GSP was being prepared. Each meeting had a scheduled time for public comments. Information about the meetings can be found on the SABGSA website: sanantoniobasingsa.org.

3. Stakeholder Briefings. Regular meetings of the Advisory Committee facilitated technical review of GSP progress and allowed for increased opportunity for discussion and input. Advisory Committee members met with and communicated regularly with organizations made up of the stakeholder groups they represent. To

[13] Brown Act requirements are provided on a website dedicated to the act: https://firstamendmentcoalition.org/facs-brown-act-primer/. (Accessed June 9, 2021.)

facilitate cohesive communication and messaging, all briefings were coordinated with SABGSA staff. All meetings are open to the public and stakeholder groups.

4. Public Input. Meetings were also held as GSP elements were being developed and served as opportunities for public input. Public educational meetings provide informal opportunities for people to learn about groundwater, SGMA, and GSP elements. Meetings included traditional presentations with facilitated question-and-answer sessions. Community meetings (i.e., workshops, Board meetings) were conducted for key stakeholders where project experts shared educational information by topic, clarified technical data and issues, and offered opportunities for public questions and input. The timing and precise format of public workshops were informed by the key issues that arose and by the input received during early stages of GSP development.

Multiple meetings were held in coordination with the following milestones/tasks:

- Preparation of the hydrogeologic conceptual model and draft groundwater conditions section of the GSP.
- Preparation of the Basin water budget.
- Establishment of Basin sustainability criteria.
- Establishment of monitoring objectives and a monitoring network.
- Identification and prioritization of projects and management actions.
- Draft GSP implementation.
- GSP draft document.

5. Briefings for the JPA Member Agencies. The CRCD (www.rcdsantabarbara.org) and LACSD (www.losalamoscsd.com) staff provided briefings to their respective board of directors regularly on GSA activities.

6. Website. The SABGSA website houses information about SGMA, the GSP process, Board, Advisory Committee, public meetings, project reports and studies, and groundwater data and information. The project website, sanantoniobasingsa.org is a tool for distributing and archiving meeting and communication materials as well as a repository for studies and other documents. Staff updated the website at least monthly, and more often when needed.

7. Email/Direct Mailings. Public meeting notices and other information were disseminated through email, from the SABGSA office, or via direct mail under special circumstances and/or if requested. This communication provided information for the community, public agencies, and other interested persons/organizations about milestones, meetings, and the progress of GSP development. A basin stakeholder list was developed from a number of sources, including lists of City government representatives, members of environmental groups, and state and county agencies. Those on the email list received news and updates about the GSP process and details about stakeholder forums and workshops. A total of 141 individuals registered to receive emails through this distribution list. Additional opportunities were sought during development of the GSP to grow and expand the email subscription list and the type of information distributed.

2.3.4.3 Progress Updates [§ 354.10(d)(4)]

§ 354.10 Notice and Communication. Each Plan shall include a summary of information relating to notification and communication by the Agency with other agencies and interested parties including the following:

(d) A communication section of the Plan that includes the following:

(4) The method the Agency shall follow to inform the public about progress implementing the Plan, including the status of projects and actions.

Plan Progress Evaluation

The methods that will be used to inform the public, including key stakeholder groups, about progress implementing the Plan and to determine the level of success of the Community Engagement Plan include Board meetings, annual reports, and plan updates. Information about implementation, monitoring results, and the status of projects and management actions will also be posted on the SABGSA website.

SABGSA Board Meetings. Information pertaining to implementation of the GSP will be presented at regularly scheduled Board meetings. These meetings will be publicly noticed as was done during GSP development. The public will have an opportunity to provide comment on the progress. A record of those attending public meetings will be maintained during GSP implementation. SABGSA will use sign-in sheets and request feedback from attendees to determine adequacy of public education and productive engagement in the GSP implementation process. Meeting minutes will also be prepared and will be provided on the SABGSA website once approved.

Annual Reports. Information pertaining to GSP implementation and monitoring program will be presented in an annual report submitted to the Board and DWR. This information will be made available to the public and a summary presentation will be given at annual Board meetings.

Plan Update. The GSP will be reviewed and updated every 5 years. The updates will include review of progress made in achieving the sustainability goal, progress toward reaching interim milestones, and recommendations for any changes to the Plan. The draft updates will be discussed with stakeholders during a public meeting before submitting to DWR.

2.4 References and Technical Studies [§ 354.4(b)]

§ 354.4 General Information.

(b) Each Plan shall include the following general information: A list of references and technical studies relied upon by the Agency in developing the Plan. Each Agency shall provide to the Department electronic copies of reports and other documents and materials cited as references that are not generally available to the public.

AECOM. 2019. *Potential Effects to California Red-legged Frog, El Segundo Blue Butterfly, Tidewater Goby, Unarmored Threespine Stickleback, and Beach Layia.* Prepared by AECOM Technical Services, Inc. Prepared for the Vandenberg Air Force Base.

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Bethel. 2011. *Los Alamos Community Services District Water Facilities Planning Study.* Prepared by Bethel Engineering.

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Census Bureau. 2010. *2010 Census U.S. Gazetteer Files – Places – California.* Published by the U.S. Census Bureau. Available at https://www2.census.gov/geo/docs/maps-data/data/gazetteer/2010_place_list_06.txt.

Dudek. 2019. *Santa Barbara County Integrated Regional Water Management Plan, Update 2019.* Prepared for the Santa Barbara County IRWM Cooperating Partners.

DWR. 2018. *Bulletin 118 Description for 3-014 San Antonio Creek Valley.* Prepared by the California Department of Water Resources.

Muir, K. 1964. *Geology and Ground-Water of San Antonio Creek Valley, Santa Barbara County, California.* U.S. Geological Survey Water-Supply Paper 1664, 53 p.

RWQCB. 2017. Agricultural Order No. R3-2017-0002, a Conditional Waiver of Waste Discharge Requirements for Discharges from Irrigated Lands. Central Coast Regional Water Quality Control Board.

RWQCB et al. 2017. *Water Quality Control Plan for the Central Coast Basin.* Prepared by the Regional Water Quality Control Board, Central Coast Region, State Water Resources Control Board, and California Environmental Protection Agency.

SABGSA. 2020. Re: San Antonio Basin Groundwater Sustainability Agency Notice of Non-Material Change to GSA Notification. May 28, 2020, Letter from the San Antonio Basin Groundwater Sustainability Agency (SABGSA) Executive Director.

Santa Barbara County. 2011. *Los Alamos Community Plan.* Prepared by the Santa Barbara County Planning and Development Department.

Santa Barbara County. 2012. *Ordinance Amending County Code Chapter 34B - Domestic Water Systems, No. 12-4843.* Board of Supervisors of the County of Santa Barbara.

Santa Barbara County. 2016. *Santa Barbara County Comprehensive Plan.* Adopted 1980, Amended December 2016. Prepared by the County of Santa Barbara.

Santa Barbara County. 2019a. *Santa Barbara County Airport Land Use Compatibility Plan Update.* Prepared by the Santa Barbara County Association of Governments.

Santa Barbara County. 2019b. *Santa Barbara County 2019 Groundwater Basins Status Report.* Prepared by the Santa Barbara County Public Works Department Water Resources Division, Water Agency.

SECTION 3: **Basin Setting [Article 5, Subarticle 2]**

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

3.1 Hydrogeologic Conceptual Model [§ 354.14]

§ 354.14 Hydrogeological Conceptual Model.

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

This section describes the hydrogeologic conceptual model of the San Antonio Creek Valley Groundwater Basin (Basin), identified in the California Department of Water Resources (DWR) Bulletin 118[14] as groundwater basin 3-014. This section describes the boundaries, geologic formations and structures, and principal aquifer units of the Basin. The section also summarizes general basin water quality, the conceptual interaction between groundwater and surface water, and generalized groundwater recharge and discharge areas. This section draws upon previously published studies, primarily hydrogeologic and geologic investigations by the U.S. Geological Survey (USGS) in cooperation with the Santa Barbara County Water Agency (Muir, 1964) and by the USGS in cooperation with the Vandenberg Air Force Base (now called Vandenberg Space Force Base [VSFB]) (Hutchinson, 1980) (Mallory, 1980). Subsequent geologic and hydrogeologic investigations and development of a two-dimensional groundwater model (Martin, 1985), relied upon original geologic interpretations (Muir, 1964; Hutchinson, 1980; Mallory, 1980) with the exception of the basin boundaries that are defined in accordance with Bulletin 118 (DWR, 2003; DWR, 2016a). The hydrogeologic conceptual model presented in this section is a summary of aspects of the basin hydrogeology that influence groundwater sustainability based on available information. Understanding of the Basin will be adapted as hydrogeology is better understood in the future. Detailed information can be found in the original reports (Muir, 1964; Hutchinson, 1980; Mallory, 1980). This section, with Section 2.2, sets the framework for subsequent sections on groundwater conditions (Section 3.2) and the water budget (Section 3.3).

[14] Developed and distributed by the California Department of Water Resources Sustainable Groundwater Management Office, California's Groundwater (Bulletin 118) is the State's official publication on the occurrence and nature of groundwater in California. The publication defines the boundaries and describes the hydrologic characteristics of California's groundwater basins and provides information on groundwater management and recommendations for the future.

3.1.1 Regional Hydrology

3.1.1.1 Topography and Watershed Boundary [§ 354.14(d)(1)]

§ 354.14 Hydrogeological Conceptual Model.

(d) Physical characteristics of the basin shall be represented on one or more maps that depict the following:

(1) Topographic information derived from the U.S. Geological Survey or another reliable source.

The basin watershed includes an area of approximately 123 square miles (USGS, 2020a). The watershed is long and narrow, approximately 30 miles long and 7 miles wide, and is structurally controlled by an underlying northwest-trending synclinal trough (resulting from folding of the rock units), referred to as the Los Alamos Syncline. Topographical highs within the Basin occur at an elevation of approximately 1,200 feet (ft) above mean sea level (amsl) along the ridges that define the northern (Casmalia Hills and Solomon Hills) and southern (Purisima Hills and Burton Mesa) basin boundaries. Topographical lows of the Basin occur along the relatively flat and narrow valley floor, coincident with the axis of the Los Alamos Syncline. Ground surface elevations along the valley floor occur at elevations ranging from approximately 800 ft amsl to the east to 250 ft amsl at the western edge of Barka Slough (Slough) (Hutchinson, 1980).

Figure 3-1 shows the topography of the Basin using 40-ft contour intervals. The Basin boundary is controlled by the outcropping of bedrock of the Los Alamos Syncline.

The Basin watershed lateral boundaries are as follows:

- The western boundary of the Basin is defined by a bedrock ridge underlying the western edge of the Barka Slough. This bedrock ridge results in no groundwater movement to the west. West of the bedrock ridge is San Antonio Valley.
- The northern boundary of the Basin is defined by the topographic divide of the Casmalia and Solomon Hills. This boundary is formed by low-permeability bedrock that crops out at ground surface.
- The eastern boundary of the Basin is defined by the topographic divide of the San Rafael Mountains.
- The southern boundary is defined by the topographic divide of the Purisima Hills. This boundary is formed by low-permeability bedrock that crops out at ground surface.

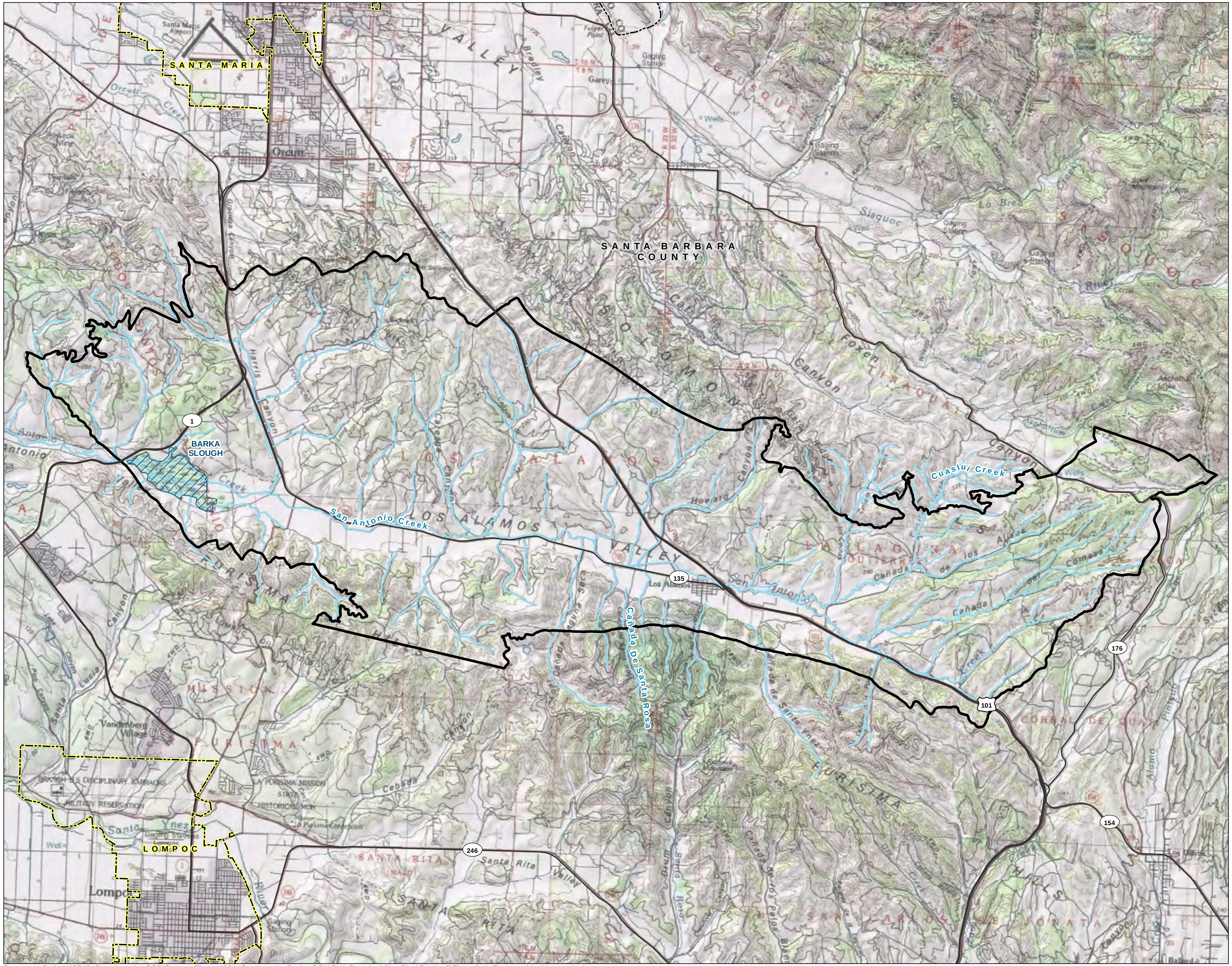


FIGURE 3-1

Topographic Map of the San Antonio Creek Valley Groundwater Basin

Groundwater Sustainability Plan
San Antonio Creek Valley
Groundwater Basin

LEGEND

- San Antonio Creek or Adjacent Tributary
- Barka Slough
- San Antonio Creek Valley Groundwater Basin

All Other Features

- County Boundary
- City Boundary
- Major Road

NOTE

San Antonio Creek Valley Groundwater Basin Boundary as defined in the California Department of Water Resources Bulletin 118.

N

0 5,000 10,000 15,000
Feet

GSI Water Solutions, Inc.

Date: September 16, 2021
Data Sources: NGS (2013), USGS (2020b), ESRI, DWR (2018a)

Document Path: Y:\0748_San_Antonio_GSP\Source_Figures\001_SanAntonio_Basin_GSA\GW_Sustainability_Plan\Section3\Figure3_1_Topographic_Map.mxd, abarry

3.1.1.2 Soil Types

Soil data from the U.S. Department of Agriculture (USDA) Natural Resources Conservation Service Soil Survey Geographic Database (SSURGO) (USDA, 2020) are shown in the four hydrologic groups on Figure 3-2.

The soil hydrologic groups shown on Figure 3-2 are determined by the water-transmitting properties of the soil, which include hydraulic conductivity and percentage of clays in the soil relative to sands and gravels. The hydrologic soil group is "determined by the water transmitting soil layer with the lowest saturated hydraulic conductivity and depth to any layer that is more or less water impermeable or depth to a water table" (USDA, 2007). Saturated hydraulic conductivity of surficial soils is a good indicator of the soil's infiltration potential. The soil hydrologic groups are defined (based on characteristics within 100 centimeters (40 inches) of the surface) as the following:

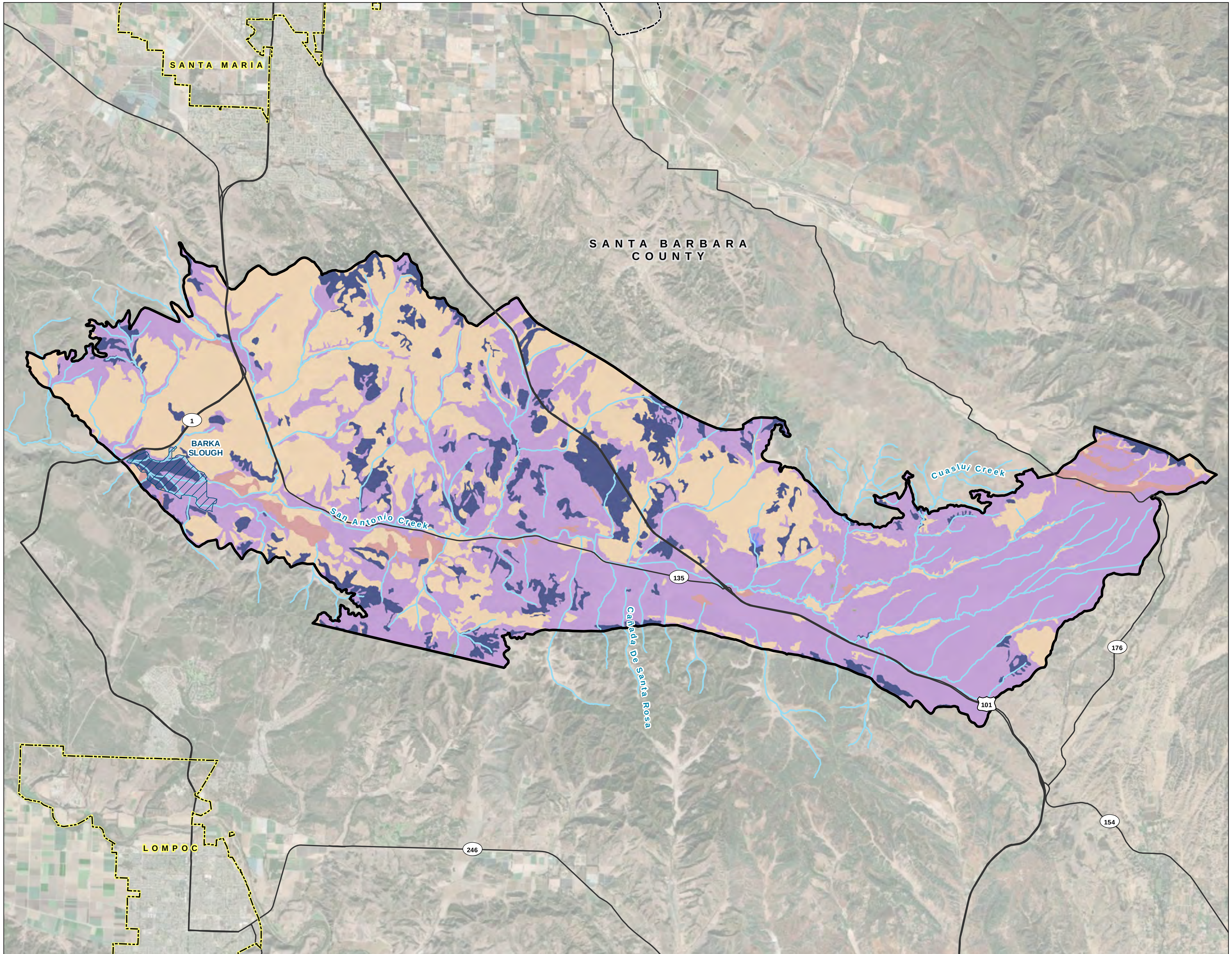
- **Group A – High Infiltration Rate:** soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.
- **Group B – Moderate Infiltration Rate:** soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.
- **Group C – Slow Infiltration Rate:** soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.
- **Group D – Very Slow Infiltration Rate:** soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material.

