ITEM NO.
3.2

Santa Clarita Valley Groundwater Sustainability Agency Stakeholder Advisory Committee Memorandum

DATE: October 14, 2020

TO: SCV-GSA Stakeholder Advisory Committee

FROM: SCV-GSA Staff

SUBJECT: Draft Tech Memo – Water Budget Development for the Santa Clara River Valley East Groundwater Subbasin

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SUMMARY:

The purpose of this item is to provide a briefing on the technical memorandum titled Water Budget Development for the Santa Clara River Valley Groundwater Basin, East Subbasin. It was prepared by GSI Water Solutions, Inc.

As we prepare to present this information in a public workshop format, we seek feedback from the Stakeholder Advisory Committee (SAC).

DISCUSSION:

A water budget defines the sources and uses of water in an area. This tech memo describes the historical, current, and future water budgets for our groundwater basin.

The primary content includes:

1. Explanation of the data sources, time periods and methods for analysis.

2. Historical water budget data beginning in 1925, and covering 14 hydrologic sequences, consisting of 5 wet periods, 4 normal periods, and 5 dry periods (droughts).

3. Current water budget data, drawn from the land and water uses in 2014. It examines how the land and water uses in 2014 would have affected the basin on a long-term basis if the 2014 land and water uses were to be repeated throughout the historical precipitation sequence.

4. The projected (future) water budget represents full build-out conditions for the basin, which are expected to occur by approximately the year 2050. Three projections are provided – full build out without climate change; two budgets with DWR provided climate change data for 2030 and 2070.

5. Basin Safe Yield Estimate, or the average amount of pumping that can occur on a long-term basis without creating a chronic (i.e., continual) lowering of groundwater levels and reduction in groundwater storage volumes.

RECOMMENDATION:

As you read the draft tech memo, consider whether it makes sense to you as a representative of your stakeholder group and whether it raises questions that are not addressed.

In item 3.3 of today's agenda, the SAC will also review draft outreach materials that have been prepared to help guide public education and discussion around this topic.

Attachment

DRAFT

Santa Clarita Valley Water Agency

Water Budget Development for the Santa Clara River Valley East Groundwater Subbasin

Santa Clarita, California

October 2020

Prepared by:
GSI Water Solutions, Inc.
418 Chapala Street, Suite H, Santa Barbara, CA 93101

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Abbreviations and Acronyms

AFY	acre-feet per year
BMP	best management practice
DEW	drier with extreme warming
DWR	California Department of Water Resources
ESA	Environmental Science Associates
ESI	Environmental Simulations, Inc.
ET	evapotranspiration
Ft	foot or feet
ft/day	foot or feet per day
GDEs	groundwater-dependent ecosystems
GHB	general head boundary
GIS	geographic information system
GSI	GSI Water Solutions, Inc.
GSSI	Geosciences Support Services, Inc.
GSP	groundwater sustainability plan
I-5	Interstate 5
in/yr	inch or inches per year
KJC	Kennedy/Jenks Consultants
LA	Los Angeles
LADWP	Los Angeles Department of Water and Power
LSCE	Luhdorff and Scalmanini Consulting Engineers
Newhall Land	Newhall Land and Farming Company
NWD	Newhall Water Division
OVOV	One Valley One Vision
RCH	Recharge Package for MODFLOW-USG
RCS	Richard C. Slade Consulting Groundwater Geologist
SCAG	Southern California Association of Governments
SCV	Santa Clarita Valley
SCV Water	Santa Clarita Valley Water Agency
SCV-GSA	Santa Clarita Valley Groundwater Sustainability Agency
SCVGWFM	Santa Clarita Valley Groundwater Flow Model
SCWD	Santa Clarita Water Division
SFR	Streamflow Routing Package for MODFLOW-USG
SGMA	State of California's Sustainable Groundwater Management Act
SWP	State Water Project
USGS	U.S. Geological Survey
UWMP	Urban Water Management Plan
VWD	Valencia Water Division
WMW	warmer with moderate warming
WRP	water reclamation plant

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SECTION 1: **Summary of Basin Conditions and Water Budget**

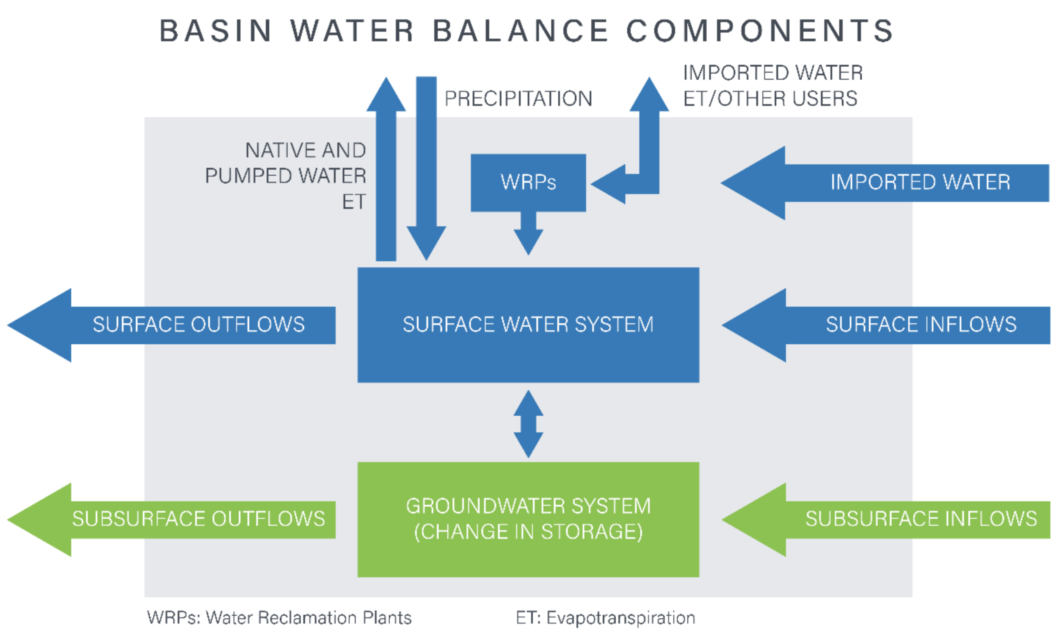
This report describes the historical, current and future water budgets for the groundwater basin that is located in the Santa Clarita Valley (the valley), in northwestern Los Angeles County, California (LA County). The water budgets have been developed as part of the ongoing process of developing a Groundwater Sustainability Plan (GSP) for the groundwater basin (basin) under the requirements of California's Sustainable Groundwater Management Act (SGMA).

1.1 Background

1.1.1 Introduction

A water budget defines the sources and uses of water in an area. The budget, like a financial budget, is intended to quantify the sources and uses of water and ensure they are in long-term balance. With variable water supplies, groundwater storage can be used to balance water supply and demand in the short term, while ensuring that supplies meet or exceed demand to provide a balanced water budget over the longer term. The water budget is thus closely related to the water balance, which tracks supplies, demands, and changes in storage.

The water budget for the groundwater basin is a regional basinwide water budget that accounts not just for groundwater, but also for surface water and imported water supplies and uses. The regional water budget provides an accounting of all surface water and groundwater flowing into and out of the basin over a specified period of time. A depiction of the Santa Clarita Valley's water budget processes (inflows and outflows) for surface water and groundwater in the basin is shown below.



In the groundwater budget, basin inflows include imported water recharge, surface water, and subsurface flows into the groundwater system; outflows include groundwater extraction (pumping), plant uptake of groundwater, groundwater flows to surface waters, and subsurface outflows. The difference between outflows and inflows result in a change in the volume of water stored within the basin.

Imported water primarily enters the groundwater system through percolation of applied water and leachate from septic systems. However, imported water is occasionally released to the river system from Castaic Lake, and a portion of these releases percolates into the groundwater basin from the river system. Outputs from the basin include subsurface and surface flows at the LA/Ventura County line (county line); evapotranspiration from plants along the river and its tributaries; and consumptive uses including agricultural municipal, institutional, and industrial uses of pumped groundwater. Changes in regional storage occur almost exclusively in the groundwater basin because surface storage in the area is dedicated to storage in Castaic Lake of imported water, not local water.

Recharge of the basin from surface waters occurs from percolation of stormflows from the Santa Clara River and its tributaries, and from precipitation falling on the basin and percolating into the groundwater system. Subsurface groundwater originating from outside of the basin is a fairly minor source of inflow.

The interactions between surface water and groundwater can be quite complex and subtle and are discussed in greater detail below. This report prepares surface water and groundwater budgets that incorporate these interactions. This assessment, or water budget analysis, provides an understanding of historical conditions, current conditions, and how future changes to supply, demand, hydrology, population, land use, and climatic conditions may affect the water budget in the Santa Clarita Valley.

1.1.2 Basin Definition

The Santa Clarita Valley's groundwater basin, or more specifically the Santa Clara River Valley East Subbasin, is the eastern-most and furthest upstream in the group of six subbasins that comprise the Santa Clara River Valley Groundwater Basin (Figure 1-1). Located in the Santa Clarita Valley in northwestern LA County, California, this groundwater basin is identified in the California Department of Water Resources (DWR) Bulletin 118 as DWR Basin 4-4.07 (LA County). The East Subbasin (also referred to in this report as the basin) sits in the Eastern Hydrologic Subarea of the Upper Santa Clara River Hydrologic Area (Figure 1-2).

1.1.3 Development of Imported Supplies and the Groundwater Operating Plan

Analysis of the current and future management of the local groundwater basin depends upon a number of parameters, including the criteria used to manage water demands, imported supplies, recycled water, and groundwater pumping. Further, future management of the local groundwater basin must consider the influences of future growth and possible climate change. In particular, the current and future management of groundwater is based on SCV's groundwater operating plan, which was incorporated into the AB 3030 Groundwater Monitoring Plan[1] and adopted in 2003 by Castaic Lake Water Agency (CLWA), the predecessor agency to today's Santa Clarita Valley Water Agency (SCV Water). The groundwater operating plan was updated in 2009 and is based upon the principle of ensuring that the basin is operated without causing an overdraft condition (i.e., it is operated within its safe yield) (LSCE and GSI, 2009). By design, the operating plan draws upon the groundwater storage reserves of the basin (primarily in the Saugus Formation) to augment imported supplies during drought years in the State Water Project (SWP) system, then reduces pumping at other times to facilitate the natural replenishment of those reserves. This operating plan is integral to the water resources plan for SCV described in its Urban Water Management Plans (UWMPs).[2]

[1] The Groundwater Management Act (AB 3030), which took effect in 1993, permitted certain local agencies to develop groundwater management plans.
[2] The Final 2015 Urban Water Management Plan for Santa Clarita Valley, published June 2016, is the current version of the UWMP (KJC et al., 2016).

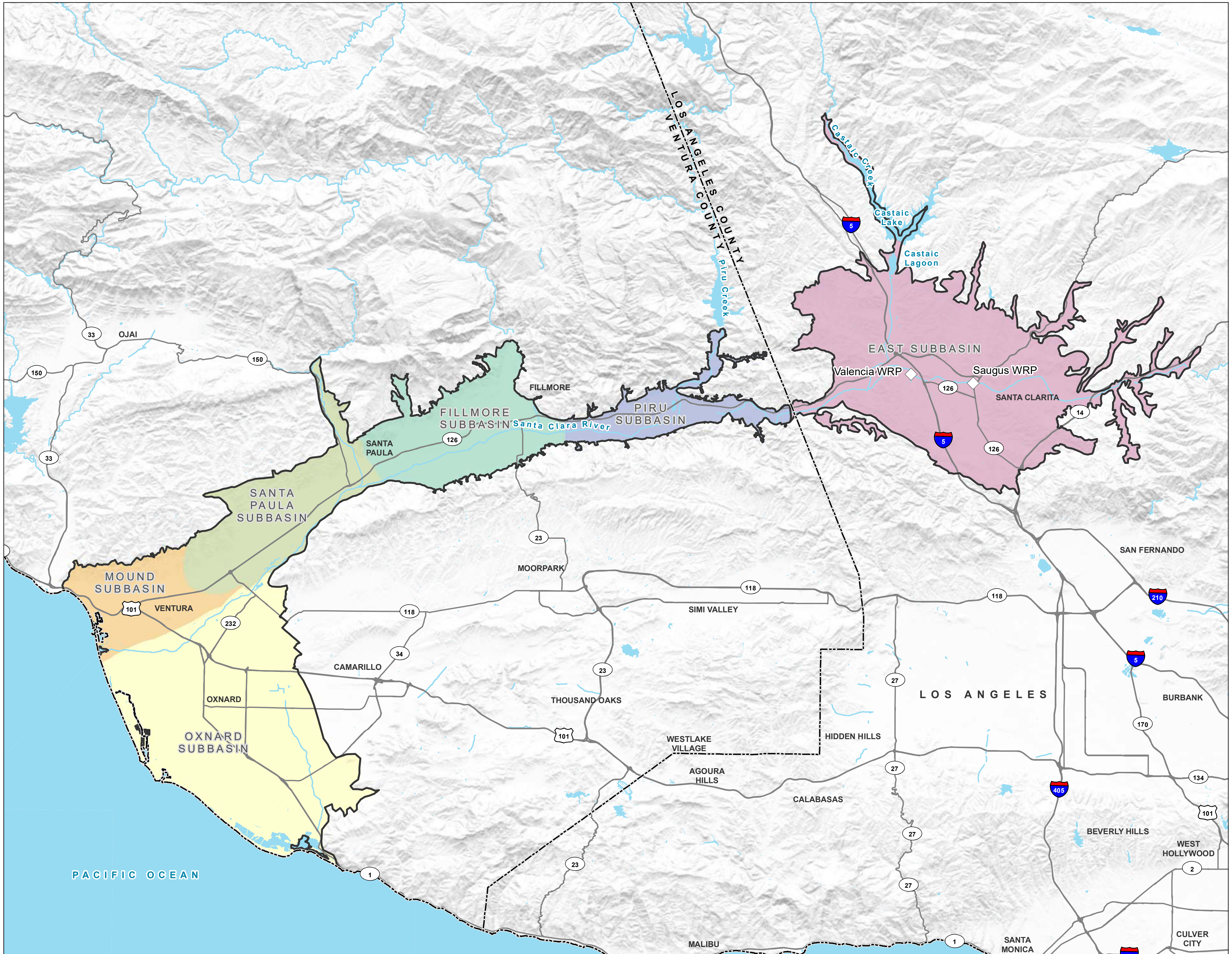


FIGURE 1-1

Santa Clara River Valley Groundwater Basin and Subbasins

Water Budget Development for the Santa Clara River Valley East Groundwater Subbasin

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- Wastewater Reclamation Plant (WRP)
- Santa Clara River Valley Groundwater Basin

Santa Clara River Valley Subbasins

- Santa Clara River Valley East
- Piru
- Fillmore
- Santa Paula
- Mound
- Oxnard

All Other Features

- County Boundary
- Major Road
- Watercourse
- Waterbody

N

0 12,500 25,000 37,500
Feet

Date: October 6, 2020
Data Sources: USGS, DWR Bulletin 118

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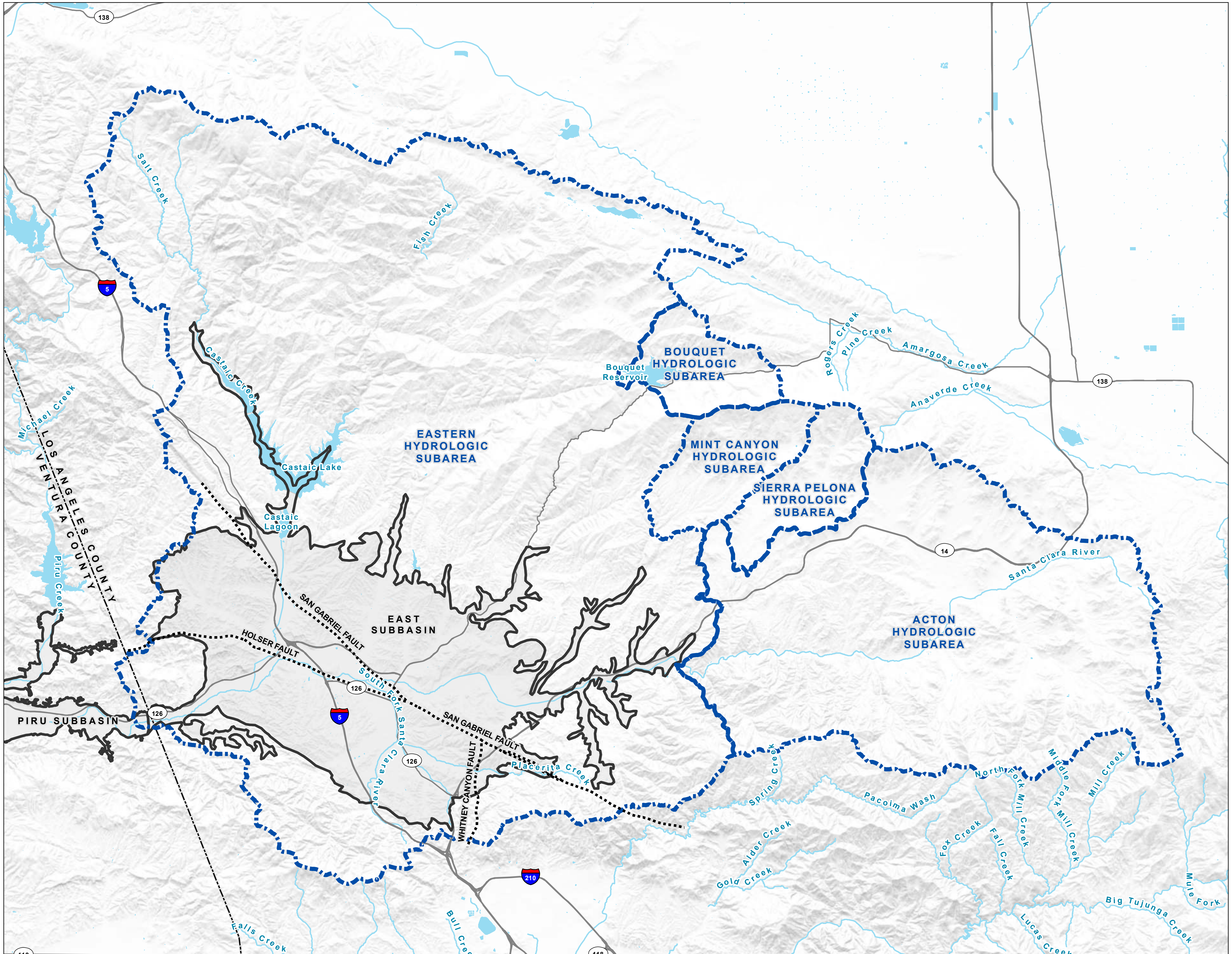

FIGURE 1-2

Watershed Boundaries for Upper Santa Clara River Hydrologic Area and Subareas

Water Budget Development for the Santa Clara River Valley East Groundwater Subbasin

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- Santa Clara River Valley Groundwater Basin
- Upper Santa Clara River Hydrologic Subarea

All Other Features

- Major Road
- Watercourse
- Waterbody

N

0 9,000 18,000 27,000
Feet

Date: September 10, 2020
Data Sources: USGS, DWR Bulletin 118

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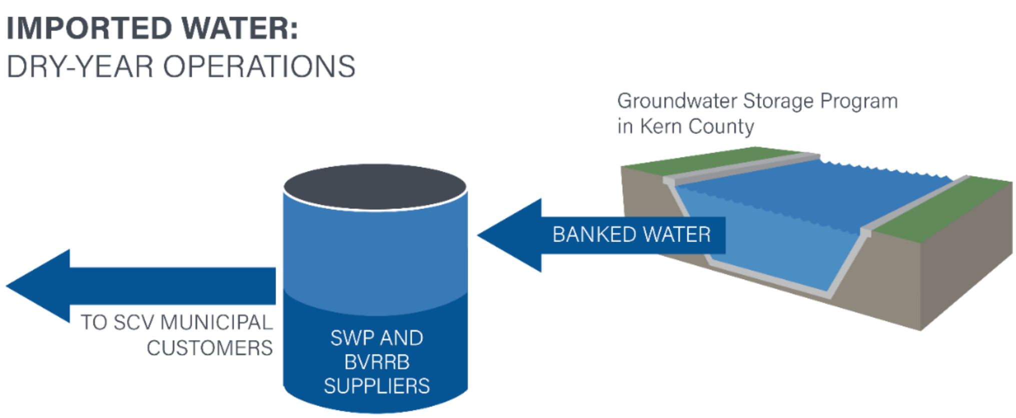
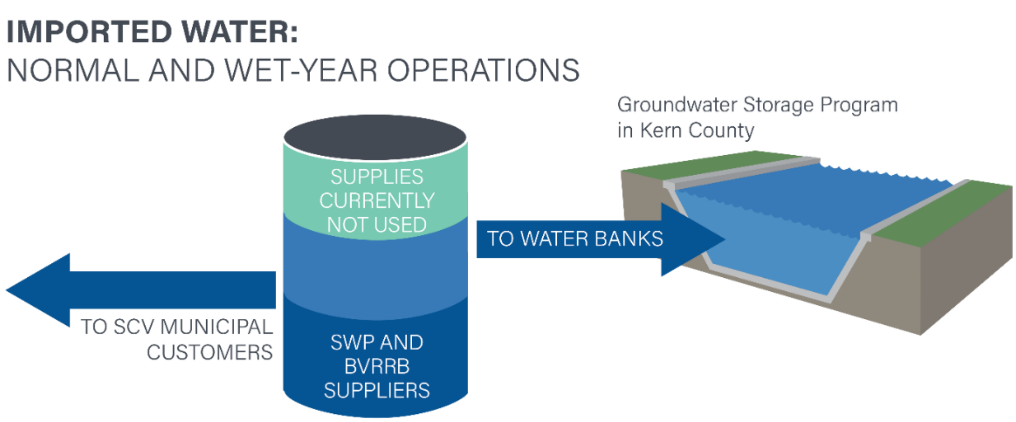
Imported Water

In 1963, the Upper Santa Clara River Valley Water Agency, the predecessor and legacy agency to CLWA and now SCV Water, entered into a contract with DWR for SWP supply. Of the 79,000 acres then encompassed by the legacy agency boundary, 10,600 acres were in agricultural production and 3,700 acres were residential, with 12,400 residents. Also, the Wayside Honor Rancho (now the Pitchess Detention Center) and other LA County correctional facilities housed an additional population consisting of 3,200 inmates. At that time, planners estimated that, by 1990, agricultural activities would end and developable land covering 51,500 acres would be urbanized and support a population of 180,000. Accordingly, the legacy agency contracted for SWP water supply of 23,000 acre-feet per year (AFY) to keep the basin in balance. Annexations and new land development practices made more land developable. In response, the legacy agency increased its contract amount to 41,500 AFY by 1966.

Later, it became apparent that the SWP was unable to reliably deliver these quantities of water for a variety of reasons, including more stringent regulatory constraints. During this period, the legacy agency took several actions to address the declining reliability of its SWP supplies. These included purchasing SWP contract rights from other water purveyors in 1991 and 1992, which increased the legacy agency's current contract amount to 95,200 AFY.

In addition, CLWA acquired a firm 11,000 AFY of groundwater from the Buena Vista and Rosedale Rio-Bravo Water Storage Districts. Further, CLWA/SCV Water has placed 140,000 acre-feet of water into long-term groundwater banks located in Kern County to provide imported water when SWP supplies are curtailed because of dry conditions. The operation of these water banks during wet/normal year and dry years is illustrated below.





BVRRB: Buena Vista and Rosedale Rio-Bravo Water Storage Districts
SCV: Santa Clarita Valley Water Agency
SWP: State Water Project

The cylinders in these diagrams show the total imported supplies available to the basin. In normal and wet years, water in excess of annual need is banked. Under wetter circumstances that water may exceed the ability to bank supplies, in which case, excess water may be turned back to the SWP system. Conversely, during dry years, water is taken out of the bank to make up for SWP shortfalls.

Basin Operating Plan

To ensure that the area had appropriate balance between reliance on imported water and reliance on groundwater, the water purveyors undertook preparation of an AB 3030 Groundwater Management Plan (AB 3030 plan) that was adopted in 2003. The AB 3030 plan built on extensive work already conducted in the basin and introduced application of a three-dimensional numerical groundwater model to ensure that the proposed operations under this plan would not result in overdraft. The AB 3030 plan established a Basin Operating Plan that specified the following annual groundwater production schedule:

	Groundwater Production (AFY)			
	Normal Years	Dry Year 1	Dry Year 2	Dry Year 3
Alluvial Aquifer	30,000 to 40,000	30,000 to 35,000	30,000 to 35,000	30,000 to 35,000
Saugus Formation	7,500 to 15,000	15,000 to 25,000	21,000 to 25,000	21,000 to 35,000
Total	**37,500 to 55,000**	**45,000 to 60,000**	**51,000 to 60,000**	**51,000 to 70,000**

AFY: acre-feet per year

As documented in the 2010 and 2015 Urban Water Management Plans (KJC et al., 2011 and 2016) and the 2017 Water Supply Reliability Plan Update (Clemm and KJC, 2017), the combination of imported water management in conjunction with the basin operating plan forms the basis for current and future water planning in the Santa Clarita Valley.

1.2 Water Budget Analysis and Presentation of Data

The water budgets presented in this report have been developed using a three-dimensional numerical computer model that simulates the natural interactions that take place between surface and groundwater components. The model conducts its calculations three times a month over multiple decades to estimate these interactions.

Figure 1-3 depicts the general characteristics of the surface and groundwater processes occurring in the basin, along with the geologic structure of the basin.

1.2.1 The Role of Imported Water in the Water Budget Analysis

Imported water is an important part of the regional water budget. The adequacy of imported water is essential to meeting the needs of the region and its water balance. Imported water comes from various water supply sources that are transported through SWP system to Castaic Lake, where SCV Water takes delivery of these supplies and treats the water at either the Earl Schmitt Filtration Plant or the Buena Vista Water Treatment Plant. Water is then distributed to municipal water users. Imported water enters the natural surface water system as return flow from municipal sewerage system discharges and releases from Castaic Lake to downstream agencies in Ventura County (a portion of which recharges the groundwater system in the East Subbasin). Imported water also recharges the groundwater system as percolation from land-applied

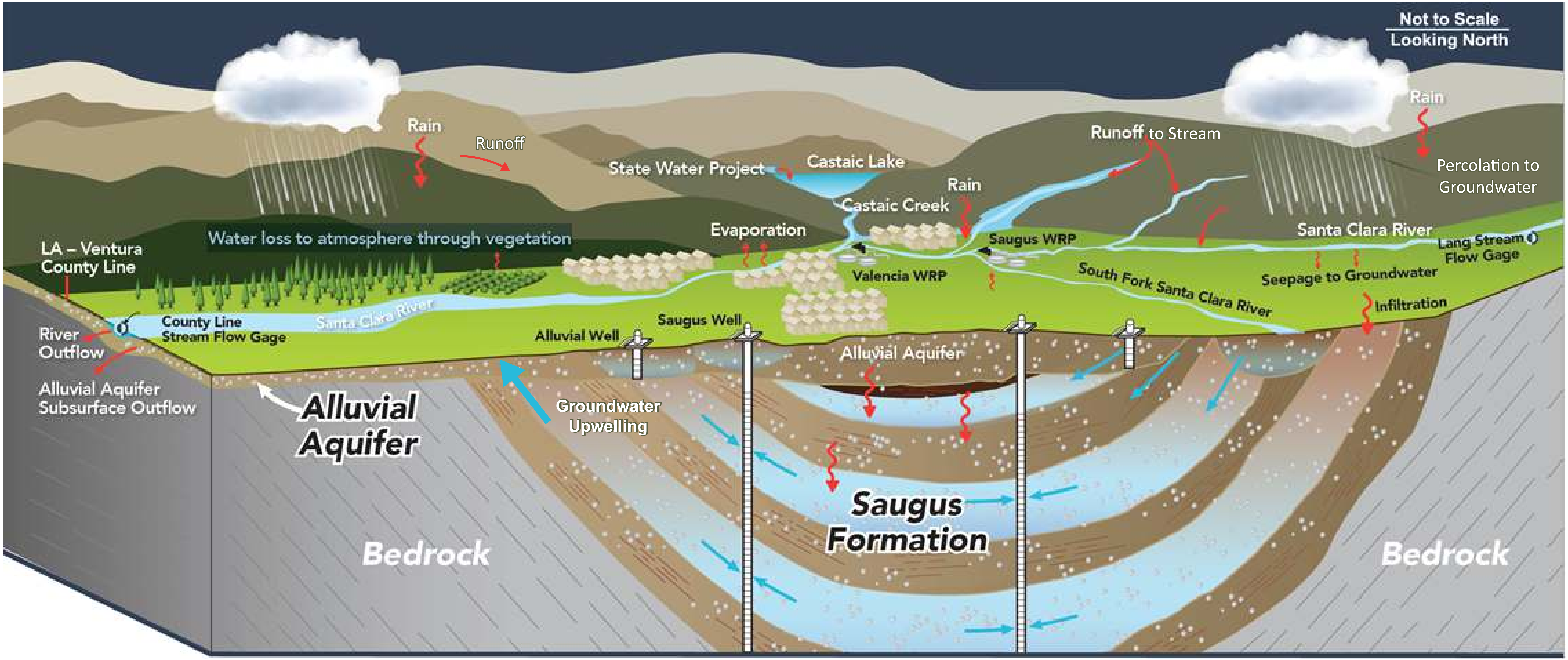


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FIGURE 1-3

Conceptual Groundwater and Surface Water Flow Diagram
Santa Clara River Valley Groundwater Basin, East Subbasin

Water Budget Development for the Santa Clara River Valley East Groundwater Subbasin

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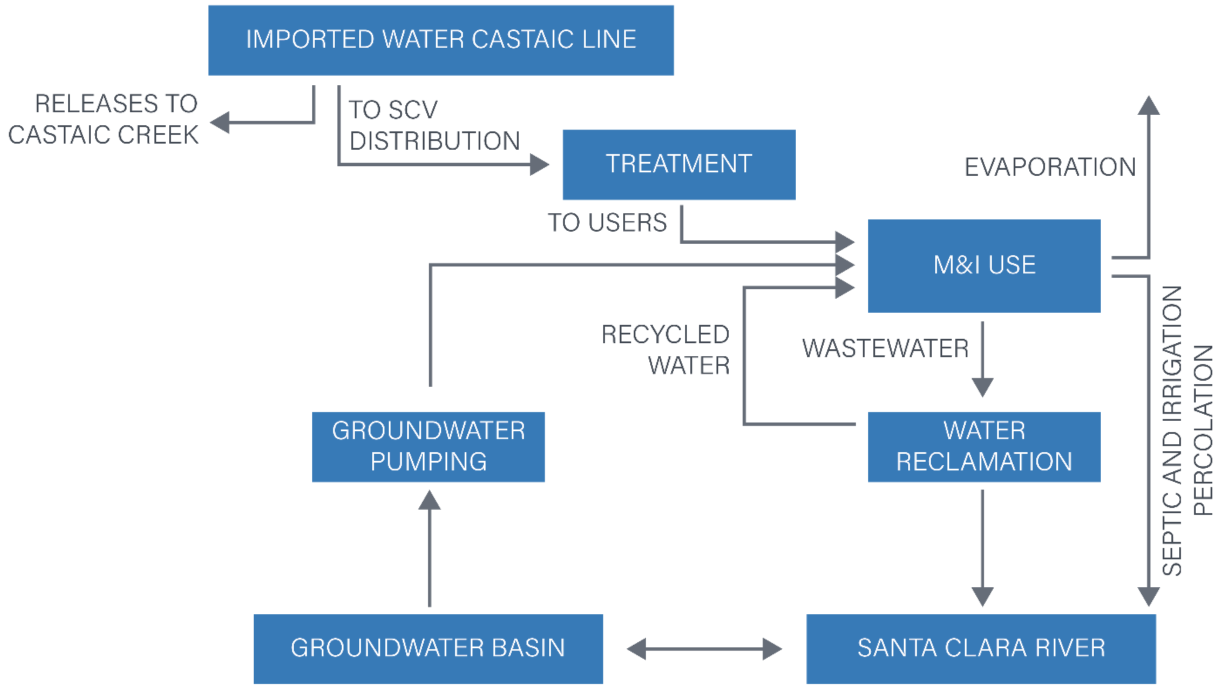
water (outdoor irrigation) and from septic systems. The use of imported water in the regional water balance is depicted in the graphic below.

IMPORTED WATER IN WATER BALANCE



M&I: Municipal and Industrial
SCV: Santa Clarita Valley Water Agency

In this report, imported water releases to Castaic Creek are included in the historical water budget analysis, but are not included in the current or future water budget analyses. Future releases of imported water to Castaic Creek are presumed to be for the benefit of downstream parties only, and therefore any incidental recharge is excluded from the future water budget for the upstream area.

The return flows of imported water (from deep percolation of applied irrigation water, septic tank percolation, and water reclamation plant [WRP] discharges to the Santa Clara River) are not tracked separately in the water budget analyses from the return flows from local groundwater supplies because these two supply sources are blended in the distribution system. Accordingly, imported water is reported only in tables showing the sources of water for delivery to customers in any year. In these tables, imported water is shown as an amount of water delivered by SCV Water from Castaic Lake through its municipal delivery system to its customers.

1.2.2 Terms Used in Water Budget Tables and Graphics

In this report, tabular data present the water budgets for the surface water system (generally the Santa Clara River and its tributaries), and the groundwater system (the East Subbasin, which is the local groundwater system in the valley). Because of the interconnections between these systems, the tables may show that an interconnected process that exchanges water between the surface and groundwater systems has a negative number in one system and an equal but positive number in the other system, to provide balancing of the water budgets in both systems. For example, streamflow losses that represent an outflow term for surface water also represent inflow (recharge) values for groundwater, while upwelling of groundwater into a stream represents an outflow (loss) of water from the groundwater system and an inflow (gain) of water in the surface water system.

In order to discern important watershed components such as surface water versus groundwater flows leaving the basin and groundwater storage changes over time, separate surface water and groundwater budgets were developed. These budgets reflect the results of modeling the interaction between the surface water and groundwater systems. These exchanges of water and the complete group of processes that are components of the surface water and groundwater budgets (and that are used in the graphics and tables) are summarized below.

- **Precipitation**, primarily in the form of rainfall, typically occurs from fall through spring. While averaging slightly over 17 inches per year, it is highly variable as shown below in Figure 1-4. The general pattern is a period of below-normal precipitation followed by shorter periods of higher precipitation. Rainfall provides surface flows in the form of runoff and directly recharges the groundwater basin through percolation through the soil column. Quantities of precipitation are impacted by climate change as discussed in the future water budget discussion (Section 5).
- **Surface Water Inflow** to the groundwater basin is depicted in the surface water tables that follow as an addition to the groundwater system and as a Surface Water Loss in the surface water tables. Surface water flow originates from precipitation in canyons and tributaries of the upper Santa Clara River watershed, which drain into the Santa Clara River. Conversely, groundwater upwelling that flows into the surface water systems is depicted as an outflow from the groundwater system but a source of water to the surface water system. The watersheds that are tributary to the basin are shown on Figure 1-5. Surface water inflows also include controlled releases of local water and (infrequently) SWP water impounded in Castaic Lake. The impounded local water consists of precipitation runoff from the watershed areas upstream of the reservoir. These releases occur into Castaic Creek near the northern basin boundary. Controlled releases of local water also occur from Bouquet Reservoir, which is located at the boundary between the Eastern and Bouquet Hydrologic Subareas (Figure 1-2). Some of these releases infiltrate the alluvial material underlying each creek, while the remainder continues as streamflow out of the East Subbasin.
- **Evapotranspiration** is the uptake of groundwater by phreatophyte plant communities. These include the riparian mixed hardwood forests and coast live oak woodlands shown in Figure 1-6.
- **Other Consumptive Uses** represent the portion of agricultural and urban water uses that are not returned to the surface or groundwater systems and hence are “consumptive” uses of water. This is almost exclusively in the form of evapotranspiration of land-applied water (water that is used for irrigation of agricultural crops and urban landscapes). Consumptive use does not include water that percolates into the ground when irrigation of agricultural lands and municipal lawns and gardens occur; these are accounted for as inflows into the groundwater system. Indoor water use is a very small consumptive use. Most of the water used inside homes and nonresidential facilities is returned to the system via wastewater systems that include WRPs that discharge treated water into the Santa Clara River, or from septic systems that percolate into the groundwater system.
- **Surface and Subsurface Outflows** represent surface or groundwater flowing out of the basin at the county line.