The soil hydrologic group generally correlates with the hydraulic conductivity of underlying geologic units, with lower soil hydraulic conductivity zones correlating to areas underlain by clayey portions of the Paso Robles Formation. The higher soil hydraulic conductivity zones correspond to areas underlain by alluvium or areas of coarser sediments within the Paso Robles Formation or Careaga Sand. The Paso Robles Formation and Careaga Sand are discussed in more detail in Sections 3.1.2 and 3.1.3.

FIGURE 3-2

Hydrologic Soil Groups of the San Antonio Creek Valley Groundwater Basin

Groundwater Sustainability Plan
San Antonio Creek Valley
Groundwater Basin



LEGEND

Hydrologic Soil Rating

- A
- B
- C
- C/D
- D

All Other Features

- San Antonio Creek or Adjacent Tributary
- Barka Slough
- San Antonio Creek Valley Groundwater Basin
- County Boundary
- City Boundary
- Major Road

NOTES

1. San Antonio Creek Valley Groundwater Basin Boundary as defined in the California Department of Water Resources Bulletin 118.
2. **Hydrologic Soil Groups**
Group A. water transmitted freely through the soil; soils typically less than 10% clay and more than 90% sand or gravel.
Group B. water transmission through the soil is unimpeded; soils typically have between 10 and 20% clay and 50 to 90% sand.
Group C. water transmission through the soil is somewhat restricted; soils typically have between 20 and 40% clay and less than 50% sand.
Group D. water movement through the soil is restricted or very restricted; soil typically has greater than 40% clay, less than 50% sand.
If soil is assigned to a dual hydrologic group (A/D, B/D, or C/D), the first letter is for drained areas and the second is for undrained areas. Only the soils that in their natural condition are in group D are assigned to dual classes.

N

0 5,000 10,000 15,000
Feet

Date: September 16, 2021
Data Sources: USDA (2020), USGS (2020b), ESRI, DWR (2018a), Maxar imagery (2020)

GSI Water Solutions, Inc.

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3.1.1.3 Surface Water Bodies [§ 354.14(d)(5)]

§ 354.14 Hydrogeological Conceptual Model.

(d) Physical characteristics of the basin shall be represented on one or more maps that depict the following:

(5) Surface water bodies that are significant to the management of the basin.

Figure 3-3 shows the creeks in the Basin that are considered significant to the management of groundwater in the Basin (USGS, 2020b). Streams in the Basin are classified in the USGS National Hydrography Dataset (NHD) as intermittent (refer to Figure 3-53) (with the exception of those located in Barka Slough) and include Cuaslui Creek, Cañada De Santa Rosa, San Antonio Creek, and Harris Canyon Creek. Cuaslui Creek, Cañada De Santa Rosa, and Harris Canyon Creek are tributaries to San Antonio Creek. Available stream-gage data indicate that the majority of surface flow in these creeks percolates into the San Antonio Creek channel alluvium and the underlying Paso Robles Formation during most of the year. San Antonio Creek discharges into the Barka Slough, an approximate 660-acre wetland (Martin, 1985) at the west end of the Basin. There are no natural lakes in the Basin. There are no water supply reservoirs in the Basin.

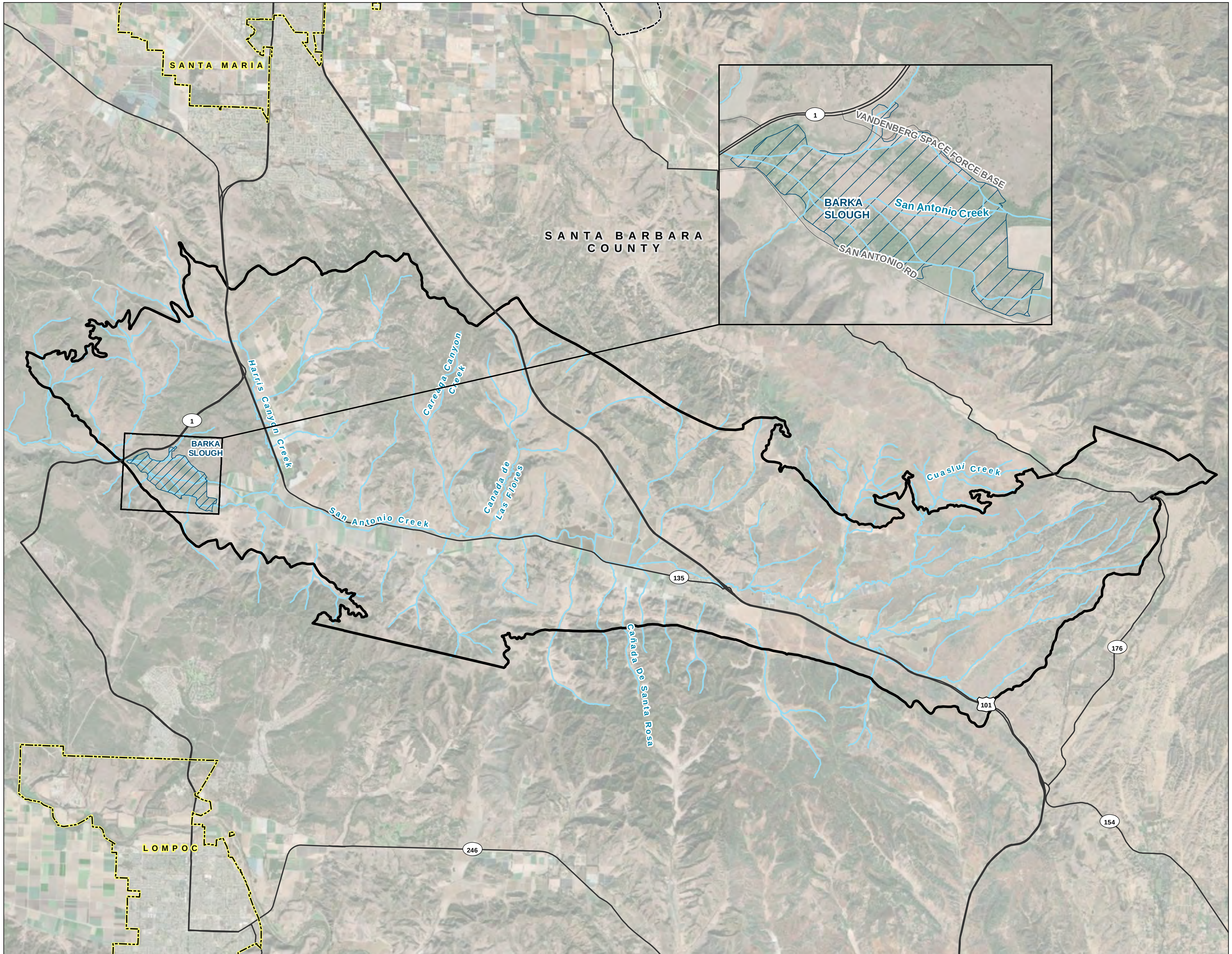

FIGURE 3-3

Surface Water Features of the San Antonio Creek Valley Groundwater Basin

Groundwater Sustainability Plan
San Antonio Creek Valley
Groundwater Basin

LEGEND

San Antonio Creek or Adjacent Tributary

Barka Slough

San Antonio Creek Valley Groundwater Basin

All Other Features

County Boundary

City Boundary

Major Road

NOTE

San Antonio Creek Valley Groundwater Basin Boundary as defined in the California Department of Water Resources Bulletin 118.

N

0 5,000 10,000 15,000
Feet

Date: November 18, 2021
Data Sources: USGS (2020b), ESRI, DWR (2018a), Maxar imagery (2020)

GSI Water Solutions, Inc.

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3.1.2 Regional Geology [§ 354.14(b)(1),(d)(2), and (d)(3)]

§ 354.14 Hydrogeological Conceptual Model.

(b) The hydrogeologic conceptual model shall be summarized in a written description that includes the following:

(1) The regional geologic and structural setting of the basin including the immediate surrounding area, as necessary for geologic consistency.

(d) Physical characteristics of the basin shall be represented on one or more maps that depict the following:

(2) Surficial geology derived from a qualified map including the locations of cross-sections required by this Section.

(3) Soil characteristics as described by the appropriate Natural Resources Conservation Service soil survey or other applicable studies.

This section provides a description of the geologic formations in the Basin. These descriptions are summarized from previously published reports (Muir, 1964; Hutchinson, 1980). Figure 3-4 shows the surficial geology and geologic structures of the Basin, as well as the locations of the geologic cross sections shown on Figure 3-5 (USGS, 2020c).

The selected geologic cross sections illustrate the relationship of the geologic formations that constitute the Basin and the geologic formations that underlie and surround the Basin. The cross sections are based on lithologic data from outcrops, wells, and exploratory borings. The cross sections were generated by the USGS as part of the San Antonio Creek Geohydrologic Framework Model (USGS, 2020c). The USGS is in the process of calibrating a groundwater model—corresponding to the San Antonio Creek Geohydrologic Framework Model—that was developed subsequent to, and based on, the cross sections and base map included in this GSP.

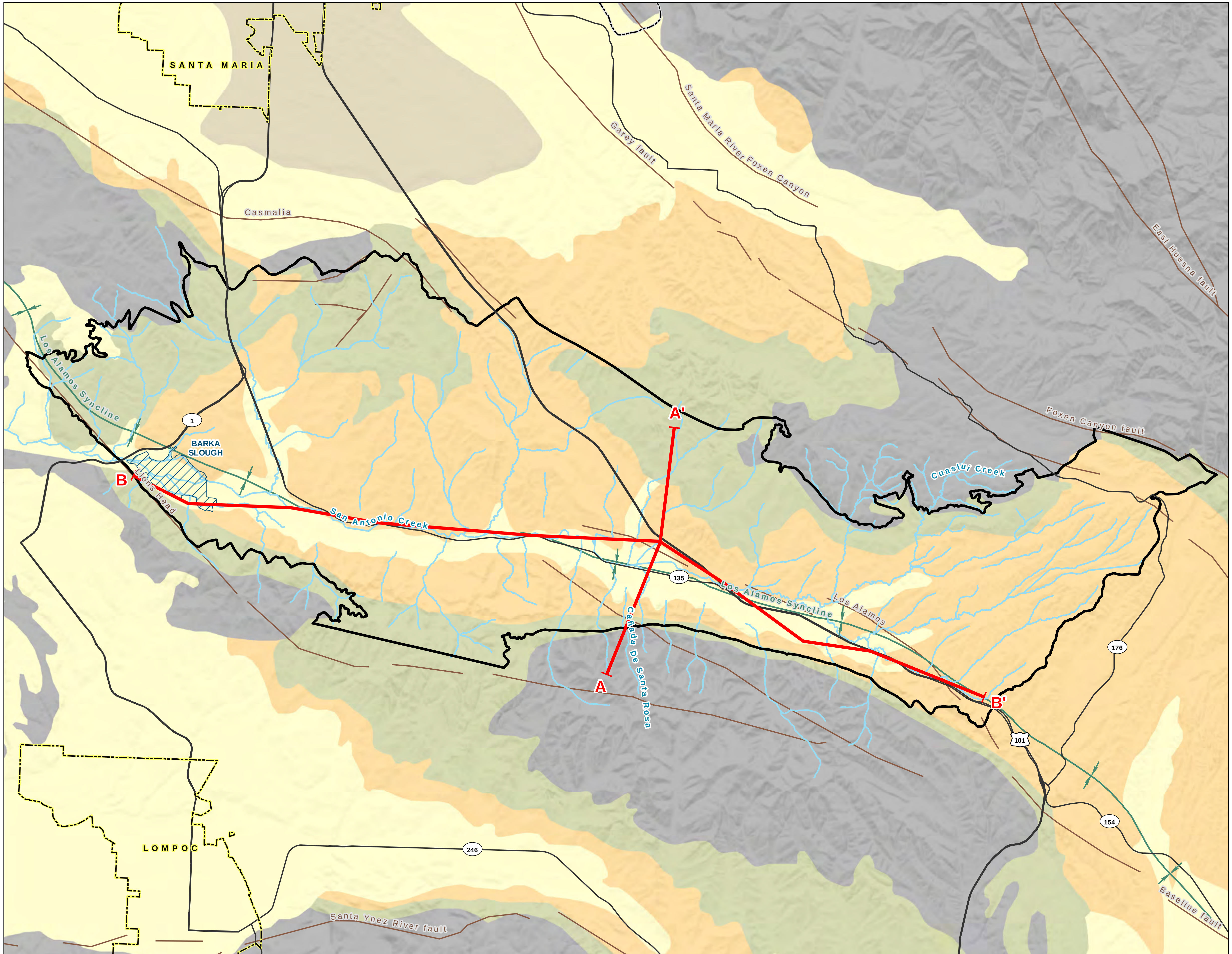

FIGURE 3-4

Geologic Map of the San Antonio Creek Valley Groundwater Basin

Groundwater Sustainability Plan
San Antonio Creek Valley
Groundwater Basin

LEGEND

- Cross Section Line
- San Antonio Creek or Adjacent Tributary
- Barka Slough
- B118 San Antonio Creek Valley Groundwater Basin

Geology

- Fault
- Syncline
- Channel Alluvium
- Paso Robles Formation
- Lake Deposits
- Careaga Sand
- Bedrock

All Other Features

- County Boundary
- City Boundary
- Major Road

NOTES

1. San Antonio Creek Valley Groundwater Basin Boundary as defined in the California Department of Water Resources Bulletin 118.
2. Geologic cross sections shown on Figure 3-5.

N

0 5,000 10,000 15,000
Feet

Date: September 16, 2021
Data Sources: USGS (2020c), ESRI, DWR (2018a), Dibblee & Ehrenspeck (1974, 1989, 1993, 1994)

GSI Water Solutions, Inc.

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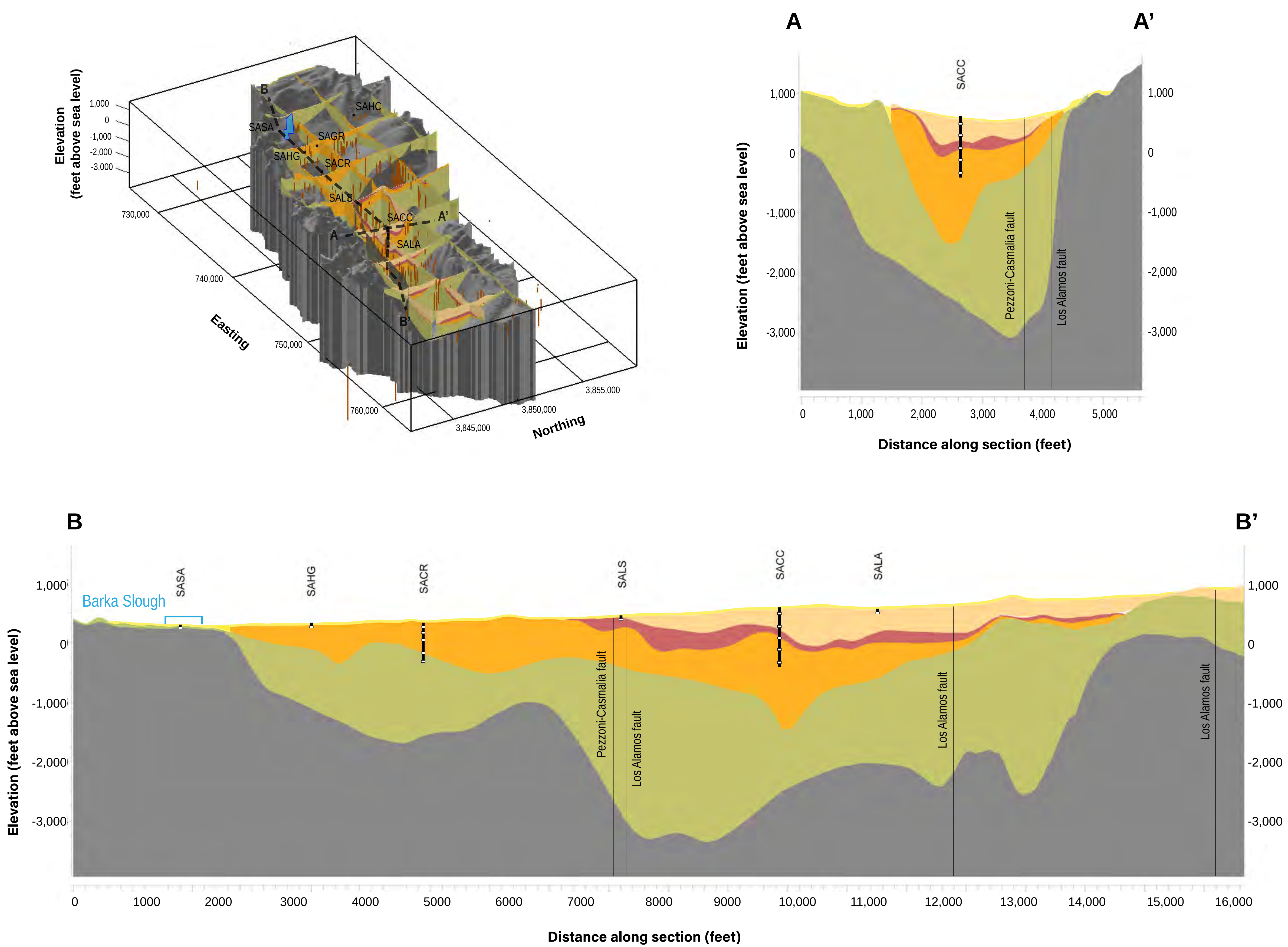

FIGURE 3-5

Geologic Cross Sections, San Antonio Creek Valley Groundwater Basin

Groundwater Sustainability Plan
San Antonio Creek Valley
Groundwater Basin

LEGEND

- Channel Alluvium
- Upper member - Paso Robles Formation
- Middle member - Paso Robles Formation
- Lower member - Paso Robles Formation
- Careaga Sand
- Consolidated bedrock

WELL LEGEND

← Screen

NOTE
Geologic cross section locations shown on Figure 3-4.

Date: September 16, 2021
Data Sources: USGS (2020c)

GSI Water Solutions, Inc.

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3.1.2.1 Regional Geologic Structures

The Basin has undergone significant deformation (folding and faulting) caused by compressional forces resulting in a series of anticlines, synclines, and faults. This region is located between the Coast Ranges (San Rafael Mountains) Geomorphic Province on the northeast and the Transverse Ranges (Santa Ynez Mountains) Geomorphic Province on the south (Muir, 1964).

The topographic expression of the valley is caused by two nearly parallel underlying synclines (downwarped geological units), the Los Alamos and San Antonio Synclines. The synclines include Miocene-to-Holocene-aged deposits and may be thought of as an elongated bowl with the thickest and deepest portion located along the center axis. The axis of the northwest-trending Los Alamos Syncline is nearly coincident with the axis of the valley and passes through the town of Los Alamos. Deposits along the axis of the syncline reach a thickness of approximately 10,000 ft. The north side of the syncline has a gentle southward dip, whereas the south side has a steep northward dip that is overturned in the vicinity of Los Alamos. The Los Alamos Syncline extends eastward into the Santa Ynez Valley near Los Olivos. The San Antonio Syncline trends northwest and is located south of Harris Canyon. East of Harris Canyon, the axis of the San Antonio Syncline is along the south flank of the valley. A few miles west of Harris Canyon, the axis of the syncline trends northwest and passes through the town of Casmalia. The limbs of the syncline generally have moderate dips (Muir, 1964).

The geology shown on Figure 3-4 was provided by the USGS (USGS, 2020c) and did not depict the location of the Los Alamos or San Antonio Synclines. The projection of the Los Alamos Syncline shown on Figure 3-4 was added based on Dibblee and Ehrenspeck, 1989, 1993a, 1993b, and Dibblee et al., 1994, who surveyed the Los Alamos and San Antonio Syncline as a single geologic structure.

The flanking Casmalia Hills, Solomon Hills, and Purisima Hills are northwest-trending anticlines (upwarped geologic units). A number of faults have been identified in the hills that flank the valley; however, they are not discussed in this GSP because they have not been observed to control the occurrence or movement of groundwater in the Basin (Muir, 1964).

3.1.2.2 Geologic Formations Within the Basin

Geologic formations in the Basin are described in this section and shown in map view on Figure 3-4 (geologic map) and in cross-sectional view on Figure 3-5.

Alluvium

Holocene alluvium underlies the valley, primarily along the San Antonio Creek and its tributary canyons. It rests unconformably on older deposits, including the Paso Robles Formation and Careaga Sand.[15] The alluvium consists of unconsolidated clay, silt, sand, and gravel and is typically coarser-textured east of Harris Canyon than west. A semi-continuous gravel bed at the base of the alluvium ranges from approximately 5 to 15 ft in thickness. The alluvium ranges in thickness up to approximately 100 ft with an average thickness of approximately 80 ft. Near the town of Los Alamos, the alluvium is approximately 90 ft thick and observed to thin to approximately 65 ft between Harris Canyon and the Marshallia Ranch. The alluvium rests on consolidated Tertiary rocks west of Harris Canyon (Muir, 1964).

[15] A conformity and unconformity are geology terms—specifically relating to stratigraphy—that describe a geologic contact between two rock layers with respect to the geologic record. If there is a large time gap between two layers, the contact is referred to as an unconformity. Large time gaps between rock units can be caused by periods of non-deposition or erosion. Conversely, if the age of rock layers indicate there is no time gap in the geologic record, the contact is referred to as a conformity.

Paso Robles Formation

The Paso Robles Formation is present within the downwarped Los Alamos Syncline underlying the San Antonio Creek Valley and outcrops in large areas along the valley flanks and in the adjacent Solomon Hills, Casmalia Hills, and Zaca Canyon. The Paso Robles Formation is Pliocene to Pleistocene in age and is the oldest nonmarine deposit in the Basin. The overlying formations rest unconformably on the Paso Robles Formation, while the Paso Robles Formation rests conformably on the Careaga Sand. The Paso Robles Formation is distinguished from the underlying Careaga Sand by its heterogeneity and the lack of marine megafossils; as well, its greater degree of deformation distinguishes it from the overlying younger formations. The Paso Robles Formation consists of poorly consolidated stream-deposited lenticular beds of gravel, sand, silt, and clay. Generally, the sand is cross bedded, poorly sorted, silty, and includes stringers of coarse sand and small pebbles. The lower part of the formation contains occasional beds of freshwater limestone ranging in thickness from approximately 1 to 30 ft. The Paso Robles Formation is about 2,000 ft thick beneath the central part of the Basin (Muir, 1964).

As shown on Figure 3-5, the USGS divided the Paso Robles Formation into three members (unofficial geologic units) during development of the San Antonio Creek Geohydrologic Framework Model (USGS, 2020c) based on differences in lithologic and hydraulic properties. The middle member of the Paso Robles Formation was identified as a confining layer inhibiting vertical flow of groundwater in the Paso Robles Formation.

Careaga Sand

The late Pliocene-age Careaga Sand outcrops extensively in the Purisima Hills and in large areas in the Solomon and Casmalia Hills and underlies the Paso Robles Formation in the Basin. The exposed Careaga Sand dips northward in the Purisima Hills and passes under the San Antonio Creek Valley at a depth of several thousand feet. The Careaga Sand is predominately of marine origin and has undergone considerable deformation in the Purisima Hills and the western area of the Solomon Hills; however little deformation of the Careaga Sand has been observed elsewhere in the Basin. Two members have been identified in the Careaga Sand: a fine-grained lower member, Cebada; and a coarse-grained upper member, Graciosa. Geologically, the two members are often mapped together, as is done in this GSP. The Careaga Sand rests conformably on the Foxen Mudstone west of the Graciosa Canyon-Harris Canyon divide and in the central and western Purisima Hills. Elsewhere in the valley, the Careaga Sand rests unconformably on the Sisquoc Formation. The Careaga Sand is distinguished from the underlying formations by its coarser-grained texture and its lesser degree of consolidation. It is distinguished from the overlying Paso Robles Formation by the uniformity of its grain size and its marine megafossils. The Careaga Sand is a gray-white to yellow-buff loosely consolidated massive fine- to medium-grained sand containing some silt and abundant well-rounded pebbles in the upper member. The pebbles are quartzite, porphyritic igneous rocks, chert, and shale of the Monterey Formation. Numerous megafossils are contained in the formation. The Careaga Sand has its maximum exposed thickness in the Purisima Hills, where it is approximately 1,425 ft thick. Northward, passing under the valley, it thins to approximately 1,000 ft, and still farther north beyond the basin boundary, under the Solomon and Casmalia Hills, it is approximately 700 ft thick (Muir, 1964).

3.1.2.3 Geologic Formations Surrounding the Basin

Underlying and surrounding the Basin are older geologic formations that are considered consolidated and impermeable. In general, the geologic units underlying the Basin include Miocene- to Pliocene-age consolidated sedimentary beds.

Figure 3-6 (DOC, 2020) shows the approximate location of active and idle oil and gas wells drilled in the Basin. These oil and gas wells help identify the depth and extent of the deeper geologic formations that surround and underlie the Basin. Figure 3-7 (Sweetkind, et al., 2010) shows a generalized regional geologic cross section based on available stratigraphic data from oil and gas wells.

Foxen Mudstone

The middle to late Pliocene-age Foxen Mudstone is marine in origin, rests conformably on the Sisquoc Formation, and is exposed in the Purisima and Casmalia Hills. In the Purisima Hills, the formation consists of mudstone and siltstone with increasing sand content west of State Highway 1. The Foxen Mudstone is estimated to be approximately 800 ft thick in the western region of the Purisima Hills but thins to the east and disappears in the central region of the Purisima Hills (Muir, 1964).

Sisquoc Formation

The Sisquoc Formation is a late-Miocene to early- and middle-Pliocene-age marine deposit that rests unconformably on the Monterey Formation. It underlies all of the valley and is exposed along the north flank of the Purisima Hills, in Foxen Canyon, and in the Casmalia Hills. It underlies the Burton Mesa and San Antonio Terrace. In the western region of the valley, the formation is covered by a veneer of younger deposits. Under the central and western valley, the formation lies at a suspected depth of approximately 3,000 ft to 4,000 ft below the land surface. The Sisquoc Formation is predominantly made up of diatomaceous mudstone, porcelaneous shale, mudstone, laminated diatomite, sandstone, and diatomaceous siltstone (Muir, 1964).

Monterey Formation

The Monterey Formation is a middle- and late-Miocene-age marine deposit. It is the principal source rock for petroleum in the region. The formation underlies the entire region and forms the core of the Casmalia, Solomon, and Purisima Hills. Two members have been described in the Monterey Formation. The lower member is composed of thin-bedded chert and cherty shale interbedded with porcelaneous shale and is of unknown thickness. The upper member is composed of either porcelaneous shale containing layers of thin-bedded concretionary limestone or porcelaneous shale overlain by laminated diatomite and diatomaceous shale and is approximately 1,000 ft thick. The base of the Monterey Formation is not exposed in the valley; therefore, its relationship to older, underlying rocks is not known (Muir, 1964). According to oil and gas well and exploratory boring logs available from the California Department of Conservation, Geologic Energy Management Division online Well Finder, or WellSTAR, tool, the top of the Monterey Formation ranges from approximately 6,500 ft (American Petroleum Institute [API] well number 08321976) below ground surface in the uplands east of Harris Canyon to 10,000 ft below ground surface (API well numbers 08322648 and 08322388) near Los Alamos and along the San Antonio Creek in the Basin.

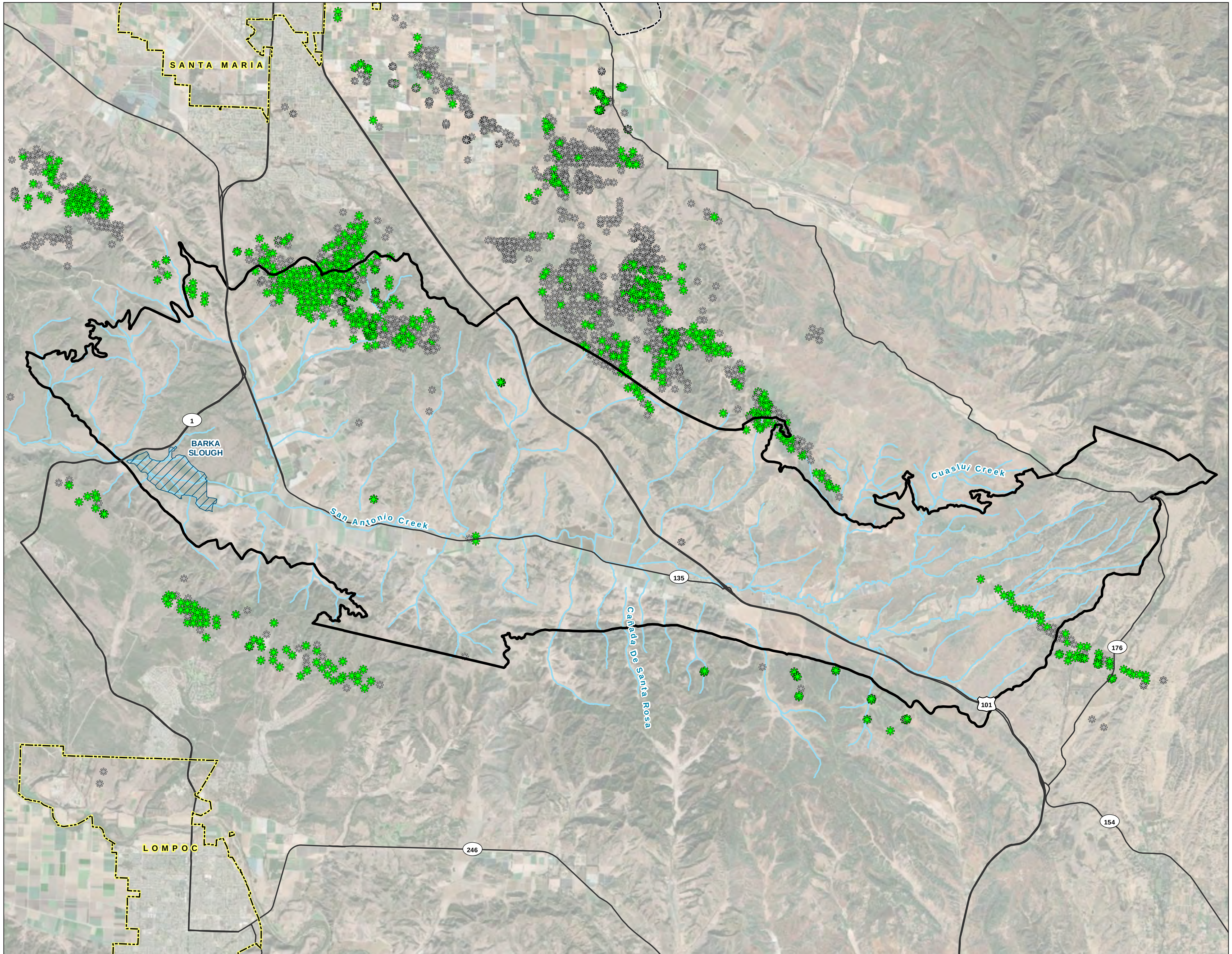

FIGURE 3-6

Oil and Gas Wells of the San Antonio Creek Valley Groundwater Basin

Groundwater Sustainability Plan
San Antonio Creek Valley
Groundwater Basin

LEGEND

WellStatus

- Active
- Idle

All Other Features

- San Antonio Creek or Adjacent Tributary
- Barka Slough
- San Antonio Creek Valley Groundwater Basin
- County Boundary
- City Boundary
- Major Road

NOTE

San Antonio Creek Valley Groundwater Basin Boundary as defined in the California Department of Water Resources Bulletin 118.

N

0 5,000 10,000 15,000
Feet

Date: September 16, 2021
Data Sources: USGS (2020b), ESRI, DWR (2018a), Department of Conservation (2020), Maxar imagery (2020)

GSI Water Solutions, Inc.

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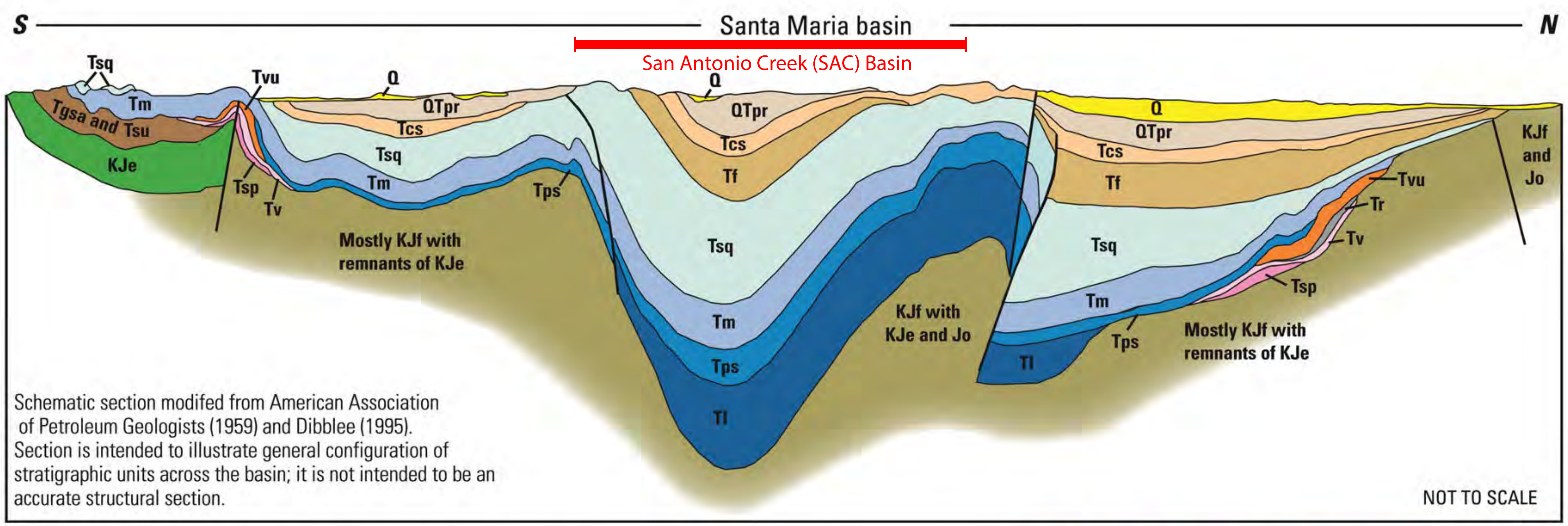
FIGURE 3-7

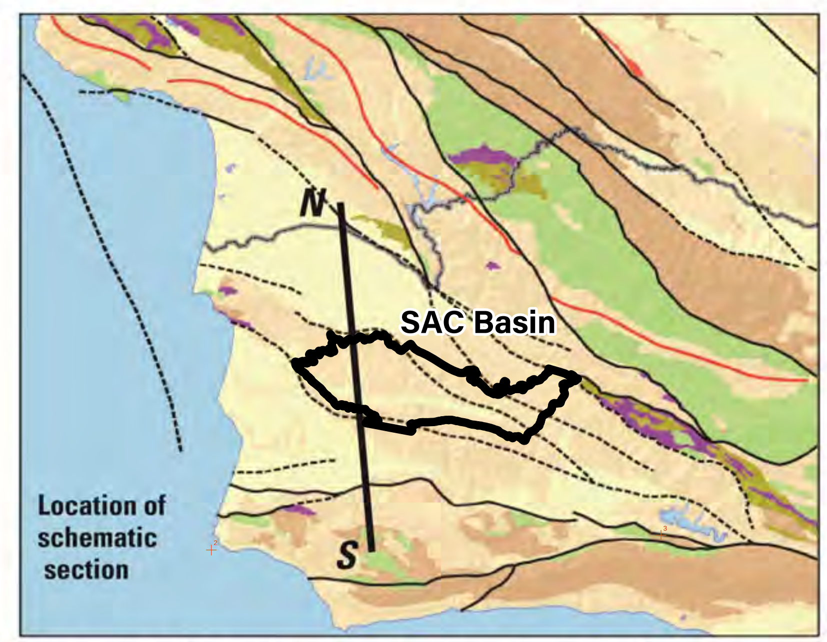
Regional Geologic Cross-Section from San Antonio Creek Valley Oil and Gas Well Stratigraphic Data

Groundwater Sustainability Plan
San Antonio Creek Valley
Groundwater Basin



Stratigraphic units shown are those compiled in data tables:

Q : Undivided Quaternary deposits
QTpr : Paso Robles Formation
Tcs : Careaga Sandstone
Tf : Foxen Mudstone
Tsq : Sisquoc Formation
Tm : Monterey Formation
Tps : Point Sal Formation
Tl : Lospe Formation
Tvu : Miocene volcanic rocks, undivided
Tr : Rincon Shale
Tv : Vaqueros Formation
Tsp: Sespe Formation
Tgsa : Gaviota Formation
Tsu: Eocene marine sandstones, undivided
KJe : Espada Formation
KJf : Franciscan Complex
Jo : Jurassic ophiolite



Date: September 16, 2021
Data Sources: Sweetkind et al. (2010)

GSI Water Solutions, Inc.

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3.1.3 Principal Aquifers and Aquitards [§ 354.14(b)(4)(A)(B)(C)]

§ 354.14 Hydrogeological Conceptual Model.

(b) The hydrogeologic conceptual model shall be summarized in a written description that includes the following:

(4) Principal aquifers and aquitards, including the following information:

(A) Formation names, if defined.

(B) Physical properties of aquifers and aquitards, including the vertical and lateral extent, hydraulic conductivity, and storativity, which may be based on existing technical studies or other best available information.

(C) Structural properties of the basin that restrict groundwater flow within the principal aquifers, including information regarding stratigraphic changes, truncation of units, or other features.

Water-bearing sand and gravel beds that may or may not be laterally and vertically continuous are generally grouped together into zones that are referred to as aquifers. The aquifers can be vertically separated by fine-grained zones that can impede movement of groundwater between aquifers. These are referred to as aquitards. Two principal aquifers have been identified in the Basin:

- The Paso Robles Formation
- The Careaga Sand

The alluvium may be water bearing, particularly in the lower reaches of San Antonio Creek, because it receives recharge from San Antonio Creek; however, it is not considered a principal aquifer because there are no known wells completed in this unit and it does not produce sufficient quantities of water to support agricultural operations.