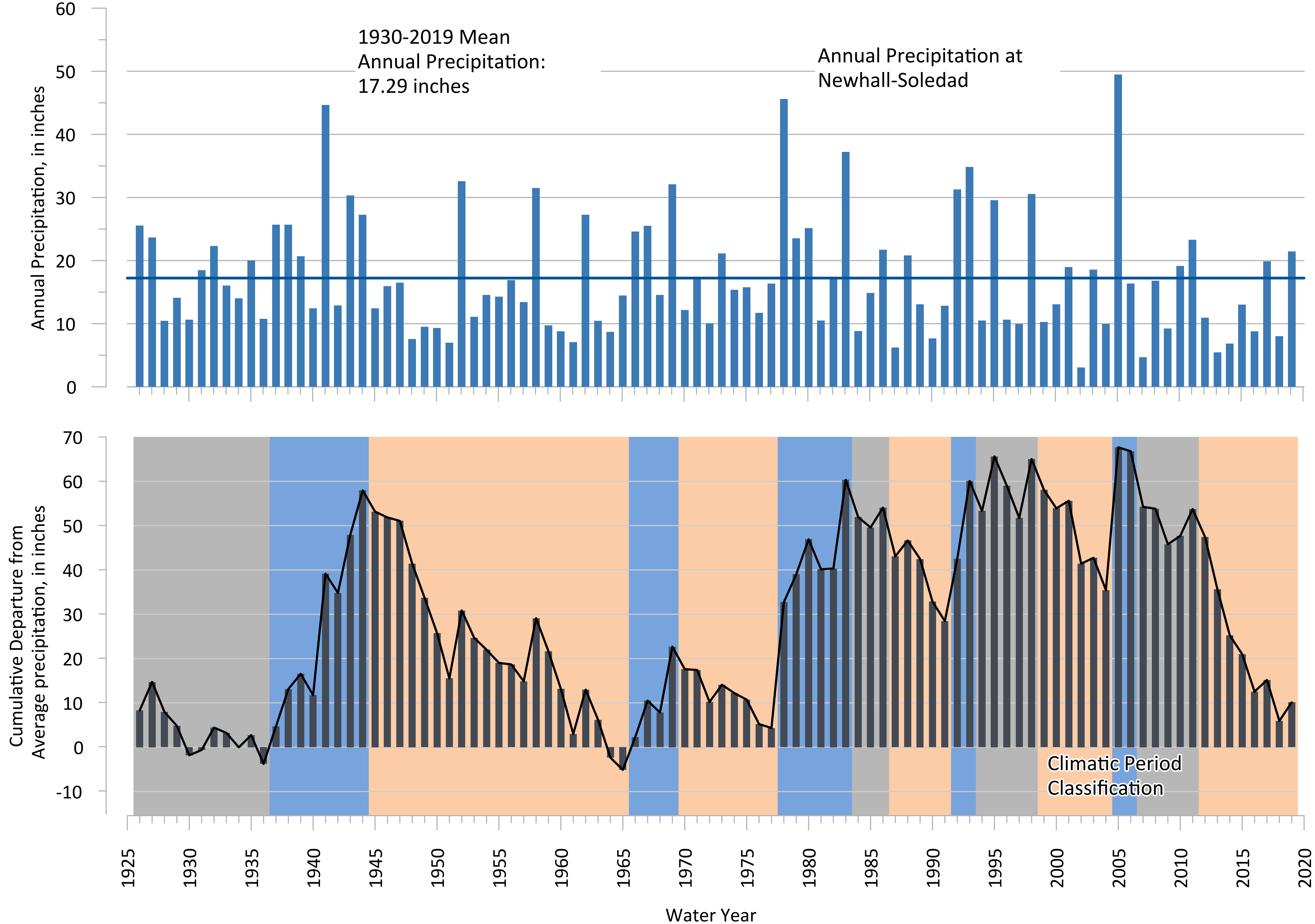


FIGURE 1-4

Annual Precipitation at the Newhall-Soledad (Newhall Fire Station #73) Rain Gage and Water Year Types for the Santa Clara River Valley East Groundwater Subbasin

Water Budget Development for the Santa Clara River Valley East Groundwater Subbasin

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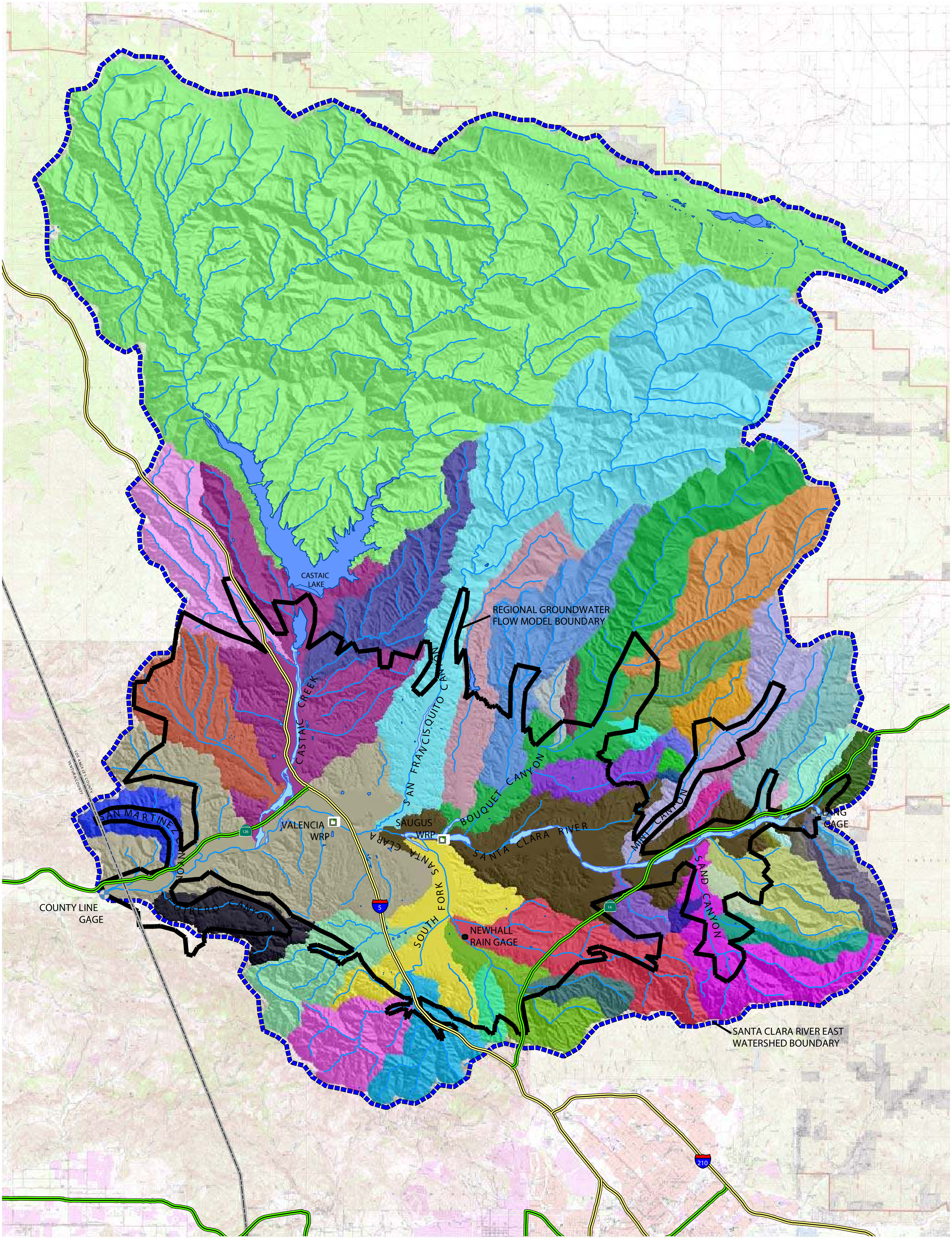
LEGEND

- Wet
- Dry
- Normal
- Cumulative Departure From Mean
- Mean Precipitation



LEGEND

Hydrography

Lake

Stream

Stream Gage

Major Road

Interstate

State Highway

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Date: October 6, 2020
Data Sources: CH2MHILL, 2004

FIGURE 1-5

Contributing Watersheds to the Santa Clara River Valley East Groundwater Subbasin

Water Budget Development for the Santa Clara River Valley East Groundwater Subbasin

N

0 2.5 5
Miles

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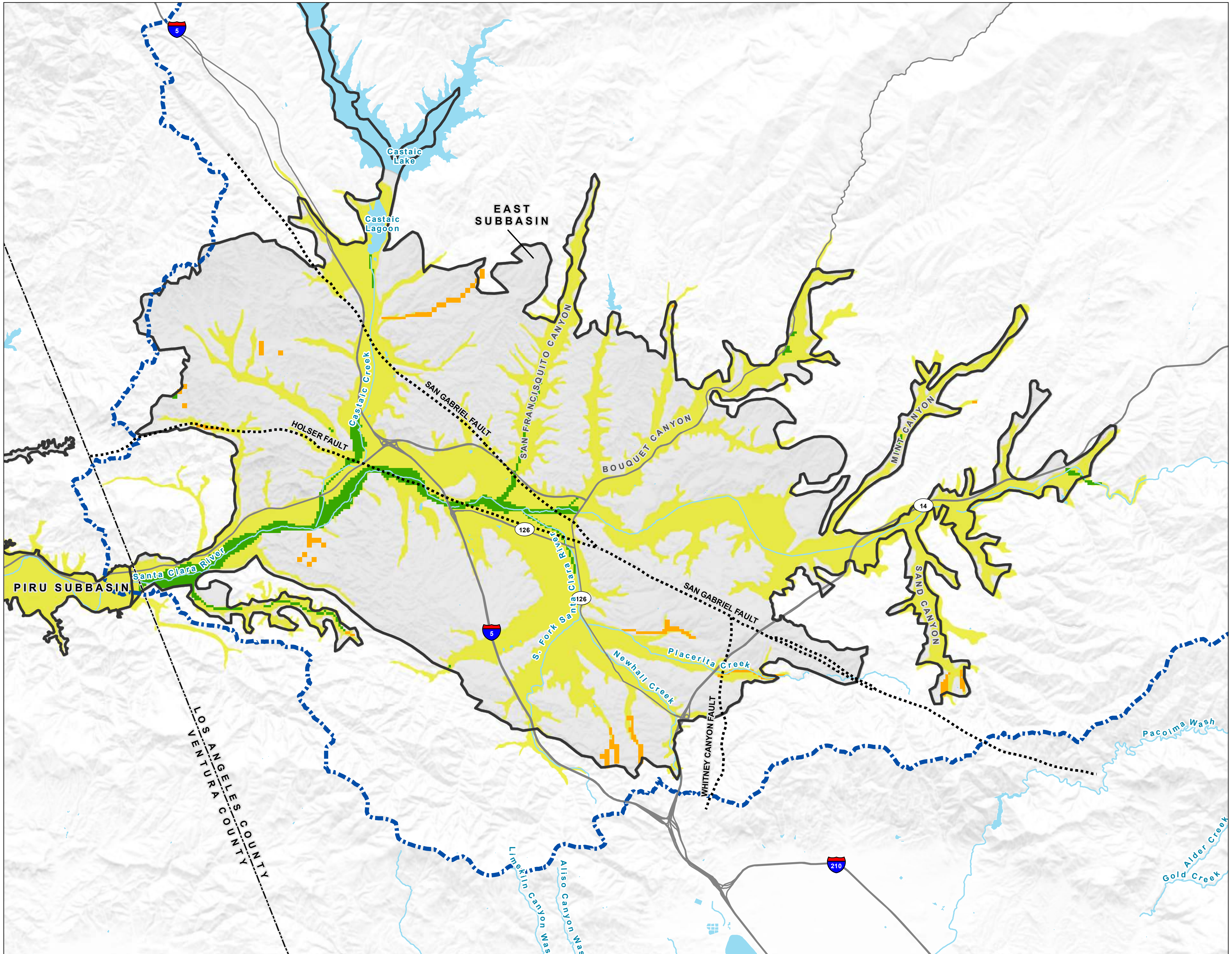

FIGURE 1-6

Phreatophyte Locations in the Model Grid

Water Budget Development for the Santa Clara River Valley East Groundwater Subbasin

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- Alluvium
- Santa Clara River Valley Groundwater Basin
- Watershed Boundary

Phreatophyte Locations

- Riparian Mixed Hardwood
- Coast Live Oak Woodland

All Other Features

- Major Road
- Watercourse
- Waterbody

N

0 5,000 10,000 15,000

Feet

Date: October 5, 2020
Data Sources: USGS, DWR Bulletin 118, ESA (2020)

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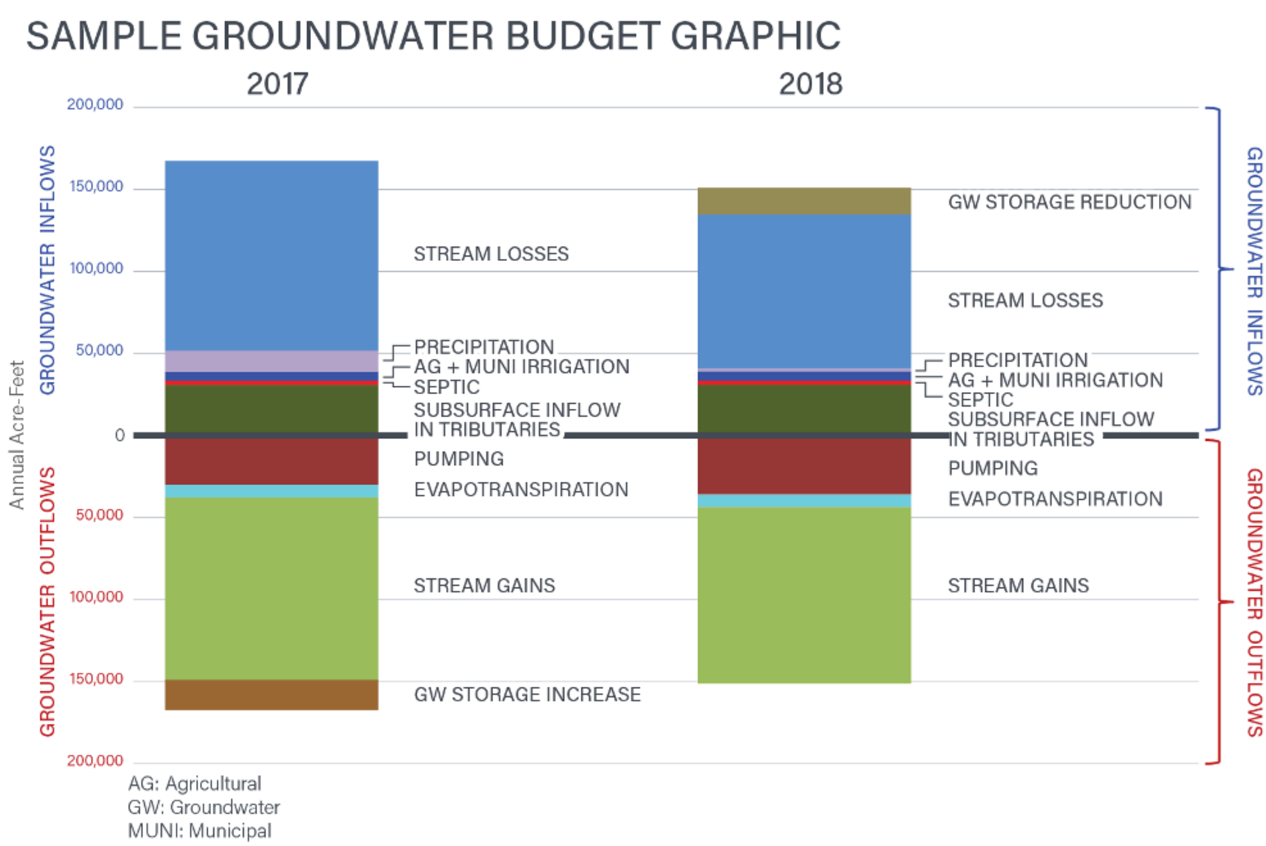
- **Point Discharges to the Santa Clara River** also occur from local WRPs and from periodic releases of groundwater that has been pumped to contain and treat perchlorate contamination on and near the former Whittaker-Bermite Corporation property.
- **Stream Losses** are surface water outflows that occur when stream flows seep into the underlying groundwater system (See Surface Water Inflows above) and when surface water flows out of the East Subbasin in the Santa Clara River at the county line.
- **Stream Gains** occur when groundwater upwells into surface streams. (See Surface Water Inflows above) These flows, beginning at the mouth of the San Francisquito Canyon and continuing beyond the county line, contribute to the perennial streamflow that occurs in most periods in the Santa Clara River.
- **Agricultural and Municipal and Industrial Irrigation** water that is not taken up by plants (through evapotranspiration) percolates into the groundwater basin. This is also referred to as irrigation return flow.
- **Septic Systems** also provide a small amount of groundwater recharge to the basin.
- **Pumping** from the groundwater basin removes water from the groundwater system. The largest pumper in the basin is SCV Water, which accesses groundwater from both the Alluvial Aquifer and the Saugus Formation. Other pumpers include Five Point, which extracts water for agricultural uses; the Pitchess Detention Center, which extracts water for municipal purposes; the Disney Corporation, which pumps Saugus Formation groundwater for irrigation purposes; golf courses; and small domestic pumpers. Historical pumping levels are documented in annual reports, including the *2019 Santa Clarita Valley Water Report* (LSCE, 2020).

The water budget analyses for the East Subbasin combine these hydrologic and water use components to arrive at annual surface water and groundwater budgets. These budgets are presented in graphical form and in tables. A sample of the terms used in the groundwater budget is shown in the diagram below for two years:



In the Sample Groundwater Budget graphic, the area below the zero line of the graphic shows pumping, evapotranspiration (ET), and stream gains, are all leaving the groundwater system (as groundwater outflows), while stream losses, precipitation, irrigation return flows, septic systems, and subsurface tributary inflows, are all recharging the groundwater basin (i.e., as groundwater inflows), as shown above the zero line. Using DWR's guidance for displaying storage changes, the net impact of stored groundwater on the water budget and the balancing of the water budget terms is shown in black for the first year and in tan for the second year.

For the second year, the positive value of this storage change (as represented by the tan bar) is called a groundwater storage reduction because the aquifer naturally releases stored water that is then available as a source of water to support the various groundwater discharge mechanisms that are operating in the basin. This occurs when the volumes of those groundwater outflow terms are higher than the amount of recharge into the aquifer system. Conversely, for the first year, the negative value of this storage change (as represented by the black bar) is called a groundwater storage increase because the aquifer naturally stores water during high precipitation/recharge periods (when the groundwater discharge mechanisms do not need to withdraw stored water because of the high amount of groundwater recharge). This method of representing the storage terms is based on the principle of conservation of mass, which states that the difference between inflows and outflows must equal the change in storage at any given time. Accordingly, under this principle, in any given year, the size of the group of bars lying above the zero line is the same as the size of the group of bars lying below the zero line.

1.3 The Process for Building the Future Water Budget

The water budget analyses that are described and developed in this report provide the basis for identifying the future water budget that will be used in subsequent steps of GSP development to evaluate basin sustainability, develop sustainable management criteria under SGMA, and identify and evaluate implementation measures for obtaining and/or maintaining long-term sustainability of the basin's groundwater resources in the next 20 years (the time frame required by SGMA for achieving sustainability). In the sections below, the estimated future water budget (which is described by DWR as the "projected" water budget) for the basin is derived. The future basin water budget is fundamental to evaluating the sustainability of the basin because it depicts how the basin operates in highly variable hydrologic conditions, how the basin interacts with the surface water system, and how the operating plan for the groundwater basin interrelates to the overall water resources supply plan for the region.

The development of the future water budget is presented in several parts.

- First, the historical water budget for the groundwater system is presented. The historical water budget shows how water use has grown over time as the area developed and how the groundwater basin water interacted with the surface water system and imported water system over time (from 1925 through 2019), including during periods of abundant precipitation and during periods of drought conditions.
- Next, the current water budget is presented. In this water budget, the performance of the basin is simulated over a repeat of the historical hydrologic record (1925 through 2019), but with a static level of pumping and overlying water demands that are representative of recent land uses and water uses in the basin. This differs from the historical water budget in that it takes out the factors associated with continual changes in the overlying land and water uses during the historical record, thereby allowing an analysis of how the basin would perform under a repeat of historical droughts and wet cycles at the current level of overlying development and water demand. The current water budget depicts how the groundwater basin currently interacts with the surface water system and how the region depends upon imported water to maintain a long-term balance between supplies and demands.

- Finally, the future water budget is presented, with a preceding discussion of how the groundwater operating plan was developed and how the groundwater operating plan interrelates to the region's dependence upon imported water supplies (based on a basin conjunctive-use management approach).

1.4 Historical Water Budget

This section provides a look back at the basin's historical water budget from 1925 through 2019. This historical water budget includes historical wet and dry periods, which are later used to represent water supply variability in current and future water budget evaluations. The historical water budget also depicts the actual history of past changes in regional water use over time.

1.4.1 Historical Water Supplies and Demands

Water use changes were dramatic during this period. The table below shows the overlying water demands and the sources of water used to meet those demands.

		Municipal Users				Other Users	Total	
Years	**Statistic**	**Local Groundwater**	**Imported Water**	**Recycled Water**	**Total**	**Local Groundwater**	**Local Groundwater**	**Demand**
1936-1949	Min	0	0	0	0	5,000	5,000	5,000
	Average	0	0	0	0	33,500	33,500	33,500
	Max	0	0	0	0	50,000	50,000	50,000
1950-1959	Min	500	0	0	500	50,000	50,500	50,500
	Average	500	0	0	500	50,000	50,500	50,500
	Max	500	0	0	500	50,000	50,500	50,500
1960-1979	Min	1,000	0	0	1,000	14,000	29,000	29,000
	Average	11,000	0	0	11,000	23,000	35,000	35,000
	Max	20,000	7	0	20,000	50,000	50,500	50,500
1980-2019	Min	12,201	1,126	0	21,386	9,975	24,138	24,138
	Average	25,820	26,486	167	52,473	13,990	39,810	39,810
	Max	34,612	47,205	507	77,311	17,312	50,373	50,373

Notes

All units are in acre-feet.

Min = minimum Max = maximum

Water use during the region's history can be logically divided into four periods: predevelopment (before 1936), agricultural (1936 to 1959), transition to urbanization (1960 to 1979), and the modern period of record (1980 to 2019).

- **Predevelopment Period (Before 1936)**. During the 1800s and early 1900s, the East Subbasin was largely rural, with ranches, rural populations, and small villages present. This early development included an outpost of Mission San Fernando that was established at Castaic Junction in 1802. See Lopez, 1974 for an ethnographic and archaeological study of these early years, including discussions of precipitation and temperature patterns during this period. Shallow hand-dug wells and direct diversions of water from perennial reaches of the Santa Clara River are thought to be the primary sources of the low-volume water needs in those days.[3]

- **Agricultural Development Period (1936–1959).** The first large-scale use of groundwater is thought to have occurred with the construction of agricultural supply wells along the Santa Clara River in the western and central portions of the East Subbasin beginning in the mid-1930s. Inspection of aerial photos from 1947 and a U.S. Geological Survey (USGS) study of the basin's agricultural and early urban years (Robson, 1972) indicate that groundwater pumping for agricultural uses supported irrigated crop cultivation on as much as 6,100 acres (approximately) of land lying along the alluvial corridors that contain the Santa Clara River and certain tributaries. See Appendix A for the locations of these lands and the wells that are estimated (based on construction dates) to have provided the irrigation water supply,. Calculations by Robson (1972), CH2M HILL (2004), and GSI (2020) for the mixture of crops farmed in those days and more recently indicate that (1) crop irrigation demands range from about 4 to 10 acre-feet (AF) per acre per year, and (2) crops consume approximately 50 to 70 percent of the land-applied irrigation water pumped from the Alluvial Aquifer, with the remainder lost to evaporation from soils and seepage back to the underlying water table. Accordingly, annual groundwater pumping to support agricultural irrigation is thought to have averaged approximately 50,000 AFY by the mid-1940s and continuing through much, if not all, of the 1950s. The Saugus Formation was not a source of groundwater supply until the early 1950s, when the newly formed Newhall County Water District drilled wells along the South Fork Santa Clara River in the town of Newhall.
- **Transition Period (1960–1979).** Beginning in the 1960s, certain parcels of agricultural land, located primarily east of the modern-day Interstate 5 (I-5) freeway, were retired and gradually urbanized. As this transition began, the region began planning water importation to meet future growth. In 1963, the Upper Santa Clara River Valley Water Agency, the predecessor to CLWA, and now SCV Water, contracted with DWR for SWP supply. Urbanization continued during the 1960s and 1970s, with the first deliveries of SWP water occurring in 1979.
- **Modern Record (1980–2019).** Over these years, the basin has continued to urbanize. By 2019 the region's population was approximately 286,000. During this period, the region invested in increased supplies of imported water and began operating the local groundwater basin in conjunction with imported water. This was formalized in a Groundwater Operating Plan near the turn of this century.

1.4.2 Historical Groundwater Budget Analysis Results

Figure 1-7, shown below, depicts the historical water budget. The figure presents a histogram plot showing the multiple groundwater inflows and outflows, with the inflows stacked as bars above the zero line and the outflows stacked as bars below the zero line. A yellow line shows the cumulative change over time in the volume of groundwater that is in storage in the East Subbasin. Like the cumulative departure curve for precipitation, the cumulative departure curve for groundwater storage indicates whether the basin is experiencing long-term changes in groundwater storage, and, in particular, whether an overdraft condition might exist (as would be shown by a curve that is declining over a long period—i.e., sloping down and to the right over multiple decades). As shown in this plot, the historical water budget shows the effects of periodic low precipitation periods but does not show long-term sustained downward trends in the cumulative departure curve over the entire period. The absence of long-term sustained downward trends in the cumulative departure curve indicates that the basin has not been in an overdraft condition. This observation is corroborated by observed groundwater levels in the basin.

[3] See https://scvhistory.com/scvhistory/lopezrobert1974rainfall.htm for details.

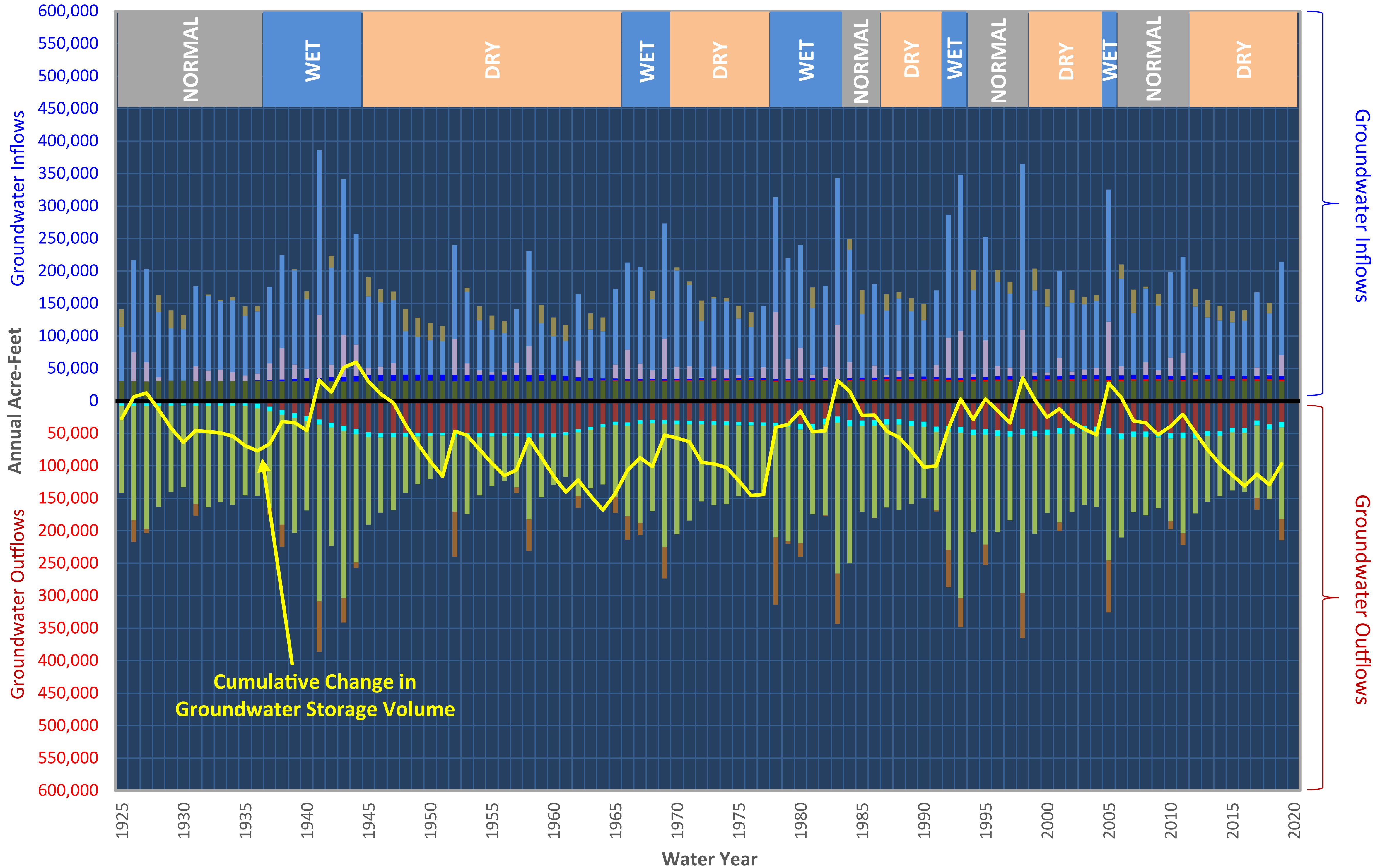


FIGURE 1-7

Historical Groundwater Budget (Water Years 1925-2019)

Water Budget Development for the Santa Clara River Valley East Groundwater Subbasin

DRAFT

LEGEND

- Stream Gains
- Stream Losses
- Precipitation
- Ag+Muni Irrigation
- Subsurface Inflow in Tributaries
- Septic
- Pumping
- ET
- Groundwater Storage Increase
- Groundwater Storage Reduction

NOTES

This projected water budget is developed by projecting the 1925-2019 historical hydrology forward in time.
Ag: agriculture
Muni: municipal
ET: evapotranspiration

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As a companion to Figure 1-7, the table below shows the sources of water delivered to end users in the historical water budget, beginning with the first delivery of imported water in 1979. Prior to 1979, all water use in the area was derived from groundwater pumping.

	Municipal Users				Other Users	Total	
Year	Local Groundwater	Imported Water	Recycled Water	Total	Local Groundwater	Local Groundwater	Demand
1979	19,500	7	0	19,507	15,223	34,723	34,730
1980	20,639	1,126	0	21,765	15,413	36,052	37,178
1981	18,482	5,817	0	24,299	17,278	35,760	41,577
1982	12,253	9,659	0	21,912	13,705	25,958	35,617
1983	12,201	9,185	0	21,386	11,937	24,138	33,323
1984	16,390	10,996	0	27,386	15,377	31,767	42,763
1985	16,659	11,823	0	28,482	13,403	30,062	41,885
1986	17,393	13,759	0	31,152	12,297	29,690	43,449
1987	17,592	16,285	0	33,877	10,611	28,203	44,488
1988	18,601	19,033	0	37,634	9,975	28,576	47,609
1989	21,195	21,618	0	42,813	10,285	31,480	53,098
1990	21,453	21,613	0	43,066	11,284	32,737	54,350
1991	31,825	7,968	0	39,793	10,279	42,104	50,072
1992	27,355	13,911	0	41,266	11,160	38,515	52,426
1993	29,959	13,393	0	43,352	10,777	40,736	54,129
1994	31,599	14,389	0	45,988	13,559	45,158	59,547
1995	28,677	16,996	0	45,673	14,347	43,024	60,020
1996	32,054	18,093	0	50,147	14,570	46,624	64,717
1997	32,025	22,148	0	54,173	15,319	47,344	69,492
1998	28,604	20,254	0	48,858	13,599	42,203	62,457
1999	29,968	27,282	0	57,250	17,154	47,122	74,404
2000	28,409	32,579	0	60,988	15,608	44,017	76,596
2001	25,367	35,369	0	60,736	16,362	41,729	77,098
2002	26,457	41,763	0	68,220	16,979	43,436	85,199
2003	22,978	44,416	50	67,444	14,829	37,807	82,273
2004	24,671	47,205	420	72,296	15,590	40,261	87,886
2005	32,316	37,997	418	70,731	12,785	45,101	83,516
2006	33,061	40,048	419	73,528	17,312	50,373	90,840
2007	31,690	45,151	470	77,311	14,768	46,458	92,079
2008	33,884	41,705	311	75,900	14,750	48,634	90,650
2009	31,100	38,546	328	69,974	16,564	47,664	86,538
2010	33,152	30,578	336	64,066	16,098	49,250	80,164
2011	33,624	30,808	373	64,805	15,439	49,063	80,244
2012	33,726	35,558	428	69,712	15,694	49,420	85,406
2013	29,779	43,281	400	73,460	16,151	45,930	89,611
2014	34,612	33,092	474	68,178	12,885	47,497	81,063
2015	29,893	24,148	450	54,491	12,079	41,972	66,570
2016	26,329	31,130	507	57,966	14,360	40,689	72,326
2017	16,403	46,651	501	63,555	13,438	29,841	76,993
2018	22,869	41,999	352	65,220	13,071	35,940	78,291
2019	17,547	42,072	458	60,077	12,510	30,057	72,587

Notes

All values are in units of acre-feet.

1.5 Current Water Budget

The approach that was used to develop the current water budget involved taking the historical pattern of natural hydrologic conditions (i.e., precipitation, basin inflows, ET, etc.) from 1925 through 2019 and using current pumping and development patterns to demonstrate how the current operation of the groundwater basin interacts with the surface water system under historical droughts and wet periods. Analysis of the current water budget allows for evaluating whether overdraft conditions would possibly occur if the current levels of groundwater pumping and overlying water uses were to continue for many decades.

1.5.1 Water Supplies and Demands for the Current Water Budget

While the historical water budget extends through 2019, the pumping patterns that have occurred beginning in 2015 have been abnormally depressed during these years—well below the annual volumes specified in the AB 3030 plan. To avoid this anomaly, this current water budget uses SCV Water's actual 2014 pumping distribution and the overlying land uses that were present that year. The 2014 land uses are believed to be within 1 percent of those found in 2019 based on the number of water accounts served by SCV Water. For other pumpers (i.e., non-municipal pumpers), the current water balance uses those well owners' average pumping during the last 10 years, which is consistent with estimation procedures used in past Urban Water Management Plan analyses.

The table below shows how water demands would be satisfied at the current level of development and the associated current level of water demands and groundwater pumping.

Municipal Users				Other Users	Total	
Local Groundwater	Imported Water	Recycled Water	Total	Local Groundwater	Local Groundwater	Demand
34,612	33,092	474	68,178	14,623	49,235	82,801

Notes

All values are in units of acre-feet.

Groundwater pumping consists of actual 2014 municipal water use, 2010-2019 average pumping for other pumpers, and 500 AFY for the containment pumping system at the Whittaker-Bermite property.

1.5.2 Current Groundwater Budget Analysis Results

The current groundwater budget is depicted in Figure 1-8, below. This plot shows the effects of periodic low precipitation periods but does not show long-term sustained downward trends in the cumulative departure curve for groundwater storage over the entire period. The absence of long-term sustained downward trends in the cumulative departure curve indicates that the basin would not be in an overdraft condition if current land use and water use conditions persisted over multiple decades of fluctuating precipitation in the basin.

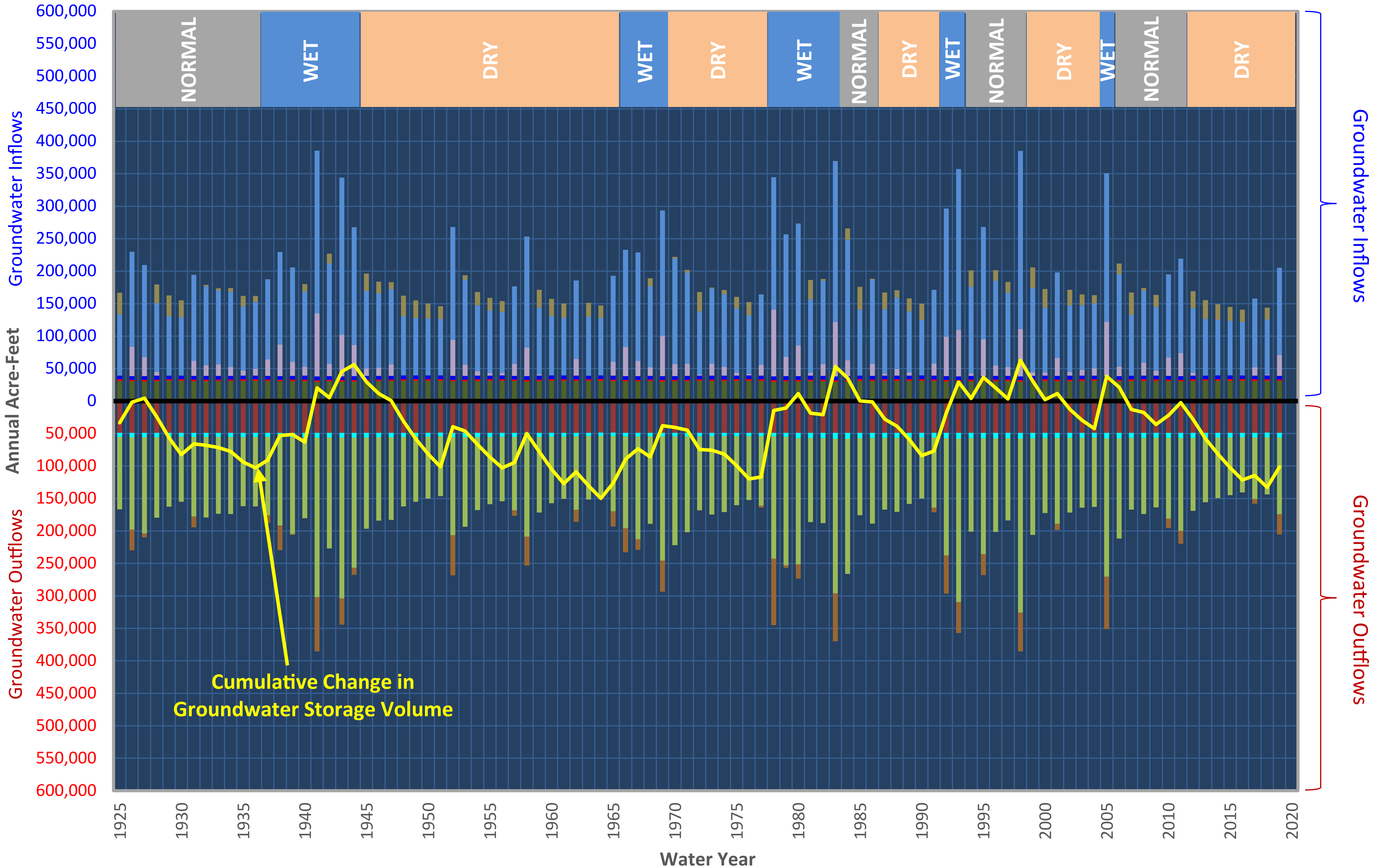

FIGURE 1-8

Current Groundwater Budget Under the 2014 Level of Development

Water Budget Development for the Santa Clara River Valley East Groundwater Subbasin

DRAFT

LEGEND

- Stream Gains
- Stream Losses
- Precipitation
- Ag+Muni Irrigation
- Subsurface Inflow in Tributaries
- Septic
- Pumping
- ET
- Groundwater Storage Increase
- Groundwater Storage Reduction

NOTES

This projected water budget is developed by projecting the 1925-2019 historical hydrology forward in time.
Ag: agriculture
Muni: municipal
ET: evapotranspiration

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1.6 Future (Projected) Water Budget

This section presents the future water budget under three alternative sets of climate assumptions and derives the future water budget that will be carried forward into later evaluations of basin sustainability.