3.1.3.1 Physical Properties of the Aquifers and Aquitards

Paso Robles Formation

The Paso Robles Formation is approximately 2,000 ft thick and much of it is saturated. Large exposures of the formation north and east of the valley receive direct infiltration of rainfall, particularly in upper elevations. The Paso Robles Formation is likely also recharged by seepage from the alluvium present beneath San Antonio Creek and its tributaries and from upward leakage from the underlying Careaga Sand in some areas of the Basin. Vertical heterogeneity in the water-bearing properties of the Paso Robles Formation is the result of coarse-grained beds that yield water freely to wells alternating with fine-grained beds that do not. Higher well yields are typically attributed to the wells that penetrate several of the coarse-grained lenses. Yields of 500 gallons per minute (gpm) and specific capacities of 5 gpm to 15 gallons per minute per foot (gpm/ft) of drawdown are common (see Table 3-1. Principal Aquifer Hydrologic Properties). A storage coefficient of 0.15 was calculated for the Paso Robles Formation (Martin, 1985). Historically, artesian groundwater occurred locally in the Paso Robles Formation (Muir, 1964). Artesian conditions exist presently within the Paso Robles Formation (although, they are less frequently observed than in the past) and were observed in a completed agricultural well as recently as 2020. Dependent on location within the Basin, artesian conditions are due to localized confining layers created by the synclinal structure of the

Basin, the presence of overlying fine-grained deposits, and or faults present within the Basin, such as the Los Alamos Fault and the Pezzoni-Casmalia Fault (Carlson, 2019) (USGS, 2021a).

Careaga Sand

The Careaga Sand is approximately 1,500 ft thick and much of the formation is saturated. There are large exposures of the formation in the Purisima Hills, Solomon Hills, and the Casmalia Hills that receive direct infiltration of rainfall at higher elevations. The formation passes below the valley at a depth of several thousand feet. The upper member of the Careaga Sand is coarse grained and uniformly graded. The Careaga Sand has a large storage capacity and transmits water readily to wells and to the overlying younger formations (Muir, 1964). Yields of less than 100 and exceeding 1,000 gpm and specific capacities of less than 10 to more than 30 gpm/ft of drawdown have been measured in wells completed in the Careaga Sand (see Table 3-1. Principal Aquifer Hydrologic Properties). A storage coefficient of 0.001 for the confined portion (Barka Slough area) of the Careaga Sand was calculated (Martin, 1985).

3.1.3.2 Basin Boundary (Vertical and Lateral Extent of Basin) [§ 354.14(b)(2),(b)(3),(b)(4)(B), and (c)]

§ 354.14 Hydrogeological Conceptual Model.

(b) The hydrogeologic conceptual model shall be summarized in a written description that includes the following:

(2) Lateral basin boundaries, including major geologic features that significantly affect groundwater flow.

(3) The definable bottom of the basin.

(4) Principal aquifers and aquitards, including the following information:

(B) Physical properties of aquifers and aquitards, including the vertical and lateral extent, hydraulic conductivity, and storativity, which may be based on existing technical studies or other best available information.

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

The groundwater basin includes an area of approximately 130 square miles (DWR, 2003). Similar to the Basin's watershed, the groundwater basin is structurally controlled by the underlying Los Alamos Syncline (Hutchinson, 1980).

Figure 3-1 shows the lateral boundaries of the groundwater basin as defined by DWR in Bulletin 118. The groundwater basin boundary is controlled by the outcropping of bedrock of the Los Alamos Syncline.

The bottom of the groundwater basin is generally defined as the base of the Pliocene-age Careaga Sand. The Basin bottom is considered a barrier to flow because the geologic units underlying the Careaga Sand are considered impermeable and produce limited quantities of water. In addition, groundwater is generally suspected to be of poor quality (Muir, 1964). Therefore, these units are not considered part of the Basin.

Figure 3-5 includes geological cross sections that illustrate the vertical boundaries of the Basin and the approximate depth to the bottom of the Careaga Sand.

The Basin lateral boundaries are as follows:

- The western boundary of the Basin is defined by a bedrock ridge underlying the western edge of the Barka Slough. The bedrock ridge forces virtually all groundwater to the surface as base flow in the San Antonio Creek or as vertical flux into the Barka Slough.
- The northern boundary of the Basin is defined by the outcropping of the impermeable consolidated bedrock underlying the Careaga Sand in the Casmalia and Solomon Hills.
- The eastern boundary of the Basin is defined by the outcropping of the impermeable consolidated bedrock underlying the Careaga Sand in the San Rafael Mountains.
- The southern boundary is defined by the outcropping of the impermeable consolidated bedrock underlying the Careaga Sand in the Purisima Hills.

Groundwater Flow Barriers [§ 354.14(b)(4)(C) and (c)]

§ 354.14 Hydrogeological Conceptual Model.

(b) The hydrogeologic conceptual model shall be summarized in a written description that includes the following:

(2) Lateral basin boundaries, including major geologic features that significantly affect groundwater flow.

(3) The definable bottom of the basin.

(4) Principal aquifers and aquitards, including the following information:

(C) Structural properties of the basin that restrict groundwater flow within the principal aquifers, including information regarding stratigraphic changes, truncation of units, or other features.

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

Dependent on location within the Basin, groundwater flow barriers exist due to localized confining layers created by the synclinal structure of the Basin, the presence of overlying fine-grained deposits, and or faults, such as the Los Alamos Fault and the Pezzoni-Casmalia Fault, present within the Basin (Carlson, 2019) (USGS, 2021a).

The Paso Robles Formation consists of stream-deposited lenticular beds of gravel, sand, silt, and clay. Generally, the sand is cross bedded, poorly sorted, silty, and includes stringers of coarse sand and small pebbles. Conceptually, the presence of laterally continuous zones of fine-grained strata within the aquifers can restrict vertical movement of groundwater. Fine-grained and coarse-grained zones have been identified within the Paso Robles Formation; however, these zones are generally not laterally continuous. The sediments of the Paso Robles Formation are heterogenous and have undergone a high degree of deformation. Vertical heterogeneity in the water-bearing properties of the Paso Robles Formation is the result of coarse-grained beds that yield water freely to wells alternating with fine-grained beds that do not.

These fine-grained zones act as confining beds and are the cause of the artesian conditions that were historically reported in some wells screened within the Paso Robles Formation. The lower part of the Paso Robles Formation contains occasional beds of limestone ranging in thickness from approximately 1 to 30 ft that may restrict vertical movement of groundwater.

As shown on Figure 3-5, the USGS divided the Paso Robles Formation into three members (unofficial geologic units) during development of the San Antonio Creek Geohydrologic Framework Model (USGS, 2020c) based on differences in lithologic and hydraulic properties. The middle member of the Paso Robles Formation was identified as a confining layer inhibiting vertical flow of groundwater within the Paso Robles Formation.

The Careaga Sand consists of fine- to medium-grained sand with some silt and abundant pebbles. Lithologic logs from wells drilled into this unit do not show that confining beds are present within the Careaga Sand that may create barriers to flow.

A number of faults and folds have been mapped in the valley; however, they are not discussed in this GSP because there is no evidence that they control the occurrence or movement of groundwater in the Basin (Muir, 1964). However, folding and uplift have brought low-permeability bedrock units to the ground surface on the north and south sides of the Basin, which prevents groundwater movement from adjacent groundwater basins into the Basin. On the west end of the Basin, faulting has brought bedrock units closer to the surface, thus forming a barrier to westward groundwater flow. This barrier causes groundwater to upwell and discharge into Barka Slough. On the east end of the Basin, there is a small segment where there could be groundwater interaction with an adjacent groundwater subbasin, the Eastern Management Area (EMA) of the Santa Ynez Groundwater Basin as well as the San Antonio Basin. Preliminary reporting of the USGS numerical groundwater model (during calibration of the model) indicate that, to reasonably simulate hydraulic head conditions in well 22J1—located along the northwest boundary of the Basin (see Figure 3-11)—a source of water from outside the model area that supplied water to two cells was simulated. It was assumed that groundwater pumping in 22J1 induced the groundwater flow from the EMA of the Santa Ynez Groundwater Basin through hydrologically connected aquifer material. The rate of flow was equal to the difference in hydraulic head and regulated by a specific hydraulic conductance (Woolfenden et al., 2021). Because the segment identified is small, and potential flow is assumed to be induced by pumping in a single well, the amount of groundwater inflow to the Basin from the EMA is considered negligible and will be further evaluated upon finalization of the USGS numerical groundwater model.

Hydraulic Properties [§ 354.14(b)(4)(B)]

§ 354.14 Hydrogeological Conceptual Model.

(b) The hydrogeologic conceptual model shall be summarized in a written description that includes the following:

(4) Principal aquifers and aquitards, including the following information:

(B) Physical properties of aquifers and aquitards, including the vertical and lateral extent, hydraulic conductivity, and storativity, which may be based on existing technical studies or other best available information.

Historical data sources published by the USGS, constant rate pumping test data provided by the Los Alamos Community Services District (LACSD), and hydraulic properties calculated for Four Deer Ranch and VSFB were reviewed to determine the hydraulic properties of the Paso Robles Formation and the Careaga Sand aquifers. Pumping tests referred to in the historical USGS reports were not available and did not discern the aquifer(s) in which the respective wells were completed. Additionally, historical USGS reports extend the Basin west to the Pacific Ocean coastline, which does not align with the current western boundary of the Basin as defined in the DWR Bulletin 118. Only constant rate pumping test data for wells LASCD 3a and 5 were available and complete for review. These wells are completed within the Paso Robles Formation. The results of the LACSD constant rate pumping test and analysis are included in Appendix D. The results of the Four Deer Ranch and VSFB well field pumping tests are also included in Appendix D.

Estimated aquifer properties based on the review of the data sources discussed above are summarized in Section 3.1.3.1 and Table 3-1. Table 3-1 includes the following characteristics:

- **Specific capacity:** the rate of discharge of a water well per unit of water level drawdown (gallons per minute per foot of drawdown).
- **Storativity:** the volume of water an aquifer releases from, or takes into, storage per unit surface area of the aquifer per unit change in head.
- **Transmissivity:** the rate at which water is transmitted through a unit width of an aquifer under a unit hydraulic gradient.
- **Hydraulic conductivity:** the rate of flow of water in gallons per day through a cross section of 1 square ft under a unit hydraulic gradient.

Table 3-1. Principal Aquifer Hydraulic Properties

Well Name	Aquifer	Test Duration (hours)	Flow (gpm)	Drawdown (ft)	Well Depth (ft bgs)	Screened Interval (ft bgs)	Total Screened Interval (ft)	Specific Capacity (gpm/ft)	Transmissivity (ft^2/day)	Hydraulic Conductivity (ft/day)
LACSD 3[1,4,5]	Paso Robles Formation	—	330	57	—	—	—	6	1,604	—
LACSD 3a[2,3]		24	401	69	510	180–300 320–400 420–510	290	6	1,920	7
LACSD 4[4,5]		—	323	79	535	230–530	300	4	1,093	4
LACSD 5[2,3]		24	785	112	962	217–352 502–702 792–952	395	7	2,706	5
LACSD 6[4,5]		—	624	96	959	196–296 338–700 823–959	598	6	1,738	3
4 - Deer (Ex Ag – 2) [5,6]	Careaga Sand	—	100	10	460	220–460	240	10	2,674	11
4 - Deer – (New Ag – 2)[5,6]		—	900	32	455	100–450	350	28	7,520	21
4 -Deer – (New Ag 3)[5,6]		—	750	46	455	100–480	380	16	4,359	11
4 - Deer Field (New Ag - 4)[5,6]		—	900	124	600	100–440	340	7	1,941	6
4 - Deer Highway (Ex Ag - 1)[5,6]		—	38	3	460	240–460	220	13	3,387	15
VSFB Well #4[5,7]		2.3	956	54	334	162–219 234–273 319–334	111	18	4,734	43
VSFB Well #7[5,7]		3	1,200	37.85	410	200–210 220–230 270–290 300–320 330–340 350–360 370–390	190	32	8,477	45
VSFB Well #6[5,7]		4	684	33.5	—	210–390	180	20	5,459	30
VSFB Well #5[5,7]		3.1	768	46.5	400	200–390	110	17	4,416	40

Notes

[1] LACSD 3 was taken offline in 2010 replaced with LACSD 3A.
[2] Transmissivity and hydraulic conductivity were calculated using the modified Cooper-Jacob Nonequilibrium Equation (Driscoll, 1986)
[3] Value for flow is an arithmetic mean of pumping rates during pump tests after well construction activities:

- LACSD 3A: A & A Pump & Well Service, (2010). Constant Run 24hr+.
- LACSD 5: Cleath & Associates, (2006). Well construction and testing report for St. Joseph Street Well #5, Los Alamos Community Services District, Santa Barbara County, December.

[4] Specific capacity was calculated using mean production and water level data provided by the LACSD.
[5] Hydraulic conductivity was calculated by using the following equation (Driscoll, 1986):
K = T / B

- K = Hydraulic conductivity (feet per day)
- T = Transmissivity (square feet per day)
- B = Aquifer thickness or screened interval (feet)

Transmissivity and specific capacity were calculated using the following formula (Driscoll, 1986):
T = [(Q/s) x 2,000] / 7.48

- T = Transmissivity, in gallons per day per foot (gpd/ft)
- Q/s = Specific Capacity, in gallons per minute per foot (gpm/ft)
- 2,000 = Constant for confined aquifers
- 7.48 = Conversion from gallons per day per foot to square feet per day.

[6] From Katherman Exploration Co., LLC, 2009.
[7] Christian Mathews, Operations Manager, American Water, for Vandenberg Space Force Base, personal communication, Friday, June 18, 2021.
— = No value on record or uncalculated
Ag = Agricultural well
Ex = Existing
ft = feet
ft bgs = feet below ground surface
ft/day = feet per day
ft^2/day = square feet per day
gpd/ft = gallons per day per foot
gpm = gallon per minute
gpm/ft = gallons per minute per foot
LACSD = Los Alamos Community Services District
VSFB = Vandenberg Space Force Base

Reference

Driscoll, F. G. *Groundwater and Wells, Second Edition*. (St. Paul, Minnesota; Johnson Screens; 1986).

Based on the LACSD pumping test data for LACSD wells, the estimated transmissivity of the Paso Robles Formation ranges between approximately 1,093 square feet per day (ft^2/day) and 2,706 ft^2/day. The geometric mean of the Paso Robles Formation transmissivity values is approximately 1,738 ft^2/day. The estimated hydraulic conductivity of the Paso Robles Formation ranges from 3 feet per day (ft/d) to 7 ft/d. The estimated specific capacity of the Paso Robles Formation ranges from 4 gpm/ft to 7 gpm/ft. The geometric mean of the specific capacity values for the Paso Robles Formation is 6 gpm/ft.

The estimated transmissivity of the Careaga Sand (based on pumping test data summarized in Table 3-1) ranges between approximately 1,941 ft^2/day and 8,477 ft^2/day. The geometric mean of the Careaga Sand transmissivity values is approximately 4,350 ft^2/day. The estimated hydraulic conductivity of the Careaga Sand ranges from 5 ft/d to 45 ft/d. The geometric mean of the hydraulic conductivity values for the Careaga Sand is 20 ft/d. The estimated specific capacity of the Careaga Sand ranges from 7 gpm/ft to 32 gpm/ft. The geometric mean of the specific capacity values for the Careaga Sand is 16 gpm/ft.

The LACSD also provided water level and production data for wells in the LACSD-operated wellfield. The LACSD wellfield provides drinking water to the town of Los Alamos. Table 3-1 lists calculated hydraulic properties values and well construction details for the LACSD wells using the gaging and production data (also referred to as specific capacity data) previously mentioned. All four LACSD wells are screened entirely within the Paso Robles Formation.

3.1.3.3 Groundwater Recharge and Discharge Areas [§ 354.14(d)(4)]

§ 354.14 Hydrogeological Conceptual Model.

(d) Physical characteristics of the basin shall be represented on one or more maps that depict the following:

(4) Delineation of existing recharge areas that substantially contribute to the replenishment of the basin, potential recharge areas, and discharge areas, including significant active springs, seeps, and wetlands within or adjacent to the basin.

Areas of significant natural areal recharge and discharge within the Basin are discussed below. Quantitative information about natural and anthropogenic recharge and discharge is provided in Section 3.3.

Groundwater Recharge Areas Inside the Basin

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

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

Figure 3-8 is a map that ranks soil suitability to accommodate groundwater recharge based on five major factors that affect recharge potential, including deep percolation, root zone residence time, topography, chemical limitations, and soil surface condition. The map was developed by the California Soil Resource Lab at University of California (UC) Davis and the UC Agricultural and Natural Resources Department. Areas with soils that have excellent recharge properties are shown in dark green, moderate recharge properties are shown in yellow, and areas with poor recharge properties are shown in orange and red.

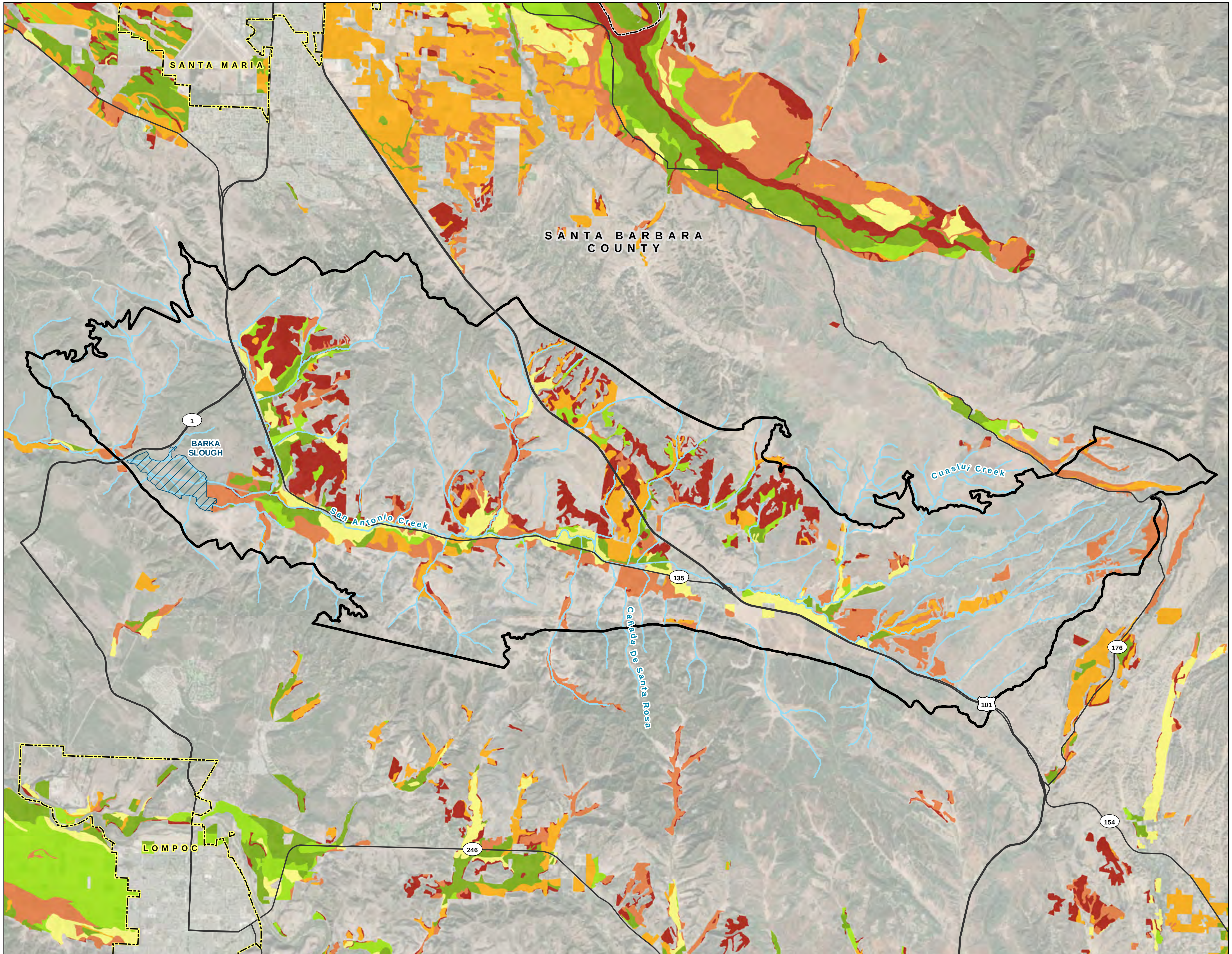


FIGURE 3-8

Potential Recharge Areas

Groundwater Sustainability Plan
San Antonio Creek Valley
Groundwater Basin

LEGEND

Soil Agriculture Groundwater Banking Index (SAGBI) Rating

- Excellent (86 - 100)
- Good (70 - 85)
- Moderately Good (50 - 69)
- Moderately Poor (30 - 49)
- Poor (16 - 29)
- Very Poor (0 - 15)

All Other Features

- San Antonio Creek or Adjacent Tributary
- Barka Slough
- San Antonio Creek Valley Groundwater Basin
- County Boundary
- City Boundary
- Major Road

NOTE

San Antonio Creek Valley Groundwater Basin Boundary as defined in the California Department of Water Resources Bulletin 118.

N

0 5,000 10,000 15,000
Feet

Date: September 16, 2021
Data Sources: USGS (2020b), ESRI, DWR (2018a), SAGBI (n.d.), Maxar imagery (2020)

GSI Water Solutions, Inc.

Document Path: Y:\0748_San_Antonio_GSP\Source_Figures\001_SanAntonio_Basin_GSA\GW_Sustainability_Plan\Section3\Figure3_8_Potential_Recharge_Areas.mxd, abarry

Recharge to the Paso Robles Formation and Careaga Sand aquifer also occurs through direct infiltration of precipitation and infiltration in creek beds in the higher elevations where these units crop out at the surface. Figure 3-8 shows the general locations of occurrence in the Basin. Natural recharge processes are discussed in more detail in Section 3.3. Appendix D includes a table of annual precipitation data for the Los Alamos Fire Department (LAFD) weather station for the water years 1910 to 2019.

Groundwater Discharge Areas Inside the Basin

Natural groundwater discharge areas in the Basin include springs and seeps, groundwater discharge to surface water bodies, and evapotranspiration (ET) by phreatophytes. Phreatophytes are plants with roots that tap into groundwater present in the alluvium along creeks and streams. Springs and seeps that have been identified by the USGS based on the NHD and reported by basin stakeholders are shown on Figure 3-9. The springs tend to be located in the uplands of the Solomon Hills and San Rafael Mountains ranges. Based on the elevation of mapped springs and seeps, it is likely that these discharge groundwater from shallow, and possibly perched, water-bearing zones.

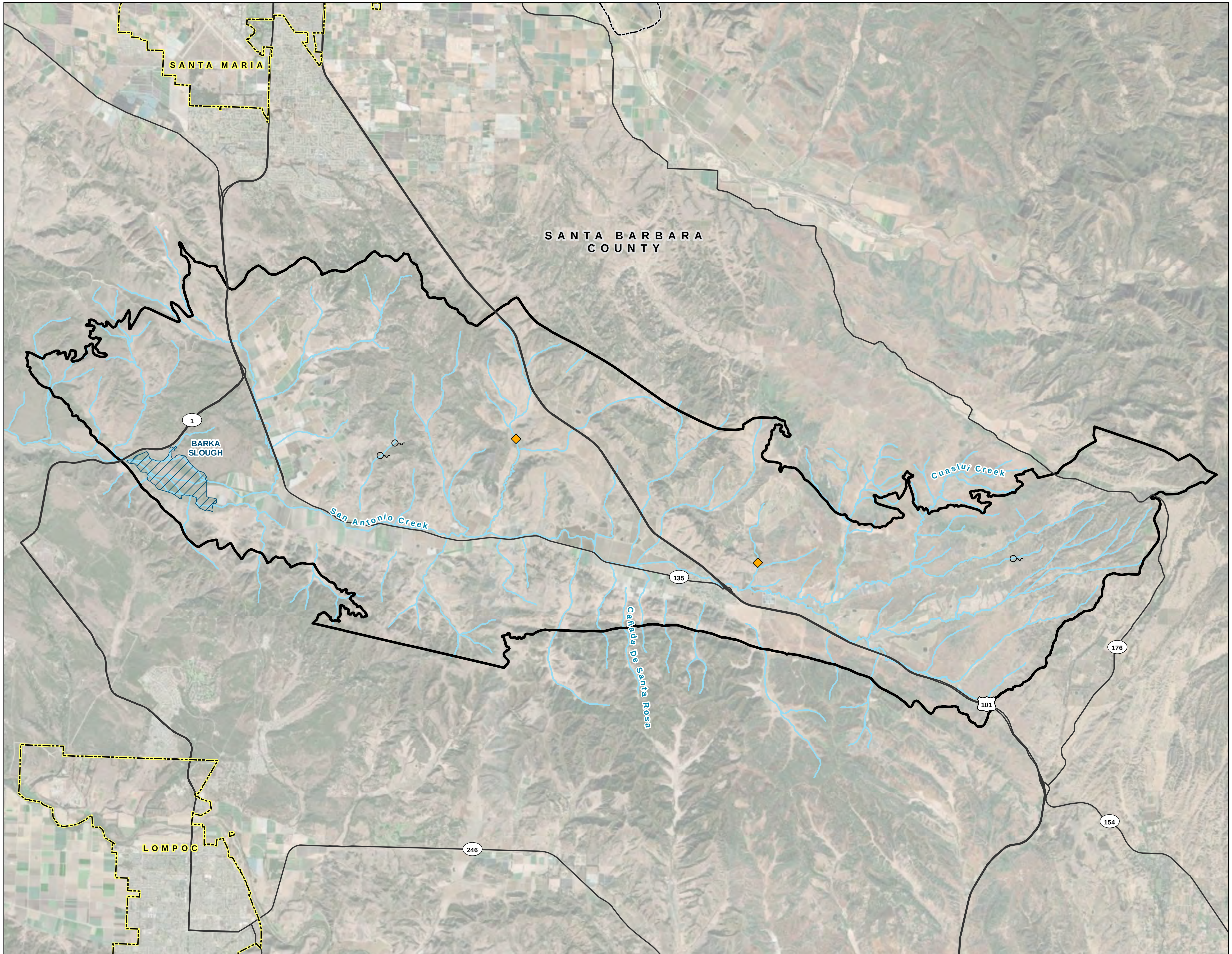
Groundwater discharge to streams has not been mapped to date. However, groundwater discharge likely occurs in the vicinity of Barka Slough on the west end of the Basin, as evidenced by the formation and continued existence of the Barka Slough, an upward vertical hydraulic gradient calculated from nested wells in the area, and the underlying geologic structure (bedrock high) that exists at the west end of the Basin. Groundwater is inferred to discharge from the shallow alluvium, Paso Robles Formation, and from the Careaga Sand in this vicinity. Figure 3-31 is a conceptual diagram illustrating this process.

Figure 3-10 shows the distribution of potential groundwater-dependent ecosystems (GDEs) and Natural Communities Commonly Associated with Groundwater (NCCAG) within the Basin. In areas where the water table is sufficiently high, groundwater discharge may occur as ET from phreatophyte vegetation. Figure 3-10 shows only *potential* GDEs identified in the NCCAG data set. Additional verification of potential GDEs was completed and is described in Section 3.2.6.

FIGURE 3-9

Springs and Seeps

Groundwater Sustainability Plan
San Antonio Creek Valley
Groundwater Basin



LEGEND

- Reported Seep
- USGS Spring

All Other Features

- San Antonio Creek or Adjacent Tributary
- Barka Slough
- San Antonio Creek Valley Groundwater Basin
- County Boundary
- City Boundary
- Major Road

NOTE

San Antonio Creek Valley Groundwater Basin Boundary as defined in the California Department of Water Resources Bulletin 118.

N

0 5,000 10,000 15,000
Feet

Date: September 16, 2021
Data Sources: USGS (2020c), ESRI, DWR (2018a), Maxar imagery (2020)

GSI Water Solutions, Inc.

Document Path: Y:\0748_San_Antonio_GSP\Source_Figures\001_SanAntonio_Basin_GSA\GW_Sustainability_Plan\Section3\Figure3_9_Springs_and_Seeps.mxd, abarry

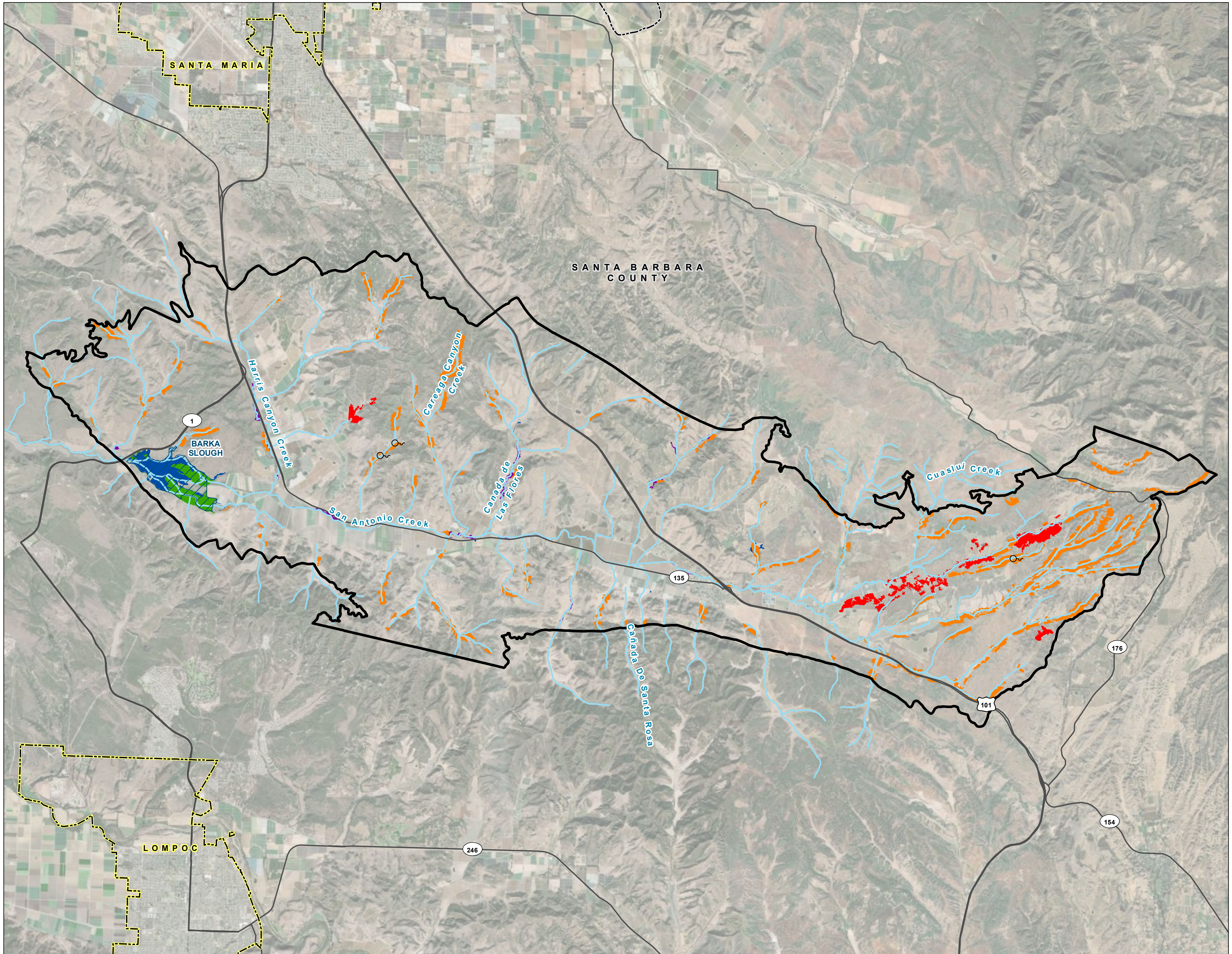


FIGURE 3-10

Natural Communities Commonly Associated with Groundwater Data Set

Groundwater Sustainability Plan
San Antonio Creek Valley
Groundwater Basin

LEGEND

Natural Communities Commonly Associated with Groundwater (NCCAG)

- Wetland Area

VEGETATION

- Coast Live Oak
- Valley Oak
- Riparian Mixed Hardwood
- Willow

All Other Features

- San Antonio Creek Valley Groundwater Basin
- Barka Slough
- Major Road
- City Boundary
- USGS Spring

NOTE

San Antonio Creek Valley Groundwater Basin Boundary as defined in the California Department of Water Resources Bulletin 118.

N

0 5,000 10,000 15,000
Feet

Date: November 18, 2021
Data Sources: USGS (2020b), ESRI, DWR (2018a, 2020b), Maxar imagery (2020)

GSI Water Solutions, Inc.

Document Path: Y:\0748_San_Antonio_GSP\Source_Figures\001_SanAntonio_Basin_GSA\GW_Sustainability_Plan\Section3\Figure3_10_Natural_Comm_Associated_GW.mxd, abarry

3.1.3.4 Water Quality [§ 354.14(b)(4)(D)]

§ 354.14 Hydrogeological Conceptual Model.

(b) The hydrogeologic conceptual model shall be summarized in a written description that includes the following:

(4) Principal aquifers and aquitards, including the following information:

(D) General water quality of the principal aquifers, which may be based on information derived from existing technical studies or regulatory programs.

This section presents a general discussion of the natural groundwater quality in the Basin. A more complete discussion of the distribution and concentrations of specific constituents is presented in Section 3.2.3. The general water quality of the Basin is based on the results from water quality samples collected for compliance with regulatory programs, sampling conducted by the USGS, data from the USGS National Water Information System (NWIS), and the California State Water Resources Control Board (SWRCB) GeoTracker USGS Groundwater Ambient Monitoring and Assessment (GAMA) database.[16]

Groundwater in the Basin is generally suitable for drinking and agricultural uses. In the past 10 years, no exceedances of maximum contaminant levels (MCLs) were indicated in drinking water supply wells. According to the GAMA database, drinking water supply wells include the LACSD wells, VSFB wells, and a few wells located in Harris Canyon and off Batchelder Road. Exceedances of secondary MCLs (SMCLs) and basin water quality objectives (WQOs) set by the Regional Water Quality Control Board (RWQCB) have been reported in both drinking water supply wells and agricultural wells. Concentrations of dissolved solids and salts increase from east to west along San Antonio Creek and are greatest near Barka Slough and in the northern portion of Harris Canyon. Summary tables of general groundwater quality are provided in Section 3.2.3.

3.1.3.5 Primary Beneficial Uses [§ 354.14(b)(4)(E)]

§ 354.14 Hydrogeological Conceptual Model.

(b) The hydrogeologic conceptual model shall be summarized in a written description that includes the following:

(4) Principal aquifers and aquitards, including the following information:

(E) Identification of the primary use or uses of each aquifer, such as domestic, irrigation, or municipal water supply.

The primary groundwater uses in the Basin includes municipal, agricultural, rural residential, and environmental (such as for GDEs). Municipal, domestic, and agricultural demands in the Basin currently rely entirely on groundwater. The LACSD pumps exclusively from the Paso Robles Formation. The VSFB wellfield

[16] Available at the California State Water Resources Control Board website: https://geotracker.waterboards.ca.gov/. (Accessed August 5, 2021.)

pumps exclusively from the Careaga Sand. Agricultural and rural residential water demand is met from wells completed in both principal aquifers. There is reportedly no pumping from the shallow alluvial deposits that underlie San Antonio Creek.

3.1.4 Data Gaps and Uncertainty [§ 354.14(b)(5)]

§ 354.14 Hydrogeological Conceptual Model.

(b) The hydrogeologic conceptual model shall be summarized in a written description that includes the following:

(5) Identification of data gaps and uncertainty within the hydrogeologic conceptual model.

Sustainable Groundwater Management Act (SGMA) regulation § 351(l) defines the term “data gap” as “a lack of information that significantly affects the understanding of the basin setting or evaluation of the efficacy of Plan implementation and could limit the ability to assess whether a basin is being sustainably managed.” SGMA regulation § 351(ai) defines the term “uncertainty” as the following:

> *…a lack of understanding of the basin setting that significantly affects an Agency’s ability to develop sustainable management criteria and appropriate projects and management actions in a Plan, or to evaluate the efficacy of Plan implementation, and therefore may limit the ability to assess whether a basin is being sustainably managed.*

All hydrologic conceptual models contain a certain amount of uncertainty and can be improved with additional data and analysis. The hydrogeologic conceptual model of the San Antonio Creek Valley Groundwater Basin could be improved with certain additional data and analyses. The data gaps are identified below.

3.1.4.1 Barka Slough Surface Water Budget

The Barka Slough is supported by groundwater upwelling as it encounters an impermeable bedrock high at the west end of the Basin as well as surface water entering from San Antonio Creek (see Figure 3-31 for conceptualized surface and groundwater discharge into Barka Slough). Groundwater levels measured in wells located near the Slough indicate that, since about 1983, groundwater levels have fallen below the Slough surface elevation in a number of locations. In addition, upward vertical gradients within the Careaga Sand near the Slough (see Figure 3-71) have been reduced. This indicates that groundwater flow into the Slough has likely declined. Currently no stream gage exists where surface water flow enters or exits the Slough. The Casmalia stream gage (11136100) is located more than 2.5 miles west of the Slough and indicates a strong correlation between precipitation and measured flow. Due to gaps in recorded data at the Casmalia stream gage (from 2003 through 2015) it is not possible to accurately determine the direct effect of pumping in the Basin on measured surface water flow using the Casmalia stream gage. Additionally, without a stream gage at the east end of the Slough, it is not known whether surface water flow into the Slough has been decreasing. Installation of surface water gages in the east and west end of the Slough and evaluation of the Slough water budget using the USGS groundwater model (when it is available) would significantly improve understanding of this dynamic. These management actions are described in Section 6.

3.1.4.2 Groundwater Level Monitoring Well Spatial Distribution and Well Construction Information

Although the existing groundwater level monitoring network satisfies the well density guidance cited in the best management practice (BMP) guidance for monitoring networks developed by DWR (DWR, 2016a, DWR 2016b), there are areas identified within the Basin (see Figure 5-3) where the addition of monitoring wells would improve the hydrogeologic conceptual model discussed in this section. Two low-density areas in both principal aquifers were identified in the Basin: the eastern uplands and the central to northwestern uplands. The SWRCB Irrigated Lands Regulatory Program indicates that private agricultural supply wells have been identified in the eastern uplands area. An effort will be made during GSP implementation to contact owners of wells in the eastern uplands area to determine whether they can be included in the monitoring program. Including these additional wells in the groundwater level monitoring network would minimize the uncertainty of groundwater elevation trends and benefit sustainable management of the Basin. Two wells in the central to northwestern uplands area, completed in the Careaga Sand, were previously monitored by the USGS or the San Antonio Basin Groundwater Sustainability Agency (SABGSA). However, well access has been denied by the well owners. The SABGSA will make an effort to negotiate access to these wells.

Well completion reports (WCRs) are available online through DWR's Online System for Well Completion Reports database; however, the WCR identification numbers are unknown for many of the wells in the groundwater level monitoring network and therefore it is not possible to always identify the associated WCRs. These are data gaps that, when filled, will improve the accuracy of the hydrogeologic conceptual model and understanding of groundwater flow in the Basin.

3.1.4.3 Hydraulic Properties

The current estimates of the hydraulic conductivity (permeability) and specific yield of the various sedimentary layers composing the Paso Robles Formation and Careaga Sand are based on limited data. This is a data gap that, when filled, will improve the ability of a groundwater flow model to reflect Basin conditions and interactions.

3.2 Groundwater Conditions [§ 354.16]

This section describes the current and historical groundwater conditions in the Paso Robles Formation and Careaga Sand in the Basin. In accordance with the SGMA Emergency Regulation § 354.16,[17] current conditions are any conditions occurring after January 1, 2015. By implication, historical conditions are any conditions occurring prior to January 1, 2015. This section focuses on information required by the GSP regulations and information that is important for developing an effective plan to achieve sustainability. The organization of this section aligns with the five sustainability indicators applicable to the Basin as prescribed by DWR. The objective is to evaluate groundwater conditions and identify whether any of the following conditions are significant and unreasonable in the Basin.