1.6.1 Water Supplies and Demands for the Future Water Budget

Simulations of the future water budget under a variety of future conditions are described below. In all of those scenarios, future demands are projected under full buildout of the basin's land uses, and hence full buildout of future water demands. Full buildout is expected to occur by the year 2050 (KJC et al., 2016), and future basin pumping is in accordance with the basin operating plan.

	Municipal Users				Other Users	Total	
Year Type	**Local Groundwater**	**Imported Water**	**Recycled Water**	**Total**	**Local Groundwater**	**Local Groundwater**	**Demand**
Normal	40,708	43,892	9,300	93,900	7,585	48,293	101,485
Dry Year 1	44,915	49,085	9,300	103,300	7,585	52,500	110,885
Dry Year 2	49,915	44,085	9,300	103,300	7,585	57,500	110,885
Dry Year 3+	59,915	34,085	9,300	103,300	7,585	67,500	110,885
Average (1925-2019)	**44,530**	**42,940**	**9,300**	**96,770**	**7,585**	**52,115**	**104,355**

Notes

All values are in units of acre-feet per year (AFY).

Other users include 500 AFY for the containment pumping system at Whittaker-Bermite.
Total demand by municipal users in normal years (93,900 AFY) and in dry years (103,300 AFY) is for Year 2050, as shown in Tables 6-2, 6-3, 6-4A, and 6-4B of the 2015 UWMP (KJC et al., 2016), and is the demand with the plumbing code and active conservation.

As described above, the future water budget is based upon full buildout demands. Three alternative future water budgets (**no climate change**, **2030 climate change**, and **2070 climate change**) are presented for consideration as the future water budget to use for evaluating basin sustainability under SGMA. The projected water budget is examined to see how changes in climate could affect precipitation and ET rates locally in the basin, as defined by DWR for the years 2030 and 2070. The analysis of the projected water budget also includes a model simulation that uses the historical climate without climate change, to help quantify the climate-change influence separately from the changes in land and water uses. All three of these projected water budgets are developed for the same historical climatic regime (1925 through 2019) as is used in the historical and current water budgets. The future water budget that is recommended for further SGMA sustainability evaluations and groundwater management planning reflects full buildout conditions in the basin plus precipitation and ET changes that are estimated by DWR to occur in 2030.

1.6.2 Evaluating the Influences of Climate Change

One of the dominant uncertainties in water resource planning in California is climate change. Hydrology in California is highly variable, and forecasts of the effects of climate change suggest even greater variability in the coming years. Moreover, climate models suggest a general warming trend, which is likely to reduce SWP water deliveries and have other profound implications for management of water supplies in the state.

When evaluating sustainable management of the East Subbasin 50 years into the future, it is prudent to consider the potential impacts that climate change could have on the state's future management of water supplies and the change in hydrology within the local groundwater system. SGMA issues guidance to local GSAs for consideration of how to factor these forecasts and uncertainties into planning for local sustainability. Sustainable groundwater management provides a buffer against drought and climate change and contributes to reliable water supplies regardless of weather patterns. The Santa Clarita Valley depends on groundwater for a portion of its annual water supply, and sustainable groundwater management is essential to a reliable and resilient water system.

SCV Water is in the process of updating its Urban Water Management Plan, which includes reviewing and (as needed) revising the future water supply and demand values described therein, including incorporating DWR's most current estimates of future SWP delivery reliability (DWR, 2020). The future water budgets assume that the current groundwater operating plan for the basin (1) will be unchanged in the upcoming 2020 UWMP and (2) is applicable to all three of the future water budget scenarios described in this report (no climate change, 2030 climate change, and 2070 climate change).

DWR provides GSAs with one climate scenario for 2030 and three climate scenarios for 2070. The climate scenario for 2030 provides the best estimate of the variability in local hydrology (precipitation and ET) that the East Subbasin might experience during the next 20 years as the GSA works to obtain and/or maintain sustainability of local groundwater resources. The three climate scenarios for 2070 demonstrate the uncertainty of climate when considering a 50-year planning horizon under SGMA. The forecasts result in a fairly minor change in local hydrology compared with the effects of climate uncertainty and future climate change on future statewide policy-making and water resource management. When considering sustainability 50 years out, SCV Water anticipates there will be a need to consider and adjust to the influences of climate change in its water demand and supply management programs. Thus, it is prudent to focus on the 2030 climate scenario for addressing sustainability within the 20-year time frame required by SGMA, while also using the results of the 2070 water budget analysis to inform water managers about conditions that may be possible afterward.

1.6.3 Future Groundwater Budget Analysis Results

The projected (future) water budgets in Figures 1-9 through 1-11 below, show that the cumulative departure curve for groundwater storage may shift slightly downward with the onset of slightly reduced precipitation and greater ET in the basin. However, chronic declines in groundwater levels are not projected to occur over long periods, which indicates that SCV Water's groundwater operating plan for the basin is unlikely to cause an overdraft condition in the local groundwater system (i.e., it is unlikely to exceed the basin's safe yield) in the future under the assumed climatic conditions.

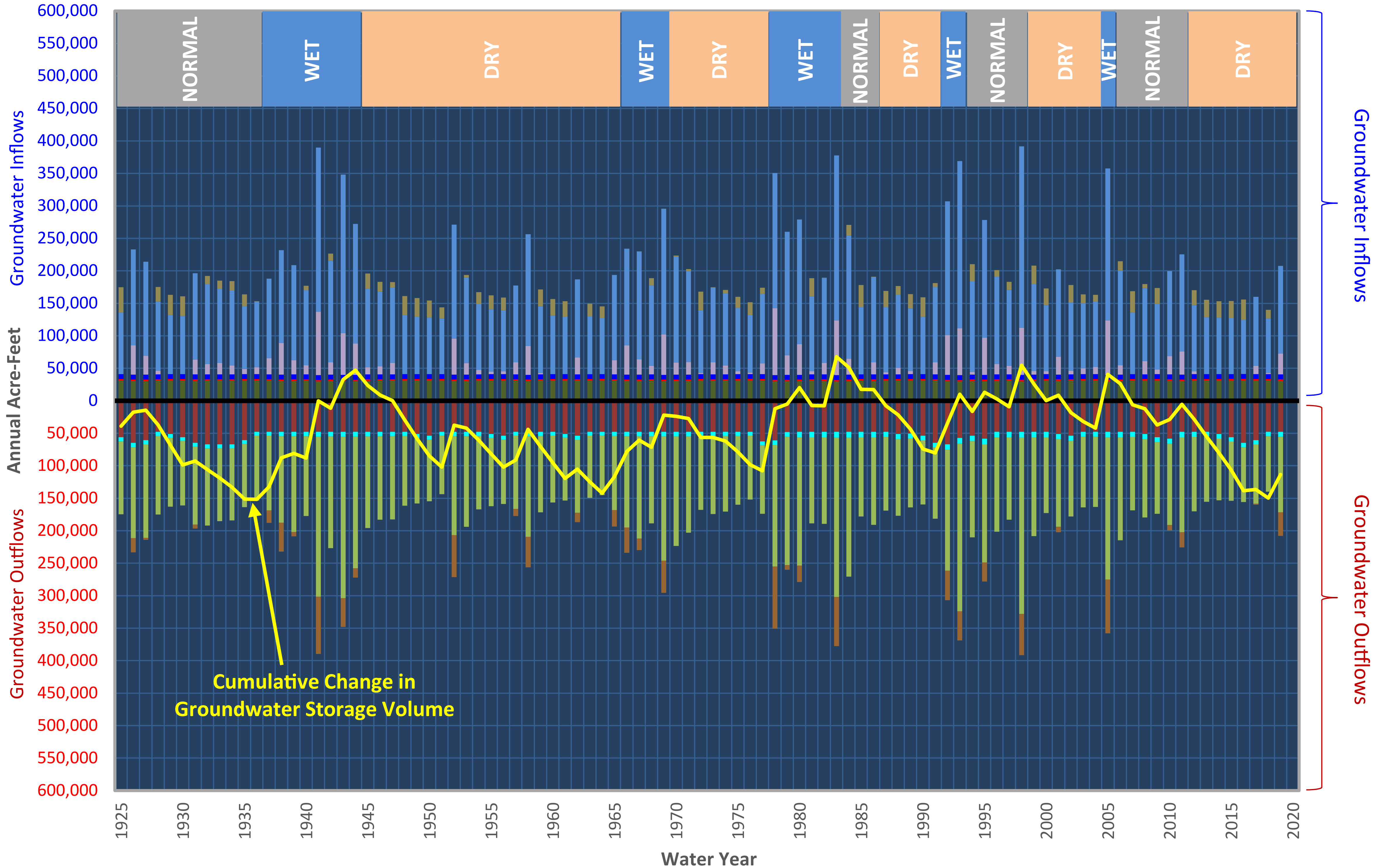

FIGURE 1-9

Projected Groundwater Budget Under Full Buildout Conditions Without Climate Change

Water Budget Development for the Santa Clara River Valley East Groundwater Subbasin

DRAFT

LEGEND

- Stream Gains
- Stream Losses
- Precipitation
- Ag+Muni Irrigation
- Subsurface Inflow in Tributaries
- Septic
- Pumping
- ET
- Groundwater Storage Increase
- Groundwater Storage Reduction

NOTES

This projected water budget is developed by projecting the 1925-2019 historical hydrology forward in time.
Ag: agriculture
Muni: municipal
ET: evapotranspiration

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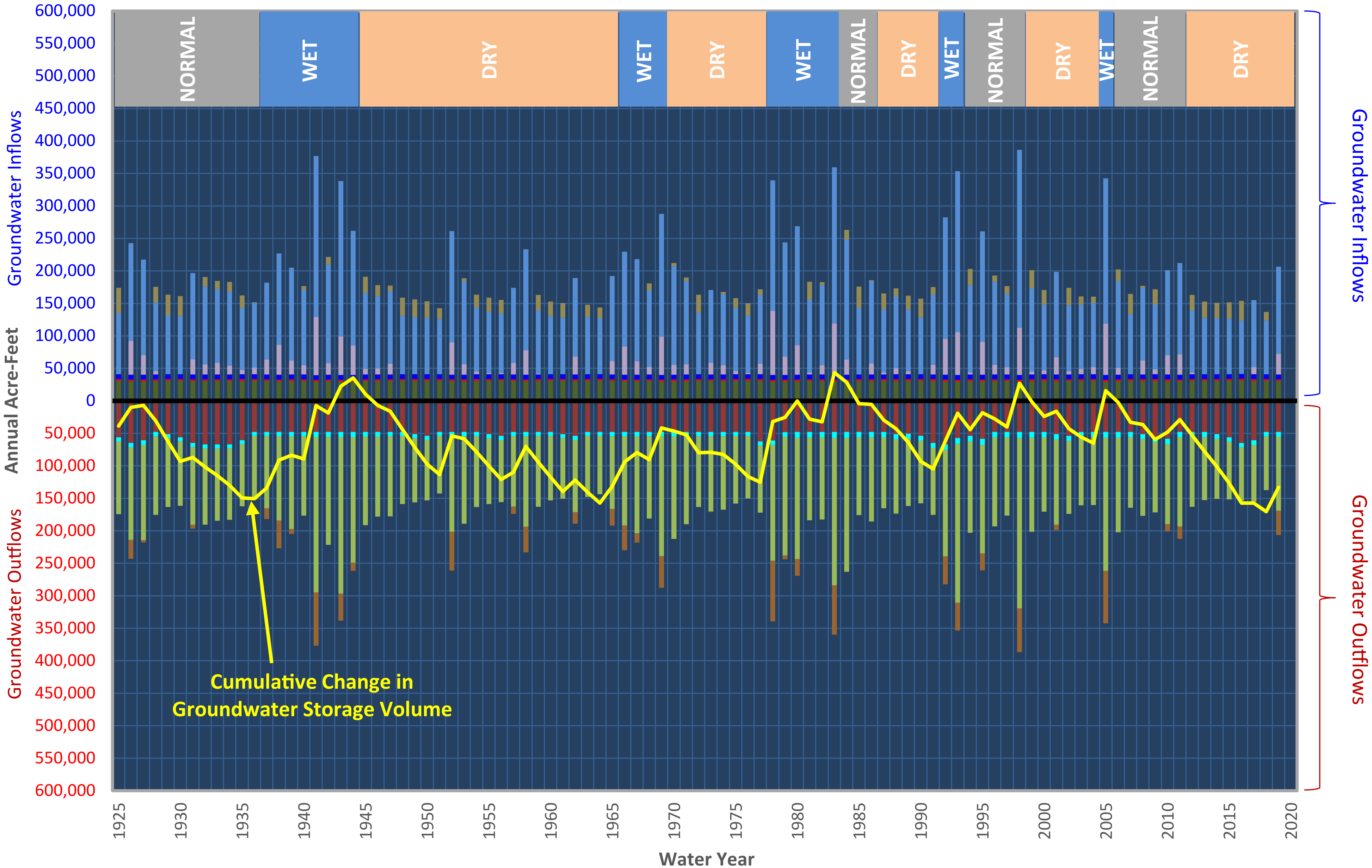

FIGURE 1-10

Projected Groundwater Budget For Year 2042 (Full Buildout Conditions With 2030 Average Climate Change)

Water Budget Development for the Santa Clara River Valley East Groundwater Subbasin

DRAFT

LEGEND

- Stream Gains
- Stream Losses
- Precipitation
- Ag+Muni Irrigation
- Subsurface Inflow in Tributaries
- Septic
- Pumping
- ET
- Groundwater Storage Increase
- Groundwater Storage Reduction

NOTES

This projected water budget is developed by projecting the 1925-2019 historical hydrology forward in time.
Ag: agriculture
Muni: municipal
ET: evapotranspiration

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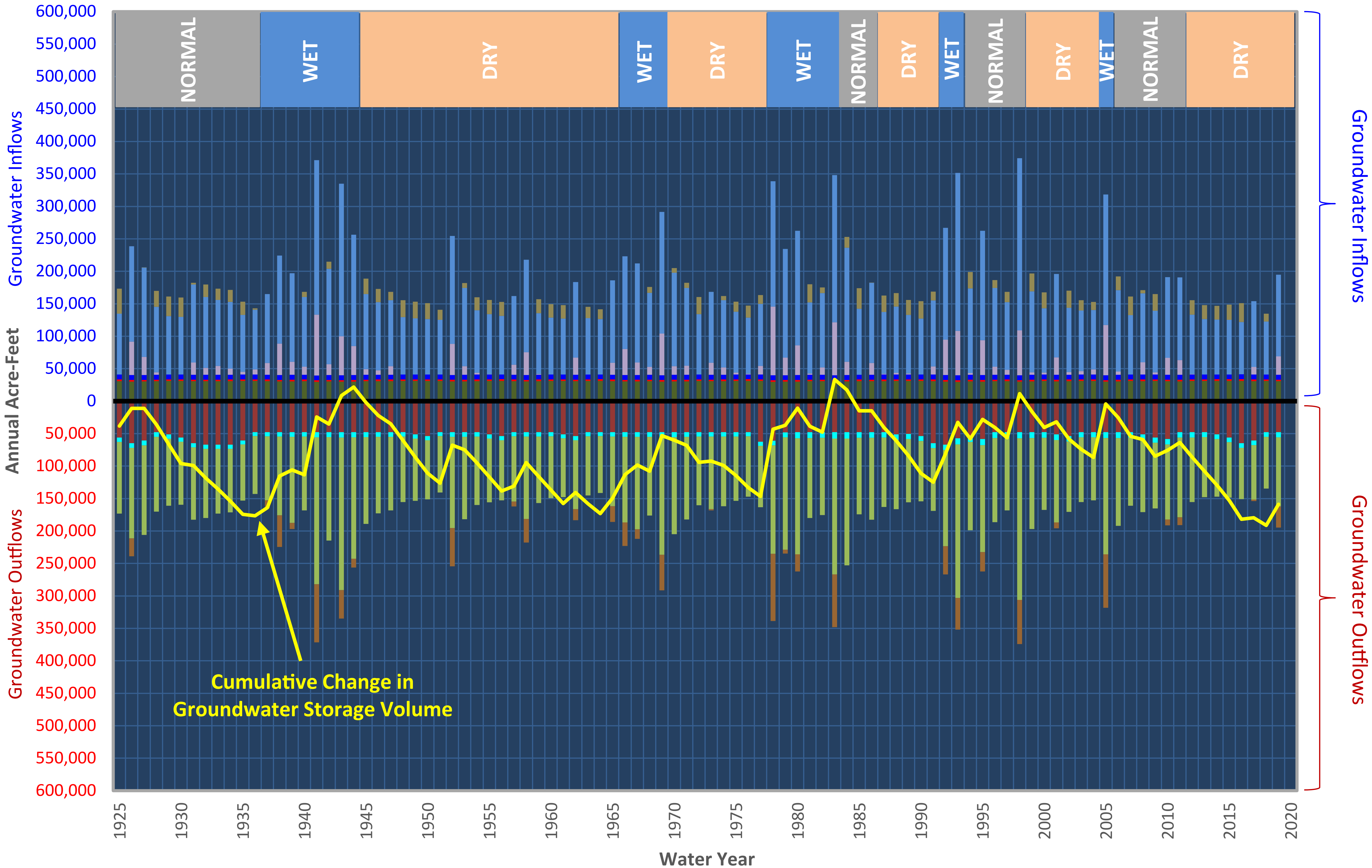

FIGURE 1-11

Projected Groundwater Budget For Year 2072 (Full Buildout Conditions With 2070 Average Climate Change)

Water Budget Development for the Santa Clara River Valley East Groundwater Subbasin

DRAFT

LEGEND

- Stream Gains
- Stream Losses
- Precipitation
- Ag+Muni Irrigation
- Subsurface Inflow in Tributaries
- Septic
- Pumping
- ET
- Groundwater Storage Increase
- Groundwater Storage Reduction

NOTES

This projected water budget is developed by projecting the 1925-2019 historical hydrology forward in time.
Ag: agriculture
Muni: municipal
ET: evapotranspiration

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1.7 Safe Yield

SGMA requires that basins be brought into balance within 20 years so as to avoid undesirable results and depletion of groundwater resources. A basin that is out of balance is characterized by a continual lowering of groundwater levels over time, a condition known as overdraft. Overdraft occurs when the average annual amount of groundwater extraction exceeds the long-term average annual supply of water to the basin. Effects of overdraft can include seawater intrusion, land subsidence, and groundwater depletion (which refers to chronic lowering of groundwater levels), eventually making a basin unusable. This is not to say that a basin must be in balance each year. It is normal for groundwater basins to experience increases and decreases in storage in response to the normal dry and wet hydrologic cycles. What is generally required is for a basin to be operated within safe yield.

The safe yield of a groundwater basin is the average amount of pumping that can occur on a long-term basis without creating a chronic (i.e., continual) lowering of groundwater levels and reduction in groundwater storage volumes. Safe yield is generally considered equal to the long-term average replenishment rate of the aquifer from natural and artificial recharge sources. Evapotranspiration and basin outflow are also factored into replenishment rates. The volume of groundwater pumped in a given year can be less than, or greater than, the long-term average volume that is used to define safe yield.

The table below compares the annual groundwater pumping volumes that were modeled for the projected water budget with the annual pumping volumes specified in the groundwater operating plan for the East Subbasin.

Year Type	Modeled Groundwater Pumping for the Projected Water Budgets	Pumping Ranges Specified in the Groundwater Operating Plan
Normal	48,300	37,500 to 55,000
Dry Year 1	52,500	45,000 to 60,000
Dry Year 2	57,500	51,000 to 60,000
Dry Year 3+	67,500	51,000 to 70,000
Modeled Average for Projected Water Budgets	**52,115**	

Note

All values are in units of acre-feet per year (AFY).

As shown in the table, annual pumping volumes increase during dry years, which are defined as years when SWP water deliveries are significantly curtailed. The increase in groundwater pumping during these years (compared with normal years) occurs in the Saugus Formation. The projected water budgets for the East Subbasin indicate this groundwater operating plan does not produce chronic declines in groundwater storage volumes or groundwater levels in the aquifer system on a long-term basis, including under the two different climate change scenarios that were evaluated. This means the safe yield of the East Subbasin is likely higher than the average annual production volume of 52,115 AFY that was simulated for the projected water budget under full buildout of the land and water uses in the basin.

The results of the projected water budget also indicate that, pursuant to the groundwater operating plan, the basin can be pumped at an annual rate of at least 67,500 AFY for multiple dry years without causing chronic water-level declines. The number of consecutive dry years that the basin can be pumped at or above 67,500

AFY without causing chronic water level declines has not been tested or determined. Thus, it is prudent to consider the long-term average safe yield of the basin to be at least 52,115 AFY, based on the long-term average amount of pumping. However, as indicated by the projected water budget analyses presented in this report, pumping at rates of 67,500 AFY (and potentially higher) can occur for multiple dry years without exceeding the long-term safe yield of the basin groundwater system.

The safe yield of the basin is not the same as the sustainable yield of the basin according to SGMA, because the GSP development process must consider not only chronic lowering of groundwater levels and chronic reduction in groundwater storage, but also whether there are other undesirable results with respect to other sustainability indicators (including degradation of water quality, subsidence, surface water depletion, and seawater intrusion). The GSP development process also must consider whether groundwater dependent ecosystems (GDEs) have been, or will be, impacted. During the process of developing sustainable management criteria for the GSP, sustainable yield will be evaluated and estimated as part of identifying whether undesirable effects have occurred or are likely to occur in the East Subbasin. If undesirable results are identified during this process, then the GSP will include projects and management actions to reach sustainability within the 20-year GSP implementation period.

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SECTION 2: **Data Sources, Time Periods, and Methods**

The SGMA regulations (herein referred to as the GSP regulations) contain specific requirements for developing and presenting the water budgets, as described in 23 California Code of Regulations (CCR) §354.18 and listed below:

§354.18 Water Budget.

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

(b) The water budget shall quantify the following, either through direct measurements or estimates based on data:

(1) Total surface water entering and leaving a basin by water source type.

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

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

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

(5) If overdraft conditions occur, as defined in Bulletin 118, the water budget shall include a quantification of overdraft over a period of years during which water year and water supply conditions approximate average conditions.

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

(7) An estimate of sustainable yield for the basin.

In accordance with these requirements, for each of the three time periods that must be evaluated (historical, current, and projected) an integrated water budget is developed for the basin's surface water and groundwater systems. Each integrated water budget describes the total inflows and outflows for surface water and the two principal aquifers (the Alluvial Aquifer and the Saugus Formation) combined. The water budgets present the magnitudes of individual inflow and outflow terms for each water year (October 1 through September 30)[4] evaluated. Additionally, for each water year, the water budget consists of distinct surface water and groundwater budgets. These water budgets quantify inflows and outflows on a basinwide basis.

The historical and current water budgets have been developed from prior and current studies of the hydrogeologic, land use, and water use characteristics of the East Subbasin, including the development and calibration of a three-dimensional numerical groundwater flow model (GSI, 2020). The projected water budgets have been developed by building upon the methodology for the historical and current water budgets, using future estimates of land use buildout and associated water demands and discharges, as well as incorporating climate-change scenarios provided by DWR for two future time horizons (the years 2030 and 2070). Tables 2-1 and 2-2 provide inventories of the inflow and outflow terms for the surface water system and the groundwater system, respectively. Details regarding the data sources, the time periods associated with each water budget, and the technical methods that are used to construct each water budget (including technical details about the numerical model) are provided below.

2.1 Data Sources and Key Basin Studies

The primary data sources for the historical water budget analyses are described in detail in the model development report (GSI, 2020) and are available as monthly and often daily records as follows:

[4] Water year 2019, for example, begins on October 1, 2018 and continues through September 30, 2019.

- Precipitation data from the Newhall-Soledad rain gage (Station FC32CE), now located at Newhall Fire Station #73. Annual precipitation records extend back to the late 1880s and early 1900s, with monthly records available beginning in water year 1928.
- Streamflow gaging data where the Santa Clara River enters the basin at Lang Station; this gage has been operated intermittently by LA County (including currently as Station F93C) and the USGS (in the past as USGS Station 11107745), and has been relocated at least twice.
- Streamflow gaging data at a former gage (USGS Station 11108500) that was located 0.75 miles downstream of the LA/Ventura county line and operated from water years 1953 through 1996.
- Streamflow gaging data at the existing replacement gage (USGS Station 11109000), which is located 3.5 miles downstream of the LA/Ventura county line and has operated since October 1996.
- Gaged and ungaged inflows to Castaic Lake, and releases of water from Castaic Lake/Castaic Lagoon into Castaic Creek, as reported by DWR.
- Releases of water from Bouquet Reservoir into Bouquet Creek, as reported by the Los Angeles Department of Water and Power (LADWP).
- Discharges of treated water from the Saugus and Valencia WRPs, as reported by the Los Angeles County Sanitation District.
- Reported and estimated discharges of water from groundwater treatment systems.
- Municipal groundwater pumping.
- Groundwater pumping by agricultural and private wells (in some cases available only annually).

Key studies and reports used to construct the historical, current, and projected water budgets are as follows:

- Annual reports presenting pumping by water use sector since 1980 (LSCE, 2020)
- A USGS study (Robson, 1972) showing the locations of irrigated and non-irrigated agricultural lands prior to urbanization and including estimates of effective groundwater pumpage for 1945 through 1967[5]
- A report presenting the mapping of potential GDEs (ESA, 2020)
- The 2015 UWMP for the basin (KJC et al., 2016)
- A 2019 study of estimated future indoor water demands and inflows to WRPs from 2020 through 2050, which is the year that full build-out of development inside the basin is expected to occur (Maddaus, 2019)

2.2 Time Periods

As discussed below, a numerical groundwater model is used to quantify the water budget terms that cannot be directly measured in the field. The model varies the natural hydrology and the water uses in the basin on a monthly basis, to provide a more accurate quantification than would be achieved by varying these processes on an annual basis. The monthly results from the modeling evaluations are combined into annual values that are presented in this report for each water year that is evaluated for historical, current, and future periods. This approach is consistent with recommendations provided in the *Water Budget Best Management Practices for the Sustainable Management of Groundwater (BMP)* guidance document (DWR,

[5] This USGS study described "effective pumpage" as the total pumping volume minus the portion of the total pumping volume that returns to the water table as deep percolation beneath irrigated lands. The study estimated that crops consume approximately 50 percent of the applied water on most of these lands, except along the South Fork Santa Clara River and in Castaic Valley, where soils are less permeable and crops likely consume about 65 percent of the applied water.

2016) regarding the time intervals for quantifying and reporting the water budgets. Details regarding the definitions of the time periods for the historical, current, and projected (future) water budgets follow.

2.2.1 Period for Historical Water Budget

The annual reports for the groundwater basin provide a thorough compilation of water use volumes by calendar year, beginning in 1980. Annual water use records are less readily available prior to 1980 and are particularly limited prior to the 1960s, when little municipal use occurred and most groundwater pumped from the basin was for agricultural irrigation. Aquifer conditions and groundwater uses prior to the 1970s are understood primarily from historical accounts and reconstruction efforts by prior researchers (Robson, 1972; RCS, 1986 and 1988), as well as from well construction records and aerial photos.

Consideration was given to beginning the historical water budget in the early to mid-1960s, to focus on the period of modern records (since 1980) while extending far enough back in time to approximately characterize the early period of urbanization, including the first years of operations by the two existing WRPs. Using water year 1965 (as the first year in the historical water budget) would have provided a 50-year duration when extending the historical period through water year 2014. Ending the historical analysis in water year 2014 would provide an accounting of conditions leading up to January 1, 2015, which is the reference date identified in the SGMA regulations for evaluating how basin conditions pertain to the establishment of measurable objectives, minimum thresholds, and sustainability criteria for the GSP.

However, such a 50-year water budget would have left the region's longest drought period out of the historical analysis—a drought that was considered by the GSP development team to be important for evaluating the projected water budget. The precipitation cumulative departure curve (Figure 1-4) shows that a 20-year dry period began in 1946 and continued through 1965, as indicated by the prolonged period of decreasing cumulative departure values (albeit with periodic interruptions for normal or modestly wet years). Additionally, as described in a prior study of the basin's groundwater operating plan (LSCE and GSI, 2009), the region (and much of California) experienced an intense drought from about 1928 through 1935. The GSP development team therefore decided to construct the projected water budget beginning in 1925 and continuing through 2019, whereupon it was decided to also construct the historical water budget for this same period to facilitate comparisons of the multiple water budgets. As shown in Figure 1-4, the 95-year historical period contains a sequence of 14 hydrologic sequences, consisting of 5 wet periods, 4 normal periods, and 5 dry periods (droughts). Note that, in some individual water years, the classification system may produce a different year type than would be suggested by the precipitation data for that particular year; in these cases, the historical classification is still useful because it is developed by considering the prevailing conditions during the years before and after any individual year.

2.2.2 Period for Current Water Budget

As stated in §354.18(c)(1) of the GSP regulations, the current water budget must quantify basin inflows and outflows for "the most recent hydrology, water supply, water demand, and land use information." In its water budget BMP, DWR (2016) states "The GSP is required to provide an accounting of current water budget conditions to inform local resource managers and help the Department *(DWR)* understand the existing supply, demand and change in storage under the most recent population, land use, and hydrologic conditions." In considering the time period to use to meet this objective, the technical team arrived at the conclusion that pumping conditions in the basin should be consistent with a number of parameters including the AB 3030 plan adopted by CLWA in 2003 and the 2009 groundwater operating plan (LSCE and GSI, 2009). Together, these documents have guided basin operations for nearly two decades and are indicative of what operators would consider current normal operations. Use of pumping data from 2015 through 2020 when pumping levels were extraordinarily depressed would lead to erroneous conclusions regarding the basin's water balance. For these reasons, 2014 water use and groundwater pumping volumes were selected for the current water budget.

The current water budget examines how the land and water uses in 2014 would have affected the basin on a long-term basis if the 2014 land and water uses were to be repeated throughout the historical precipitation sequence (i.e., for the historical precipitation and streamflow conditions that occurred during the period 1925 through 2019). This allows the 2014 water demand and supply usage condition to be evaluated against the same 95-year period for which the historical and projected water budgets are constructed, including during the prevailing dry conditions that occurred from 1945 through 1965 and the more intense drought period that began in 2012 and continued through 2016, as shown in Figure 1-4.

2.2.3 Period for Projected Water Budget

The projected (future) water budget represents full build-out conditions for the basin, which are expected to occur by approximately the year 2050, as described in the 2015 UWMP (KJC et al., 2016) and other recent planning studies (e.g., Maddaus, 2019). Three projected water budgets have been developed which are distinguished by the following climate and land use/water use characteristics:

- A **full build-out water budget** without climate change provides insights on the effects of estimated future land and water uses on local groundwater conditions, and provides a direct comparison with the historical and current water budgets without introducing the added factor of climate change.
- The **2042 water budget** uses the same full build-out condition for land and water uses as the prior water budget and adds a 2030 level of climate change. This water budget corresponds to the 20-year implementation timeframe for groundwater sustainability measures to be implemented under the GSP.
- The **2072 water budget** uses the same full build-out conditions for land and water uses and adds a 2070 level of climate change. This water budget describes conditions for the 50-year planning and implementation horizon under SGMA.

Based on the current status of future development plans, it is anticipated that approximately 75 percent of the future growth in the basin will have occurred by the year 2042, which will be the end of the 20-year period for implementing the GSP in this basin. Full buildout is expected to occur by the year 2050, as discussed in the 2015 UWMP (KJC et al., 2016). Given the uncertainties associated with the rate of development and given the desire to understand any potential consequences of full buildout of the basin's land uses and water demands on groundwater sustainability, the GSP development team concluded that a conservative approach to developing the projected water budget should be used—specifically, to examine full buildout conditions for the year 2042 to account for all future anticipated water demands, rather than estimating the actual level of demand in that year.

As a result, the distinction between the three projected water budgets lies in the representation of potential future changes in climate. The 2042 and 2072 projected water budgets use the 1925 through 2019 historical precipitation record, but with climate-change adjustment factors that are applied to the monthly historical record to account for future potential changes in precipitation and ET. The climate-change factors consist of average precipitation multipliers and ET multipliers from 20 global climate models. These precipitation and ET factors have been provided by DWR on a monthly basis for the period from January 1915 through December 2011, and are available at a 6-kilometer (3.75-mile) spatial resolution throughout California, including at the location of the Newhall-Soledad rain gage in the town of Newhall. Because it is impossible to know what precipitation and air temperatures will actually be in the years 2042 and 2072 (and in the preceding years), this approach of applying the climate-change factors to the historical climate allows the full buildout land-use and water-use condition to be evaluated against the observed long-term record of historical year-to-year variability in climate while adjusting the magnitude of that variability to account for future potential changes in climate.

2.3 Model Description and Use for Water Budget Development

The historical water budget has been developed using a combination of historical data and groundwater modeling, while the current and projected water budgets use groundwater modeling to examine the effects of current and future land and water use scenarios. A three-dimensional numerical groundwater flow model has been developed for the East Subbasin, and is documented by GSI (2020). The numerical model has been used to quantify the terms that cannot be directly measured in the field, such as groundwater recharge volumes, groundwater withdrawals by phreatophytes, and year-to-year changes in the volume of groundwater in storage. Numerical groundwater models provide the most robust state-of-the-art method for quantifying these terms, especially when the model has been calibrated to historically measured groundwater levels and streamflows, as has occurred for this model.

The numerical groundwater flow model of the East Subbasin simulates the occurrence and movement of groundwater flow in the two primary aquifer systems: the surficial Alluvial Aquifer and the underlying Saugus Formation. The model simulates groundwater flow processes and groundwater budgets in both aquifers, as well as the connection of the local groundwater resources to the Santa Clara River and its tributaries. The model uses multiple layers to provide a three-dimensional representation of groundwater movement horizontally within individual model layers and vertically between layers. The model is called the Santa Clarita Valley Groundwater Flow Model, and is referred to as the SCVGWFM or the regional model. The model uses the USGS software MODFLOW-USG (Panday et al., 2013; Panday, 2019) and replaces a model that was first developed in 2004 (CH2M HILL, 2004) using the European MicroFEM® finite-element software (Hemker and de Boer, 2003 and 2017). The regional model has been developed by GSI for the Santa Clarita Valley Water Agency (SCV Water) to use as its primary tool for developing water budgets and analyzing groundwater management options in the context of projected (future) hydrology, water demand, and water supply conditions in the valley.

In addition to using MODFLOW-USG, the new regional model relies on other two key companion codes for its successful operation: (1) a graphical user interface (Groundwater Vistas) (ESI, 2017) and (2) a customized tool specific to the East Subbasin (and named the SCV Recharge Compiler) that compiles and translates all recharge terms into the form needed by the Recharge (RCH) Package for MODFLOW-USG. As described in the model development report (GSI, 2020), the SCV Recharge Compiler is a Microsoft Visual Basic program developed in Microsoft Excel® that was written by GSI to specify the total amount of recharge (1) occurring at each grid node in the uppermost model layer and (2) for each period during a given model simulation. This tool also estimates the surface flow entering the model in ungaged tributary streams from the upper reaches of their watersheds (i.e., the portion of the watershed upstream of the East Subbasin), and it provides mechanisms for tracking and infiltrating this flow as a given ephemeral stream enters the groundwater basin, thereby facilitating the development of the surface water inflow terms that are required to be reported in the historical, current, and projected surface water budgets.

Tables 2-3 and 2-4 identify the components of the groundwater model (MODFLOW-USG) and the SCV Recharge Compiler that address each inflow and outflow term for the surface water and groundwater budgets. The methods for accounting for these terms in the model, along with underlying assumptions regarding certain terms, are described in Section 2.4 below.

2.4 Methods and Assumptions for Developing Specific Input Terms for the Water Budget Analyses

The methods, data, and assumptions that are used to simulate various water budget processes are described in detail in the model development report (GSI, 2020; see Section 3 and Appendix B of that report). The methods, data, and assumptions are summarized below for the following water budget processes that require estimation and/or data analysis methods to generate input to the groundwater model:

- Deep percolation of precipitation falling within the groundwater basin boundary
- Streamflows entering the basin in the Santa Clara River and its ungaged tributaries, and the subsequent infiltration of water from these ephemeral streams to the underlying water table
- Subsurface groundwater inflows
- Deep percolation of irrigation water from agricultural lands
- Deep percolation of irrigation water from urbanized lands
- Deep percolation from septic systems in areas served by municipal water supplies
- Point discharges of water into the Santa Clara River
- ET demands by phreatophytes in and outside of riparian habitat corridors

2.4.1 Deep Percolation of Precipitation Falling Within the East Subbasin

Annual precipitation volumes arising from precipitation within the boundaries of the groundwater basin are estimated from annual precipitation data using a variation of a method described by Turner (1986). Turner empirically derived a power-function equation that describes the average statewide relationship between annual precipitation and ET rates, based on the measured yields from 68 different watersheds throughout California. Precipitation not taken up by ET is available for surface water runoff and infiltration to groundwater. During large storm events, some of this water leaves the basin before it has a chance to infiltrate to groundwater. However, during smaller storm events, precipitation that is not consumed by ET eventually infiltrates to groundwater. Using the equation provided by Turner, the calibration process for the numerical model resulted in the following equation for the historical relationship between precipitation and infiltration in the East Subbasin on an annual basis:

For historical conditions: Infiltration = Precipitation – 5.00(Precipitation)$^{0.41}$ (Equation 2-1)

DWR has published climate-change factors across California, including at the locations of the Newhall-Soledad rain gage and the nearby Newhall Water Division (NWD) rain gage. The factors apply to precipitation and ET during the years 2030 and 2070. Each climate-change factor represents the average change[6] computed by DWR from the simulation results of 20 global climate models that have been downscaled throughout the state to grid blocks that are 6 kilometers (3.75 miles) on a side. Each climate-change factor is provided by DWR as a multiplier to apply to the local historical records of precipitation and ET; these multipliers are available on a monthly basis for the period 1915 through 2011. GSI applied these factors directly to the period of water years 1925 through 2011, then used the precipitation records during that period to select climate-change factors that are likely to be representative of climate change for water years

[6] In its BMP documents for water budgets and climate change analysis under SGMA, DWR (2016 and 2018) refers to the average change as the central-tendency evaluation. In some locations, DWR also provides precipitation and ET factors for two other scenarios named "drier with extreme warming (DEW)" and "wetter with moderate warming (WMW)." However, precipitation and ET factors for these two scenarios are not available for the East Subbasin.

2012 through 2019. Compared with historical conditions, the 2030 climate-change factors produce about 1.2 percent less annual precipitation and 4.8 percent greater ET, while the 2070 factors produce about 1.4 percent less annual precipitation and 10.8 percent greater ET.

Future increases in ET will affect soil moisture levels in a manner that reduces the amount of deep percolation to groundwater that arises from precipitation within the basin. This phenomenon will increase the amount of precipitation needed to overcome soil moisture deficits and produce deep percolation to groundwater. As shown in Figure 2-1, the mathematical relationship shown in Equation (2-1) for historical conditions results in no deep percolation occurring until annual precipitation exceeds 15 inches. Examination of this relationship and the ET climate-change factors indicates that ET increases of 4.8 percent in 2030 and 10.8 percent in 2070 would increase the threshold annual precipitation amounts necessary to generate deep percolation from 15 inches (under historical conditions) to about 16 inches in 2030 and 18 inches in 2070. The equations for 2030 and 2070 that are used in the model to simulate the effect of reduced precipitation and increased ET on deep percolation are as follows:

For 2030 climate change: Infiltration = Precipitation – 5.08(Precipitation)$^{0.41}$ (Equation 2-2)

For 2070 climate change: Infiltration = Precipitation – 6.00(Precipitation)$^{0.37}$ (Equation 2-3)

Through the use of these equations, the combination of slightly lower precipitation and higher ET is estimated to result in decreases in the amount of deep percolation to groundwater by about 5 percent under the 2030 average climate-change scenario and 14 percent under the 2070 average climate-change scenario.

2.4.2 Stream Inflows and Subsequent Infiltration

For each month of a given model simulation, the SCV Recharge Compiler calculates the amounts of stormwater flow and groundwater recharge in streams, plus the amount of surface water inflow and subsequent groundwater recharge arising from controlled releases to Castaic Creek and Bouquet Creek from impoundments on those streams. Details regarding these methods are presented in Appendix B of the model development report (GSI, 2020). A summary is as follows:

- For the Santa Clara River, historical volumes of streamflow entering the East Subbasin are defined from measured and estimated streamflow data at the Lang Station gage. These historical streamflows are reduced by 4.8 percent and 10.8 percent for the 2030 and 2070 climate change simulations, respectively.
- For ungaged tributaries of the Santa Clara River, the natural inflows of stormwater generated in the watershed areas lying outside the groundwater basin boundary are generated by the SCV Recharge Compiler using precipitation data, rainfall isohyets,[7] and the watershed area as described in Section 4.2.1 of Appendix B of the model development report (GSI, 2020). For historical conditions, Equation 2-1 is then used to define the amount of the water generated in the upstream watershed that enters into the basin and is available to infiltrate to groundwater. Equations 2-2 and 2-3 are used to estimate these inflow volumes for the 2030 and 2070 climate-change scenarios, respectively.
- Historical stormwater flows generated in the contributing watershed to Castaic Lake are derived from inflow and outflow records reported by DWR's Southern Field Division Water Operations office in its monthly operations tables for the complex comprising Pyramid Lake, the Elderberry Forebay, Castaic Lake, and Castaic Lagoon. These reports date back to 1974 and account for releases of stormwater impounded behind Castaic Dam and periodic releases of SWP water to downstream users in Ventura

[7] Isohyets are contour maps showing the spatial distribution of rainfall on a long-term basis.

County. Additional details regarding how these flows are treated in the modeling analyses for the historical, current, and projected water budgets are as follows:

- For years prior to 1974, precipitation records at the Newhall-Soledad rain gage are used to identify individual years during the period of historical record (1974 through 2019) that provide reasonable prototypes for estimating the stormwater flows that occurred prior to 1974. The historical, current, and projected water budgets use these estimated stormwater flows prior to 1974, while the historical water budget uses the actual historical monthly and annual releases that occurred during the period 1974 through 2019.
- In the current and projected water budgets, the releases from Castaic Lake from 1974 through 2019 consist solely of stormwater as defined from gaged and ungaged flows reported by DWR during this period. Accordingly, the releases from Castaic Lake for the entire period of 1925 through 2019 consist solely of storm flows and do not include releases of SWP water. This method is used to avoid including SWP deliveries to downstream users, because the timing and magnitude of future releases of SWP water are unknown.
- In the projected water budget, the stormwater flows are reduced by 4.8 percent and 10.8 percent for the 2030 and 2070 climate change simulations, respectively. No such adjustments are made, however, for the version of the projected water budget that does not include climate change.

- Releases from Bouquet Reservoir are based on LADWP recorded values for the historical water budget and the 1978 release agreement between LADWP and the United Water Conservation District[8] for the current and projected water budgets. Based on the results of the model calibration process, it is estimated that only a small fraction of these releases enters the basin as surface flow (assumed to be 5 percent for modeling purposes) and that a portion of these releases may also enter as subsurface flow that is implicitly accounted for via the use of the general-head boundary condition (GHB) that allows subsurface flow from outside the basin boundary to enter the basin in the thin alluvial veneer present in this area.
- The infiltration of stormwater and controlled flow releases is computed by the SCV Recharge Compiler, using a streamflow accounting method from one model grid cell to another, coupled with streambed permeability terms that were developed during calibration of the numerical groundwater flow model. See Section 4.2.5 of Appendix B in the model development report (GSI, 2020) for further details. Where groundwater elevations rise above the elevation of the riverbed intermittently or perennially, the Streamflow Routing (SFR) Package in MODFLOW-USG computes the rate of groundwater discharge to the stream and routes the water downstream to allow for possible re-infiltration of this water.

2.4.3 Subsurface Inflows to the Alluvial Aquifer in Tributary Valleys

GHBs are used in MODFLOW-USG to simulate the subsurface inflows of water that likely occur from the thin surficial alluvium underlying the Santa Clara River and its 48 tributaries that provides subterranean flow into the model (groundwater basin) boundary from the 49 upstream watersheds. The GHBs are also used to help guide the model on groundwater elevations in the upper ends of these tributaries, and were checked during model construction and calibration to ensure that flow is predominantly (if not exclusively) into the model domain (i.e., inflow to the model) rather than flowing out of (discharge from) the model. A total of 149 grid cells use GHBs in the model, and the application of a GHB in any given model cell is identical for each of the water budget periods.

[8] Agreement No. 10162 between Department of Water and Power of the City of Los Angeles and United Water Conservation District. March 9, 1978.

2.4.4 Deep Percolation of Irrigation Water from Agricultural Lands

As discussed previously, there has been a long history of agricultural development and irrigation in the basin, including by the Newhall Land and Farming Company (Newhall Land), the former Wayside Honor Rancho, and the Disney Corporation. The largest amount of agricultural irrigation occurs on lands owned and operated by Newhall Land, a subsidiary of Five Point Holdings, LLC. Newhall Land has published data regarding irrigated acreages, crop types, and water use volumes for five calendar years (1996 through 2000) as part of its water resources analysis planning for the future Newhall Ranch development. (See Appendix 2.5m in Impact Sciences, 2001.) These data indicate that, during that period, approximately 877 acres were irrigated for agricultural purposes, with approximately 90 percent of these lands overlying the Alluvial Aquifer and the remaining 10 percent overlying terrace deposits. These lands are used primarily to grow row crops. As discussed in Section 4.3 of the model development report (GSI, 2020), these data indicate the following:

1. The average applied water volume was 7,038 AFY.
2. The average amount of water that was not consumptively used by the crops was 2,583 AFY, which is approximately 37 percent of the applied water volume.
3. Over the 877-acre area, the equivalent average rate of water application beyond the water requirement of crops was 2.9 AFY (which is equivalent to 2.9 feet per year [ft/yr] and 34.8 inches per year).

Over-application of water is necessary to flush salts from the soil and maintain target soil moisture levels. Only a portion of this 2.9 ft/yr over-application volume will seep downward past the root zone and directly recharge the underlying Alluvial Aquifer. The SCV Recharge Compiler assumes that an average of 1.96 ft/yr (2/3 of the over-applied water) infiltrated to the underlying water table during the period 1996 through 2000. The SCV Recharge Compiler adjusts this average rate up or down in each individual year based on the difference between a given year's actual pumping volume compared with the 1996–2000 average pumping volume. Accordingly, in the historical water budget, deep percolation is higher during years of higher water use, and lower during years of reduced water use. The current water budget (for the year 2014) simulates the deep percolation rate that is derived from the average agricultural pumping volume from the Alluvial Aquifer from 2010 through 2019 (10,497 AFY), which is about 16 percent less than the average pumping of 12,553 AFY that occurred from 1996 through 2000[9]

With the development of the Newhall Ranch community, the currently irrigated lands will no longer be irrigated, because their water source will be used as part of the water supply for this community. Therefore, under future full buildout conditions for Newhall Ranch, only minimal agricultural irrigation recharge (primarily by the Disney Corporation) will occur within the area simulated by the regional groundwater model for the projected water budgets.

2.4.5 Deep Percolation of Irrigation Water from Urbanized Lands

As derived by CH2M HILL (2004), the long-term infiltration rates of applied irrigation water in urban areas as defined in the SCV Recharge Compiler is calculated to be 1.0 inch/year (in/yr) for industrial and retail lands, 2.2 in/yr for residential developments and parks, and 4.6 in/yr for golf courses. An additional separate infiltration rate has been defined for schools and recreational facilities (ranging from 3.4 in/yr to 4.6 in/yr). These rates are applied during each year (and each month) of the simulation period, but are varied in the historical water budget to reflect changes in urban water use volumes from year to year. In the current water

[9] During the period 1996 through 2000, the average pumping volume of 12,553 AFY is assumed to have been applied in LA County (averaging 7,038 AFY) and on agricultural lands located just west of the LA/Ventura county line (averaging 5,515 AFY).

budget, these rates are unchanged from year to year, reflecting conditions in 2014. See Section 4.4 of Appendix B in the model development report (GSI, 2020) for further details.

The areas over which these rates are applied are as follows:

- Land uses in the historical and current water budgets are defined from land use data provided to the local water purveyors by the City of Santa Clarita in 2013 when an update was occurring to the original finite-element groundwater flow model of the East Subbasin (GSI and LSCE, 2013).
- For the projected water budget, the locations and categories of land use are defined from geographic information system (GIS) coverages that were developed during preparation of the Salt Nutrient Management Plan for the basin (GSSI, 2016; GSI, 2014). Those coverages were obtained from the following sources: (1) the Southern California Association of Governments (SCAG) 2008 land use survey; (2) the One Valley One Vision (OVOV) land use planning process; and (3) Newhall Land personnel for the Newhall Ranch Specific Plan and four other developments (Legacy Village, Entrada North Village, Entrada South Village, and Valencia Commerce Center). These land use coverages provide planning-level estimates of future land uses; actual land uses will differ as development plans are permitted in the future.

2.4.6 Deep Percolation from Septic Systems

Infiltration from septic systems was defined for residential developments that are served by public water supplies but not served by sanitary storm sewers. In these developments, the onsite treatment of wastewater (via septic systems) represents an importation of water into the residential development with resulting recharge to groundwater from the septic systems.

The locations of these areas were obtained in 2013 during development of the Salt Nutrient Management Plan for the East Subbasin (GSSI, 2016; GSI, 2014). In the historical water budget, septic systems are introduced beginning in 1961 and are assumed to have increased to a full buildout level for septic systems by the late 1980s. The current and projected water budgets maintain the full buildout (late 1980s) amount of septic systems. The deep percolation rate from septic systems is 2,432 AF/yr, which is the rate that was estimated during development of the Salt Nutrient Management Plan (GSSI, 2016; GSI, 2014). The loading rate from septic systems over the 1,750-acre area in the model grid where septic systems are present is 1.39 ft per year, which is equivalent to 16.7 in/yr.

2.4.7 Point Discharges of Water into the Santa Clara River

No diversions of water are known to occur from the Santa Clara River or its tributaries within the East Subbasin. Water is discharged into the Santa Clara River from the Saugus WRP east of I-5 and the Valencia WRP west of I-5, both of which are owned and operated by the Los Angeles County Sanitation District (LACSD), which was the source of the discharge data that were used to construct the historical water budget. A third WRP (the Newhall WRP) is planned to be constructed just east of the LA/Ventura county line to treat wastewater from the future Newhall Ranch community, and likely will discharge a portion of its treated wastewater during the coolest months of the year.

Additionally, periodic short-duration discharges to the river have occurred from two outfalls conveying treated water from perchlorate-treatment programs at certain wells pumping from the Saugus Formation. A third outfall began operating in 2017, is currently in operation, and is expected to continue operating for the indefinite future. These three outfalls are:

- Outfall for wells SCWD-Saugus1 and SCWD-Saugus2, discharging just upstream of the Saugus WRP; operated from May 2010 through January 2011; further discharges unlikely.

- Outfall for well VWD-201, discharging just downstream of the Saugus WRP; began operating in January 2018 and continues operating at this time; expected to end soon.
- Outfall for onsite extraction wells at the Whittaker-Bermite property, discharging about 1 mile upstream of the Saugus WRP: began operating in August 2017; discharges currently at or below about 500 AFY; future discharges assumed to be 500 AFY.

2.4.8 Evapotranspiration Demands by Phreatophytes

As described in Section 3.3.5 of the model development report (GSI, 2020), the model simulates uptake of groundwater by phreatophyte plant communities. The locations of two types of communities identified as potential GDEs are described by ESA (2020) and are programmed into the model; these communities are riparian mixed hardwood forests and coast live oak woodlands. See Figure 1-6 for a map showing their geographic distribution. The riparian mixed hardwood forests and coast live oak woodlands occupy 1,780 acres and 520 acres, respectively, in the model grid.

The mapping work indicates that the predominant species that are present in the riparian mixed hardwood forests are Fremont Cottonwood (40 percent), willow trees and shrubs (30 percent), and non-native grasses such as *Arundo donax (Arundo)* (30 percent). For this mixed plant community, monthly ET demands under current conditions (i.e., without climate change) range from 0.22 to 0.87 ft per month (ft/month) (67 to 270 millimeters per month [mm/month]), with peak demands occurring during the summer. ET demands for the coast live oak woodlands range from 0.02 to 0.33 ft/month (5 to 100 mm/ month), with peak demands occurring during the winter and spring, and the lowest demands occurring in the late summer and early fall. (See Section 3.3.7 of the model development report [GSI, 2020] for details regarding the derivation of the monthly ET demands.) The monthly distributions for ET demands by these two types of plant communities are programmed directly into the model and are assumed to be representative of potential ET demands in all years throughout the 1925–2019 period for the historical water budget. These rates are adjusted upwards by 4.8 percent and 10.8 percent for the 2030 and 2070 climate change scenarios, respectively, based on the DWR climate-change factors for ET that are described in Section 2.4.1 of this report.

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SECTION 3: **Historical Water Budget**

This section of the report presents a summary-level description of historical water uses in the East Subbasin (Section 3.1), the historical surface water and groundwater budgets (Sections 3.2 and 3.3), a summary of the influence of land and water use conversions on the historical water budget (Section 3.4), and the uncertain aspects of the historical water budget (Section 3.5). Figures 3-1 and 3-2 and Table B-1 in Appendix B present the year-by-year historical surface water budget. Figures 3-3 and 3-4 and Table B-2 in Appendix B present the year-by-year historical groundwater budget.

3.1 Description of Historical Water Uses in the East Subbasin

As discussed in Section 1, the East Subbasin was largely rural during the 1800s and early 1900s, with ranches, rural populations, and small villages present in the basin. The first large-scale use of groundwater is thought to have occurred with the construction of agricultural supply wells along the Santa Clara River in the western and central portions of the East Subbasin beginning in the mid-1930s. Inspection of air photos from 1947 and a U.S. Geological Survey (USGS) study of the basin's agricultural and early urban years (Robson, 1972) indicates that groundwater pumping for agricultural uses supported irrigated crop cultivation on as much as 6,100 acres (approximately) of land lying along the alluvial corridors that contain the Santa Clara River and certain tributaries. See Appendix A for the locations of these lands and the wells that are estimated to have provided the irrigation water supply, based on their construction dates. Calculations by Robson (1972), CH2M HILL (2004), and GSI (2020) for the mixture of crops farmed in those days and more recently indicate that (1) crop irrigation demands range from about 4 to 10 acre-feet (AF) per acre per year, and (2) crops consume approximately 50 to 70 percent of the land-applied irrigation water pumped from the Alluvial Aquifer, with the remainder lost to evaporation (ET) from soils and seepage back to the underlying water table. Accordingly, annual groundwater pumping to support agricultural irrigation is thought to have averaged approximately 50,000 acre-feet per year (AFY) by the mid-1940s and continuing through much, if not all, of the 1950s. Beginning in the 1960s, certain parcels of agricultural land, located primarily east of the modern-day I-5 freeway, were retired and eventually urbanized. Agricultural groundwater pumping from the Alluvial Aquifer declined to 23,000 AFY by 1967 (Robson, 1972), and, until the mid-1990s, total pumping from the Alluvial Aquifer (for agricultural plus municipal supplies) remained below 30,000 AFY in most years as the basin gradually urbanized. Pumping from the Alluvial Aquifer has averaged approximately 36,000 AFY since the mid-1990s, which includes an assumed 500 AFY of small domestic uses in unincorporated rural areas, The highest annual pumping volume (43,406 AFY during 1999) was approximately 6,600 AFY below the historical average amount of agricultural pumping (50,000 AFY).

The Saugus Formation was not a source of groundwater supply until the early 1950s, when the newly-formed Newhall County Water District drilled wells along the South Fork Santa Clara River in the town of Newhall. In 1964, an irrigation well was drilled in the Saugus Formation to supply a newly built golf course west of the Valencia Town Center, which was also under development at that time. The Newhall Land and Farming Company constructed an agricultural supply well in the Saugus Formation in 1961; this was generally pumped only periodically until it was taken out of service in 2012 and then abandoned. Pumping from the Saugus Formation remained below 5,000 AFY until 1986, then rose to between 10,600 and 14,900 AFY during the early 1990s before decreasing to below 10,000 AFY for nearly 20 years and then returning to levels between approximately 10,000 and 12,000 AFY in recent years. Pumping from the Saugus Formation is primarily for municipal uses, though The Disney Corporation pumps the Saugus Formation for irrigation supply near the southern margin of the basin.

Table 3-1 shows the historical water demands and the sources of water used to meet those demands. As discussed in Sections 1 and 2 of this report, the values prior to 1980 are estimates, whereas the values from 1980 through 2019 are obtained from the most recent annual water report for the basin (LSCE, 2020).

Table 3-2 summarizes the historical annual groundwater pumping by water-use sector. Agriculture was the dominant user of groundwater during the peak agricultural years of 1945 through 1960 and remained the largest use through the late 1970s and into the early 1980s. Golf course water use began in the 1960s, and small domestic uses are thought to have begun in the 1960s as urbanization was accompanied by an increased number of rural homes and their associated domestic water uses. The past four decades as a whole have been characterized by municipal uses becoming the largest uses of groundwater, followed by agricultural irrigation (which occurs primarily along I-5 in and near Castaic Junction and in portions of the alluvial valley situated west of I-5). Golf course water use has also been higher during the past four decades than before 1980.

3.2 Historical Surface Water Budget

The GSP regulations (§354.18) require development of a surface water budget for the GSP. The surface water budget quantifies important sources of surface water and evaluates their historical and future reliability. The BMP document for water budget development (DWR, 2016; see page 19) states that surface water sources should be identified as one of the following:

- Central Valley Project
- State Water Project
- Colorado River Project
- Local imported supplies
- Local supplies

The East Subbasin has two of these surface water source types: (1) local imported supplies stored in Castaic Lake, which lies along the margin of the Bulletin 118 basin boundary for the East Subbasin, and (2) local river/stream systems, which are not sources of agricultural, municipal, or private water supplies in the East Subbasin but instead exist in the form of perennial streamflows in the western portion of the East Subbasin and ephemeral streamflows in other portions of the East Subbasin. Following are discussions of these historical surface water source types.

3.2.1 Historical Imported Supplies

SCV Water's portfolio of imported water supplies consists of SWP water and supplies that are available from six long-term groundwater banking and water exchange programs outside the East Subbasin (LSCE, 2020). To date, the imported supplies used by SCV Water have consisted primarily of SWP water. As documented in the 2010 and 2015 UWMPs (KJC et al., 2011 and 2016) and the 2017 Water Supply Reliability Plan Update (Clemm and KJC, 2017), the combination of imported water management in conjunction with the operating plan for the local groundwater basin forms the basis for current and future water planning in the Santa Clarita Valley. By design, the groundwater operating plan draws upon the groundwater storage reserves of the basin (primarily in the Saugus Formation) to augment imported supplies during drought years in the SWP, then reduces pumping at other times to facilitate the natural replenishment of those reserves. This groundwater operating plan is integral to the water resources plan for SCV described in its UWMPs, as the imported water puts the region into a position where available water supplies exceed demands (LSCE and GSI, 2009).

SCV Water takes deliveries of its imported water supplies at Castaic Lake, which serves as the terminal reservoir of the SWP's West Branch. SCV Water treats this water at its Earl Schmitt Filtration Plant or its Rio Vista Water Treatment Plant. This treated water then enters the municipal water supply distribution system where it is blended with locally pumped municipal groundwater supplies. No accounting is available to track the amount of the imported supply applied to different categories of urban land uses. Hence, in the East

Subbasin it is not possible to develop an accounting of applied surface water by water use sector (as described in the water budget BMP [DWR, 2016] with regards to the requirements of §354.18(b)(1) of the GSP regulations). The historical annual usage of imported water supplies is tabulated in the annual water reports for the basin (LSCE, 2020) and is included in Table 3-1.

3.2.2 Historical Local Surface Water Inflows

Local surface water inflows in river and stream systems are not sources of municipal or agricultural water supply in the basin, but instead consist solely of stormwater and other flows in the Santa Clara River and its tributaries. These surface water inflows consist of the following:

- Ungaged surface water flows arising as precipitation runoff (stormwater) within the East Subbasin (estimated from precipitation data and modeling studies)
- Gaged surface water flow in the Santa Clara River that enters the East Subbasin from the upstream Acton Basin (obtained from intermittently available stream gaging records at Lang Station and from streamflow regression estimates)
- Ungaged surface water flows that enter the East Subbasin in other tributaries to the Santa Clara River, which originate in the upper portions of the watersheds lying outside the groundwater basin boundary (estimated from precipitation data and modeling studies)
- Periodic releases of water into Castaic Creek from the Castaic Lake/Lagoon complex (from records maintained by DWR)
- Releases of water from Bouquet Reservoir into Bouquet Creek upstream of the East Subbasin, a portion of which can flow into the East Subbasin (estimated from data and modeling studies)
- Discharges of treated water to the Santa Clara River from the Saugus and Valencia WRPs (from records provided by the Los Angeles County Sanitation District)
- Periodic point discharges to the river from groundwater treatment facilities
- Natural discharges of groundwater in perennial (gaining) reaches of the Santa Clara River

Table 3-3 summarizes the average, minimum, and maximum values of these annual historical surface inflows to the East Subbasin.

3.2.3 Historical Surface Water Outflows

The estimated annual surface water outflow leaving the East Subbasin (as storm and non-storm flows in the Santa Clara River at the LA/Ventura county line, deep percolation from ephemeral streams, and evaporative losses) is summarized in Table 3-4 for the historical base period. The non-storm flow in the Santa Clara River at the county line is estimated from groundwater modeling, given that the historical period begins before stream gaging began.

For the purpose of reporting the water budgets, the historical non-storm flows in the Santa Clara River at the LA/Ventura county line include the amount of subsurface flow that occurs within a thin veneer of alluvium that is present at the county line, which comprises the western boundary of the East Subbasin and the groundwater flow model. These subsurface flows are included in the non-storm surface water outflow term because (1) the alluvium generally thins in a westerly direction in this area, and (2) aerial imagery indicates the stream channel becomes more defined (less braided and narrower) west of the county line and continuing downstream to the existing stream gage at Las Brisas Bridge (USGS Station 11109000, which is located 3.5 miles downstream of the county line).

3.2.4 Historical Surface Water Budget

A comparison of Tables 3-3 and 3-4 shows the following noteworthy observations about the historical surface water budget:

- The point discharges to the river are a minor portion of the total surface water inflows on a basinwide basis. However, because these discharges occur in the western portion of the basin, they have a notable influence on streamflows at the LA/Ventura county line, as shown by a comparison of the point discharges with gaging records at the county line during the summer season, when little to no storm flow occurs in the river. (See Figure 3-2.)
- The controlled releases of water from Bouquet Reservoir also are a minor portion of the total surface water inflows. In contrast, controlled releases from Castaic Lake can be significant during wet years but have little to no influence on the surface water budget during dry periods.
- The amount of stormwater generated from precipitation falling directly within the basin is an important component of the surface water budget, as is the streamflow entering the basin in the Santa Clara River and its tributaries.
- Groundwater discharges to the perennial reach of the river are the second-highest source of inflow to surface water on average, and the minimum value of these discharges is also the second highest of the minimums for all surface water inflow terms.
- As shown in Table 3-4 and in Table B-1 of Appendix B, on average, 52 percent of the precipitation and streamflow occurring in the basin becomes stormwater outflow at the LA/Ventura county line or is lost to ET. Groundwater recharge from precipitation outside of stream channels constitutes another 12 percent of the total surface outflow from the basin, and another 11 percent infiltrates to groundwater in streambeds. The remaining 25 percent leaves the basin as non-storm flow at the LA/Ventura county line.
- As shown in Table B-1 of Appendix B, for the non-storm surface water outflows, the minimum annual flow volume (11,311 AFY) is about 25 percent of the average annual volume of non-storm flow for the 95-year historical period (44,905 AFY). As shown in Figures 3-2 and 3-4, the lowest flows occurred during the mid-1940s through the early 1960s, which is the period when groundwater pumping from the Alluvial Aquifer was at its historical highest (to meet agricultural irrigation needs before urbanization began).

3.3 Historical Groundwater Budget

The annual historical groundwater budget is shown on Figures 3-3 and 3-4 and in Table B-2 in Appendix B in this report.

3.3.1 Historical Groundwater Inflows

Table 3-5 summarizes the average, minimum, and maximum values of the annual inflows to groundwater in the East Subbasin. Noteworthy observations are as follows:

- Recharge from streams provides by far the most important source of recharge to the basin's groundwater resources, contributing about 67 percent of the total recharge on average during the 95-year historical period.
- During wet years, recharge from precipitation falling within the East Subbasin is also an important source of groundwater recharge; however, the 95-year average of this recharge term is only 12 percent of total recharge.

- Subsurface inflows entering the basin in the thin veneers of alluvium that are present beneath the Santa Clara River and its 48 tributaries are the second-highest recharge source during normal and dry years, as the upstream contributing watersheds steadily drain their water and provide it in the form of a steady subterranean flow into the East Subbasin.
- On average, septic systems have provided less than 1 percent of total recharge to groundwater, while irrigation (applied water) has provided about 3 percent of the total recharge to groundwater. The contribution from irrigation on a long-term basis has been below 3 percent regardless of whether the irrigation uses were comprised of agricultural irrigation alone (as occurred before the 1960s) or a mixture of agricultural and municipal irrigation (since 1960). However, during the peak agricultural years, the estimated maximum value of irrigation recharge (9,524 AFY) may have provided as much as 10 percent of total recharge to groundwater during the low-precipitation periods (such as water years 1948 through 1951 and 1960; see Table B-2 of Appendix B).

3.3.2 Historical Groundwater Outflows

Table 3-6 summarizes the average, minimum, and maximum values of the annual outflows (discharges) of groundwater from the East Subbasin. Groundwater discharges to streams are by far the biggest source of outflow, with groundwater pumping becoming the second largest source of outflow once the basin went into agricultural production, and continuing with the expansion of urbanization after 1960. Groundwater withdrawals by riparian vegetation (phreatophytes) have remained within a relatively narrow range of values, varying over a range of about 5,000 AFY (from about 4,200 AFY to 9,265 AFY), in contrast to the range of nearly 200,000 AFY for total groundwater discharge (which ranged between 115,470 AFY and 308,270 AFY).

3.3.3 Historical Changes in Groundwater Storage

The yellow line on Figure 3-3 shows how much the volume of stored groundwater changes progressively over time. The slopes of this cumulative change in storage line are the primary indicator of the storage changes over the short and long terms. A rising slope indicates that recharge is greater than discharge, and a declining slope indicates that recharge is less than discharge. Figure 3-3 shows that the occurrence of rising compared with declining slopes varies frequently during the 95-year historical period. In the year 2011, which was one year before the recent drought began, the cumulative change in storage was similar to that of the first year in the 1925–2019 historical period, indicating that no long-term decline in storage had occurred. In 2012, the onset of the drought began a period of declining storage that lasted until the curve began rising in 2017. The curve's slope during the drought from 2012 through 2016 is similar to that calculated for prior drought periods, such as 1945 through 1965 and 1987 through 1991. Most importantly, the historical water budget indicates that the onset of groundwater pumping and the changing locations and uses of groundwater have not resulted in an overdraft condition in the East Subbasin.

3.4 Influence of Land and Water Use Conversions on the Historical Water Budget

The historical surface and groundwater budgets are influenced by the conversion of land and water uses beginning in the 1960s.

- For the surface water budget, historical stream gaging data show that stormwater flows into and out of the basin were highly variable from year to year, based on year-to-year variations in precipitation. Figure 3-2 shows that historically, the seasonal low (summer-season) flow volumes in the river at and below the LA/Ventura county line have increased since 1965 because of increases in treated water discharges from WRPs as the basin became increasingly urbanized and more water was imported from SWP to meet demand. The annual volume of combined discharges to the river from the two local WRPs increased to as high as 22,900 AFY in 2005 and ranged between approximately 20,000 AFY and 22,000 AFY from 2011 through 2019. As shown in Figure 3-4, model simulations of historical conditions indicate that annual non-storm flow volumes crossing the county line were likely lower during the period of peak agricultural production (from the mid-1940s through the early to mid-1960s) than occurred before or after that period. This is thought to be the result of the prevailing dry conditions in the region plus the groundwater pumping that occurred from the Alluvial Aquifer (pumping that was higher in those years than any other time before or after).

- In the groundwater budget, the initiation of urbanization and the corresponding retirement of certain agricultural lands from the 1960s through the 1980s coincides with an increase in the minimum and maximum inflection points on the cumulative-change curve shown in Figure 3-3 for groundwater storage volumes. These inflection points arise partly from greater precipitation but also from reduced pumping (see the maroon bars) as agricultural pumping decreased quickly while urban pumping slowly increased. The gradual rise in the cumulative change in storage curve (the yellow line in Figure 3-3) continued through the early to mid-2000s despite increased municipal pumping during this period, in part because of the lack of a prolonged drought but also because of the continued pumping of the Alluvial Aquifer at levels lower than occurred during the years of peak agricultural land uses. Along with the increased importation of SWP water into the basin starting in 1979, the changing groundwater pumping patterns and changing water use patterns associated with urbanization and reduced agricultural production have kept the basin in a sustainable condition with respect to the SGMA criterion of chronic lowering of groundwater levels.

3.5 Uncertain Aspects of the Historical Water Budget

The definitions section of the GSP regulations (§351) defines uncertainty as follows:

> (ai) "Uncertainty" refers to 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.

Uncertainties in the historical water budget exist in the form of (1) data gaps and measurement accuracy and (2) modeling uncertainties

The primary data gaps and uncertainties that may have effects on the model and the historical water budget are the following:

- A long record of precipitation data is available in the East Subbasin, consisting of monthly records dating back to late 1927 and annual (calendar-year) records dating to the late 1880s. In contrast, no streamflow records are available prior to the early 1950s on the Santa Clara River and prior to 1974 in the watershed upstream of Castaic Lake. Precipitation records and regression techniques have been used to estimate streamflows prior to these times, as well as to fill in data gaps during the period of record (an issue primarily at the Lang Gage, where the Santa Clara River enters the East Subbasin).
- For agricultural lands, data on groundwater pumping volumes, irrigated crop types and acreages, and irrigation return flow volumes are not available prior to the modern era of record-keeping (i.e., prior to 1980). This information has been estimated from aerial photos showing the locations of agricultural lands, general descriptions of historical cropping, and the application of more recent data on the water needs of various types of crops.

- Pumping volumes for wells owned by SCV Water are metered and are available from recording systems that provide real-time operational information, thereby minimizing uncertainty in municipal groundwater pumping records. Other wells in the basin report their groundwater pumping on an annual, or occasionally monthly, basis using meter readings and/or electrical performance tests.
- Elevation surveys are not available for some non-purveyor-owned wells in the basin. This creates a small amount of uncertainty in converting groundwater level depth measurements to groundwater elevations. Additionally, the documentation of protocols for measuring "static" groundwater levels at other non-purveyor-owned wells (when they are not pumping) is not readily available. These factors create uncertainty in interpreting groundwater level measurements in the western portion of the basin and calibrating the groundwater flow model in this area.
- Few wells are present in certain areas—specifically, in the northwestern portion of the Saugus Formation and in certain tributary valleys in the Alluvial Aquifer. This creates uncertainty in calibrating the model in these outlying areas.

Modeling uncertainties pertain to (1) a model's general ability to replicate actual physical conditions in streams and in the subsurface and (2) a model's calibration quality. As discussed in the model development report (GSI, 2020), the regional model of the East Subbasin has been created through a detailed process of planning, construction, and calibration. In the judgment of the GSP development team, the model and its underlying data render the model to be a viable and reliable tool for the SCV-GSA and SCV Water to use for development, implementation, and monitoring of the GSP for the East Subbasin, and for other groundwater resource planning and management programs. Nonetheless, despite its detail and the in-depth nature of the calibration and validation process, the numerical model is a simplification of a complex hydrogeologic system and has been designed with certain built-in assumptions. As with any groundwater model, there are data limitations inherent in the use of the model, as described above. Nonetheless, reasonable estimates of conditions for periods when data are missing or are uncertain have been possible to derive in this basin using information from periods of more detailed recordkeeping. Additionally, the process of calibrating the model to a 40-year record of (1) streamflows at the LA/Ventura county line and (2) groundwater level fluctuations in numerous pumping and non-pumping wells in both the Alluvial Aquifer and the Saugus Formation has provided substantial insights regarding the relative influences of the multiple hydrologic processes across the basin and in specific locations. As discussed in the model development report, the modeling tools and the basin understanding that have arisen from the process of collecting data routinely for 40 years and fitting a model to those data have provided tools and a historical water budget that likely would not change appreciably if additional calibration refinements were to be sought. This means that the SCV-GSA's approach to maintaining the historical non-overdraft condition and conducting related decision-making is not likely to change with further calibration work, which in turn means that the definition of uncertainty as cited in §351 of the GSP regulations does not exist with regards to the historical water budget.