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

The sixth sustainability indicator, seawater intrusion, is not applicable to the Basin.

[17] On May 16, 2016, the State Water Board adopted Resolution 2017-33 to adopt an Emergency Regulation for Implementation of the Sustainable Groundwater Management Act of 2014 (SGMA). On June 19, 2017, the regulation was submitted to the Office of Administrative Law (OAL) for review. OAL approved the regulation on June 29, 2017.

3.2.1 Groundwater Elevations [§ 354.16(a)]

The following assessment of groundwater elevation conditions is largely based on historical groundwater gaging data compiled by the USGS, the USGS GAMA Program, and quarterly groundwater gaging completed by GSI Water Solutions, Inc. (GSI), beginning in the fourth quarter of 2019 and continuing to the present. Groundwater levels are measured by GSI through a network of public and private wells in the Basin. Historical groundwater elevation data compiled by the USGS include data obtained from available sources such as the California Statewide Groundwater Elevation Monitoring (CASGEM) Program database and other regulatory compliance programs. The locations of the wells (totaling approximately 56, depending on the year) used for the groundwater elevation assessment are shown on Figure 3-11. Access to some of these wells is currently being negotiated or has been denied. Consequently, more recent (2020 to the present) groundwater elevation data are not available for these wells. The set of wells shown on Figure 3-11 denoted as *representative wells* were selected from the larger set of monitoring wells included in the Basin's groundwater level monitoring network. This subset of wells was selected based on the existence of sufficient information to assign the well to either the Paso Robles Formation or the Careaga Sand and whether the well has a sufficiently long period of record to identify groundwater elevation trends in the well's hydrograph.

Groundwater elevation data were deemed representative of static conditions, based on a check of consistency with nearby wells. Additional information about the monitoring network is provided in Section 5. In accordance with the SGMA regulations, the following information, based on available data for both principal aquifers in the Basin, is presented:

- Groundwater elevation contour maps for the seasonal high and low periods for 2018
- Hydrographs for wells with publicly available data
- Assessments of horizontal and vertical groundwater gradients

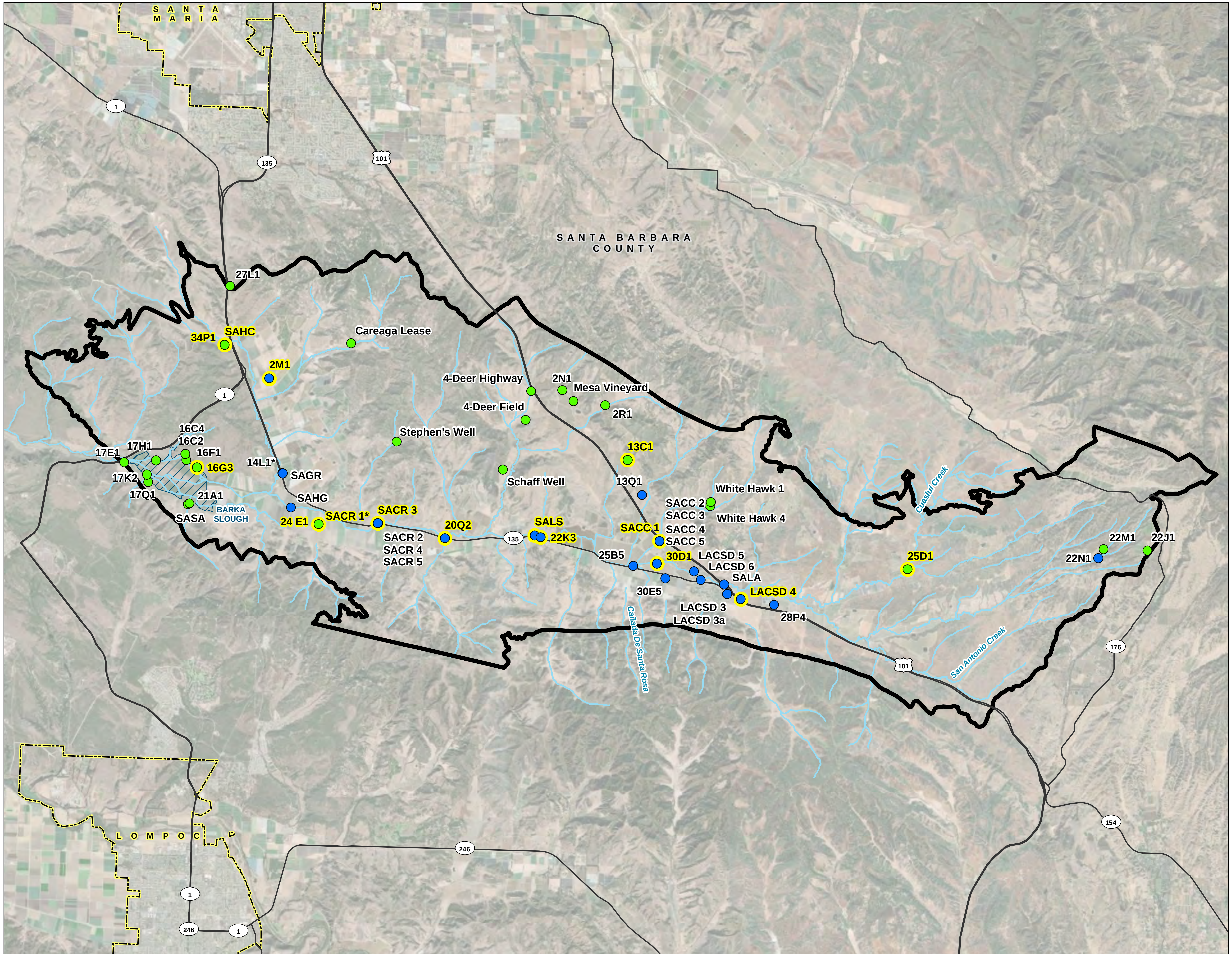


FIGURE 3-11

Wells Included in the San Antonio Creek Valley Groundwater Basin Groundwater Monitoring Network

Groundwater Sustainability Plan
San Antonio Creek Valley
Groundwater Basin

LEGEND

Representative Well

Wells (by screened aquifer)

Paso Robles Formation

Careaga Sand

All Other Features

San Antonio Creek or Tributary

Major Road

San Antonio Creek Valley Groundwater Basin

Barka Slough

City Boundary

NOTES

*SACR 1 and 14L1 are screened in the Careaga Sand.

San Antonio Creek Valley Groundwater Basin Boundary as defined in the California Department of Water Resources Bulletin 118.

N

0 5,000 10,000 15,000
Feet

Date: September 16, 2021
Data Sources: USGS (2020b), ESRI, DWR (2019a), Maxar imagery (2020)

GSI Water Solutions, Inc.

Document Path: Y:\0748_San_Antonio_GSP\Source_Figures\001_SanAntonio_Basin_GSA\GW_Sustainability_Plan\Section3\Figure3_11_Representative_Wells.mxd

3.2.1.1 Groundwater Elevation Contours [§ 354.16(a)(1)]

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

(a) Groundwater elevation data demonstrating flow directions, lateral and vertical gradients, and regional pumping patterns, including:

(1) Groundwater elevation contour maps depicting the groundwater table or potentiometric surface associated with the current seasonal high and seasonal low for each principal aquifer within the basin.

Groundwater elevation data for 2018 for the Paso Robles Formation and Careaga Sand were contoured to assess current spatial variations, groundwater flow directions, and horizontal groundwater gradients. Contour maps were prepared for the seasonal high groundwater levels, which typically occur in the spring, and the seasonal low groundwater levels, which typically occur in the fall. In general, the spring groundwater data are for March and the fall groundwater data are for October. Data from public and private wells were used for contouring; information identifying the owner or detailed location of private wells is not shown on the maps. The contours are based on groundwater elevations measured at the well locations shown on Figure 3-11. Contour maps were generated using a computer-based contouring program and checked for representativeness by a qualified hydrogeologist. Groundwater elevation data deemed unrepresentative of static conditions, or erroneous, were not used for contouring.

Paso Robles Formation Groundwater Elevation Contours and Horizontal Groundwater Gradients

Figures 3-12 and 3-13 show the contours of groundwater elevations in the Paso Robles Formation for spring and fall 2018, respectively. In general, groundwater conditions in the Basin in the spring and fall of 2018 were similar. Close inspection of the contour maps indicates that groundwater elevations are generally lower in the fall than spring. Groundwater elevations in 2018 ranged from approximately 1,120 ft amsl in the northeast portion of the Basin to about 270 ft amsl just east of Barka Slough. Groundwater flow direction is inferred as being from high to low elevations in a direction perpendicular to groundwater elevation contours. Groundwater flow direction is generally to the west across most of the Basin, except in the northwest area of the Basin, where groundwater flow is to the south. In general, groundwater flow in the Basin tends to converge toward the lower groundwater levels in the San Antonio Creek and Barka Slough. Low groundwater elevation contour lines near the town of Los Alamos indicate a groundwater pumping center. Low groundwater elevations along Harris Canyon indicate another potential pumping center. Horizontal groundwater gradients range from approximately 0.004 ft/ft along the San Antonio Creek between Los Alamos and the Barka Slough to approximately 0.02 ft/ft in the area between Alisos Canyon Road and Fox Canyon Road east of Los Alamos.

The groundwater level contours in this GSP are based on a reasonable and thorough analysis of the currently available data. As discussed in Section 5, the monitoring network may be expanded to more completely assess Basin conditions and demonstrate compliance with the sustainability goal for the Basin. Expanding the monitoring network and acquiring more groundwater elevation data will allow the SABGSA to refine and modify this GSP in the future based on a more complete understanding of basin conditions.

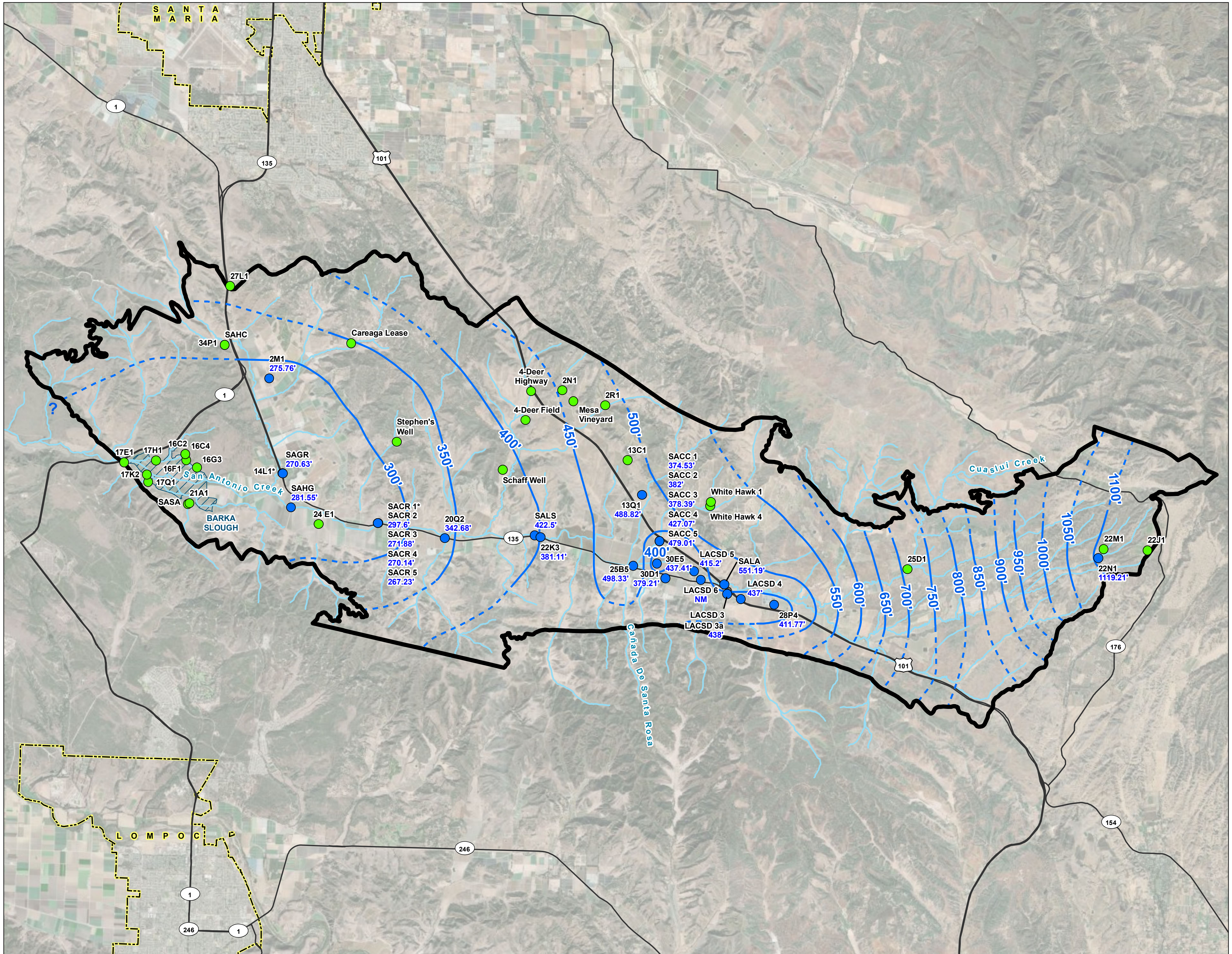


FIGURE 3-12

Paso Robles Formation Groundwater Elevation Contours Spring 2018

Groundwater Sustainability Plan
San Antonio Creek Valley
Groundwater Basin

LEGEND

Groundwater Elevation Contour, feet amsl (dashed where inferred)

Wells (by screened aquifer)

- Paso Robles Formation
  Groundwater Elevation (feet amsl)
- Careaga Sand

All Other Features

- San Antonio Creek or Adjacent Tributary
- Major Road
- San Antonio Creek Valley Groundwater Basin
- Barka Slough
- City Boundary

NOTES

*SACR 1 and 14L1 are screened in the Careaga Sand.

San Antonio Creek Valley Groundwater Basin Boundary as defined in the California Department of Water Resources Bulletin 118.

amsl: above mean sea level
NM: not measured

N

0 5,000 10,000 15,000
Feet

GSI Water Solutions, Inc.

Date: November 18, 2021
Data Sources: USGS (2020b), ESRI, DWR (2018a), Maxar imagery (2020)

Document Path: Y:\0748_San_Antonio_GSP\Source_Figures\001_SanAntonio_Basin_GSA\GW_Sustainability_Plan\Section3\Figure3_12_GW_Contours_PasoRoblesSpring2018.mxd

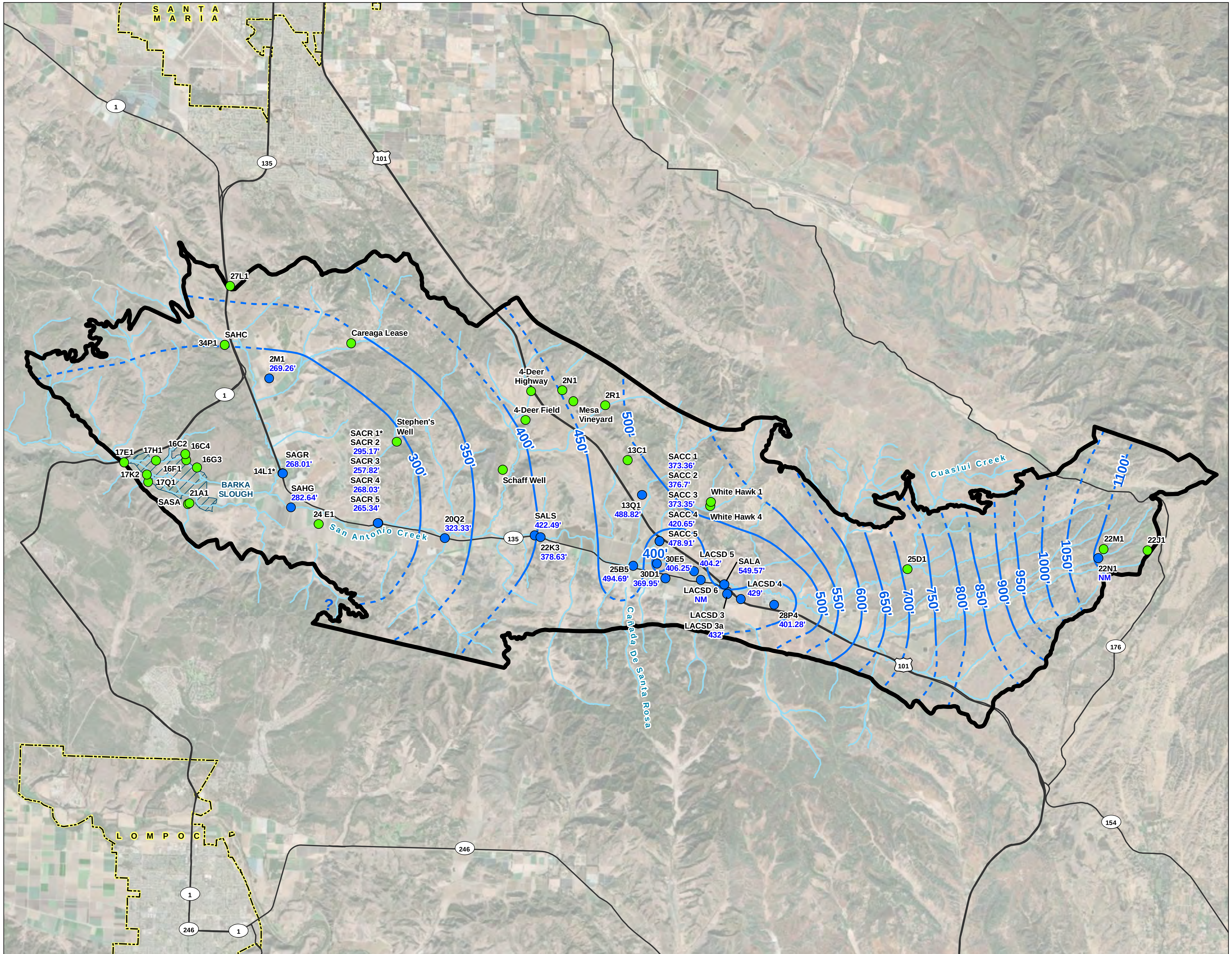


FIGURE 3-13

Paso Robles Formation Groundwater Elevation Contours Fall 2018

Groundwater Sustainability Plan
San Antonio Creek Valley
Groundwater Basin

LEGEND

Groundwater Elevation Contour, ft amsl (dashed where inferred)

Wells (by screened aquifer)

- Paso Robles Formation Groundwater Elevation (feet amsl)
- Careaga Sand

All Other Features

- San Antonio Creek or Adjacent Tributary
- Major Road
- San Antonio Creek Valley Groundwater Basin
- Barka Slough
- City Boundary

NOTES

*SACR 1 and 14L1 are screened in the Careaga Sand.

San Antonio Creek Valley Groundwater Basin Boundary as defined in the California Department of Water Resources Bulletin 118.

amsl: above mean sea level
NM: not measured

N

0 5,000 10,000 15,000
Feet

Date: September 16, 2021
Data Sources: USGS (2020b), ESRI, DWR (2018a), Maxar imagery (2020)

GSI Water Solutions, Inc.

Careaga Sand Groundwater Elevation Contours and Horizontal Groundwater Gradients

Figures 3-14 and 3-15 show contours of current groundwater elevations in the Careaga Sand for spring and fall 2018, respectively. In general, groundwater conditions in the Basin in the spring and fall of 2018 were similar. Close inspection of the contour maps indicates that groundwater elevations are generally lower in the fall than spring. Groundwater elevations in 2018 ranged from approximately 1,157 ft amsl in the northeast portion of the Basin to about 227 ft amsl at the west end of Barka Slough. Groundwater flow direction is inferred as being from high to low elevations in a direction perpendicular to groundwater elevation contours. Groundwater flow direction is generally to the west over most of the Basin, except in the northwest area of the Basin where groundwater flow is to the south-southwest. In general, groundwater flow in the Basin tends to converge toward the lower groundwater levels in the San Antonio Creek and Barka Slough. Low groundwater elevations near well 24E1 indicate a potential pumping center. The horizontal groundwater gradient is steeper east of Los Alamos (at approximately 0.02 ft/ft) than between Los Alamos to the Barka Slough (where it flattens to approximately 0.01 ft/ft).

The groundwater level contours in this GSP are based on a reasonable and thorough analysis of the currently available data. As discussed in Section 5, the monitoring network should be expanded to more completely assess Basin conditions and demonstrate compliance with the sustainability goal for the Basin. Expanding the monitoring network and acquiring more groundwater elevation data will allow the SABGSA to refine and modify this GSP in the future based on a more complete understanding of basin conditions.

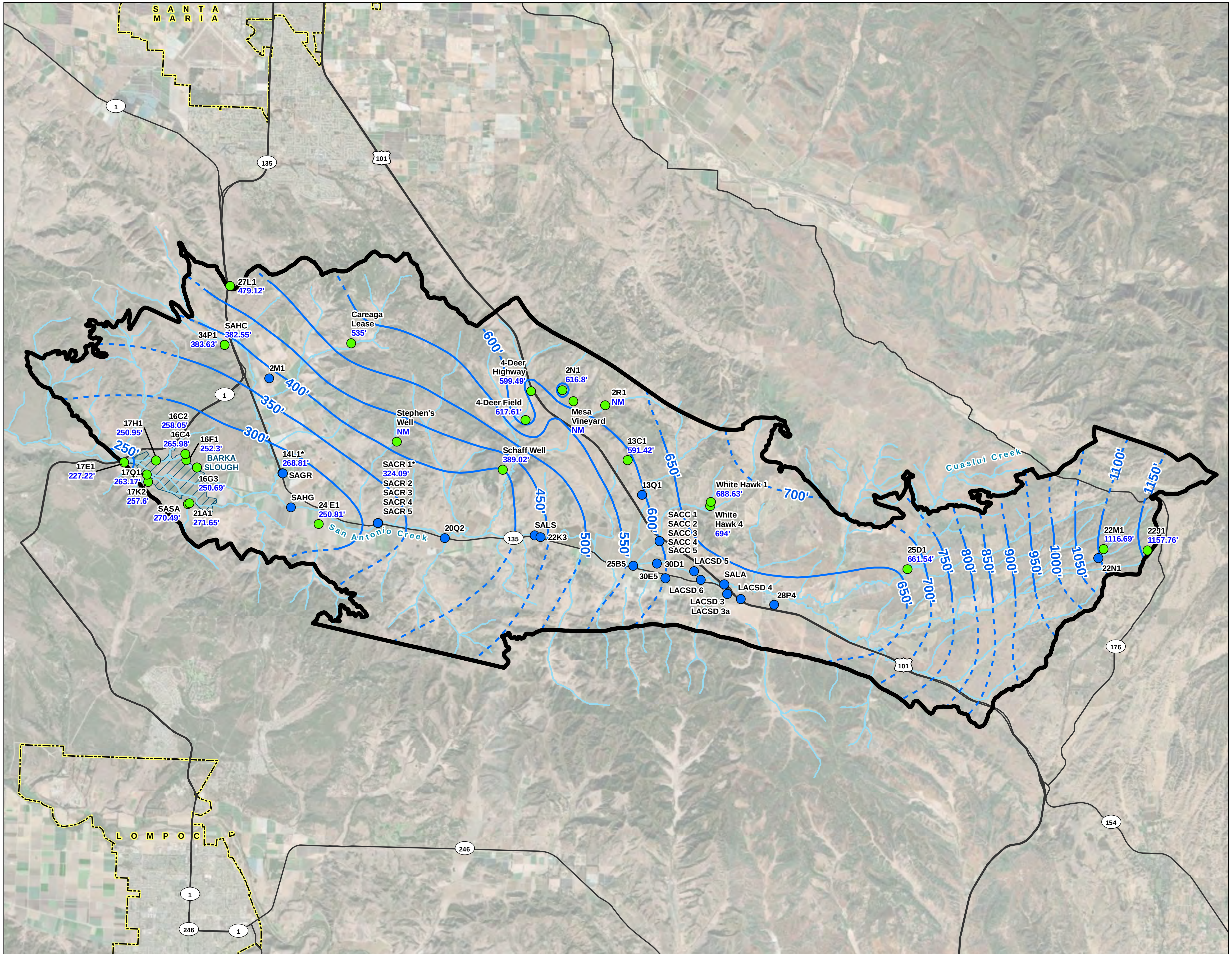


FIGURE 3-14

Careaga Sand Groundwater Elevation Contours Spring 2018

Groundwater Sustainability Plan
San Antonio Creek Valley
Groundwater Basin

LEGEND

Groundwater Elevation Contour, ft amsl (dashed where inferred)

Wells (by screened aquifer)

- Paso Robles Formation
- Careaga Sand
  Groundwater Elevation (feet amsl)

All Other Features

- San Antonio Creek or Adjacent Tributary
- Major Road
- San Antonio Creek Valley Groundwater Basin
- City Boundary

NOTES

*SACR 1 and 14L1 are screened in the Careaga Sand.

San Antonio Creek Valley Groundwater Basin Boundary as defined in the California Department of Water Resources Bulletin 118.

amsl: above mean sea level
NM: not measured

N

0 5,000 10,000 15,000
Feet

GSI Water Solutions, Inc.

Date: September 16, 2021
Data Sources: USGS (2020b), ESRI, DWR (2018a), Maxar imagery (2020)

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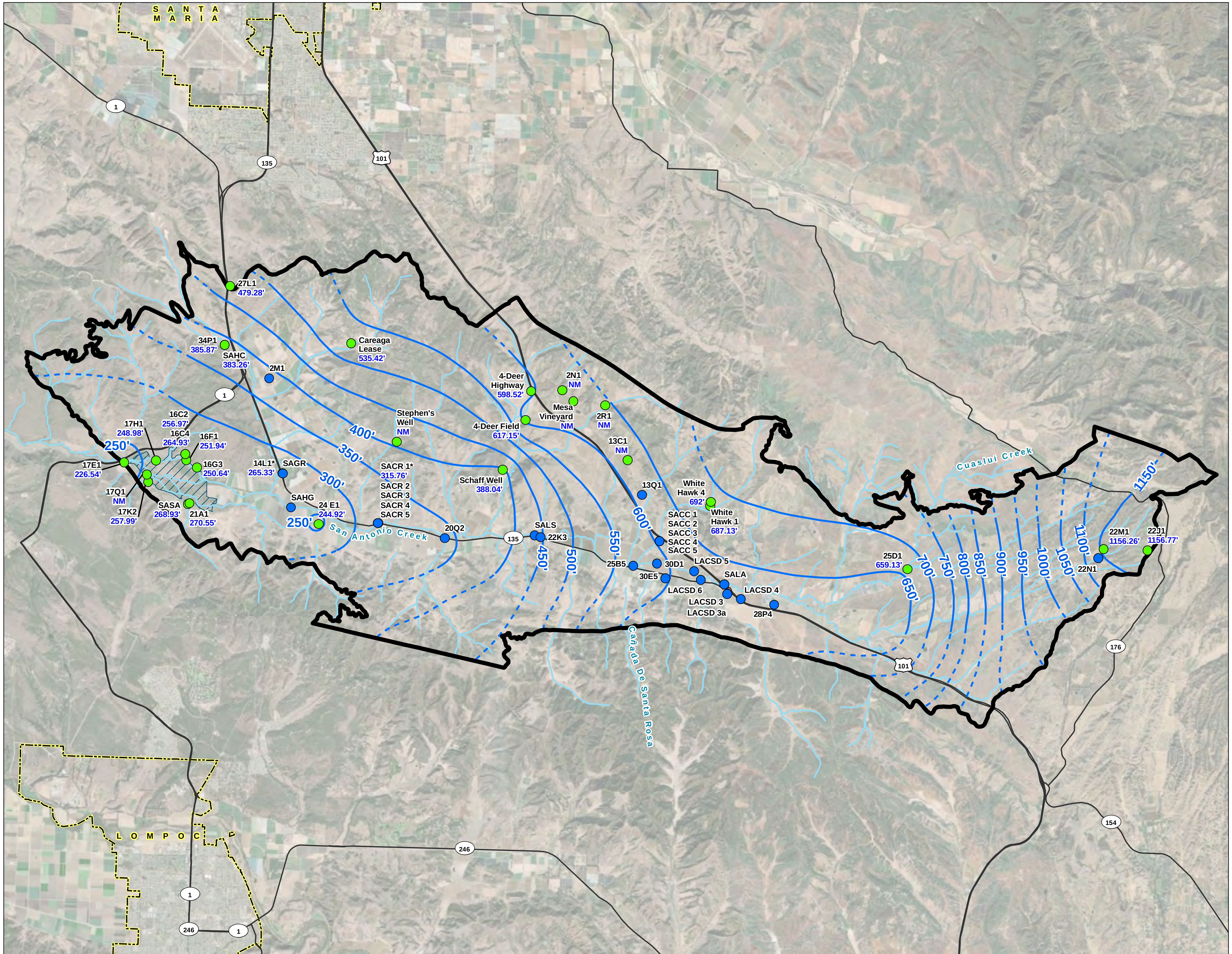

FIGURE 3-15

Careaga Sand Groundwater Elevation Contours Fall 2018

Groundwater Sustainability Plan
San Antonio Creek Valley
Groundwater Basin

LEGEND

Groundwater Elevation Contour, ft amsl (dashed where inferred)

Wells (by screened aquifer)

- Paso Robles Formation
- Careaga Sand
  Groundwater Elevation (feet amsl)

All Other Features

- San Antonio Creek or Adjacent Tributary
- Major Road
- San Antonio Creek Valley Groundwater Basin
- Barka Slough
- City Boundary

NOTES

*SACR 1 and 14L1 are screened in the Careaga Sand.

San Antonio Creek Valley Groundwater Basin Boundary as defined in the California Department of Water Resources Bulletin 118.

amsl: above mean sea level
NM: not measured

N

0 5,000 10,000 15,000
Feet

GSI Water Solutions, Inc.

Date: September 16, 2021
Data Sources: USGS (2020b), ESRI, DWR (2018a), Maxar imagery (2020)

Document Path: Y:\0748_San_Antonio_GSP\Source_Figures\001_SanAntonio_Basin_GSA\GW_Sustainability_Plan\Section3\Figure3_15_GW_Contours_CareagaFall2018.mxd

3.2.1.2 Groundwater Elevation Hydrographs [§ 354.16(a)(2)]

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

(a) Groundwater elevation data demonstrating flow directions, lateral and vertical gradients, and regional pumping patterns, including:

(2) Hydrographs depicting long-term groundwater elevations, historical highs and lows, and hydraulic gradients between principal aquifers.

Paso Robles Formation Hydrographs

Appendix D includes hydrographs for the wells in the Paso Robles Formation that have publicly available data. A total of 27 of the 57 monitoring wells included in the Basin monitoring network were identified as screened in the Paso Robles Formation. The aquifer in which wells are screened was determined from historical well logs, wells with reported screened interval data, hydrograph signatures, and the USGS San Antonio Creek Geohydrologic Framework Model (USGS, 2020c). As of June 2020, access agreements have been secured for 19 of the 27 monitoring wells. Areas within the Basin with lower well density and limited publicly available groundwater level data for the Paso Robles Formation have been identified on Figure 5-3.

Long-term groundwater elevation declines are evident on the hydrographs shown in Appendix D. The magnitude of measured declines for wells with a period of record of at least 10 years ranges from approximately 26 (25B5) to 143 ft (30D1). The most significant water level declines occurred during the current drought (2012 to the present).

Precipitation data were reviewed and analyzed to determine the occurrence and duration of wet and dry periods for the Basin. Precipitation from the LAFD weather station was used for this analysis because it is representative of conditions in the Basin and has the longest period of record of any station in the Basin. Figure 3-16 shows total annual precipitation by water year recorded at the LAFD station. Mean annual precipitation during the period from 1910 to 2019 is 15.3 inches. Wet and dry periods were determined based the positive or negative trend of the slope generated using the cumulative departure from mean annual precipitation.

Figures 3-12 and 3-13 depict current groundwater elevations in the Basin for the Paso Robles Formation. Figures 3-17, 3-18, and 3-19 are hydrographs for wells 30D1, 20Q2, and 2M1, respectively. The hydrographs represent groundwater elevation over time shown by a dark blue line. In addition to groundwater levels, the figures also have a light blue line plotted that represents the cumulative departure from mean annual precipitation for the Basin.

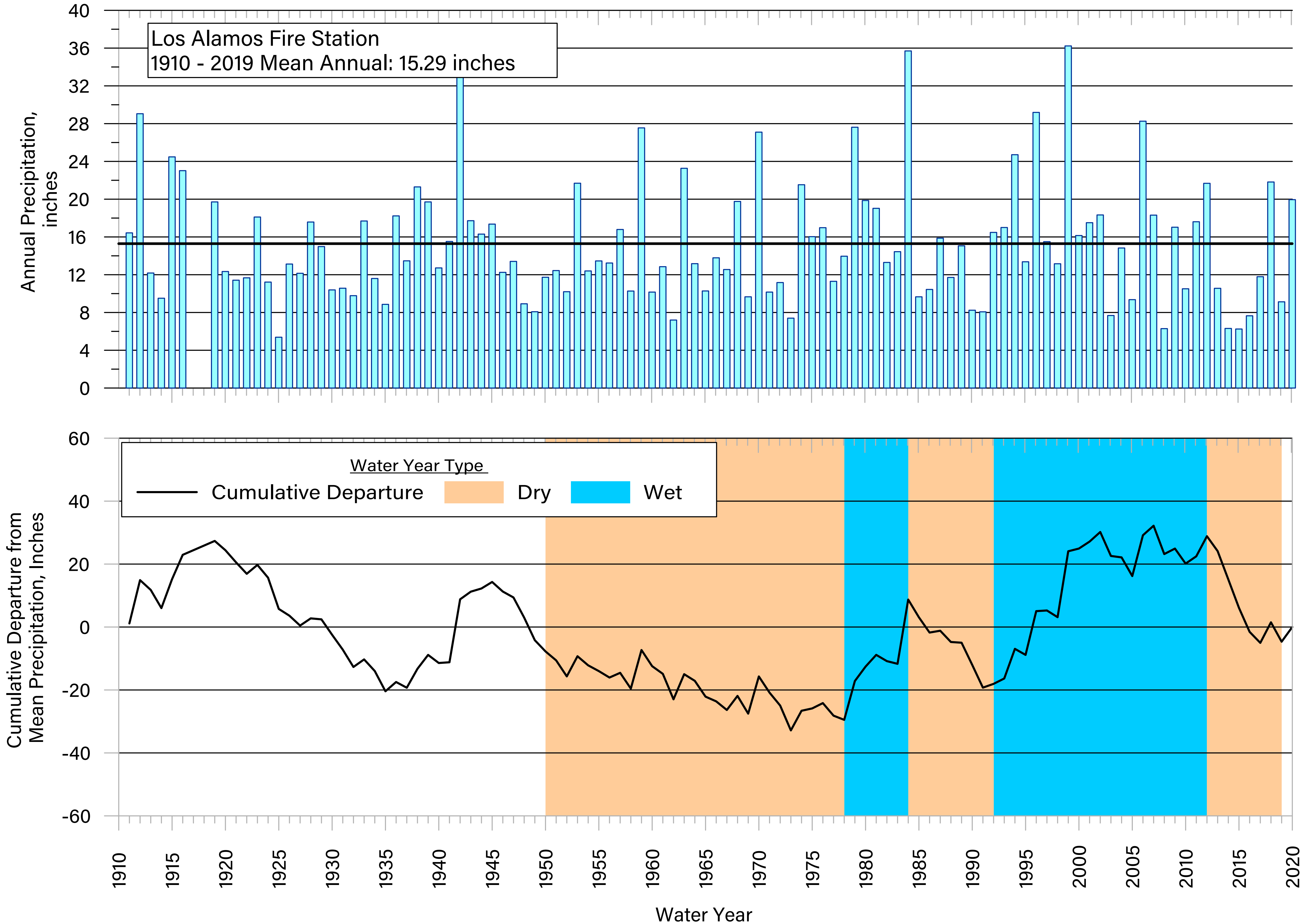

FIGURE 3-16

LAFD Annual Precipitation and Cumulative Departure from Mean Annual Precipitation

Groundwater Sustainability Plan
San Antonio Creek Valley
Groundwater Basin

Date: September 16, 2021
Data Sources: County of Santa Barbara Public Works Department (n.d.)

GSI Water Solutions, Inc.