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SECTION 4: **Current Water Budget**

As discussed in Section 2.2.2, the current water budget examines how the land and water uses in 2014 would have affected the basin on a long-term basis if the 2014 land and water uses were to be repeated throughout the historical precipitation sequence (i.e., the historical precipitation and streamflow conditions during the period 1925 through 2019).

4.1 Current Water Uses Under the 2014 Level of Development

The current water budget uses SCV Water's actual 2014 pumping distribution and the overlying land uses that were present that year. The 2014 land uses are believed to be within 1 percent of those found in 2019, based on the number of water accounts served by SCV Water. For other pumpers, the current water budget uses those purveyors' average pumping during the last 10 years. This is consistent with estimation procedures used in past UWMP analyses. Table 4-1 shows how water demands would be satisfied at the current level of development and the associated current level of water demands and groundwater pumping. Table 4-2 shows the annual groundwater pumping by water use sector under the 2014 level of development, as evaluated for the current water budget.

4.2 Current Surface Water Budget

For the current water budget (which evaluates the effects of the 2014 level of development and water use for the historical hydrology that occurred during water years 1925 through 2019), the annual surface water budget is shown on Figure 4-1 and in Table C-1 of Appendix C.

4.2.1 Current Imported Supplies

The historical annual usage of imported water supplies is tabulated in the annual water reports for the basin (LSCE, 2020) and presented in Table 3-1 for the period 1925 through 2019 that is used to report the historical water budget. For the current water budget, the imported water volume is 33,092 AF, which was the actual amount of water imported into the basin in 2014.

At the end of 2019, SCV Water had secured more than 164,000 AF of recoverable water outside the East Subbasin through multiple long-term groundwater banking and exchange programs (LSCE, 2020). These programs consist of the following:

- Two water banks (one with the Semitropic Water Storage District [now called the Stored Water Recovery Unit, SWRU] and one with the Buena Vista and Rosedale Rio-Bravo Water Storage Districts)
- Two-for-one exchange programs that SCV Water initiated with four entities (Rosedale Rio-Bravo Water Storage District, West Kern Water District, Antelope Valley-East Kern Water Agency, and United Water Conservation District)
- An option contract under the Yuba Accord Agreement with DWR and the Yuba County Water Agency

These imported supplies are in addition to the SWP water supply, for which SCV Water holds a contractual Table A amount of 92,500 AFY.[10] During the recent drought, SCV Water's allocations of Table A water ranged from 9 percent in 2014 to 36 percent in 2016. After the drought period, these allocations were 77 percent in 2017, 40 percent in 2018, and 75 percent in 2019.

[10] The amount of SWP water received by each SWP contractor each year is determined by multiple factors, including the contractor's maximum contracted allotment (referred to as its Table A amount) and the amount of available water supply in the SWP system.

4.2.2 Current Local Surface Water Inflows

Table 4-3 summarizes the average, minimum, and maximum values of these annual surface water inflows to the East Subbasin in the current water budget, as computed by applying the 2014 level of water demand to the historical hydrology of 1925 through 2019. (See Figure 4-1 and Table C-1 in Appendix C for the annual water budgets during each year.) In-basin precipitation and stream inflows (natural and controlled releases) are the largest source of inflows to the surface water system, even during below-normal precipitation years (such as the drought years of 2012 through 2016). On average, the next largest sources of streamflow are discharges to the Santa Clara River in the western portion of the basin from local WRPs and upwelling of (inflow from) groundwater.

4.2.3 Current Surface Water Outflows

Surface water outflows for the current water budget are shown in Figure 4-1, Table 4-4, and Table C-1 of Appendix C. Evaporative losses (ET) and stormwater outflows together comprise 53 percent of the total outflow of surface water on average during the period 1925 through 2019. Non-storm streamflows at the LA/Ventura county line are the next-highest outflow (25 percent on average), followed by groundwater recharge from in-basin precipitation (11 percent) and from streambeds (11 percent). During drought periods (such as the years 2015, 2016, and 2018), most stormwater generated from precipitation within the basin is lost to evaporation, because little to no deep percolation of this stormwater occurs.

4.3 Current Groundwater Budget

The groundwater budget for current conditions (which simulated the effects of the 2014 level of development and water use for the historical hydrology that occurred during water years 1925 through 2019) is shown on Figure 4-2 and in Table C-2 of Appendix C.

4.3.1 Current Groundwater Inflows

Table 4-5 summarizes the average, minimum, and maximum values of the annual inflows to groundwater in the East Subbasin. The percentage contribution of each recharge term in the current water budget to total groundwater recharge is similar to the percentages in the historical water budget (shown in Table 3-5). Recharge from streams provides by far the most important source of recharge to the basin's groundwater resources, followed by subsurface inflows and precipitation recharge, with irrigation and septic system recharge being minor contributors.

4.3.2 Current Groundwater Outflows

Table 4-6 summarizes the average, minimum, and maximum values of the annual outflows (discharges) of groundwater from the East Subbasin. As was seen in the historical water budget for water years 1925 through 2019, groundwater discharges to streams are by far the biggest source of groundwater outflows in the current water budget, with groundwater pumping being the second-largest outflow from the groundwater system. Annual groundwater withdrawals by phreatophytes are substantially lower than the other groundwater discharge mechanisms.

4.3.3 Changes in Groundwater Storage Under Current Conditions

The yellow line on Figure 4-2 shows how much the volume of stored groundwater changes progressively over time when simulating the effects of the 2014 level of development and water uses through the historical hydrologic record projected forward in time. Figure 4-2 shows that the occurrence of rising versus declining slopes in the modeled cumulative-change curve varies frequently during the 95-year historical period and has a generally similar shape as the cumulative-change curve for actual historical conditions during that 95-year period (Figure 3-3).

Close inspection of Figures 3-3 and 4-2 also shows that the downward slope of the cumulative-change curve during the drought period for 1945 through 1965 is greater under historical conditions (Figure 3-3) than under the 2014 level of development and water uses (Figure 4-2). This difference is attributable to the lesser amount of groundwater pumping from the Alluvial Aquifer under the 2014 land and water uses (38,131 AFY) than the approximately 50,000 AFY of pumping that is estimated to have actually occurred from the Alluvial Aquifer during the historical peak agricultural period.

4.4 Summary of Basin Condition Under the Current Water Budget

As with the historical water budget, the current water budget assessment for the 2014 level of development and water use in the East Subbasin indicates that no long-term decline in the volume of stored groundwater would be expected to have arisen if the 2014 level of groundwater pumping had occurred throughout the past 95 years. This observation in turn indicates that the basin likely would not be in an overdraft condition under a sustained level of pumping at the 2014 level of demand for groundwater. Figure 4-3 shows that non-storm flows in the river during the agricultural period are higher when simulating the current (2014) conditions for development, groundwater pumping, and WRP discharges, compared with non-storm river flows under the actual historical pumping condition (Figure 3-4).

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SECTION 5: **Projected Water Budget**

As discussed in Section 2.2.3, three sets of projected water budgets are developed to quantify the estimated effects of future buildout conditions and climate change in the East Subbasin. Section 5.1 presents the details of the water use scenario for these projected (future) water budgets. Sections 5.2 through 5.4 present the three water budgets. Section 5.5 summarizes the projected basin conditions, and Section 5.6 discusses the uncertainties in the analysis.

5.1 Water Use Scenario for Future Projected Conditions

For all three projected (future) water budgets, the water use scenario accounts for full buildout of land uses in the East Subbasin, as identified in the SCAG and OVOV local land-use plans. The SCAG and OVOV full buildout volumes are incorporated into water demand estimate planning during preparation of UWMPs for the East Subbasin (KJC et al., 2016). The use of groundwater under these land-use plans is based on the existing groundwater operating plan, which is described in the annual reports for the basin and in the most recent and prior UWMPs. The groundwater operating plan calls for pumping as follows:

	Groundwater Production (AFY)			
	Normal Years	Dry Year 1	Dry Year 2	Dry Year 3
Alluvial Aquifer	30,000 to 40,000	30,000 to 35,000	30,000 to 35,000	30,000 to 35,000
Saugus Formation	7,500 to 15,000	15,000 to 25,000	21,000 to 25,000	21,000 to 35,000
Total	**37,500 to 55,000**	**45,000 to 60,000**	**51,000 to 60,000**	**51,000 to 70,000**

The definition of normal versus dry years is governed by local hydrologic (precipitation) conditions in the case of the Alluvial Aquifer and by the allocation amounts of imported water supplies in the case of the Saugus Formation. The groundwater operating plan calls for a gradual increase in pumping when SWP allocations decrease to an extent that would warrant an increase in Saugus Formation pumping above normal-year rates. Based on delivery estimates published recently by DWR (2020), it is estimated that approximately 26 of the past 95 years of the historical record could have been characterized as years when Saugus pumping would be at dry-year rates, including four dry-year periods lasting between 3 and 7 years, one dry-year period lasting two years, and a single dry year (1978) when the allocation would have been about 5 percent and thereby warranted pumping the Saugus Formation at its Dry Year 2 or Dry Year 3 rate. In essence, the groundwater operating plan contemplates using Saugus Formation groundwater as a drought buffer when SWP supplies are curtailed.

The primary aspects of water use that are simulated in the groundwater model for full buildout conditions in the East Subbasin are (1) groundwater pumping under the operating plan; (2) retirement of agricultural lands in the East Subbasin, with the exception of the Disney Corporation; (3) construction of new urban developments as identified in local land-use plans; and (4) recycled water uses and discharges of treated water from WRPs into the Santa Clara River. Table 5-1 shows the distribution of pumping by water-use sector for each aquifer and year type, and Table 5-2 shows the details of all point discharges to the Santa Clara River. Specific details regarding the design of the water-use scenario for full buildout conditions are as follows:

- Groundwater pumping from the Alluvial Aquifer during normal years is 37,193 AFY. During years of increased Saugus Formation pumping (as a result of curtailments of SWP supplies), municipal pumping from the Alluvial Aquifer is reduced by 4,693 AFY, which results in 32,500 AFY of total pumping from this aquifer. Additional aspects of Alluvial Aquifer pumping in the projected water budgets are as follows:

  - Consistent with the Newhall Ranch Specific Plan and other agreements, 6,100 AFY of pumping is transferred from irrigation wells owned by Newhall Land to wells owned by SCV Water near Castaic Junction to provide potable municipal supply to the Newhall Ranch Specific Plan development. This transfer is assumed to involve the decommissioning of Newhall Land's existing C and E series of wells located along and near the lower portion of the alluvial valley containing Castaic Creek.
  - Newhall Land continues pumping, on average, an assumed 3,459 AFY of Alluvial Aquifer groundwater from its B series wells, which are the furthest west of its existing agricultural supply wells. This water is assumed to be conveyed out of the East Subbasin to land parcels owned by Newhall Land in the Piru Basin.

- Groundwater pumping from the Saugus Formation during normal years is 11,100 AFY, which consists of the actual 2014 historical groundwater pumping volume (10,600 AFY) plus an assumed 500 AFY of pumping for containment and treatment of a contaminant plume that is present on the Whittaker-Bermite property (located near the mouth of the South Fork Santa Clara River). During the first, second, and 3+ years of increased Saugus pumping, total pumping from this aquifer is capped at volumes of 20,000 AFY, 25,000 AFY, and 35,000 AFY, respectively, which includes the 500 AFY of site remediation pumping occurring on the Whittaker-Bermite property. The increased pumping during the second and subsequent years would include operating at least six new wells, two of which are currently in final design and are about to be constructed near Magic Mountain.
- Newhall Land's agricultural lands in the East Subbasin are retired, with no further irrigation for agricultural purposes except by the Disney Corporation along the southern margin of the basin. Irrigation for urban uses occurs inside the Newhall Ranch Specific Plan, in four other communities being developed by Newhall Land, and in other currently-undeveloped areas identified in local land-use plans for future development.
- Wastewater flows into local WRPs total to 30,300 AFY, as defined in a demand modeling forecast conducted by Maddaus (2019). This study estimates the amount of indoor water use savings that will arise from the implementation of plumbing codes and conservation program measures through the projected buildout year of 2050 in the East Subbasin. The plumbing codes and conservation measures accounted for in the study reduce indoor water use to 50 gallons per capita per day (gpcpd) by the year 2030, per state requirements in legislation that was passed in 2018 (Senate Bill 606 and Assembly Bill 1668). The demand modeling forecast for the East Subbasin uses 50 gpcpd as the indoor water use rate for new developments and also accounts for how existing housing stock will experience increased efficiencies in indoor water uses as (1) remodeling projects occur under the new plumbing code, and (2) existing appliances and plumbing fixtures are replaced by new and more efficient units. Of the 30,300 AFY of flows that will occur into local WRPs under the forecasts from the 2019 study, approximately 21,000 AFY is discharged to the Santa Clara River and 9,300 AFY becomes recycled water supply. During the winter months, a small portion of the treated water that is discharged to the Santa Clara River from local WRPs is estimated to come from the future Newhall WRP, which will be located about 0.5 mile upstream of (east of) the LA/Ventura county line.
- The treatment system that is currently treating groundwater pumped from the Whittaker-Bermite property discharges 500 AFY of treated water to the Santa Clara River at its existing outfall, located about 1 mile upstream of the Saugus WRP.

5.2 Projected Water Budget without Climate Change

5.2.1 Surface Water Budget

Figure 5-1 displays the year-by-year projected surface water budget without climate change. See also Table D-1 in Appendix D for detailed calculations.

5.2.1.1 Projected Imported Supplies

The amounts of imported and other water supplies in the projected water budget are displayed in Table 5-3 for normal years, a single dry year (labeled as Dry Year 1 in the table), and multiple dry years (Dry Year 2 and Dry Year 3+ in the table). The magnitudes of imported water are the amounts that meet the demands listed in the table after accounting for the other supply amounts that are specified in the projected water budget. The demands are obtained from the 2015 UWMP (KJC et al., 2016); see the values for the year 2050 that are contained in Tables 6-2, 6-3, 6-4A, and 6-4B of the 2015 UWMP. Table 5-4 shows these values for each year in the 95-year model simulations that were used to construct the projected water budgets.[11]

The imported water volumes displayed in Tables 5-3 and 5-4 are less than the amount of combined imported supply that is available from (1) the SWP system and (2) the additional imported supplies that have been secured to date by SCV Water (which were discussed in Section 4.2.1). Table 5-5 shows the available amounts of each water supply source for normal years, single dry years, and multiple dry years, and compares the total supply to the full buildout demands, This comparison uses the supply and demand details presented for the year 2050 in Tables 6-2, 6-3, 6-4A, and 6-4B of the 2015 UWMP. For SWP water, the estimates of imported water supplies are based on the 2015 Delivery Capability Report (DCR) for the SWP system (DWR, 2015), which was the basis for incorporating uncertainties about future SWP deliveries into the reliability planning portion of the 2015 UWMP. As shown in Table 5-5, under full buildout conditions, the available supplies exceed the demand estimates by an estimated 28,636 AFY in normal years, by an estimated 19,341 AFY in single dry years, by an estimated 39,931 for a 3-year dry period, and by an estimated 27,071 AFY for a 4-year dry period. As discussed in Section 1.6.2, SCV Water currently is in the process of updating its UWMP, which includes reviewing and (as needed) revising the water supply and demand values described herein, including incorporating DWR's most current estimates of future SWP delivery reliability as contained in the 2019 DCR (DWR, 2020). Although the 2020 UWMP will update the supply and demand estimates for future buildout conditions, the future water budgets that have been developed to support preparation of the GSP assume that the current groundwater operating plan for the basin (1) will be unchanged in the upcoming 2020 UWMP and (2) is applicable to all three of the future water budget scenarios described in this report (no climate change, 2030 climate change, and 2070 climate change).

5.2.1.2 Projected Local Surface Water Inflows

Table 5-6 summarizes the average, minimum, and maximum values of the annual surface inflows to the East Subbasin in the projected water budget without climate change. (See Table D-1 in Appendix D for detailed calculations.) These inflows are the same as for the current water budget for the 2014 level of development, with the exception of the discharge volumes from the Valencia WRP, the addition of discharges from the future Newhall WRP, and a reduction in the net inflow of groundwater. The net inflow of

[11] Table 5-4 identifies the first year after a dry year or dry period as being a "post-drought" year. This year type was included in the projected water budget because, operationally, the end of a dry period often is not known until the spring season arrives. Until then, municipal pumping remains at dry-year levels, then will return to normal-year levels typically by May or June.

groundwater ranges from 1,245 AFY to 68,580 AFY (averaging 22,960 AFY) in this projected water budget, compared with a range of 6,700 AFY to 84,000 AFY (averaging 36,000 AFY) in the historical water budget.

5.2.1.3 Projected Surface Water Outflows

Table 5-7 summarizes the average, minimum, and maximum values of the annual surface outflows from the East Subbasin for the projected water budget without climate change. (See Table D-1 in Appendix D for detailed calculations.) Annual surface water outflows for the projected water budget without climate change are slightly higher than under the actual historical conditions for the basin (Table 3-4), primarily because of an increase in the amount of stormwater that is lost to ET and an increase in stormwater outflow at the LA/Ventura county line. Non-storm flows crossing the county line show a wider range historically (11,300 AFY to 100,000 AFY) than under the projected water budget (22,600 AFY to 89,400 AFY), but the average values are similar (44,900 AFY historically and 44,400 AFY projected) which suggests the constant nature of the point discharges to the river from one year to the next tempers the variability in these non-storm flows compared with the highly variable point discharges of the past.

5.2.2 Groundwater Budget

Figures 5-2 and 5-3 display the year-by-year projected groundwater budget without climate change. See also Table D-2 in Appendix D for detailed calculations.

5.2.2.1 Projected Groundwater Inflows

Table 5-8 summarizes the average, minimum, and maximum values of the annual inflows to groundwater in the East Subbasin for the projected water budget without climate change. (See Table D-2 in Appendix D for detailed calculations.) Compared with historical groundwater inflows (Table 3-5), the primary difference in groundwater inflows is the constant amounts of recharge from septic systems and irrigation in urbanized areas under the projected water budget. Differences in the amount of recharge from stream leakage also occur, because of differences at various locations in the ephemeral and perennial reaches of the Santa Clara River. Recharge from streams is also higher because of timing differences between large natural inflows to Castaic Lake (which are used in the projected water budget) and the later controlled releases during its early operating years (which are used in the historical water budget).

5.2.2.2 Projected Groundwater Outflows

Table 5-9 summarizes the average, minimum, and maximum values of the annual outflows of groundwater from the East Subbasin for the projected water budget without climate change. (See Table D-2 in Appendix D for detailed calculations.) Compared with historical groundwater outflows (Table 3-6), the average projected water budget shows higher groundwater pumping rates but similar rates of phreatophyte ET and groundwater discharges to streams. Average groundwater pumping (51,375 AFY) is 17,495 AFY higher than in the historical water budget (33,880 AFY), and appears to be partly compensated for by a 15,620 AFY increase in average groundwater recharge under projected conditions (190,950 AFY on average) compared with historical conditions (175,330 AFY on average).

5.2.2.3 Projected Changes in Groundwater Storage

The yellow line on Figure 5-2 shows how much the volume of stored groundwater changes progressively over time when simulating the effects of the full buildout level of development and water uses through the historical hydrologic record projected forward in time. Figure 5-2 shows that the occurrence of rising versus declining slopes in the modeled cumulative-change curve varies frequently during the 95-year historical period and has a generally similar shape as the cumulative-change curve for actual historical conditions during that 95-year period (Figure 3-3). Accordingly, as was indicated by the water budgets for historical conditions and the 2014 level of development, the water budget assessment for the full buildout level of development and water use in the East Subbasin indicates that a chronic long-term decline (i.e., a continual year-to-year decline) in the volume of stored groundwater is not expected to arise from increased future development or from the increased pumping that will occur in the future under the groundwater operating plan. The basin is anticipated to remain in a sustainable condition with respect to the SGMA criterion of chronic lowering of groundwater levels and not be in an overdraft condition as a result of future development and associated groundwater uses. The combined influence of full build-out conditions and climate change is examined next, in Sections 5.3 and 5.4.

5.3 Projected 20-Year Water Budget (Year 2042)

As DWR discusses in its BMP for water budget development (DWR, 2016), the climate change analysis is a process in which variability in the historical climatic record is preserved while the magnitudes of events are increased or decreased based on projected changes in precipitation and air temperature, as obtained from global climate model outputs that have been downscaled to localized areas such as the East Subbasin. This approach is used because it is impossible to know what precipitation and air temperatures will actually be in the year 2042, which is the end of the 20-year period for achieving sustainability under SGMA (based on the planned submittal in early 2022 of the GSP for the East Subbasin). As a result, the projected water budgets for year 2042 conditions apply the 2030 climate-change factors to the historical (1925 through 2019) climate record while simulating full buildout of land and water uses. Output for the water budget is displayed in figures and tables as being for the period 1925 through 2019, even though the water budget is for year 2042 conditions.

5.3.1 Surface Water Budget for Year 2042

Figure 5-4 displays the year-by-year projected surface water budget for year 2042 conditions. See also Table E-1 in Appendix E for detailed calculations.

5.3.1.1 Projected Imported Supplies

Projected imported supplies for the 20-year water budget are the same as for the projected water budget without climate change. See Section 5.2.1.1 for details.

5.3.1.2 Projected Local Surface Water Inflows

Table 5-10 summarizes the average, minimum, and maximum values of the annual surface inflows to the East Subbasin for the Year 2042 water budget. (See Table E-1 in Appendix E for detailed calculations.) These inflows are the same as for the projected water budget without climate change (see Table 5-6), with the exception of stormwater generation and stream inflows in the Santa Clara River and its tributaries (including Castaic Creek inflows), all of which are directly varied by DWR's climate change factors for 2030. Additionally, the net inflow of groundwater to streams changes as the result of the aquifer system's response to climate-change influences. The net effect of these changes during the 95-year historical hydrologic period projected forward in time is an average surface water inflow of 174,950 AFY under 2030 climate change, compared with an average 181,570 AFY in the projected surface water budget without climate change (a difference of approximately 6,600 AFY, or 3.6 percent).

5.3.1.3 Projected Surface Water Outflows

Table 5-11 summarizes the average, minimum, and maximum values of the annual surface outflows from the East Subbasin for the Year 2042 water budget. (See Table E-1 in Appendix E for detailed calculations.) Each of the three surface outflow terms are slightly smaller under 2030 climate change than without climate change (see Table 5-7). Total surface water outflows are equal to total surface water inflows because there is no reservoir storage in the basin.

5.3.2 Groundwater Budget for Year 2042

Figures 5-5 and 5-6 display the year-by-year projected groundwater budget for year 2042 conditions. See also Table E-2 in Appendix E for detailed calculations.

5.3.2.1 Projected Groundwater Inflows

Table 5-12 summarizes the average, minimum, and maximum values of the annual inflows to groundwater in the East Subbasin for the Year 2042 water budget (with DWR's 2030 climate change factors). (See Table E-2 in Appendix E for detailed calculations.) These inflows are the same as for the projected water budget without climate change, except for small reductions in deep percolation from stormwater and from precipitation falling directly within the basin. The net effect of these changes during the 95-year historical hydrologic period is an average groundwater inflow of 185,900 AFY under the 2030 climate change scenario, compared with 190,950 AFY in the projected groundwater budget without climate change (see Table 5-8), which is a difference of 5,050 AFY, or 2.6 percent.

5.3.2.2 Projected Groundwater Outflows

Table 5-13 summarizes the average, minimum, and maximum values of the annual outflows from groundwater in the East Subbasin for the Year 2042 water budget (with DWR's 2030 climate change factors). (See Table E-2 in Appendix E for detailed calculations.) Groundwater pumping is the same as for the projected water budget without climate change, while riparian ET increases slightly and groundwater discharge to streams decreases slightly using DWR's 2030 climate change factors. The average groundwater outflow is 187,300 AFY under 2030 climate change, which is 4,800 AFY (2.5 percent) lower than the 192,100 AFY of outflow that occurs in the projected groundwater budget without climate change (see Table 5-9).

5.3.2.3 Projected Changes in Groundwater Storage

The yellow line on Figure 5-5 shows how much the volume of stored groundwater changes progressively over time when simulating the combined effects of (1) 2030 climate change and (2) full buildout land and water uses through the historical hydrologic record projected forward in time. As with the cumulative-change plots for groundwater budgets discussed previously (Figures 3-3 and 4-2), the cumulative-change plots for groundwater storage under Year 2042 conditions (Figure 5-5) show that the occurrence of rising versus declining slopes in the cumulative-change curve varies frequently during the 95-year historical period and has a generally similar shape as the cumulative-change curve for the other groundwater budgets during that 95-year period. Accordingly, as was indicated by the prior water budgets, the water budget assessment for Year 2042 indicates that the combined effects of increased future development, the increased pumping that will occur in the future under the groundwater operating plan, and 2030 climate change are not likely to create a chronic long-term decline in the volume of stored groundwater. The basin is anticipated to remain in a sustainable condition with respect to the SGMA criterion of avoiding chronic lowering of groundwater levels and not being in an overdraft condition as a result of future development, associated groundwater uses, and the influences of 2030 climate change.

5.4 Projected 50-Year Water Budget (Year 2072)

As DWR discusses in its BMP for water budget development (DWR, 2016), the climate change analysis is a process in which variability in the historical climatic record is preserved while the magnitudes of events are increased or decreased based on projected changes in precipitation and air temperature, as obtained from global climate model outputs that have been downscaled to localized areas such as the East Subbasin. This approach is used because it is impossible to know what precipitation and air temperatures will actually be in the year 2072, which is the end of the 50-year planning horizon for the projected water budget. As a result, the projected water budgets for year 2072 conditions apply the 2070 climate-change factors to the historical (1925 through 2019) climate record while simulating full buildout of land and water uses. Output for the water budget is displayed in figures and tables as being for the period 1925 through 2019, even though the water budget is for year 2072 conditions.

5.4.1 Surface Water Budget for Year 2072

Figure 5-7 displays the year-by-year projected surface water budget for year 2072 conditions. See also Table F-1 in Appendix F for detailed calculations.

5.4.1.1 Projected Imported Supplies

Projected imported supplies for the 20-year water budget are the same as for the projected water budget without climate change. See Section 5.2.1.1 for details.

5.4.1.2 Projected Local Surface Water Inflows

Table 5-14 summarizes the average, minimum, and maximum values of the annual surface inflows to the East Subbasin for the Year 2072 water budget. (See Table F-1 in Appendix F for detailed calculations.) These inflows are the same as for the projected water budget without climate change (see Table 5-6), with the exception of stormwater generation and stream inflows in the Santa Clara River and its tributaries (including Castaic Creek inflows), all of which are directly varied by DWR's climate change factors for 2070. Additionally, the net inflow of groundwater to streams changes as the result of the aquifer system's response to climate-change influences. The net effect of these decreases during the 95-year historical hydrologic period projected forward in time is an average surface water inflow of 167,950 AFY under 2070 climate change, compared with an average 181,570 AFY in the projected surface water budget without climate change (a difference of approximately 13,600, or 7.5 percent).

5.4.1.3 Projected Surface Water Outflows

Table 5-15 summarizes the average, minimum, and maximum values of the annual surface outflows from the East Subbasin for the Year 2072 water budget. (See Table F-1 in Appendix F for detailed calculations.) Each of the three surface outflow terms are somewhat smaller under 2070 climate change than without climate change (see Table 5-7). Total surface water outflows are equal to total surface water inflows because there is no reservoir storage in the basin.

5.4.2 Groundwater Budget for Year 2072

Figures 5-8 and 5-9 display the year-by-year projected groundwater budget for year 2072 conditions. See also Table F-2 in Appendix F for detailed calculations.

5.4.2.1 Projected Groundwater Inflows

Table 5-16 summarizes the average, minimum, and maximum values of the annual inflows to groundwater in the East Subbasin for the Year 2072 water budget (with DWR's 2070 climate change factors). (See Table F-2 in Appendix F for detailed calculations.) These inflows are the same as for the projected water budget without climate change, except for reductions in deep percolation from stormwater and from precipitation falling directly within the basin. The net effect of these changes during the 95-year historical hydrologic period projected forward in time is an average groundwater inflow of 179,300 AFY under 2070 climate change compared with 190,950 AFY in the projected groundwater budget without climate change (see Table 5-8), which is a difference of 11,650 AFY, or 6.1 percent.

5.4.2.2 Projected Groundwater Outflows

Table 5-17 summarizes the average, minimum, and maximum values of the annual outflows from groundwater in the East Subbasin for the Year 2072 water budget (with DWR's 2070 climate change factors). (See Table F-2 in Appendix F for detailed calculations.) Groundwater pumping is the same as for the projected water budget without climate change, while riparian ET increases slightly and groundwater discharge to streams decreases slightly under 2070 climate change. The average groundwater outflow is 181,000 AFY under 2070 climate change, which is 11,100 AFY (5.8 percent) lower than the 192,100 AFY of outflow that occurs in the projected groundwater budget without climate change (see Table 5-9).

5.4.2.3 Projected Changes in Groundwater Storage

The yellow line on Figure 5-8 shows how much the volume of stored groundwater changes progressively over time when simulating the combined effects of (1) 2070 climate change and (2) full buildout land and water uses through the historical hydrologic record projected forward in time. As with the cumulative change plots for groundwater budgets discussed previously (Figures 3-3, 4-2, and 5-5), the cumulative-change plots for groundwater storage under Year 2072 conditions (Figure 5-8) shows that the occurrence of rising versus declining slopes in the cumulative-change curve varies frequently during the 95-year historical period and has a generally similar shape as the cumulative-change curve for the other groundwater budgets during that 95-year period. Accordingly, as was indicated by the prior water budgets, the water budget assessment for Year 2072 indicates that the combined effects of increased future development, the increased pumping that will occur in the future under the groundwater operating plan, and 2070 climate change are not likely to create a chronic long-term decline in the volume of stored groundwater. The basin is anticipated to remain in a sustainable condition with respect to the SGMA criterion of avoiding chronic lowering of groundwater levels and not being in an overdraft condition as a result of future development, associated groundwater uses, and the influences of 2070 climate change.

5.5 Summary of Basin Conditions Under the Projected Future Water Budgets

The projected water budgets show that the cumulative departure curve for groundwater storage may shift slightly downward with the onset of slightly reduced precipitation and greater ET in the basin. However, as with the historical and current water budgets, the three projected water budgets for the East Subbasin indicate that chronic long-term declines in the volume of stored groundwater are not expected to occur in the future under (1) the pattern of wet/normal/dry year fluctuations observed during the past 95 years and (2) the influence of climate change on the magnitudes of precipitation and streamflows during that period. This observation in turn indicates (1) the basin is not likely to be in an overdraft condition under a sustained level of pumping at the full buildout level of demand for groundwater, even under the average climate change scenarios for 2030 and 2070; and (2) the operating plan for the basin is expected to continue operating within the basin's safe yield in the future.

Figures 5-3, 5-6, through 5-9 show that the projected annual non-storm flow volumes across the LA/Ventura county line are expected to fluctuate according to precipitation patterns but otherwise show no discernible long-term trends in the future. This occurs in part because of the year-to-year uniformity in WRP discharge volumes to the river that is expected to occur once the basin is fully built out. Under full buildout conditions in the basin, future inflows to local WRPs are estimated to rise to 30,300 AFY (Maddaus, 2019); of this inflow, approximately 21,000 AFY of the treated water is planned to be discharged to the river, with the remaining 9,300 AFY available as recycled water supply for urban irrigation uses.

5.6 Uncertainties

The uncertainties in the projected water budgets fall into four categories:

- **Data and quantification methods**, including how the basin responds and how well the model represents the responses (i.e., a discussion of the model's calibration quality, plus the model's limitations/ uncertainties as discussed in the model development report [GSI, 2020])
- **Future water demands, water uses, and WRP discharges to the river**
- **Restrictions in the availability of future imported supplies** (restrictions that are minimized because of the breadth of SCV Water's imported water supply portfolio and SCV's past and ongoing investments in banked supply sources outside the basin and two-for-one exchanges with neighboring water districts)
- **Climate change and future cycles of wet/normal/dry year conditions**

Estimating the effects of future climate changes and changes in land use and water demand 20 and 50 years into the future is challenging and full of uncertainties. The uncertainty of data and quantification methods is described and addressed in Section 3.5 of this report. The remaining three uncertainties pertain to topics that have been examined and defined in detail in local land-use plans (SCAG, OVOV, and the Newhall Ranch Specific Plan); local water-use plans (the 2015 UWMP; see KJC et al., 2016); a recent study of indoor water uses and the resulting inflows to local WRPs under full buildout conditions in the East Subbasin (Maddaus, 2019); in past and recent DCRs for the SWP system (DWR, 2015 and 2020); and in climate change studies by DWR, which has provided local climate-change factors for the GSP development team's use in developing the projected water budgets for the East Subbasin. Accordingly, these references provide the best possible estimates of most aspects of future buildout, water demands, water supply availability, and climate-change conditions. Nonetheless, certain assumptions have been required to develop the projected water budgets—primarily the amount of pumping by private groundwater users and the future volumes of WRP flows to be discharged to the river versus used as recycled water supply for urban irrigation purposes. Additionally, a close examination of DWR's climate-change factors for precipitation and ET was conducted to develop modifications to the precipitation-recharge relationship that is used by the groundwater model to define recharge from local precipitation and stormwater inflows. Through these efforts, sufficient planning and climate-change analysis has occurred to date such that reasonable assumptions regarding these uncertainties can be made for the purposes of developing the projected water budgets. If future planning indicates that the amounts of these or other specified inflow terms to the basin are likely to differ from the values presented in these projected water budgets, then the new estimates can be incorporated into modeling and water budget analyses during the GSP implementation period for the purpose of developing updated projected water budgets.

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SECTION 6: **Basin Safe Yield Estimate**

The safe yield of a groundwater basin is the average amount of pumping that can occur on a long-term basis without creating a chronic (i.e., continual) lowering of groundwater levels and reduction in groundwater storage volumes. Safe yield is generally considered equal to the average replenishment rate of the aquifer from natural and artificial recharge sources. Evapotranspiration and basin outflow are also factored into replenishment rates. If pumping exceeds recharge on a long-term basis, the safe yield of the basin can be estimated to be equal to the average amount of historical pumping minus the change in storage under the historically observed conditions.

Safe yield is not the same as sustainable yield. As defined by SGMA, sustainable groundwater management avoids the occurrence of an undesirable result. An undesirable result is one or more of the following effects:

- Chronic water level declines in the aquifer system[12]
- Significant and unreasonable reductions in groundwater storage
- Significant and unreasonable degradation of water quality
- Seawater intrusion
- Significant and unreasonable land subsidence that interferes with surface land uses
- Depletion of interconnected surface water that has significant and unreasonable adverse impacts on beneficial uses of surface water, including impacts to GDEs

Defining the safe yield of a groundwater basin provides a starting point for later establishing sustainability criteria through the consideration of each of the six sustainability indicators (undesirable results) listed above. During the process of developing sustainable management criteria for the GSP, sustainable yield will be evaluated and estimated as part of identifying whether undesirable effects have occurred or are likely to occur in the East Subbasin. If undesirable results are identified during this process, then the GSP will include projects and management actions to reach sustainability within the 20-year GSP implementation period

The water budgets presented in Sections 3, 4, and 5 of this report identify that conditions indicative of groundwater overdraft have not been observed historically and are not likely to occur during the 50-year planning horizon for SGMA (through the year 2072) under the basin's existing groundwater operating plan and under future full buildout conditions in the basin (which are expected to occur by 2050). The lack of overdraft conditions is indicated by the cumulative-change-in-storage curves for the historical, current, and projected (2042 and 2072) groundwater budgets, which show a lack of chronic declines in groundwater storage volumes during the 95-year historical hydrologic record through which each level of groundwater pumping demand has been evaluated. In particular, the 2042 and 2072 projected water budgets indicate that the combination of a changing climate and full buildout of the basin are unlikely to create chronic declines in the basin's groundwater resources over long periods of time (i.e., no repeated lowering of groundwater levels and groundwater storage volumes is expected to occur from one period to the next when viewed on a multi-decadal time scale). As with the historical record, short-term periods of lowered groundwater storage volumes are likely to occur in the future in tandem with local droughts that are prolonged (as occurred from 1945 through 1965) and/or local droughts that are particularly intense (i.e., with substantially below-normal precipitation, as occurred from 2012 through 2016).

Historical observations are consistent with the finding by the water budget analyses of the absence of an overdraft condition in the groundwater system. Modeling analyses of the historical water budget indicate

[12] A chronic decline means a decline that continues and progresses over time, with groundwater levels and groundwater storage volumes not achieving a long-term equilibrium condition.

that the period of peak groundwater pumping from the Alluvial Aquifer during the basin's peak agricultural years did not create chronic declines in groundwater levels that could not be recovered once agricultural lands began to be retired (starting in the 1960s). Since that time, the municipal water providers have pumped groundwater from the Alluvial Aquifer at rates that have not created a condition of chronic reductions in groundwater levels and groundwater storage in the basin's groundwater system, as indicated by water level data that are presented in the annual water reports for the basin, including the 2019 annual report (LSCE, 2020).

Given that the historical, current, and projected water budgets indicate that the basin's groundwater operating plan does not produce chronic and sustained declines in groundwater storage volumes or groundwater levels in the aquifer system on a long-term basis, the safe yield of the East Subbasin is likely higher than the average pumping rate simulated in the projected water budget for full buildout conditions. Table 6-1 compares the annual groundwater pumping volumes that were modeled for the projected water budget with the annual pumping volumes specified in the groundwater operating plan for the East Subbasin. As discussed in a prior detailed study (LSCE and GSI, 2009), the basin groundwater operating plan calls for maximizing the use of Alluvial Aquifer groundwater and imported water during years of normal or above-normal availability of those supplies, limiting the use of Saugus Formation groundwater during those periods, and temporarily increasing Saugus Formation pumping during years when supplemental imported water supplies are significantly curtailed. The groundwater operating plan calls for total groundwater production from the basin ranging from a limit of 55,000 AFY during normal years (locally and with respect to SWP water availability) to a limit of 70,000 AFY during years that are characterized by both locally dry conditions and a multi-year curtailment of SWP water. The average annual pumping volume in the model simulations of full buildout conditions was 52,115 AFY, and pumping during each multiple-year dry-year period was simulated at 67,500 AFY.

The projected water budgets described in Section 5 of this report indicate that if the basin continues to be operated conjunctively as was modeled for full buildout conditions (i.e., if Saugus pumping is low except during periods of significant curtailments of SWP water), then the basin can be expected to not be in overdraft, and hence to remain in a sustainable condition with respect to the SGMA criterion of avoiding chronic water level declines in the aquifer system. The results of the projected water budget analyses also indicate that pursuant to the operating plan, the basin can be pumped at an annual rate of at least 67,500 AFY for multiple dry years without causing chronic water level declines. The number of consecutive dry years that the basin can be pumped at or above 67,500 AFY without causing chronic water level declines has not been tested or determined. Thus, it is prudent to consider the safe yield of the basin to be at least 52,115 AFY, based on the long-term average amount of pumping in the projected water budget.

SECTION 7: **References**

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Tables

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DRAFT Table 2-1. Inventory of Surface Water Inflows and Outflows for the East Subbasin

Blue = Surface Water System Process
Green = Exchange with Groundwater
Purple = Internal Flow Process Within the Surface Water System

Surface Water Process	Information Source
INFLOWS	
In-Basin Precipitation	Rain Gage Data and Isohyetes
Stormwater Generated from In-Basin Precipitation	Rainfall Data and Modeling
Stream Inflow (Santa Clara River)	Stream Gaging Data
Stream Inflow (Releases from Castaic Lake/Lagoon)	Data and Projections
Stream Inflow (Releases from Bouquet Reservoir)	Data and Projections
Stream Inflow (Other Santa Clara River Tributaries)	Modeling
Discharges to Santa Clara River from WRPs	Data and Projections
Discharges to Santa Clara River from Groundwater Treatment Systems	Data and Projections
Net Inflow from Groundwater	Modeling
OUTFLOWS	
Santa Clara River Non-Storm Outflow at LA/Ventura County Line	Data and Modeling
Groundwater Recharge from Precipitation	Modeling
Groundwater Recharge from Ephemeral Streams	Modeling
ET and Stormwater Outflow	Modeling
CHANGE IN STORAGE	
Change in Surface Water Storage (None)	---

Notes

Inflows to - and storage in - Castaic Lake and Bouquet Reservoir are not included in the surface water budgets because these water bodies lie at or upstream of the margins of the groundwater basin.

The term "Net inflow from Groundwater" is the difference between streamflow gains (in ephemeral and perennial streams) and streamflow infiltration (in perennial streams). This term does not include infiltration from ephemeral streams, which is accounted for separately as an outflow term.

Subsurface outflow through the thin alluvial material beneath the Santa Clara River at the LA/Ventura county line is accounted for in the "Santa Clara River Non-Storm Outflow at LA/Ventura County Line" because the historical and current stream gages are located further downstream where bedrock is thought to be at or just beneath the river channel, which causes most if not all subsurface water at the county line to appear in the river upstream of those gages.

DRAFT Table 2-2. Inventory of Groundwater Inflows and Outflows for the East Subbasin

Blue = Exchange with Surface Water
Green = Groundwater System Process
Purple = Internal Flow Process Within the Groundwater System

Groundwater Process	Information Source
INFLOWS	
Recharge from Precipitation	Rainfall Data and Modeling
Recharge from Streams	Rainfall Data and Modeling
Subsurface Inflow	Modeling
Septic System Percolation	Data and Modeling
Recharge of Applied Water	Data and Modeling
OUTFLOWS	
Groundwater Pumping	Data and Projections
Riparian Evapotranspiration	Modeling
Groundwater Discharge to Streams	Modeling
CHANGE IN STORAGE	
Change in Groundwater Storage	Modeling

Notes

Subsurface outflow through the thin alluviual material beneath the river at the LA/Ventura county line is accounted for as outflow in the surface water budget because the historical and current stream gages are located further downstream where bedrock is thought to be at or just beneath the river channel, which causes most if not all subsurface water at the county line to appear in the river upstream of those gages.

Recharge of applied water consists of deep percolation of irrigation water and conveyance system losses.

Changes in the volume of groundwater in storage are accounted for separately from the inflow and outflow terms in the groundwater budget.

DRAFT Table 2-3. Quantification Methods for Surface Water Inflows and Outflows in the East Subbasin

Blue = Surface Water System Process
Green = Exchange with Groundwater
Purple = Internal Flow Process Within the Surface Water System

Surface Water Process	Quantification Method	How Used
INFLOWS		
In-Basin Precipitation	Rain Gage Data and Isohyetes	Volumetric Control on Stormwater Recharge
Stormwater Generated from In-Basin Precipitation	SCV Recharge Compiler	Volumetric Control on Stormwater Recharge
Stream Inflow (Santa Clara River)	Stream Gaging Data, Including Regression Analysis	Volumetric Control on Stormwater Recharge
Stream Inflow (Releases from Castaic Lake/Lagoon)	Flood Flow Data	Volumetric Control on Stormwater Recharge
Stream Inflow (Releases from Bouquet Reservoir)	Historical Data and Release Agreements	Volumetric Control on Stormwater Recharge
Stream Inflow (Other Santa Clara River Tributaries)	SCV Recharge Compiler	Volumetric Control on Stormwater Recharge
Discharges to Santa Clara River from WRPs	Data and Projections	SFR Package in MODFLOW-USG
Discharges to Santa Clara River from Groundwater Treatment Systems	Data and Projections	SFR Package in MODFLOW-USG
Net Inflow from Groundwater	Numerical Flow Model (MODFLOW-USG)	MODFLOW-USG Output
OUTFLOWS		
Santa Clara River Non-Storm Outflow at LA/Ventura County Line	Data and Numerical Flow Model (MODFLOW-USG)	Control data for MODFLOW-USG calibration
Groundwater Recharge from Precipitation	SCV Recharge Compiler	RCH Package in MODFLOW-USG
Groundwater Recharge from Ephemeral Streams	SCV Recharge Compiler	RCH Package in MODFLOW-USG
ET and Stormwater Outflow	Balancing the Water Budget	—
CHANGE IN STORAGE		
Change in Surface Water Storage (None)	—	—

Notes

The term "Net inflow from Groundwater" is the difference between stream gains and stream losses arising from groundwater/surface water exchanges in the Santa Clara River and its tributaries.

Inflows to - and storage in - Castaic Lake and Bouquet Reservoir are not included in the surface water budgets because these water bodies lie at or upstream of the margins of the groundwater basin.

Subsurface outflow through the thin alluviual material beneath the Santa Clara River at the LA/Ventura county line is accounted for in the "Santa Clara River Outflow at County Line" because the historical and current stream gages are located further downstream where bedrock is thought to be at or just beneath the river channel, which causes most if not all subsurface water at the county line to appear in the river upstream of those gages.

RCH = Recharge Package
SFR = Streamflow Routing Package
SCV = Santa Clarita Valley
WRP = water reclamation plant

DRAFT Table 2-4. Quantification Methods for Groundwater Inflows and Outflows in the East Subbasin

Blue = Exchange with Surface Water
Green = Groundwater System Process
Purple = Internal Flow Process Within the Groundwater System

Groundwater Process	Quantification Method	How Used
INFLOWS		
Recharge from Precipitation	SCV Recharge Compiler	Input to RCH Package in MODFLOW-USG
Recharge from Streams	SCV Recharge Compiler	Input to RCH Package in MODFLOW-USG
Subsurface Inflow Beneath Santa Clara River	Modeling	Computed by GHB Package in MODFLOW-USG
Subsurface Inflow Beneath Castaic Dam	Modeling	Input to WEL Package in MODFLOW-USG
Subsurface Inflow Beneath Other Tributaries	Modeling	Computed by GHB Package in MODFLOW-USG
Septic System Percolation	Data and SCV Recharge Compiler	Input to RCH Package in MODFLOW-USG
Recharge of Applied Water from Agricultural Water Uses	Data and SCV Recharge Compiler	Input to RCH Package in MODFLOW-USG
Recharge of Applied Water from Municipal Water Uses	Data and SCV Recharge Compiler	Input to RCH Package in MODFLOW-USG
OUTFLOWS		
Groundwater Pumping	Data and Projections	Input to CLN and WEL Packages in MODFLOW-USG
Riparian Evapotranspiration	Modeling	Computed by EVT Package in MODFLOW-USG
Groundwater Discharge to Streams	Modeling	Computed by SFR Package in MODFLOW-USG
OUTFLOWS		
Change in Groundwater Storage	Modeling	Computed by MODFLOW-USG

Notes

Subsurface outflow through the thin alluviual material beneath the river at the LA/Ventura county line is accounted for as outflow in the surface water budget because the historical and current stream gages are located further downstream where bedrock is thought to be at or just beneath the river channel, which causes most if not all subsurface water at the county line to appear in the river upstream of those gages.

Changes in the volume of groundwater in storage are accounted for separately from the inflow and outflow terms in the groundwater budget.

CLN = Connected Linear Network Process
EVT = Evapotranspiration Package
GHB = General Head Boundary Package
RCH = Recharge Package
SCV = Santa Clarita Valley
SFR = Streamflow Routing Package
WEL = Well Package

DRAFT Table 3-1. Historical Annual Water Demands and Supplies

	Municipal Users				Other Users	Total	
Year	Local Groundwater	Imported Water	Recycled Water	Total	Local Groundwater	Local Groundwater	Demand
1925	0	0	0	0	0	0	0
1926	0	0	0	0	0	0	0
1927	0	0	0	0	0	0	0
1928	0	0	0	0	0	0	0
1929	0	0	0	0	0	0	0
1930	0	0	0	0	0	0	0
1931	0	0	0	0	0	0	0
1932	0	0	0	0	0	0	0
1933	0	0	0	0	0	0	0
1934	0	0	0	0	0	0	0
1935	0	0	0	0	0	0	0
1936	0	0	0	0	4,933	4,933	4,933
1937	0	0	0	0	9,865	9,865	9,865
1938	0	0	0	0	14,798	14,798	14,798
1939	0	0	0	0	19,730	19,730	19,730
1940	0	0	0	0	24,663	24,663	24,663
1941	0	0	0	0	29,595	29,595	29,595
1942	0	0	0	0	34,528	34,528	34,528
1943	0	0	0	0	39,460	39,460	39,460
1944		0	0	0	44,393	44,393	44,393
1945	0	0	0	0	49,325	49,325	49,325
1946	0	0	0	0	49,325	49,325	49,325
1947	0	0	0	0	49,325	49,325	49,325
1948	0	0	0	0	49,325	49,325	49,325
1949	0	0	0	0	49,325	49,325	49,325
1950	500	0	0	500	49,325	49,825	49,825
1951	500	0	0	500	49,325	49,825	49,825
1952	500	0	0	500	49,325	49,825	49,825
1953	500	0	0	500	49,325	49,825	49,825
1954	500	0	0	500	49,325	49,825	49,825
1955	500	0	0	500	49,325	49,825	49,825
1956	500	0	0	500	49,325	49,825	49,825
1957	500	0	0	500	49,325	49,825	49,825
1958	500	0	0	500	49,325	49,825	49,825
1959	500	0	0	500	49,325	49,825	49,825
1960	1,000	0	0	1,000	49,325	50,325	50,325
1961	1,000	0	0	1,000	47,512	48,512	48,512
1962	1,000	0	0	1,000	41,532	42,532	42,532
1963	4,000	0	0	4,000	35,364	39,364	39,364
1964	5,500	0	0	5,500	29,291	34,791	34,791
1965	8,000	0	0	8,000	23,657	31,657	31,657
1966	9,500	0	0	9,500	24,584	34,084	34,084
1967	10,500	0	0	10,500	18,370	28,870	28,870
1968	11,250	0	0	11,250	18,149	29,399	29,399
1969	12,000	0	0	12,000	17,866	29,866	29,866
1970	12,750	0	0	12,750	17,583	30,333	30,333
1971	13,500	0	0	13,500	17,362	30,862	30,862
1972	14,250	0	0	14,250	17,079	31,329	31,329
1973	15,000	0	0	15,000	16,797	31,797	31,797
1974	15,750	0	0	15,750	16,575	32,325	32,325
1975	16,500	0	0	16,500	16,292	32,792	32,792
1976	17,250	0	0	17,250	16,010	33,260	33,260

DRAFT Table 3-1. Historical Annual Water Demands and Supplies

	Municipal Users				Other Users	Total	
Year	Local Groundwater	Imported Water	Recycled Water	Total	Local Groundwater	Local Groundwater	Demand
1977	18,000	0	0	18,000	15,788	33,788	33,788
1978	18,750	0	0	18,750	15,506	34,256	34,256
1979	19,500	7	0	19,507	15,223	34,723	34,730
1980	20,639	1,126	0	21,765	15,413	36,052	37,178
1981	18,482	5,817	0	24,299	17,278	35,760	41,577
1982	12,253	9,659	0	21,912	13,705	25,958	35,617
1983	12,201	9,185	0	21,386	11,937	24,138	33,323
1984	16,390	10,996	0	27,386	15,377	31,767	42,763
1985	16,659	11,823	0	28,482	13,403	30,062	41,885
1986	17,393	13,759	0	31,152	12,297	29,690	43,449
1987	17,592	16,285	0	33,877	10,611	28,203	44,488
1988	18,601	19,033	0	37,634	9,975	28,576	47,609
1989	21,195	21,618	0	42,813	10,285	31,480	53,098
1990	21,453	21,613	0	43,066	11,284	32,737	54,350
1991	31,825	7,968	0	39,793	10,279	42,104	50,072
1992	27,355	13,911	0	41,266	11,160	38,515	52,426
1993	29,959	13,393	0	43,352	10,777	40,736	54,129
1994	31,599	14,389	0	45,988	13,559	45,158	59,547
1995	28,677	16,996	0	45,673	14,347	43,024	60,020
1996	32,054	18,093	0	50,147	14,570	46,624	64,717
1997	32,025	22,148	0	54,173	15,319	47,344	69,492
1998	28,604	20,254	0	48,858	13,599	42,203	62,457
1999	29,968	27,282	0	57,250	17,154	47,122	74,404
2000	28,409	32,579	0	60,988	15,608	44,017	76,596
2001	25,367	35,369	0	60,736	16,362	41,729	77,098
2002	26,457	41,763	0	68,220	16,979	43,436	85,199
2003	22,978	44,416	50	67,444	14,829	37,807	82,273
2004	24,671	47,205	420	72,296	15,590	40,261	87,886
2005	32,316	37,997	418	70,731	12,785	45,101	83,516
2006	33,061	40,048	419	73,528	17,312	50,373	90,840
2007	31,690	45,151	470	77,311	14,768	46,458	92,079
2008	33,884	41,705	311	75,900	14,750	48,634	90,650
2009	31,100	38,546	328	69,974	16,564	47,664	86,538
2010	33,152	30,578	336	64,066	16,098	49,250	80,164
2011	33,624	30,808	373	64,805	15,439	49,063	80,244
2012	33,726	35,558	428	69,712	15,694	49,420	85,406
2013	29,779	43,281	400	73,460	16,151	45,930	89,611
2014	34,612	33,092	474	68,178	12,885	47,497	81,063
2015	29,893	24,148	450	54,491	12,079	41,972	66,570
2016	26,329	31,130	507	57,966	14,360	40,689	72,326
2017	16,403	46,651	501	63,555	13,438	29,841	76,993
2018	22,869	41,999	352	65,220	13,071	35,940	78,291
2019	17,547	42,072	458	60,077	12,510	30,057	72,587

Note

All values are in units of acre-feet per year.

DRAFT Table 3-2. Estimated Historical Annual Groundwater Pumping by Water Use Sector for the East Subbasin (Water Years 1945-2019)

Water Use Sector	Minimum	Maximum	Average
Peak Agricultural Period (1945-1960)			
Agricultural	---	---	50,000
Municipal	---	---	1,000
Golf Courses	0	0	0
Rural Domestic	---	---	---
Small Public Water Systems	0	0	0
Total	—	—	51,000
Transitional Period (1961-1979)			
Agricultural	14,200	47,500	21,500
Municipal	1,000	19,500	11,800
Golf Courses	0	500	400
Rural Domestic	0	500	300
Small Public Water Systems	0	0	0
Total	29,000	48,500	34,000
Modern Record (1980-2019)			
Agricultural	5,950	13,250	10,350
Municipal	12,200	34,600	25,800
Golf Courses	425	1,375	800
Rural Domestic	500	500	500
Small Public Water Systems	1,000	3,500	2,350
Total	24,150	50,375	39,800

Notes

All values are in units of acre-feet.

Agricultural groundwater use is by the Newhall Land and Farming Company. These pumping volumes do not include agricultural pumping by the Disney Corporation along the southern margin of the basin.

For the period of modern record (1980-2019), the "small public water system" water use sector consists solely of the Pitchess Detention Center (which was formerly called Wayside Honor Rancho).

Golf course groundwater is dedicated to golf courses and is not obtained from potable water supplies.

Dashed values are for cases where the values are unknown and cannot be readily estimated.

For the minimum and maximum values, the total values shown in this table are not equal to the sum of the individual values because the minimum values of the individual terms occur in different years, and similarly for the maximum values.

DRAFT Table 3-3. Estimated Historical Annual Surface Water Inflows to the East Subbasin (Water Years 1925-2019)

Surface Water Inflow Component	Minimum	Maximum	Average
In-Basin Precipitation	27,400	224,500	87,600
Stormwater Generated from In-Basin Precipitation	25,100	135,800	67,000
Stream Inflow (Santa Clara River)	0	37,850	5,170
Stream Inflow (Releases from Castaic Lake/Lagoon)	0	101,800	14,750
Stream Inflow (Releases from Bouquet Reservoir)	35	130	100
Stream Inflow (Other Santa Clara River Tributaries)	0	148,400	24,150
Discharges to Santa Clara River from Saugus WRP (1963-2019)	250	7,840	4,700
Discharges to Santa Clara River from Valencia WRP (1967-2019)	120	18,150	8,920
Discharges to Santa Clara River from Groundwater Treatment Systems (2011, 2018, 2019)	150	1,930	1,080
Net Inflow from Groundwater	6,700	84,000	36,000
Total	47,700	581,500	175,700

Notes

All values are in units of acre-feet.

5% of the releases from Bouquet Reservoir remain as surface flow where Bouquet Creek enters the East Subbasin.

The term "Net inflow from Groundwater" is the difference between stream gains and stream losses arising from groundwater/surface water exchanges in the Santa Clara River and its tributaries.

Total values do not include storrmwater generated from in-basin precipitation, which is an internal flow process (and not an inflow to, or outflow from, the basin).

For the minimum and maximum and average values, the total values shown at the bottom of this table are not equal to the sum of the individual terms because the minimum, maximum, and average values of the individual terms are for different years.

DRAFT Table 3-4. Estimated Historical Annual Surface Water Outflows from the East Subbasin (Water Years 1925-2019)

Surface Water Outflow Component	Minimum	Maximum	Average
Santa Clara River Non-Storm Outflow at LA/Ventura County Line	11,300	100,000	44,900
Groundwater Recharge from Precipitation	0	102,985	20,585
Groundwater Recharge from Ephemeral Streams	50	74,450	18,825
ET and Stormwater Outflow	24,550	331,350	91,350
Total	47,700	581,500	175,700

Notes

All values are in units of acre-feet.

Outflows at County line are from modeling analyses, rather than using data from the gages which are located further downstream.

For the minimum and maximum values, the total values shown in this table are not equal to the sum of the individual outflow terms because the minimum values of the individual terms occur in different years, and similarly for the maximum values.

ET: evapotranspiration

GSI Water Solutions, Inc.

DRAFT Table 3-5. Estimated Historical Annual Inflows to Groundwater in the East Subbasin (Water Years 1925-2019)

Groundwater Inflow Component	Minimum	Maximum	Average	Percent of Total
Recharge from Precipitation	0	102,985	20,585	12%
Recharge from Streams	50	74,450	18,825	67%
Subsurface Inflow Beneath Castaic Dam	1,675	1,680	1,675	1%
Subsurface Inflow Beneath Santa Clara River and Other Tributaries	28,005	29,700	29,070	17%
Septic System Percolation	0	2,440	1,140	<1%
Recharge of Applied Water	0	9,525	4,685	<3%
Total	91,930	386,200	175,330	100%

Notes

All values are in units of acre-feet.

Deep percolation from streams is the combined amount in ephemeral and perennial reaches.

Deep percolation from irrigation is the sum for agricultural and municipal lands.

Septic system percolation applies to areas served by public water supplies that do not have public sewer collection systems.

The "percent of total" values are computed using the average values shown in this table.

For the minimum and maximum values, the total values shown in this table are not equal to the sum of the individual inflow terms because the minimum values of the individual terms occur in different years, and similarly for the maximum values.

DRAFT Table 3-6. Estimated Historical Annual Groundwater Outflows from the East Subbasin (Water Years 1925-2019)

Groundwater Outflow Component	Minimum	Maximum	Average	Percent of Total
Groundwater Pumping	0	50,058	33,880	19%
Riparian Evapotranspiration	4,200	9,265	7,080	4%
Groundwater Discharge to Streams	62,230	271,730	135,390	77%
Total	115,470	308,270	176,350	100%

Notes

All values are in units of acre-feet.

Groundwater pumping volumes do not include small domestic wells because they are not directly simulated in the model.

Groundwater discharge to streams are the combined amount in ephemeral and perennial reaches.

The "percent of total" values are computed using the average values shown in this table.

For the minimum and maximum values, the total values shown in this table are not equal to the sum of the individual outflow terms because the minimum values of the individual terms occur in different years, and similarly for the maximum values.

DRAFT Table 4-1. Annual Water Demands and Supplies for the Current Water Budget (Under the 2014 Level of Development)

Municipal Users				Other Users	Total	
Local Groundwater	Imported Water	Recycled Water	Total	Local Groundwater	Local Groundwater	Demand
34,612	33,092	474	68,178	14,623	49,235	82,801

Note

Groundwater pumping consists of actual 2014 municipal water use, 2010-2019 average pumping for other pumpers, and 500 acre-feet per year for the containment pumping system at Whittaker-Bermite.

DRAFT Table 4-2. Estimated Annual Groundwater Pumping by Water Use Sector for the East Subbasin (Under the 2014 Level of Development)

Water Use Sector	Annual Groundwater Pumping
Agricultural	10,497
Municipal	34,612
Golf Courses	1,044
Rural Domestic	500
Small Public Water Systems	2,082
Whittaker-Bermite Contaminant Treatment/Extraction System	500
Total	**49,235**

Notes

All values are in units of acre-feet.

Agricultural groundwater use is by the Newhall Land and Farming Company. These pumping volumes do not include agricultural pumping by the Disney Corporation along the southern margin of the basin.

The Pitchess Detention Center is counted as a small public water system for the purpose of calculating the current water budget.

Golf course groundwater is dedicated to golf courses and is not obtained from potable water supplies.

For the minimum and maximum values, the total values shown in this table are not equal to the sum of the individual values because the minimum values of the individual terms occur in different years, and similarly for the maximum values.

DRAFT Table 4-3. Estimated Annual Surface Water Inflows to the East Subbasin for the Current Water Budget (Under the 2014 Level of Development)

Surface Water Inflow Component	Minimum	Maximum	Average
In-Basin Precipitation	27,400	224,500	87,600
Stormwater Generated from In-Basin Precipitation	25,100	135,800	67,000
Stream Inflow (Santa Clara River)	0	37,850	5,170
Stream Inflow (Releases from Castaic Lake/Lagoon)	200	197,500	20,050
Stream Inflow (Releases from Bouquet Reservoir)	110	110	110
Stream Inflow (Other Santa Clara River Tributaries)	0	148,400	24,150
Discharges to Santa Clara River from Saugus WRP	5,005	5,020	5,010
Discharges to Santa Clara River from Valencia WRP	16,815	16,860	16,825
Discharges to Santa Clara River from Groundwater Treatment Systems	500	501	500
Net Inflow from Groundwater	3,850	69,600	23,750
Total	65,600	634,400	183,200

Notes

All values are in units of acre-feet.

5% of the releases from Bouquet Reservoir remain as surface flow where Bouquet Creek enters the East Subbasin.

The term "Net inflow from Groundwater" is the difference between stream gains and stream losses arising from groundwater/surface water exchanges in the Santa Clara River and its tributaries.

Total values do not include storrmwater generated from in-basin precipitation, which is an internal flow process (and not an inflow to, or outflow from, the basin).

The total values shown at the bottom of this table are not equal to the sum of the individual terms because the minimum, maximum, and average values occur in different years for each of the individual surface water inflows.

DRAFT Table 4-4. Estimated Annual Surface Water Outflows from the East Subbasin for the Current Water Budget (Under the 2014 Level of Development)

Surface Water Outflow Component	Minimum	Maximum	Average
Santa Clara River Non-Storm Outflow at LA/Ventura County Line	26,250	91,300	46,000
Groundwater Recharge from Precipitation	0	102,985	20,585
Groundwater Recharge from Ephemeral Streams	400	75,500	19,050
ET and Stormwater Outflow	25,950	421,700	97,550
Total	65,600	634,400	183,200

Notes

All values are in units of acre-feet.

Non-storm outflows at the county line are from modeling analyses, rather than using data from stream gages which are located further downstream.

The total values shown at the bottom of this table are not equal to the sum of the individual terms because the minimum, maximum, and average values occur in different years for each of the individual surface water outflows.

ET = evapotranspiration

DRAFT Table 4-5. Estimated Annual Inflows to Groundwater in the East Subbasin for the Current Water Budget (Under the 2014 Level of Development)

Groundwater Inflow Component	Minimum	Maximum	Average	Percent of Total
Recharge from Precipitation	0	102,985	20,585	11%
Recharge from Streams	82,150	274,550	128,500	69%
Subsurface Inflow Beneath Castaic Dam	1,675	1,680	1,675	1%
Subsurface Inflow Beneath Santa Clara River and Other Tributaries	28,000	29,700	29,000	15%
Septic System Percolation	2,430	2,440	2,435	1%
Recharge of Applied Water	5,740	5,750	5,745	3%
Total	121,825	385,650	187,950	100%

Notes

All values are in units of acre-feet.

Deep percolation from irrigation is the sum for agricultural and municipal lands.

Septic system percolation applies to areas served by public water supplies that do not have public sewer collection systems.

The "percent of total" values are computed using the average values shown in this table.

For the minimum and maximum values, the total values shown in this table are not equal to the sum of the individual inflow terms because the minimum values of the individual terms occur in different years, and similarly for the maximum values.

DRAFT Table 4-6. Estimated Annual Groundwater Outflows from the East Subbasin (Under the 2014 Level of Development)

Groundwater Outflow Component	Minimum	Maximum	Average	Percent of Total
Groundwater Pumping	48,620	48,800	48,735	26%
Riparian Evapotranspiration	5,025	9,185	7,100	4%
Groundwater Discharge to Streams	85,050	267,950	133,200	70%
Total	140,800	325,800	189,000	100%

Notes

All values are in units of acre-feet.

Groundwater pumping volumes do not include 500 AFY from small domestic wells because they are not directly simulated in the model.

Groundwater discharge to streams are the combined amount in ephemeral and perennial reaches.

The "percent of total" values are computed using the average values shown in this table.

For the minimum and maximum values, the total values shown in this table are not equal to the sum of the individual outflow terms because the minimum values of the individual terms occur in different years, and similarly for the maximum values.

DRAFT Table 5-1. Annual Groundwater Pumping by Water Use Sector for the Current and Projected Water Budgets in the East Subbasin

Groundwater Pumpers	Type of Water Use	Current Conditions	Future			
			(Normal Years)	(Dry Year 1)	(Dry Year 2)	(Dry Year 3+)
Alluvial Aquifer						
Municipal	Municipal	24,687	30,783	26,090	26,090	26,090
Five Point	Agricultural	10,497	3,459	3,459	3,459	3,459
Pitchess	Small Public Water System	2,082	2,082	2,082	2,082	2,082
Robinson Ranch	Golf Course	369	369	369	369	369
Domestic	Domestic	500	500	500	500	500
	Subtotal	**38,135**	**37,193**	**32,500**	**32,500**	**32,500**
Saugus Formation						
Municipal	Municipal	9,925	9,925	18,825	23,825	33,825
Valencia Country Club & Vista Valencia	Golf Course	675	675	675	675	675
Whittaker-Bermite	Site Remediation	500	500	500	500	500
	Subtotal	**11,100**	**11,100**	**20,000**	**25,000**	**35,000**
Alluvial Aquifer and Saugus Formation Combined						
	TOTAL	**49,235**	**48,293**	**52,500**	**57,500**	**67,500**

Notes

All values are in units of acre-feet.

Five Point is the parent company of the Newhall Land and Farming Company. Pitchess refers to the Pitchess Detention Center.

DRAFT Table 5-2. Annual Point Discharges to the Santa Clara River for the Projected Water Budgets in the East Subbasin

Source	Current Conditions	Future			
		(Normal Years)	(Dry Year 1)	(Dry Year 2)	(Dry Year 3+)
Saugus WRP	5,004	5,004	5,004	5,004	5,004
Valencia WRP	16,813	15,514	15,514	15,514	15,514
Subtotal	**21,817**	**20,518**	**20,518**	**20,518**	**20,518**
Newhall WRP	0	480	480	480	480
Subtotal	**21,817**	**20,998**	**20,998**	**20,998**	**20,998**
Whittaker-Bermite	500	500	500	500	500
TOTAL	**22,317**	**21,498**	**21,498**	**21,498**	**21,498**

Notes

All values are in units of acre-feet.

DRAFT Table 5-3. Annual Water Supplies and Demands in Normal and Dry Years for the Projected Water Budgets

	Municipal Users				Other Users	Total	
Year Type	Local Groundwater	Imported Water	Recycled Water	Total	Local Groundwater	Local Groundwater	Demand
Normal	40,708	36,307	9,300	86,315	7,585	48,293	93,900
Dry Year 1	44,915	41,500	9,300	95,715	7,585	52,500	103,300
Dry Year 2	49,915	36,500	9,300	95,715	7,585	57,500	103,300
Dry Year 3+	59,915	26,500	9,300	95,715	7,585	67,500	103,300
Average (1925-2019)	44,530	35,355	9,300	89,185	7,585	52,115	96,770

Notes

All values are in units of acre-feet per year (AFY).

Other users include 500 AFY for the containment pumping system at Whittaker Bermite.

Total demand by municipal users in normal years (93,900 AFY) and in dry years (103,300 AFY) is for Year 2050, as shown in Tables 6-2 through 6-4 of the 2015 Urban Water Management Plan (KJC et al., 2016), and is the demand with the plumbing code and active conservation.

GSI Water Solutions, Inc.

DRAFT Table 5-4. Annual Water Demands and Supplies in the 95-Year Model Simulation for the Projected Water Budgets

		Municipal Users				Other Users	Total	
Year	Year Type	Local Groundwater	Imported Water	Recycled Water	Total	Local Groundwater	Local Groundwater	Demand
1925	Dry Year 2	49,915	36,500	9,300	95,715	7,585	57,500	103,300
1926	Dry Year 3	59,915	26,500	9,300	95,715	7,585	67,500	103,300
1927	Post-Drought	49,308	32,407	9,300	91,015	7,585	56,893	98,600
1928	Normal	40,708	36,307	9,300	86,315	7,585	48,293	93,900
1929	Dry Year 1	44,915	41,500	9,300	95,715	7,585	52,500	103,300
1930	Dry Year 2	49,915	36,500	9,300	95,715	7,585	57,500	103,300
1931	Dry Year 3	59,915	26,500	9,300	95,715	7,585	67,500	103,300
1932	Dry Year 4	59,915	26,500	9,300	95,715	7,585	67,500	103,300
1933	Dry Year 5	59,915	26,500	9,300	95,715	7,585	67,500	103,300
1934	Dry Year 6	59,915	26,500	9,300	95,715	7,585	67,500	103,300
1935	Post-Drought	49,308	32,407	9,300	91,015	7,585	56,893	98,600
1936	Normal	40,708	36,307	9,300	86,315	7,585	48,293	93,900
1937	Normal	40,708	36,307	9,300	86,315	7,585	48,293	93,900
1938	Normal	40,708	36,307	9,300	86,315	7,585	48,293	93,900
1939	Normal	40,708	36,307	9,300	86,315	7,585	48,293	93,900
1940	Normal	40,708	36,307	9,300	86,315	7,585	48,293	93,900
1941	Normal	40,708	36,307	9,300	86,315	7,585	48,293	93,900
1942	Normal	40,708	36,307	9,300	86,315	7,585	48,293	93,900
1943	Normal	40,708	36,307	9,300	86,315	7,585	48,293	93,900
1944	Normal	40,708	36,307	9,300	86,315	7,585	48,293	93,900
1945	Normal	40,708	36,307	9,300	86,315	7,585	48,293	93,900
1946	Normal	40,708	36,307	9,300	86,315	7,585	48,293	93,900
1947	Normal	40,708	36,307	9,300	86,315	7,585	48,293	93,900
1948	Normal	40,708	36,307	9,300	86,315	7,585	48,293	93,900
1949	Dry Year 1	44,915	41,500	9,300	95,715	7,585	52,500	103,300
1950	Post-Drought	45,808	35,907	9,300	91,015	7,585	53,393	98,600
1951	Normal	40,708	36,307	9,300	86,315	7,585	48,293	93,900
1952	Normal	40,708	36,307	9,300	86,315	7,585	48,293	93,900
1953	Normal	40,708	36,307	9,300	86,315	7,585	48,293	93,900
1954	Normal	40,708	36,307	9,300	86,315	7,585	48,293	93,900
1955	Dry Year 1	44,915	41,500	9,300	95,715	7,585	52,500	103,300
1956	Post-Drought	45,808	35,907	9,300	91,015	7,585	53,393	98,600
1957	Normal	40,708	36,307	9,300	86,315	7,585	48,293	93,900
1958	Normal	40,708	36,307	9,300	86,315	7,585	48,293	93,900
1959	Normal	40,708	36,307	9,300	86,315	7,585	48,293	93,900
1960	Normal	40,708	36,307	9,300	86,315	7,585	48,293	93,900
1961	Dry Year 1	44,915	41,500	9,300	95,715	7,585	52,500	103,300
1962	Post-Drought	45,808	35,907	9,300	91,015	7,585	53,393	98,600
1963	Normal	40,708	36,307	9,300	86,315	7,585	48,293	93,900
1964	Normal	40,708	36,307	9,300	86,315	7,585	48,293	93,900
1965	Normal	40,708	36,307	9,300	86,315	7,585	48,293	93,900
1966	Normal	40,708	36,307	9,300	86,315	7,585	48,293	93,900
1967	Normal	40,708	36,307	9,300	86,315	7,585	48,293	93,900
1968	Normal	40,708	36,307	9,300	86,315	7,585	48,293	93,900
1969	Normal	40,708	36,307	9,300	86,315	7,585	48,293	93,900
1970	Normal	40,708	36,307	9,300	86,315	7,585	48,293	93,900
1971	Normal	40,708	36,307	9,300	86,315	7,585	48,293	93,900
1972	Normal	40,708	36,307	9,300	86,315	7,585	48,293	93,900
1973	Normal	40,708	36,307	9,300	86,315	7,585	48,293	93,900
1974	Normal	40,708	36,307	9,300	86,315	7,585	48,293	93,900
1975	Normal	40,708	36,307	9,300	86,315	7,585	48,293	93,900
1976	Normal	40,708	36,307	9,300	86,315	7,585	48,293	93,900
1977	Dry Year 3	59,915	26,500	9,300	95,715	7,585	67,500	103,300
1978	Post-Drought	49,308	32,407	9,300	91,015	7,585	56,893	98,600

DRAFT Table 5-4. Annual Water Demands and Supplies in the 95-Year Model Simulation for the Projected Water Budgets

		Municipal Users				Other Users	Total	
Year	Year Type	Local Groundwater	Imported Water	Recycled Water	Total	Local Groundwater	Local Groundwater	Demand
1979	Normal	40,708	36,307	9,300	86,315	7,585	48,293	93,900
1980	Normal	40,708	36,307	9,300	86,315	7,585	48,293	93,900
1981	Normal	40,708	36,307	9,300	86,315	7,585	48,293	93,900
1982	Normal	40,708	36,307	9,300	86,315	7,585	48,293	93,900
1983	Normal	40,708	36,307	9,300	86,315	7,585	48,293	93,900
1984	Normal	40,708	36,307	9,300	86,315	7,585	48,293	93,900
1985	Normal	40,708	36,307	9,300	86,315	7,585	48,293	93,900
1986	Normal	40,708	36,307	9,300	86,315	7,585	48,293	93,900
1987	Normal	40,708	36,307	9,300	86,315	7,585	48,293	93,900
1988	Dry Year 1	44,915	41,500	9,300	95,715	7,585	52,500	103,300
1989	Post-Drought	45,808	35,907	9,300	91,015	7,585	53,393	98,600
1990	Dry Year 3	59,915	26,500	9,300	95,715	7,585	67,500	103,300
1991	Dry Year 4	59,915	26,500	9,300	95,715	7,585	67,500	103,300
1992	Dry Year 5	59,915	26,500	9,300	95,715	7,585	67,500	103,300
1993	Post-Drought	44,915	36,800	9,300	91,015	7,585	52,500	98,600
1994	Dry Year 7	59,915	26,500	9,300	95,715	7,585	67,500	103,300
1995	Post-Drought	49,308	32,407	9,300	91,015	7,585	56,893	98,600
1996	Normal	40,708	36,307	9,300	86,315	7,585	48,293	93,900
1997	Normal	40,708	36,307	9,300	86,315	7,585	48,293	93,900
1998	Normal	40,708	36,307	9,300	86,315	7,585	48,293	93,900
1999	Normal	40,708	36,307	9,300	86,315	7,585	48,293	93,900
2000	Normal	40,708	36,307	9,300	86,315	7,585	48,293	93,900
2001	Dry Year 1	44,915	41,500	9,300	95,715	7,585	52,500	103,300
2002	Post-Drought	45,808	35,907	9,300	91,015	7,585	53,393	98,600
2003	Normal	40,708	36,307	9,300	86,315	7,585	48,293	93,900
2004	Normal	40,708	36,307	9,300	86,315	7,585	48,293	93,900
2005	Normal	40,708	36,307	9,300	86,315	7,585	48,293	93,900
2006	Normal	40,708	36,307	9,300	86,315	7,585	48,293	93,900
2007	Normal	40,708	36,307	9,300	86,315	7,585	48,293	93,900
2008	Dry Year 1	44,915	41,500	9,300	95,715	7,585	52,500	103,300
2009	Dry Year 2	49,915	36,500	9,300	95,715	7,585	57,500	103,300
2010	Post-Drought	49,308	32,407	9,300	91,015	7,585	56,893	98,600
2011	Normal	40,708	36,307	9,300	86,315	7,585	48,293	93,900
2012	Normal	40,708	36,307	9,300	86,315	7,585	48,293	93,900
2013	Normal	40,708	36,307	9,300	86,315	7,585	48,293	93,900
2014	Dry Year 1	44,915	41,500	9,300	95,715	7,585	52,500	103,300
2015	Dry Year 2	49,915	36,500	9,300	95,715	7,585	57,500	103,300
2016	Dry Year 3	59,915	26,500	9,300	95,715	7,585	67,500	103,300
2017	Post-Drought	49,308	32,407	9,300	91,015	7,585	56,893	98,600
2018	Normal	40,708	36,307	9,300	86,315	7,585	48,293	93,900
2019	Normal	40,708	36,307	9,300	86,315	7,585	48,293	93,900
AVERAGE	1925-2019	44,530	35,355	9,300	89,185	7,585	52,115	96,770

Notes

All values are in units of acre-feet per year (AFY).