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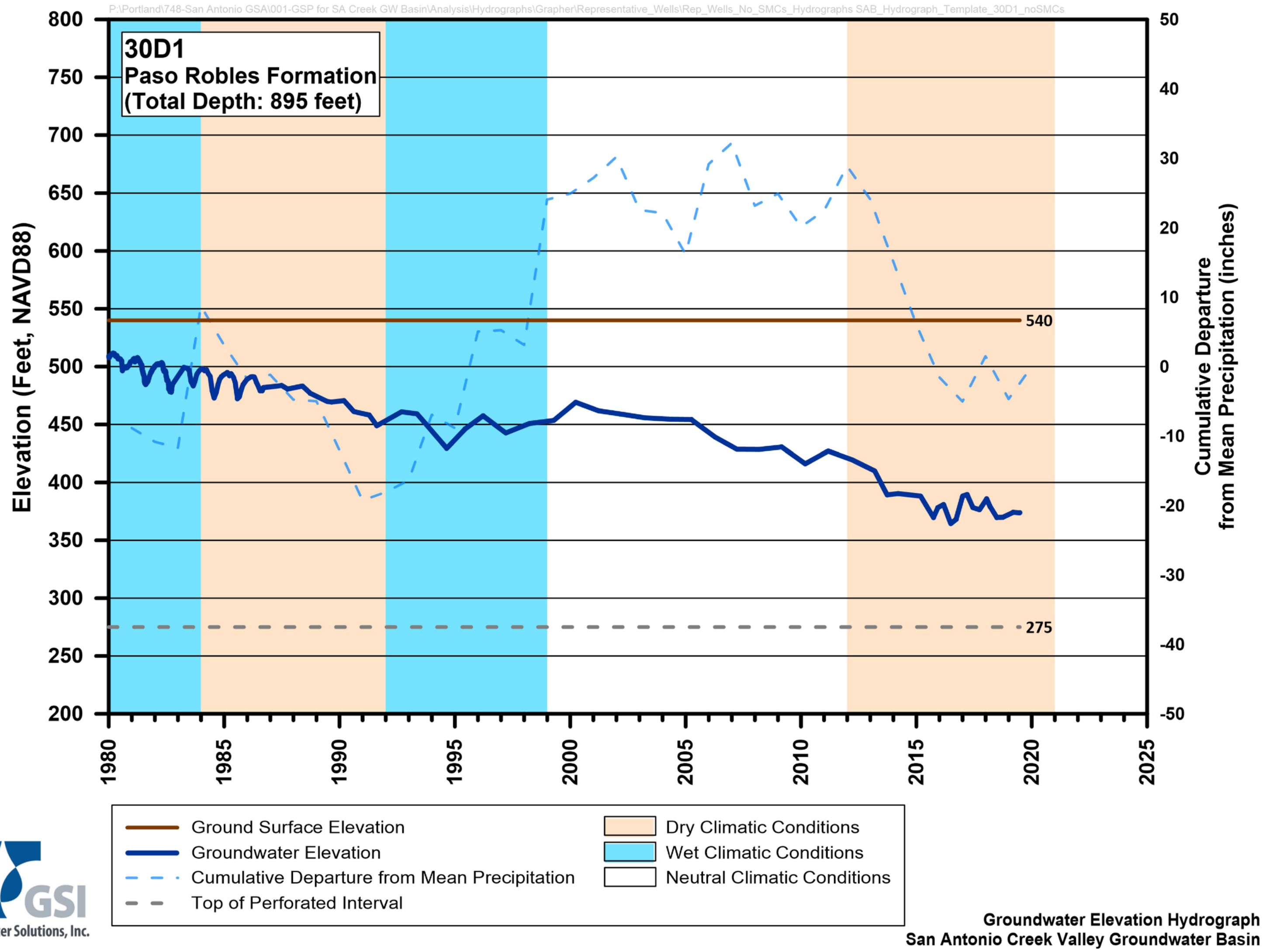

Figure 3-17. Hydrograph for Well 30D1, Paso Robles Formation

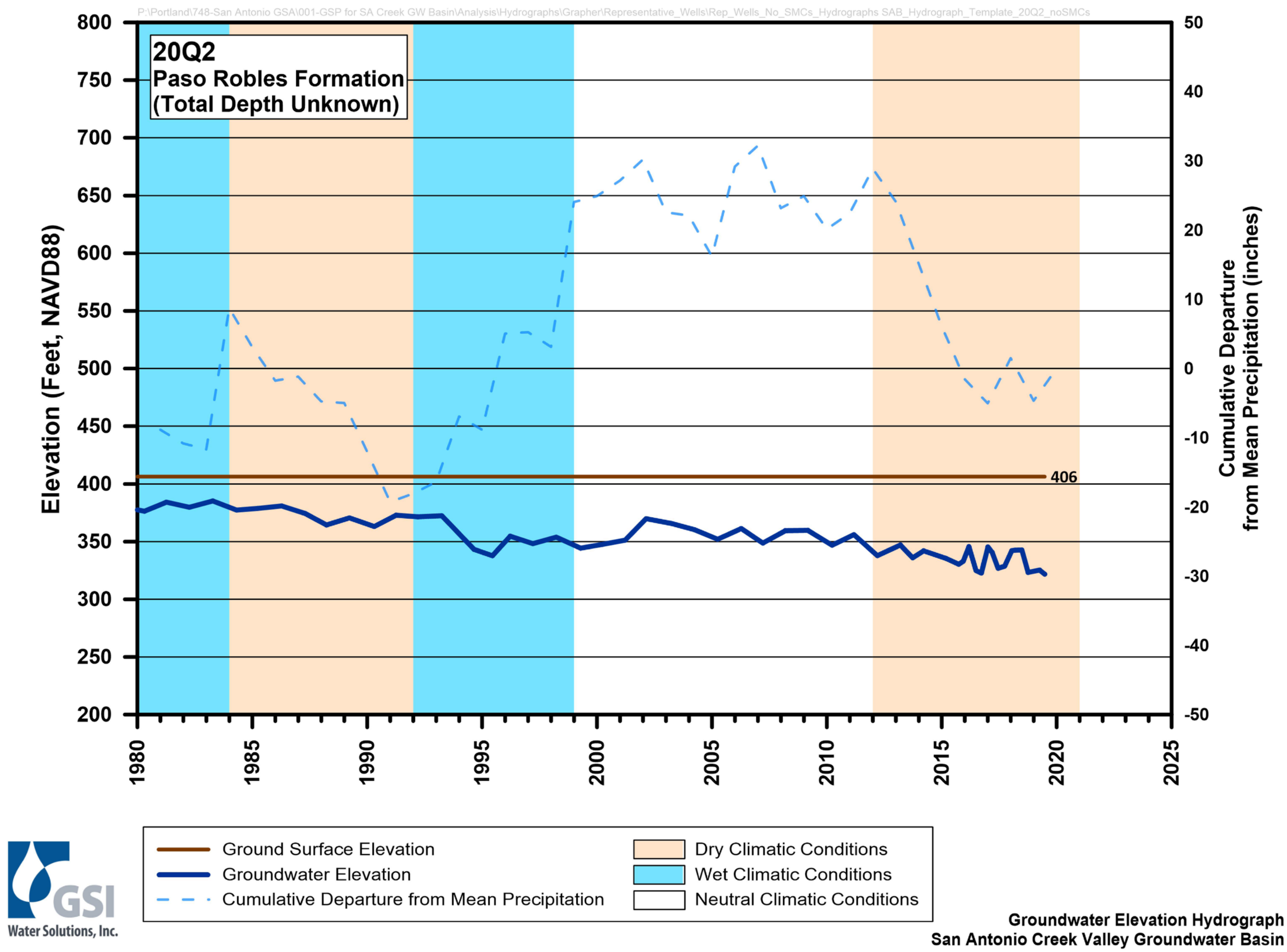

Figure 3-18. Hydrograph for Well 20Q2, Paso Robles Formation

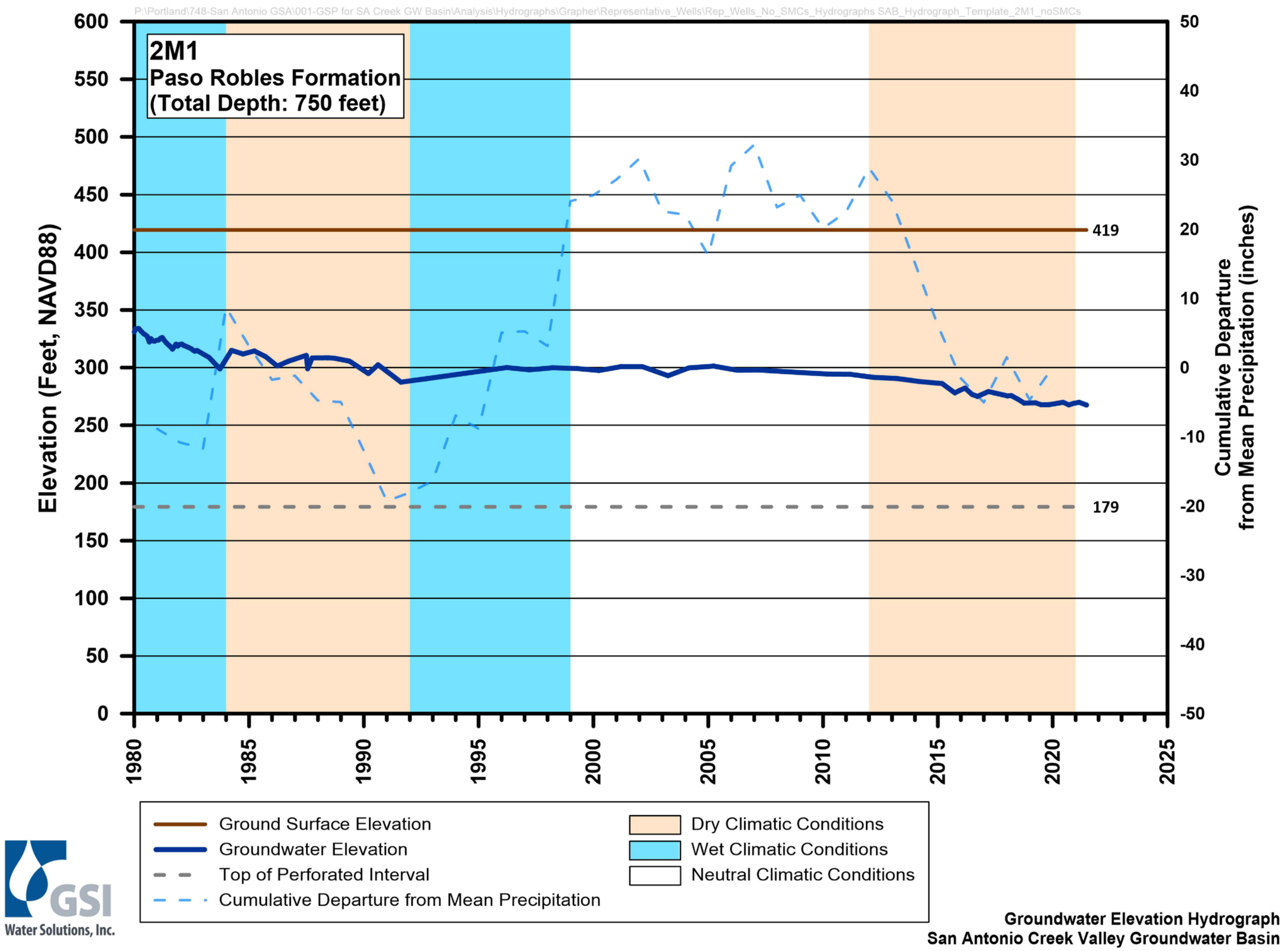

Figure 3-19. Hydrograph for Well 2M1, Paso Robles Formation

The locations of wells 30D1, 20Q2, and 2M1 can be seen on Figure 3-11. Well 30D1 is near the town of Los Alamos. Well 20Q2 is along the San Antonio Creek, approximately halfway between Los Alamos and the Barka Slough. Well 2M1 is in Harris Canyon, near the intersection of State Highway 1 and State Highway 135. The locations of the three wells provides a spatially representative picture of groundwater levels in the Basin from approximately 1980 to the present. Groundwater levels in all three hydrographs indicate a downward trend until approximately 2017. A plot of the cumulative departure from mean annual precipitation indicates a period of above-average precipitation beginning prior to 1980 and lasting until 1983. That period was followed by below-average rainfall until 1990. A period of above-average rainfall continued until 2011. These changes in rainfall are generally reflected in the water level hydrographs. Although some recovery has occurred in groundwater levels during periods of above-average rainfall, the overall trend shows sharply declining water levels. Since 2017, which had above average precipitation, the observed water levels in wells 30D1 and 2M1 indicate stabilization. It is unclear whether this is the case at well 20Q2.

Table 3-2 lists the groundwater elevation high, low, and total change over the period of record for wells 30D1, 20Q2, and 2M1. The historical groundwater elevation low for all three wells has occurred in the last 5 years.

Table 3-2. Change in Groundwater Elevations – Paso Robles Formation

Well Name	Aquifer	Groundwater Elevation High (ft amsl)	Year	Groundwater Elevation Low (ft amsl)	Year	Total Change (ft)	Period of Record (Years)
30D1	Paso Robles Formation	516.82	1978	364.45	2016	(142.57)	42
20Q2	Paso Robles Formation	399.01	1958	321.80	2019	(77.21)	61
2M1	Paso Robles Formation	335.89	1978	267.21	2019	(62.71)	43

Notes

Parentheses around a value, such as (142.57), indicate a negative value.

ft amsl = feet above mean sea level ft = feet

Careaga Sand Hydrographs

Appendix D includes hydrographs for wells with publicly available data completed in the Careaga Sand. A total of 30 of the 57 monitoring wells included in the Basin monitoring network were identified as being screened in the Careaga Sand. Screened interval data are not available for many of the wells included in the Basin monitoring network. The aquifer in which wells are screened was determined from historical well logs, wells with reported screened interval data, hydrograph signatures, and the USGS San Antonio Creek Geohydrologic Framework Model (USGS, 2020c). As of June 2020, access agreements have been secured for 17 of the 30 monitoring wells. The limited spatial coverage of publicly available groundwater level data for the Careaga Sand is a significant data gap. Long-term groundwater elevation declines are evident in virtually all of the hydrographs shown in Appendix D. The magnitude of measured declines for wells with a period of record of at least 10 years ranges from approximately 1 (22J1) to 70 ft (14L1).

Figures 3-14 and 3-15 depict current groundwater elevations within the Basin for the Careaga Sand. Figures 3-20, 3-21, and 3-22 are hydrographs for wells 25D1, 14L1, and 16G3, respectively. The hydrographs represent groundwater elevations over time shown by a dark blue line. In addition to groundwater levels, the figures also have a light blue line plotted representing the cumulative departure from mean annual precipitation for the Basin.

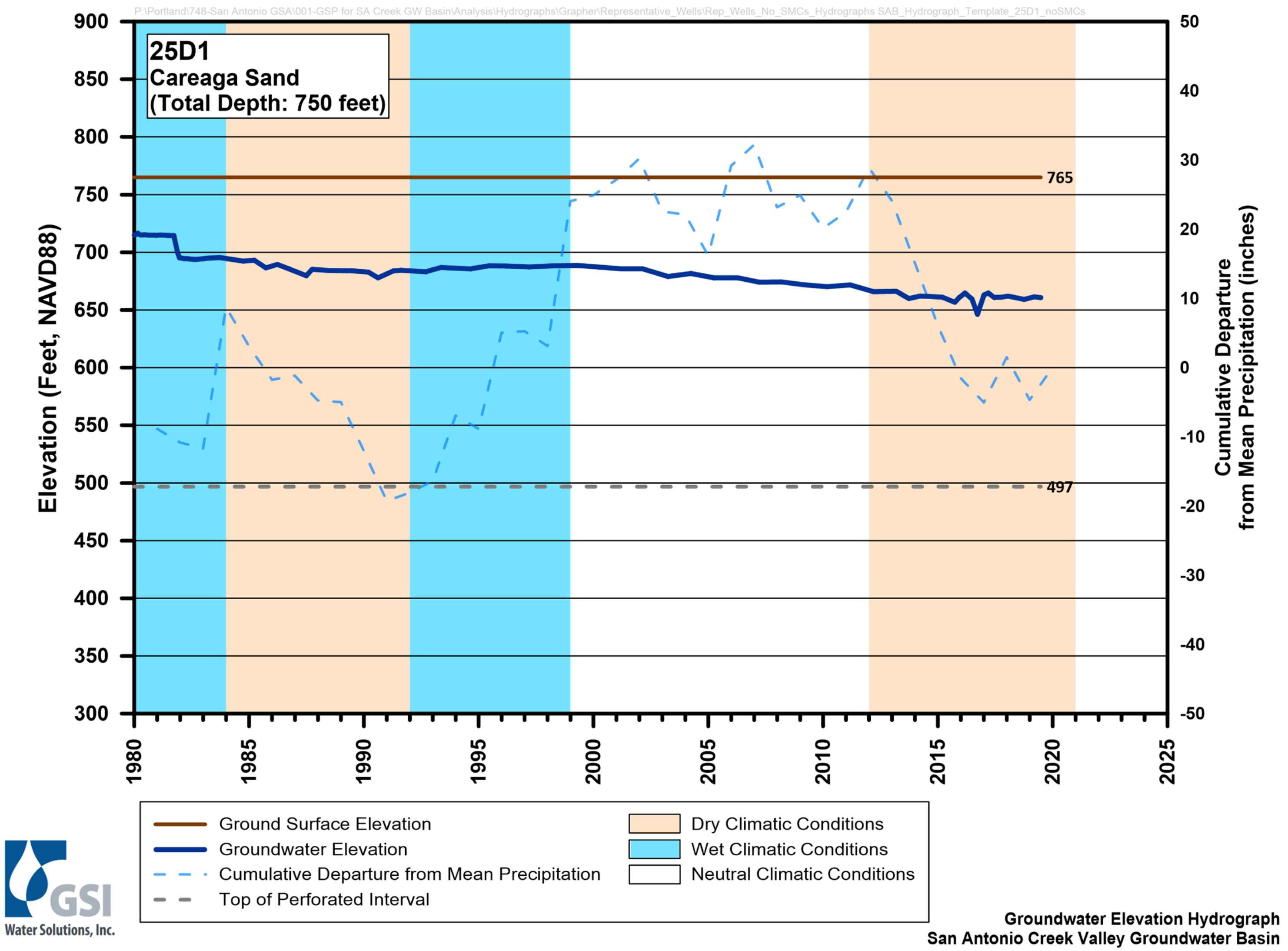

Figure 3-20. Hydrograph of Well 25D1, Careaga Sand

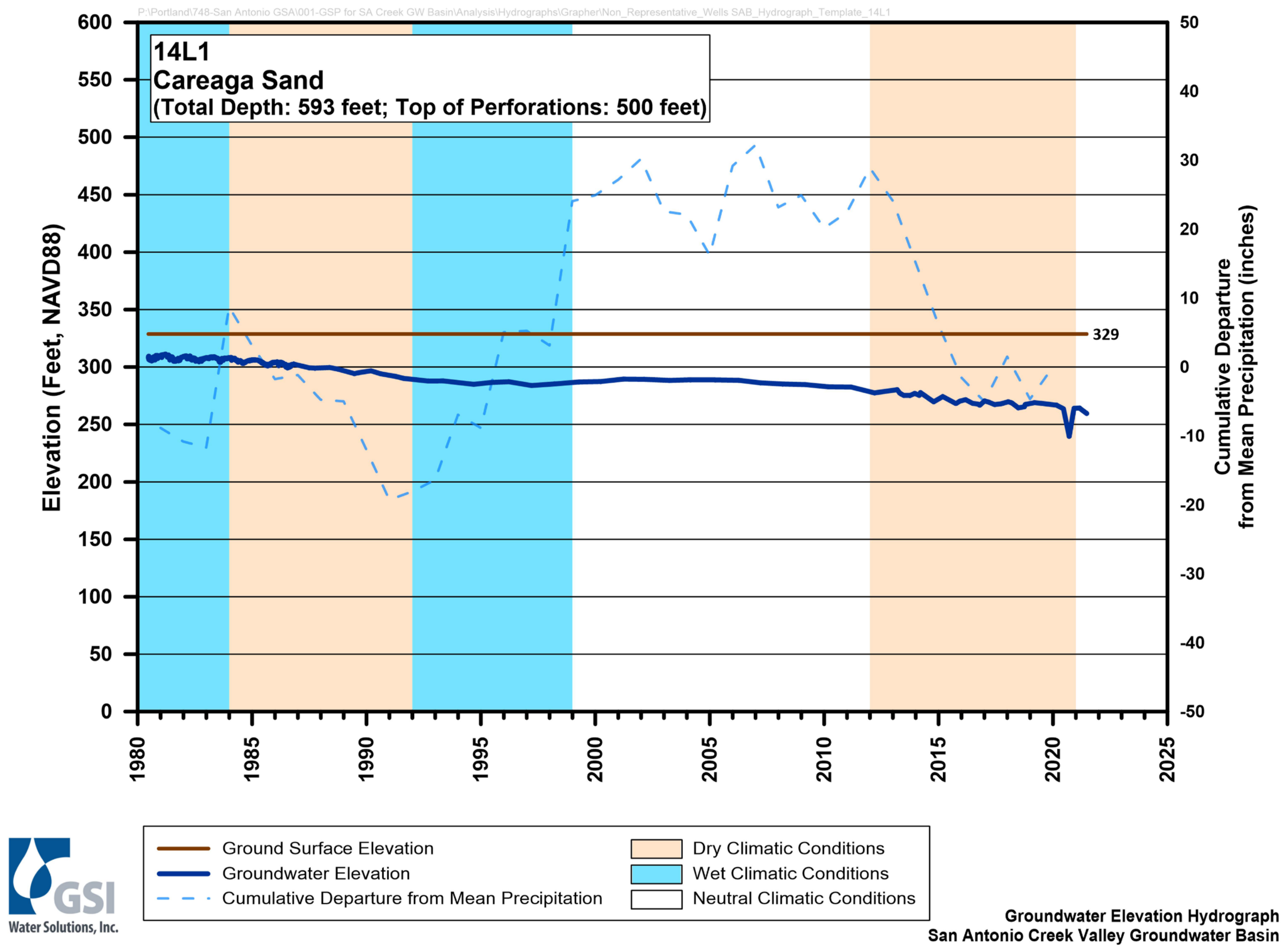

Figure 3-21. Hydrograph of Well 14L1, Careaga Sand