Other users include 500 AFY for the containment pumping system at Whittaker-Bermite.

Total demand by municipal users in normal years (93,900 AFY) and in dry years (103,300 AFY) is for Year 2050, as shown in Tables 6-2, 6-3, 6-4A, and 6-4B of the 2015 Urban Water Management Plan (KJC et al., 2016), and is the demand with the plumbing code and active conservation.

DRAFT Table 5-5. Annual Water Supply and Demand Comparisons for Municipal Water Use in Year 2050 (From the 2015 UWMP)

Year Type	SWP and Related Sources[(a)]	Banking and Exchange Programs[(b)]	Total Imported Water Supply[(c)]	Local Groundwater	Recycled Water	Total Supply	Demand[(d)]	Total Supply Minus Demand
Normal Year	70,707	0	70,707	41,775	10,054	122,536	93,900	28,636
Single Dry Year	22,087	29,950	52,037	60,550	10,054	122,641	103,300	19,341
Three-Year Dry Period	45,177	29,950	75,127	58,050	10,054	143,231	103,300	39,931
Four-Year Dry Period	33,167	29,950	63,117	57,200	10,054	130,371	103,300	27,071

Notes

All values are in units of acre-feet per year (AFY).

Values are for the year 2050 and are from Tables 6-2, 6-3, 6-4A, and 6-4B in the 2015 Urban Water Management Plan (UWMP) (KJC et al., 2016).

(a) Related sources are listed in Tables 6-2, 6-3, 6-4A, and 6-4B of the 2015 UWMP (KJC et al., 2016) under the "Imported Water" row of each table and consist of flexible storage accounts, Buena Vista-Rosedale, Nickel Water-Newhall Land, and Yuba Accord water.

(b) Baking and exchange programs are listed in Tables 6-2, 6-3, 6-4A, and 6-4B of the 2015 UWMP (KJC et al., 2016) and consist of Rosedale-Rio Bravo Bank, Semitropic Bank, Semitropic-Newhall Land Bank, Rosedale Rio-Bravo Exchange, and West Kern Exchange.

(c) The total imported water supply is the sum of the prior two columns.

(d) Total demand by municipal users is the demand that accounts for the plumbing code and active conservation.

SWP = State Water Project

UWMP = Urban Water Management Plan

DRAFT Table 5-6. Estimated Annual Surface Water Inflows to the East Subbasin for the Projected Water Budget Without Climate Change

Surface Water Inflow Component	Minimum	Maximum	Average
In-Basin Precipitation	27,400	224,500	87,600
Stormwater Generated from In-Basin Precipitation	25,100	135,800	67,000
Stream Inflow (Santa Clara River)	0	37,850	5,170
Stream Inflow (Releases from Castaic Lake/Lagoon)	200	197,500	20,050
Stream Inflow (Releases from Bouquet Reservoir)	110	110	110
Stream Inflow (Other Santa Clara River Tributaries)	0	148,400	24,150
Discharges to Santa Clara River from Saugus WRP	5,005	5,020	5,010
Discharges to Santa Clara River from Valencia WRP and Newhall WRP	15,995	16,055	16,000
Discharges to Santa Clara River from Groundwater Treatment Systems	500	501	500
Net Inflow from Groundwater	1,245	68,580	22,960
Total	65,000	634,100	181,570

Notes

All values are in units of acre-feet.

This projected water budget is developed by projecting the 1925-2019 historical hydrology forward in time.

5% of the releases from Bouquet Reservoir remain as surface flow where Bouquet Creek enters the East Subbasin.

The term "Net inflow from Groundwater" is the difference between stream gains and stream losses arising from groundwater/surface water exchanges in the Santa Clara River and its tributaries.

Total values do not include storrmwater generated from in-basin precipitation, which is an internal flow process (and not an inflow to, or outflow from, the basin).

The total values shown at the bottom of this table are not equal to the sum of the individual terms because the minimum, maximum, and average values occur in different years for each of the individual surface water inflows.

WRP = water reclamation plant

DRAFT Table 5-7. Estimated Annual Surface Water Outflows from the East Subbasin for the Projected Water Budget Without Climate Change

Surface Water Outflow Component	Minimum	Maximum	Average
Santa Clara River Non-Storm Outflow at LA/Ventura County Line	22,600	89,400	44,400
Groundwater Recharge from Precipitation	0	102,985	20,585
Groundwater Recharge from Ephemeral Streams	400	75,500	19,050
ET and Stormwater Outflow	25,950	421,850	97,550
Total	65,000	634,100	181,570

Notes

All values are in units of acre-feet.

This projected water budget is developed by projecting the 1925-2019 historical hydrology forward in time.

Non-storm outflows at the county line are from modeling analyses, rather than using data from stream gages which are located further downstream.

hhe total values shown at the bottom of this table are not equal to the sum of the individual terms because the minimum, maximum, and average values occur in different years for each of the individual surface water outflows.

ET = evapotranspiration

DRAFT Table 5-8. Estimated Annual Groundwater Inflows to the East Subbasin for the Projected Water Budget Without Climate Change

Groundwater Inflow Component	Minimum	Maximum	Average	Percent of Total
Recharge from Precipitation	0	102,985	20,585	11%
Recharge from Streams	83,000	279,200	129,750	68%
Subsurface Inflow Beneath Castaic Dam	1,675	1,680	1,675	1%
Subsurface Inflow Beneath Santa Clara River and Other Tributaries	27,950	29,700	29,000	15%
Septic System Percolation	2,430	2,440	2,435	1%
Recharge of Applied Water	7,480	7,490	7,485	4%
Total	124,370	391,730	190,950	100%

Notes

All values are in units of acre-feet.

This projected water budget is developed by projecting the 1925-2019 historical hydrology forward in time.

Deep percolation from irrigation is the sum for agricultural and municipal lands.

Septic system percolation applies to areas served by public water supplies that do not have public sewer collection systems.

The "percent of total" values are computed using the average values shown in this table.

For the minimum and maximum values, the total values shown in this table are not equal to the sum of the individual inflow terms because the minimum values of the individual terms occur in different years, and similarly for the maximum values.

DRAFT Table 5-9. Estimated Annual Groundwater Outflows from the East Subbasin for the Projected Water Budget Without Climate Change

Groundwater Outflow Component	Minimum	Maximum	Average	Percent of Total
Groundwater Pumping	47,735	67,115	51,375	27%
Riparian Evapotranspiration	5,735	9,165	7,110	3%
Groundwater Discharge to Streams	84,240	271,100	133,650	70%
Total	140,000	327,900	192,100	100%

Notes

All values are in units of acre-feet.

This projected water budget is developed by projecting the 1925-2019 historical hydrology forward in time.

Groundwater pumping volumes do not include 500 AFY from small domestic wells because they are not directly simulated in the model.

Groundwater discharge to streams are the combined amount in ephemeral and perennial reaches.

The "percent of total" values are computed using the average values shown in this table.

For the minimum and maximum values, the total values shown in this table are not equal to the sum of the individual outflow terms because the minimum values of the individual terms occur in different years, and similarly for the maximum values.

DRAFT Table 5-10. Estimated Annual Surface Water Inflows to the East Subbasin for the Year 2042 Projected Water Budget (Using 2030 Climate Change Factors)

Surface Water Inflow Component	Minimum	Maximum	Average
In-Basin Precipitation	27,400	221,600	86,800
Stormwater Generated from In-Basin Precipitation	23,950	135,800	67,500
Stream Inflow (Santa Clara River)	0	35,700	4,880
Stream Inflow (Releases from Castaic Lake/Lagoon)	185	186,300	18,900
Stream Inflow (Releases from Bouquet Reservoir)	110	110	110
Stream Inflow (Other Santa Clara River Tributaries)	0	140,400	22,100
Discharges to Santa Clara River from Saugus WRP	5,005	5,020	5,010
Discharges to Santa Clara River from Valencia WRP and Newhall WRP	15,995	16,055	16,000
Discharges to Santa Clara River from Groundwater Treatment Systems	500	501	500
Net Inflow from Groundwater	-425	63,900	20,640
Total	64,500	601,650	174,950

Notes

All values are in units of acre-feet.

This projected water budget is developed by projecting the 1925-2019 historical hydrology forward in time.

5% of the releases from Bouquet Reservoir remain as surface flow where Bouquet Creek enters the East Subbasin.

The term "Net inflow from Groundwater" is the difference between stream gains and stream losses arising from groundwater/surface water exchanges in the Santa Clara River and its tributaries.

Total values do not include storrmwater generated from in-basin precipitation, which is an internal flow process (and not an inflow to, or outflow from, the basin).

The total values shown at the bottom of this table are not equal to the sum of the individual terms because the minimum, maximum, and average values occur in different years for each of the individual surface water inflows.

WRP = water reclamation plant

DRAFT Table 5-11. Estimated Annual Surface Water Outflows from the East Subbasin for the Year 2042 Projected Water Budget (Using 2030 Climate Change Factors)

Surface Water Outflow Component	Minimum	Maximum	Average
Santa Clara River Non-Storm Outflow at LA/Ventura County Line	20,950	84,750	42,050
Groundwater Recharge from Precipitation	0	98,700	19,250
Groundwater Recharge from Ephemeral Streams	375	73,900	18,000
ET and Stormwater Outflow	24,700	401,500	95,600
Total	64,500	601,650	174,950

Notes

All values are in units of acre-feet.

This projected water budget is developed by projecting the 1925-2019 historical hydrology forward in time.

Non-storm outflows at the county line are from modeling analyses, rather than using data from stream gages which are located further downstream.

The total values shown at the bottom of this table are not equal to the sum of the individual terms because the minimum, maximum, and average values occur in different years for each of the individual surface water outflows.

ET = evapotranspiration

DRAFT Table 5-12. Estimated Annual Groundwater Inflows to the East Subbasin for the Year 2042 Projected Water Budget (Using 2030 Climate Change Factors)

Groundwater Inflow Component	Minimum	Maximum	Average	Percent of Total
Recharge from Precipitation	0	98,700	19,250	10%
Recharge from Streams	82,100	274,200	126,000	68%
Subsurface Inflow Beneath Castaic Dam	1,675	1,680	1,675	1%
Subsurface Inflow Beneath Santa Clara River and Other Tributaries	28,050	29,700	29,000	16%
Septic System Percolation	2,430	2,440	2,435	1%
Recharge of Applied Water	7,480	7,490	7,485	4%
Total	123,385	386,525	185,900	100%

Notes

All values are in units of acre-feet.

This projected water budget is developed by projecting the 1925-2019 historical hydrology forward in time.

Deep percolation from irrigation is the sum for agricultural and municipal lands.

Septic system percolation applies to areas served by public water supplies that do not have public sewer collection systems.

The "percent of total" values are computed using the average values shown in this table.

For the minimum and maximum values, the total values shown in this table are not equal to the sum of the individual inflow terms because the minimum values of the individual terms occur in different years, and similarly for the maximum values.

DRAFT Table 5-13. Estimated Annual Groundwater Outflows from the East Subbasin for the Year 2042 Projected Water Budget (Using 2030 Climate Change Factors)

Groundwater Outflow Component	Minimum	Maximum	Average	Percent of Total
Groundwater Pumping	47,735	67,115	51,375	27%
Riparian Evapotranspiration	5,900	9,400	7,300	4%
Groundwater Discharge to Streams	82,200	262,500	128,600	69%
Total	137,150	319,550	187,300	100%

Notes

All values are in units of acre-feet.

This projected water budget is developed by projecting the 1925-2019 historical hydrology forward in time.

Groundwater pumping volumes do not include 500 AFY from small domestic wells because they are not directly simulated in the model.

Groundwater discharge to streams are the combined amount in ephemeral and perennial reaches.

The "percent of total" values are computed using the average values shown in this table.

For the minimum and maximum values, the total values shown in this table are not equal to the sum of the individual outflow terms because the minimum values of the individual terms occur in different years, and similarly for the maximum values.

DRAFT Table 5-14. Estimated Annual Surface Water Inflows to the East Subbasin for the Year 2072 Projected Water Budget (Using 2070 Climate Change Factors)

Surface Water Inflow Component	Minimum	Maximum	Average
In-Basin Precipitation	24,400	233,000	86,300
Stormwater Generated from In-Basin Precipitation	20,675	138,150	68,350
Stream Inflow (Santa Clara River)	0	33,700	4,600
Stream Inflow (Releases from Castaic Lake/Lagoon)	175	175,800	17,850
Stream Inflow (Releases from Bouquet Reservoir)	110	110	110
Stream Inflow (Other Santa Clara River Tributaries)	0	150,200	19,900
Discharges to Santa Clara River from Saugus WRP	5,005	5,020	5,010
Discharges to Santa Clara River from Valencia WRP and Newhall WRP	15,995	16,055	16,000
Discharges to Santa Clara River from Groundwater Treatment Systems	500	501	500
Net Inflow from Groundwater	-2,100	60,400	17,700
Total	57,950	578,400	167,950

Notes

All values are in units of acre-feet.

This projected water budget is developed by projecting the 1925-2019 historical hydrology forward in time.

5% of the releases from Bouquet Reservoir remain as surface flow where Bouquet Creek enters the East Subbasin.

The term "Net inflow from Groundwater" is the difference between stream gains and stream losses arising from groundwater/surface water exchanges in the Santa Clara River and its tributaries.

Total values do not include storrmwater generated from in-basin precipitation, which is an internal flow process (and not an inflow to, or outflow from, the basin).

The total values shown at the bottom of this table are not equal to the sum of the individual terms because the minimum, maximum, and average values occur in different years for each of the individual surface water inflows.

WRP = water reclamation plant

DRAFT Table 5-15. Estimated Annual Surface Water Outflows from the East Subbasin for the Year 2072 Projected Water Budget (Using 2070 Climate Change Factors)

Surface Water Outflow Component	Minimum	Maximum	Average
Santa Clara River Non-Storm Outflow at LA/Ventura County Line	19,300	81,200	39,100
Groundwater Recharge from Precipitation	0	106,100	17,950
Groundwater Recharge from Ephemeral Streams	360	71,700	16,200
ET and Stormwater Outflow	20,850	391,250	94,650
Total	57,950	578,400	167,950

Notes

All values are in units of acre-feet.

This projected water budget is developed by projecting the 1925-2019 historical hydrology forward in time.

Non-storm outflows at the county line are from modeling analyses, rather than using data from stream gages which are located further downstream.

The total values shown at the bottom of this table are not equal to the sum of the individual terms because the minimum, maximum, and average values occur in different years for each of the individual surface water outflows.

ET = evapotranspiration

DRAFT Table 5-16. Estimated Annual Groundwater Inflows to the East Subbasin for the Year 2072 Projected Water Budget (Using 2070 Climate Change Factors)

Groundwater Inflow Component	Minimum	Maximum	Average	Percent of Total
Recharge from Precipitation	0	106,100	17,950	10%
Recharge from Streams	80,700	264,900	120,650	68%
Subsurface Inflow Beneath Castaic Dam	1,675	1,680	1,675	1%
Subsurface Inflow Beneath Santa Clara River and Other Tributaries	28,100	29,700	29,100	16%
Septic System Percolation	2,430	2,440	2,435	1%
Recharge of Applied Water	7,480	7,490	7,485	4%
Total	121,975	374,150	179,300	100%

Notes

All values are in units of acre-feet.

This projected water budget is developed by projecting the 1925-2019 historical hydrology forward in time.

Deep percolation from irrigation is the sum for agricultural and municipal lands.

Septic system percolation applies to areas served by public water supplies that do not have public sewer collection systems.

The "percent of total" values are computed using the average values shown in this table.

For the minimum and maximum values, the total values shown in this table are not equal to the sum of the individual inflow terms because the minimum values of the individual terms occur in different years, and similarly for the maximum values.

DRAFT Table 5-17. Estimated Annual Groundwater Outflows from the East Subbasin for the Year 2072 Projected Water Budget (Using 2070 Climate Change Factors)

Groundwater Outflow Component	Minimum	Maximum	Average	Percent of Total
Groundwater Pumping	47,690	67,115	51,375	28%
Riparian Evapotranspiration	6,000	9,700	7,500	4%
Groundwater Discharge to Streams	79,000	248,800	122,100	68%
Total	134,575	306,150	181,000	100%

Notes

All values are in units of acre-feet.

This projected water budget is developed by projecting the 1925-2019 historical hydrology forward in time.

Groundwater pumping volumes do not include 500 AFY from small domestic wells because they are not directly simulated in the model.

Groundwater discharge to streams are the combined amount in ephemeral and perennial reaches.

The "percent of total" values are computed using the average values shown in this table.

For the minimum and maximum values, the total values shown in this table are not equal to the sum of the individual outflow terms because the minimum values of the individual terms occur in different years, and similarly for the maximum values.

DRAFT Table 6-1. Annual Groundwater Pumping for the Operating Plan and the Projected Water Budgets

Year Type	Modeled Groundwater Pumping for the Projected Water Budgets	Pumping Ranges Specified in the Groundwater Operating Plan
Normal	48,300	37,500 to 55,000
Dry Year 1	52,500	45,000 to 60,000
Dry Year 2	57,500	51,000 to 60,000
Dry Year 3+	67,500	51,000 to 70,000
Modeled Average for Projected Water Budgets	52,115	

All values are in units of acre-feet per year (AFY).

Figures

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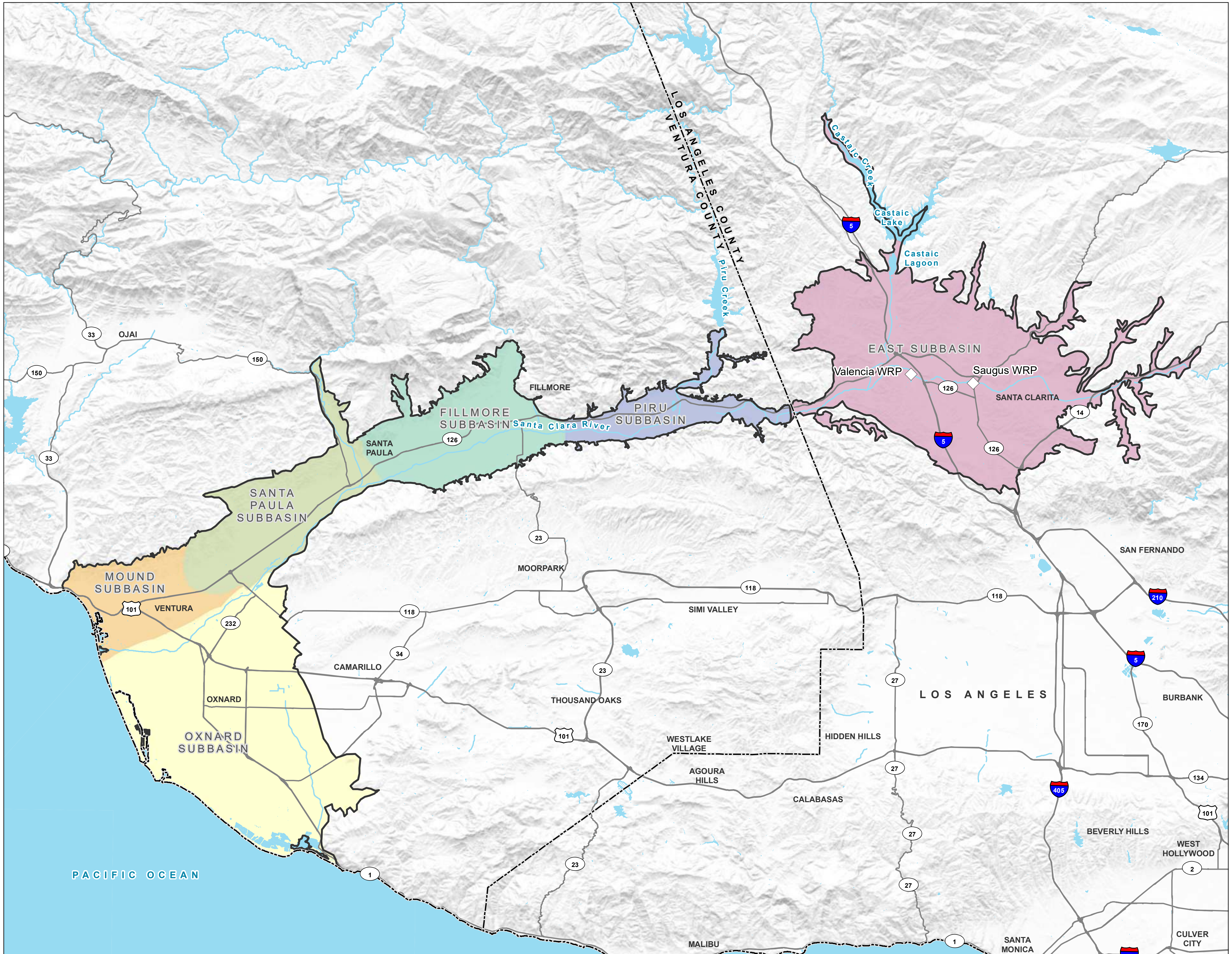
FIGURE 1-1

Santa Clara River Valley Groundwater Basin and Subbasins

Water Budget Development for the Santa Clara River Valley East Groundwater Subbasin

DRAFT



LEGEND

- Wastewater Reclamation Plant (WRP)
- Santa Clara River Valley Groundwater Basin

Santa Clara River Valley Subbasins

- Santa Clara River Valley East
- Piru
- Fillmore
- Santa Paula
- Mound
- Oxnard

All Other Features

- County Boundary
- Major Road
- Watercourse
- Waterbody

N

0 12,500 25,000 37,500
Feet

Date: October 6, 2020
Data Sources: USGS, DWR Bulletin 118

GSI Water Solutions, Inc.

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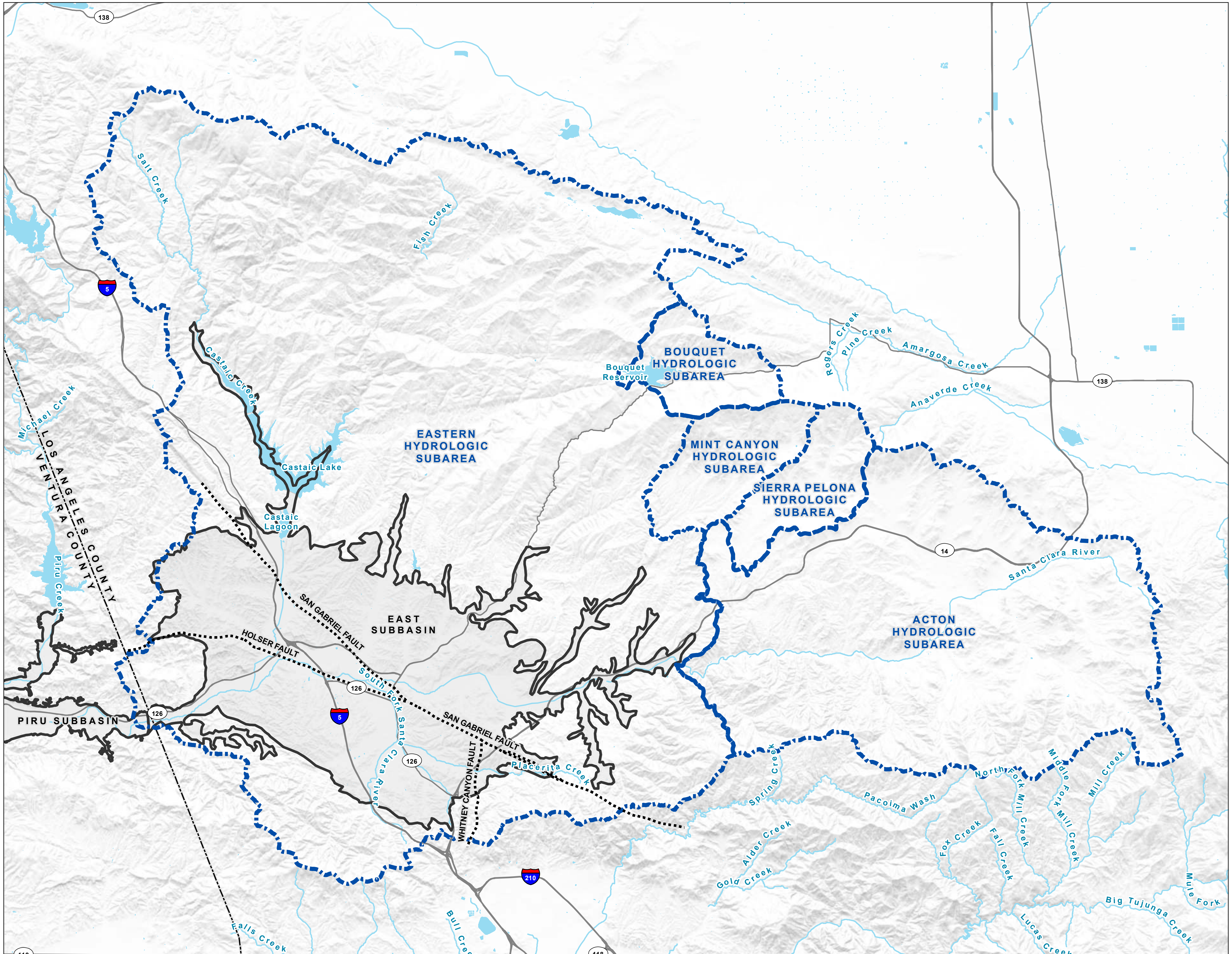

FIGURE 1-2

Watershed Boundaries for Upper Santa Clara River Hydrologic Area and Subareas

Water Budget Development for the Santa Clara River Valley East Groundwater Subbasin

DRAFT

LEGEND

- Santa Clara River Valley Groundwater Basin
- Upper Santa Clara River Hydrologic Subarea

All Other Features

- Major Road
- Watercourse
- Waterbody

N

0 9,000 18,000 27,000
Feet

Date: September 10, 2020
Data Sources: USGS, DWR Bulletin 118

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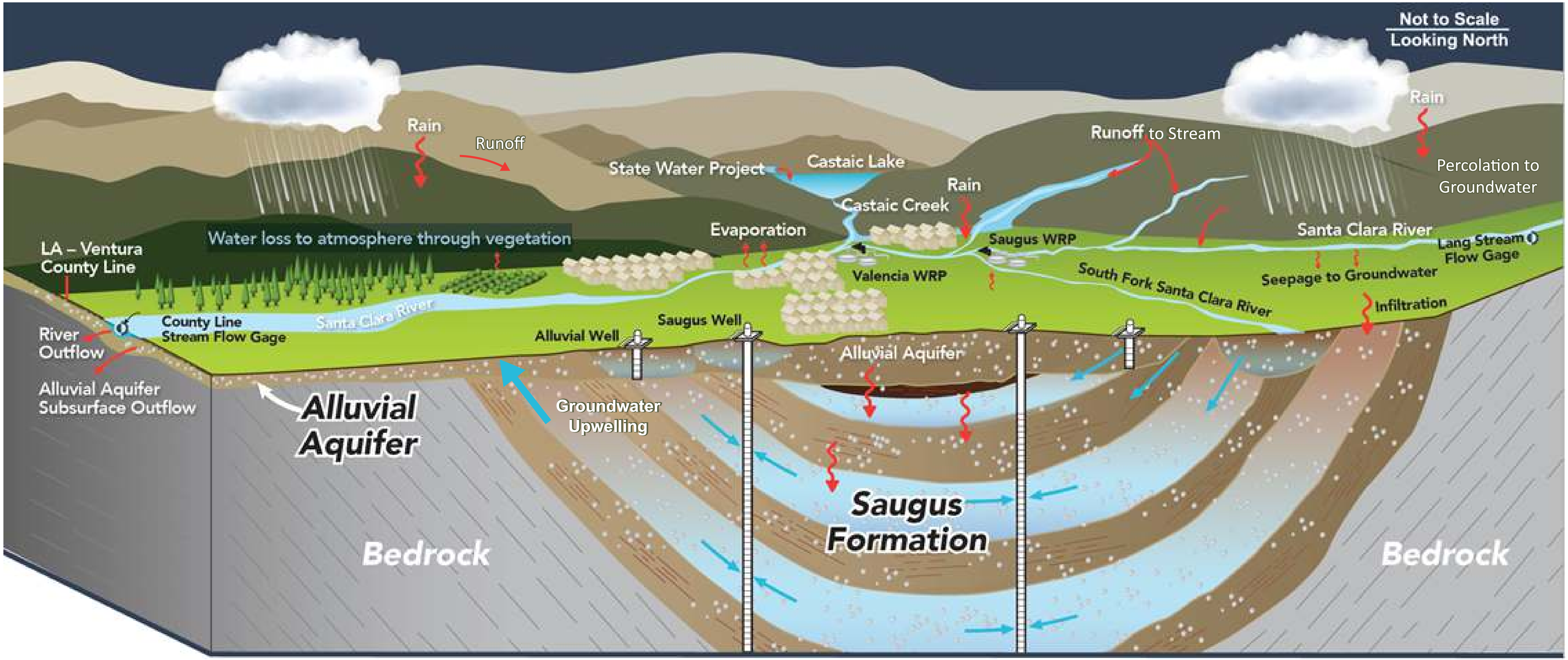

DRAFT

FIGURE 1-3

Conceptual Groundwater and Surface Water Flow Diagram
Santa Clara River Valley Groundwater Basin, East Subbasin
Water Budget Development for the Santa Clara River Valley East Groundwater Subbasin

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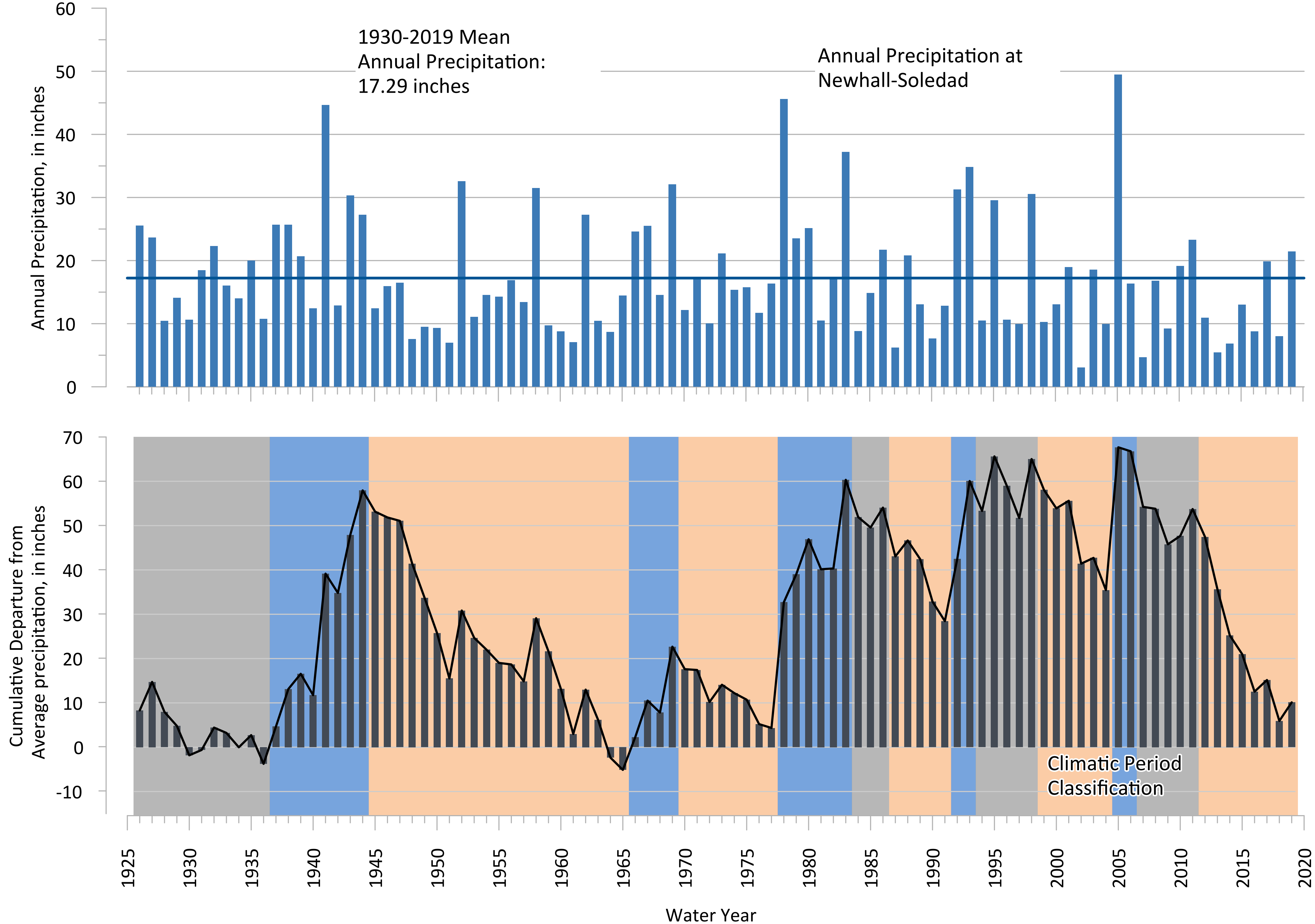

FIGURE 1-4

Annual Precipitation at the Newhall-Soledad (Newhall Fire Station #73) Rain Gage and Water Year Types for the Santa Clara River Valley East Groundwater Subbasin

Water Budget Development for the Santa Clara River Valley East Groundwater Subbasin

DRAFT

LEGEND

- Wet
- Dry
- Normal
- Cumulative Departure From Mean
- Mean Precipitation

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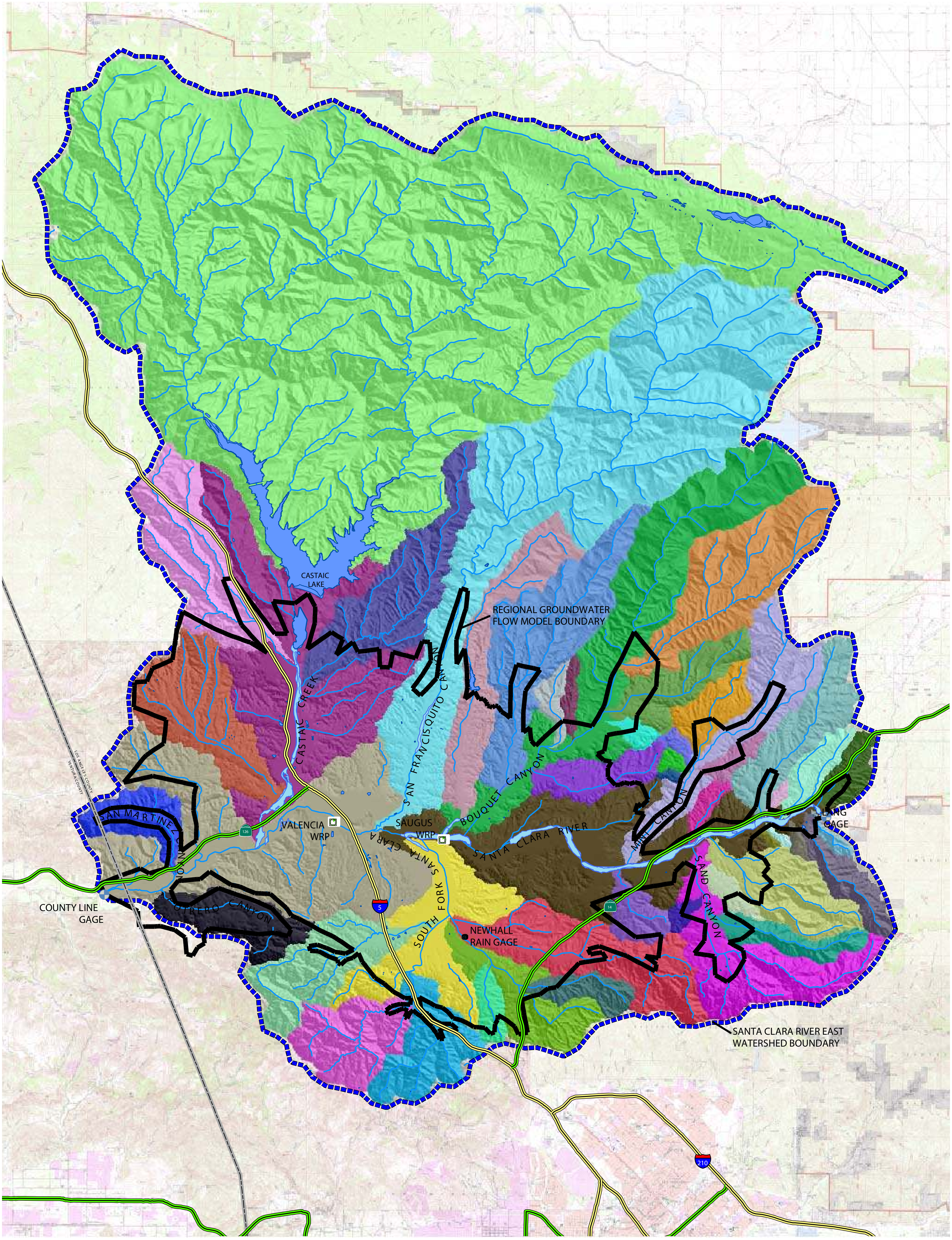

LEGEND

Hydrography

- Lake
- Stream
- Stream Gage

Major Road

- Interstate
- State Highway

DRAFT

Date: October 6, 2020
Data Sources: CH2MHILL, 2004

FIGURE 1-5

Contributing Watersheds to the Santa Clara River Valley East Groundwater Subbasin

Water Budget Development for the Santa Clara River Valley East Groundwater Subbasin

N

0 2.5 5
Miles

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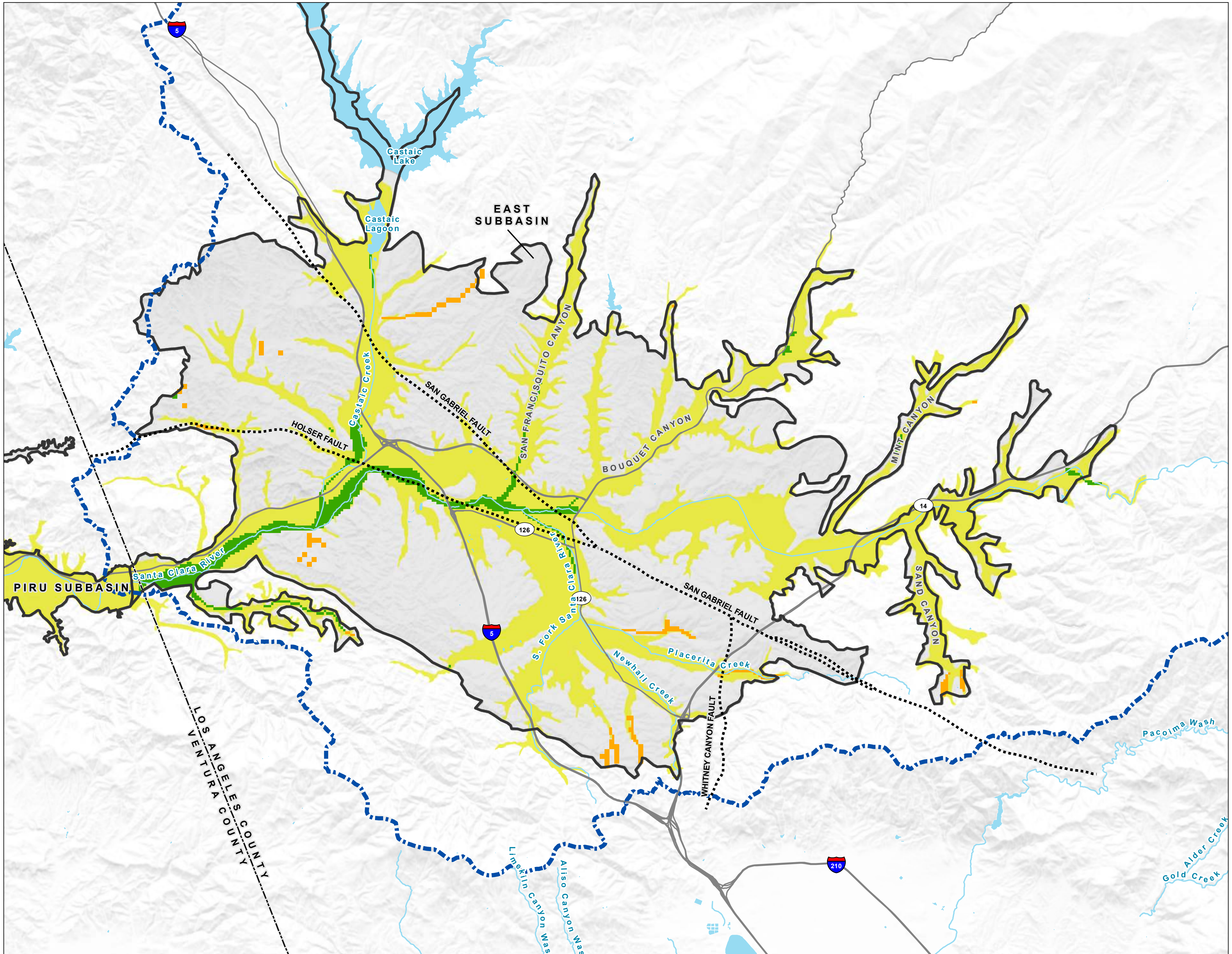

FIGURE 1-6

Phreatophyte Locations in the Model Grid

Water Budget Development for the Santa Clara River Valley East Groundwater Subbasin

DRAFT

LEGEND

- Alluvium
- Santa Clara River Valley Groundwater Basin
- Watershed Boundary

Phreatophyte Locations

- Riparian Mixed Hardwood
- Coast Live Oak Woodland

All Other Features

- Major Road
- Watercourse
- Waterbody

N

0 5,000 10,000 15,000
Feet

Date: October 5, 2020
Data Sources: USGS, DWR Bulletin 118, ESA (2020)

GSI Water Solutions, Inc.

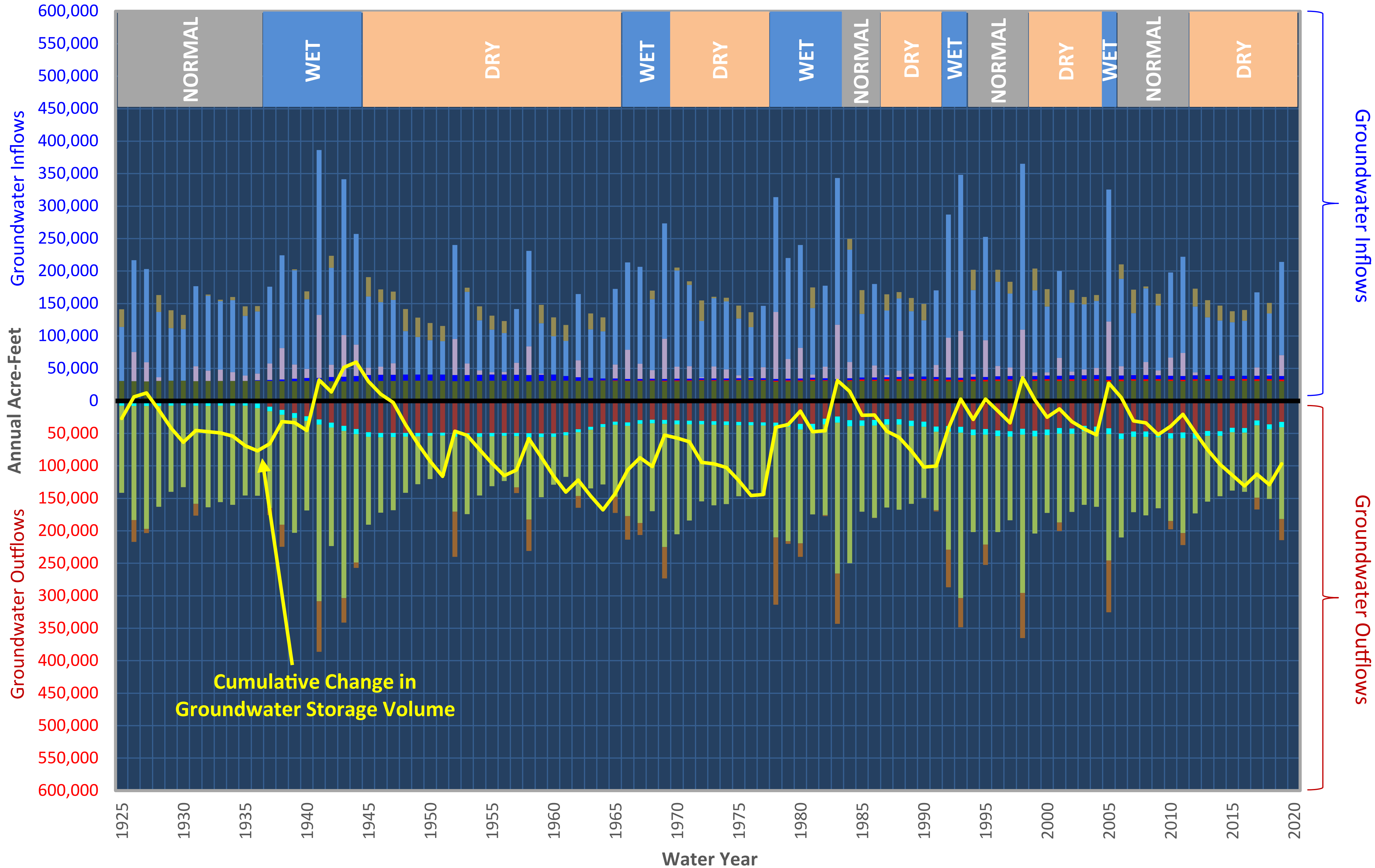

FIGURE 1-7

Historical Groundwater Budget (Water Years 1925-2019)

Water Budget Development for the Santa Clara River Valley East Groundwater Subbasin

DRAFT

LEGEND

- Stream Gains
- Stream Losses
- Precipitation
- Ag+Muni Irrigation
- Subsurface Inflow in Tributaries
- Septic
- Pumping
- ET
- Groundwater Storage Increase
- Groundwater Storage Reduction

NOTES

This projected water budget is developed by projecting the 1925-2019 historical hydrology forward in time.
Ag: agriculture
Muni: municipal
ET: evapotranspiration

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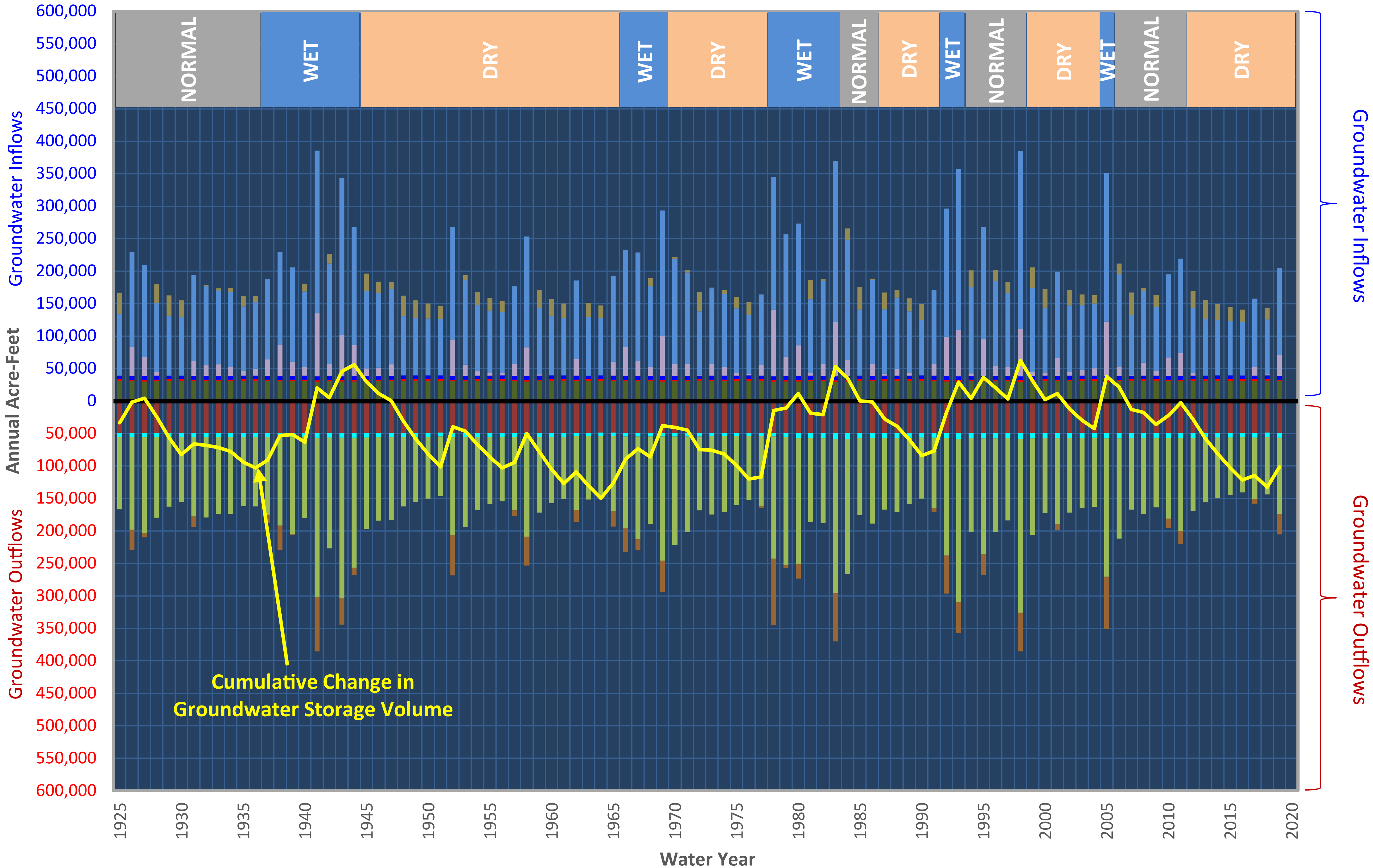

FIGURE 1-8

Current Groundwater Budget Under the 2014 Level of Development

Water Budget Development for the Santa Clara River Valley East Groundwater Subbasin

DRAFT

LEGEND

- Stream Gains
- Stream Losses
- Precipitation
- Ag+Muni Irrigation
- Subsurface Inflow in Tributaries
- Septic
- Pumping
- ET
- Groundwater Storage Increase
- Groundwater Storage Reduction

NOTES

This projected water budget is developed by projecting the 1925-2019 historical hydrology forward in time.
Ag: agriculture
Muni: municipal
ET: evapotranspiration

GSI Water Solutions, Inc.

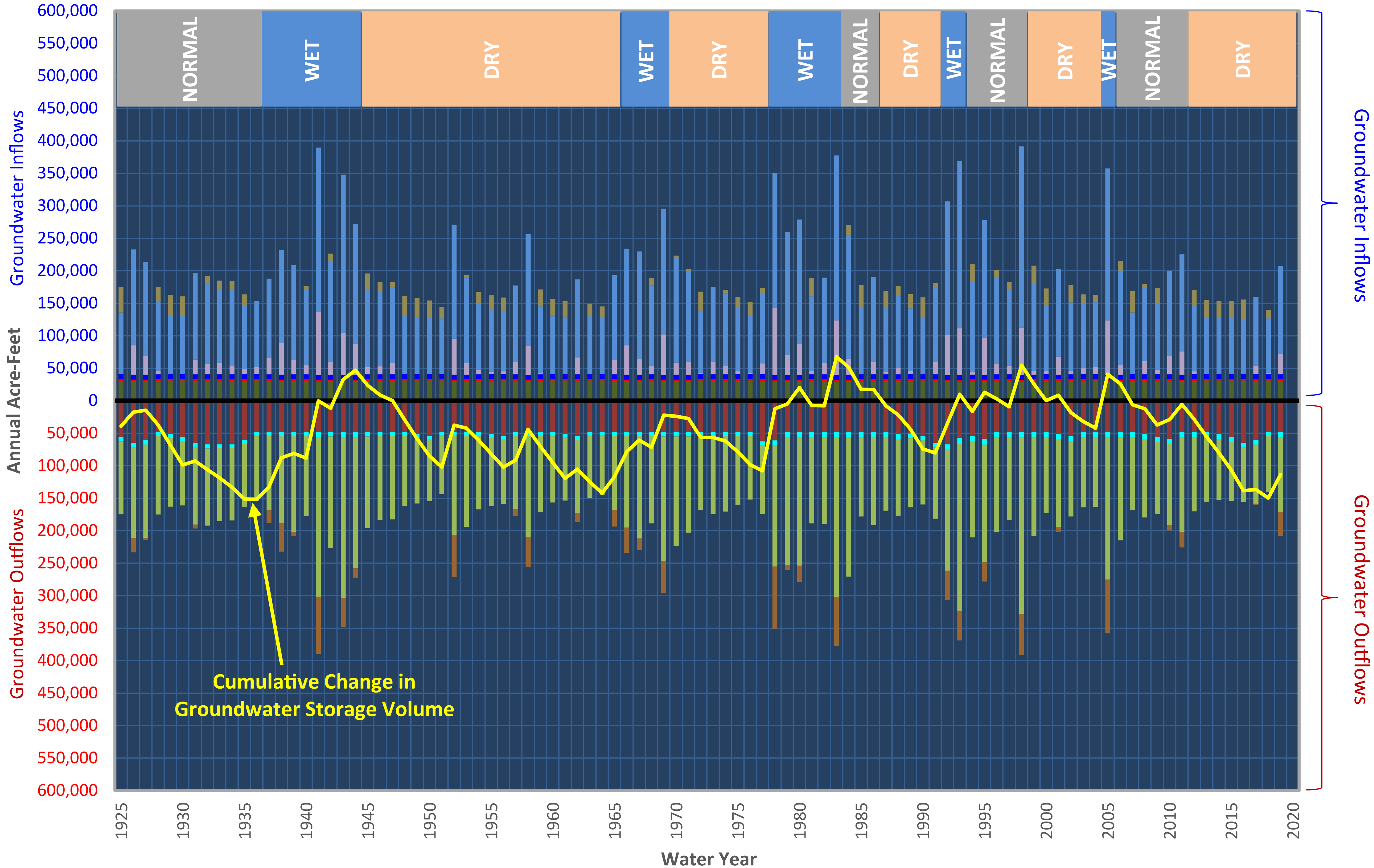

FIGURE 1-9

Projected Groundwater Budget Under Full Buildout Conditions Without Climate Change

Water Budget Development for the Santa Clara River Valley East Groundwater Subbasin

DRAFT

LEGEND

- Stream Gains
- Stream Losses
- Precipitation
- Ag+Muni Irrigation
- Subsurface Inflow in Tributaries
- Septic
- Pumping
- ET
- Groundwater Storage Increase
- Groundwater Storage Reduction

NOTES

This projected water budget is developed by projecting the 1925-2019 historical hydrology forward in time.
Ag: agriculture
Muni: municipal
ET: evapotranspiration

GSI Water Solutions, Inc.

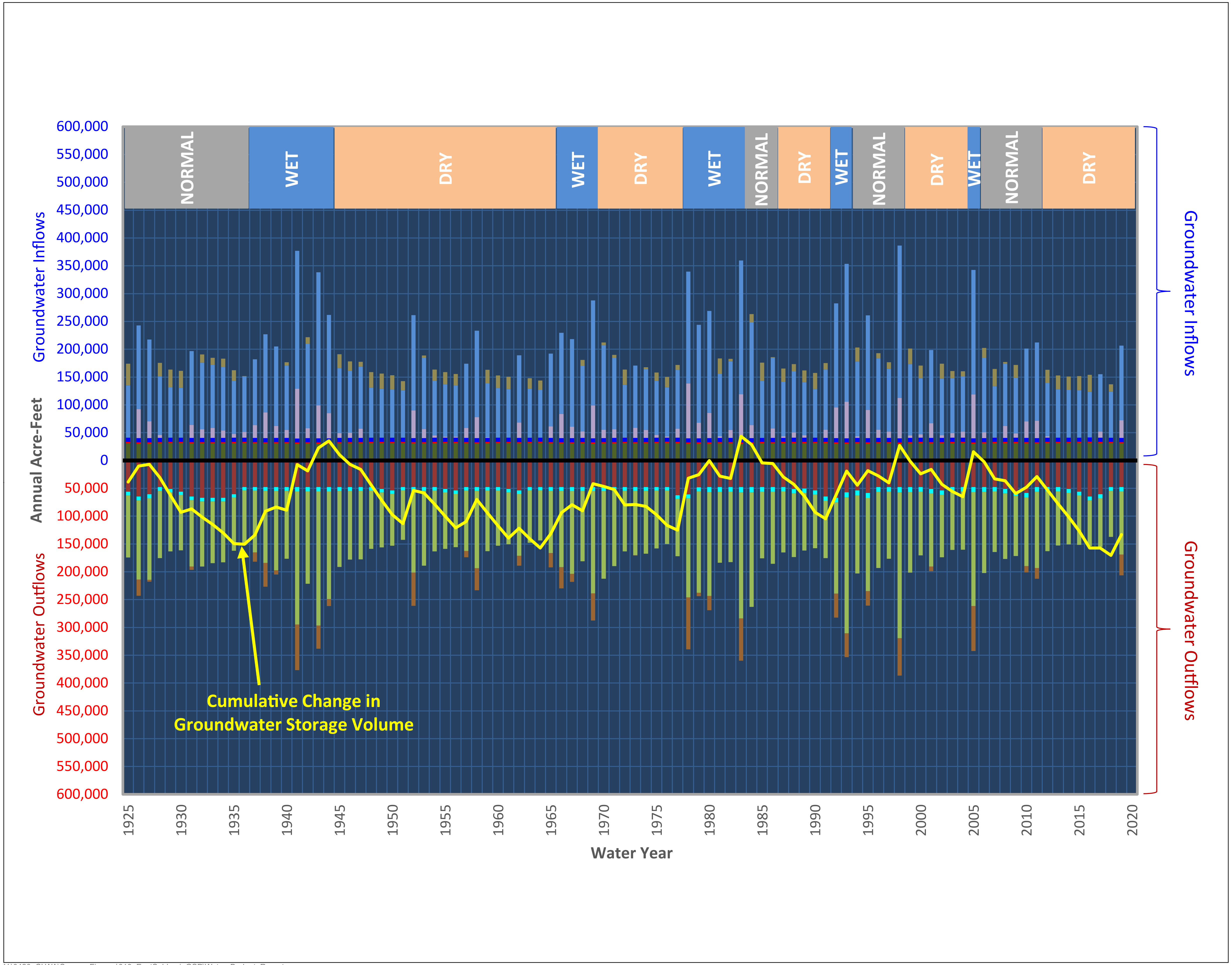

FIGURE 1-10

Projected Groundwater Budget For Year 2042 (Full Buildout Conditions With 2030 Average Climate Change)

Water Budget Development for the Santa Clara River Valley East Groundwater Subbasin

DRAFT

LEGEND

- Stream Gains
- Stream Losses
- Precipitation
- Ag+Muni Irrigation
- Subsurface Inflow in Tributaries
- Septic
- Pumping
- ET
- Groundwater Storage Increase
- Groundwater Storage Reduction

NOTES

This projected water budget is developed by projecting the 1925-2019 historical hydrology forward in time.
Ag: agriculture
Muni: municipal
ET: evapotranspiration

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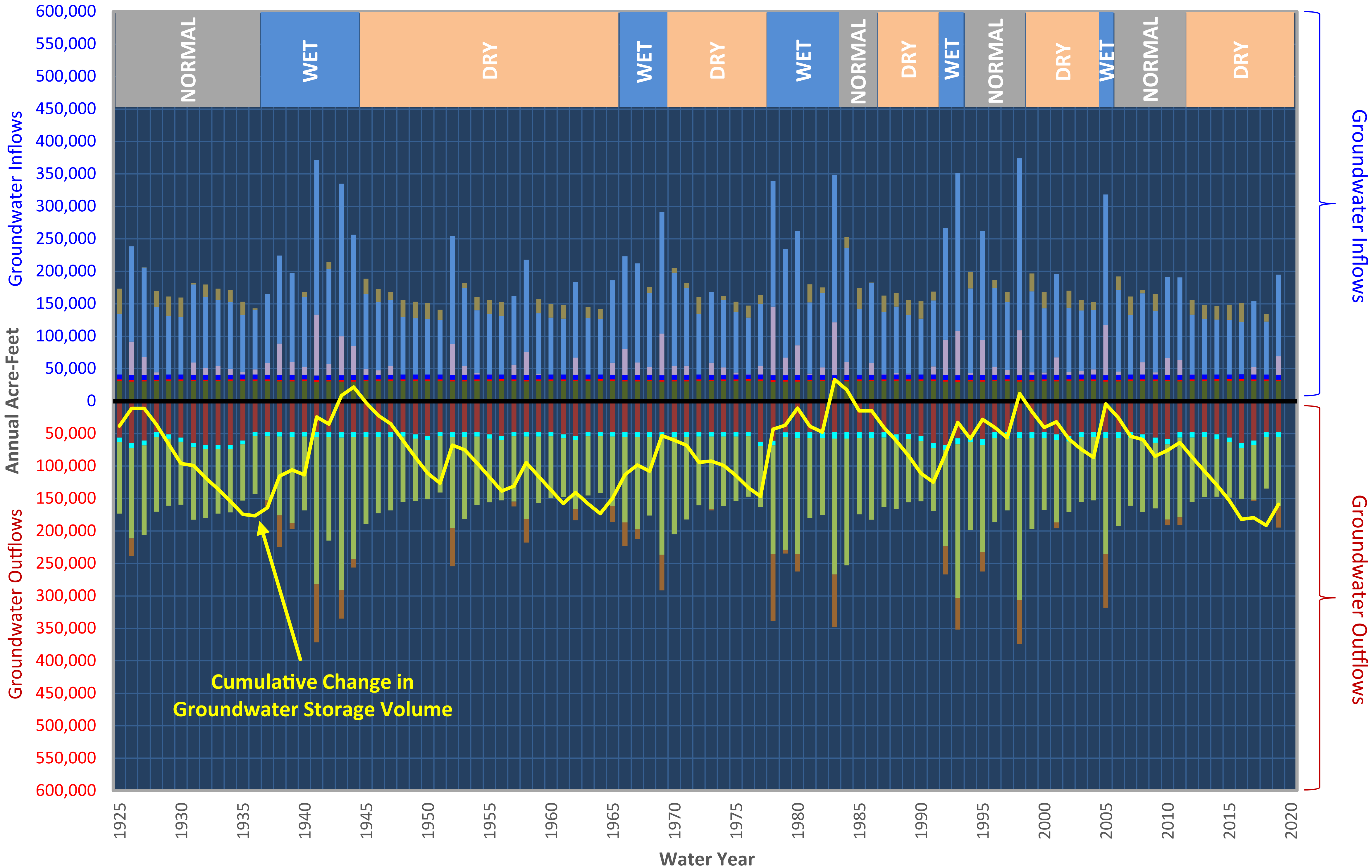

FIGURE 1-11

Projected Groundwater Budget For Year 2072 (Full Buildout Conditions With 2070 Average Climate Change)

Water Budget Development for the Santa Clara River Valley East Groundwater Subbasin

DRAFT

LEGEND

- Stream Gains
- Stream Losses
- Precipitation
- Ag+Muni Irrigation
- Subsurface Inflow in Tributaries
- Septic
- Pumping
- ET
- Groundwater Storage Increase
- Groundwater Storage Reduction

NOTES

This projected water budget is developed by projecting the 1925-2019 historical hydrology forward in time.
Ag: agriculture
Muni: municipal
ET: evapotranspiration

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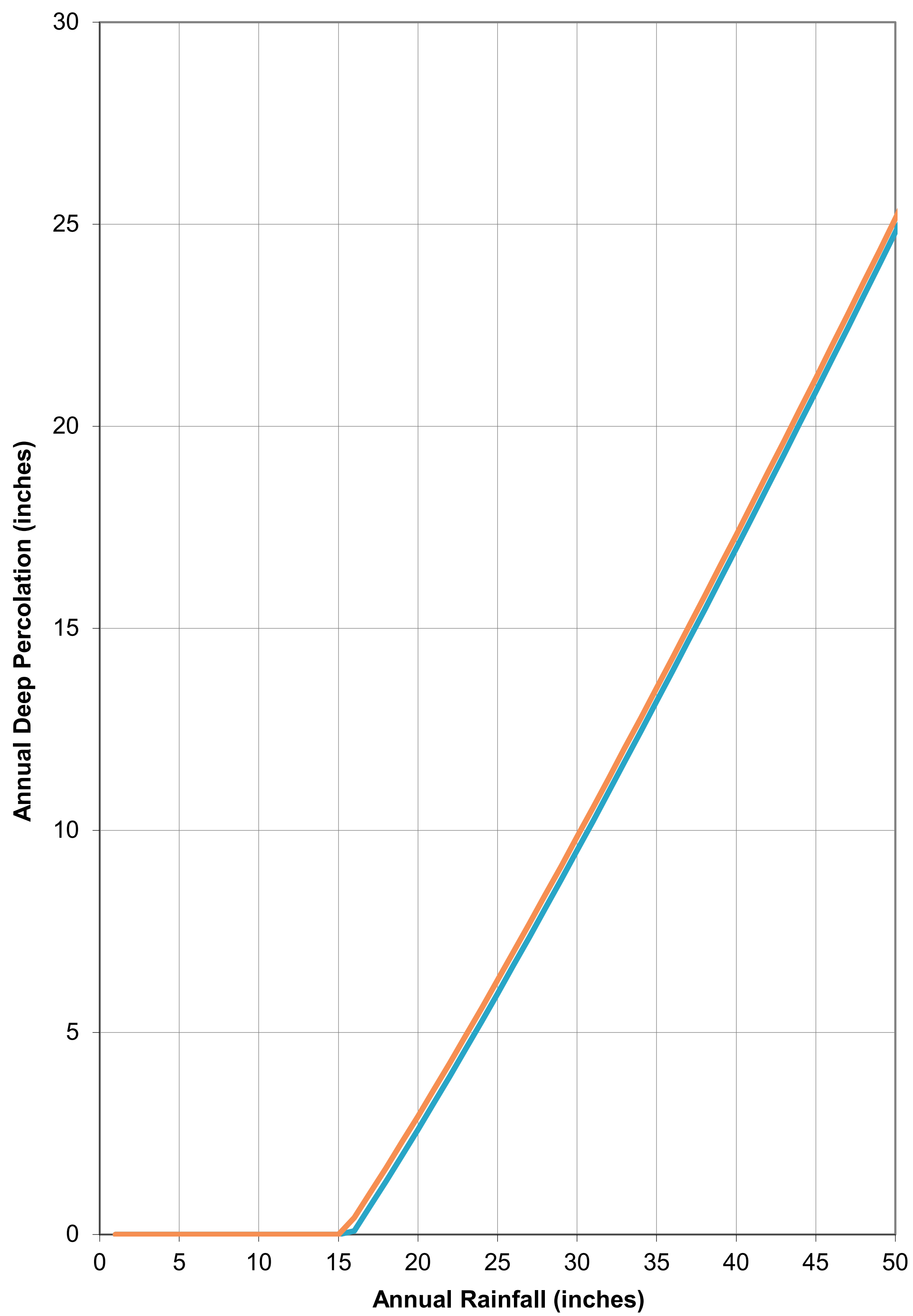
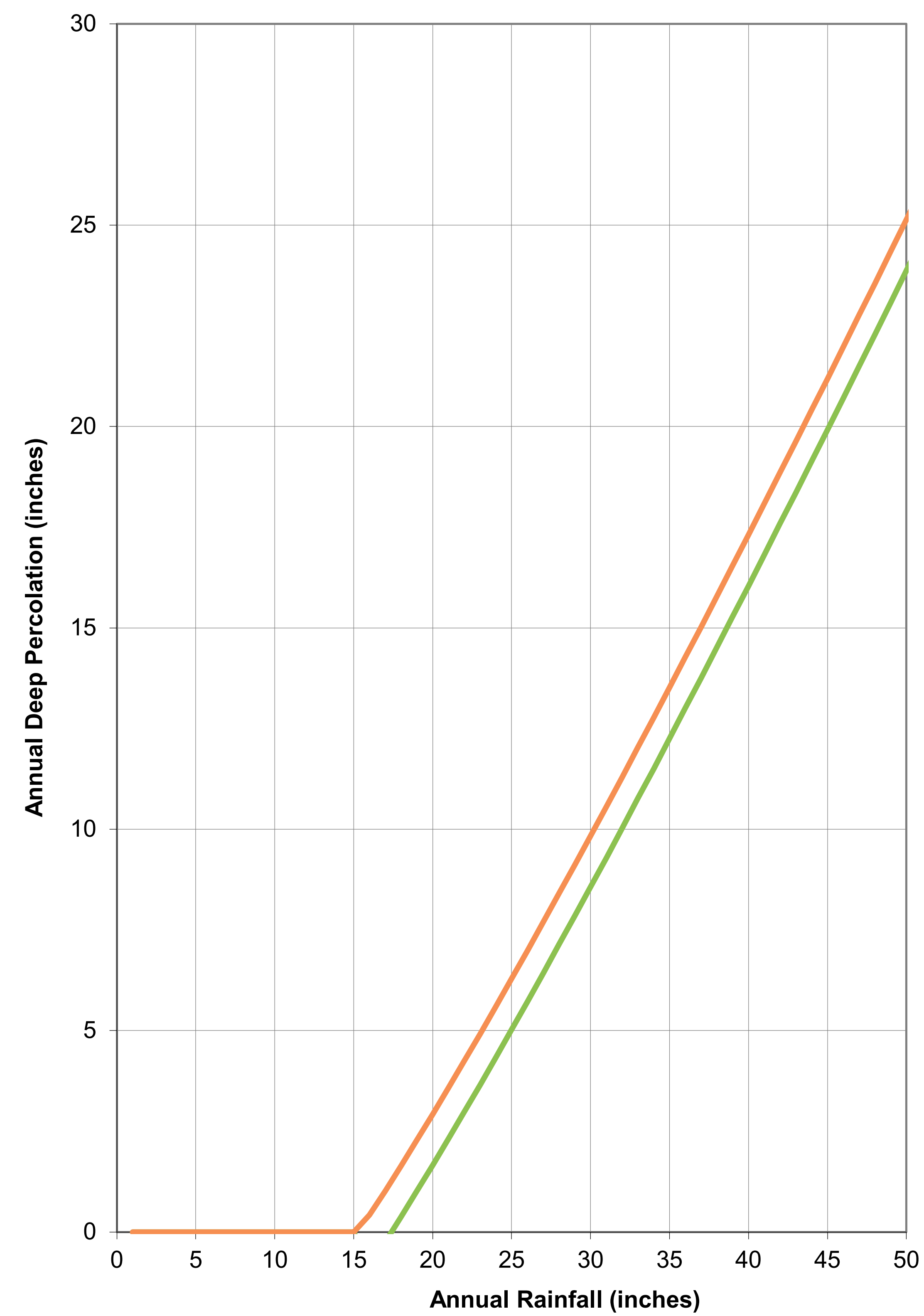
FIGURE 2-1

Rainfall-Recharge Relationship Under Historical Conditions and the 2030 and 2070 Average Climate Change Scenarios

Water Budget Development for the Santa Clara River Valley East Groundwater Subbasin

DRAFT





LEGEND

- 2030 Climate Change
- 2070 Climate Change
- Historical Conditions

NOTES

For historical conditions, the rainfall-recharge relationships are derived from model calibration.
For 2030 and 2070 climate change, the rainfall-recharge relationship is developed using factors for rainfall and ET that are provided by DWR for the East Subbasin on its SGMA web portal https://sgma.water.ca.gov/webgis/?appid=SGMADataViewer#waterbudget
DWR: California Department of Water Resources
ET: evapotranspiration
SGMA: Sustainable Groundwater Management Act

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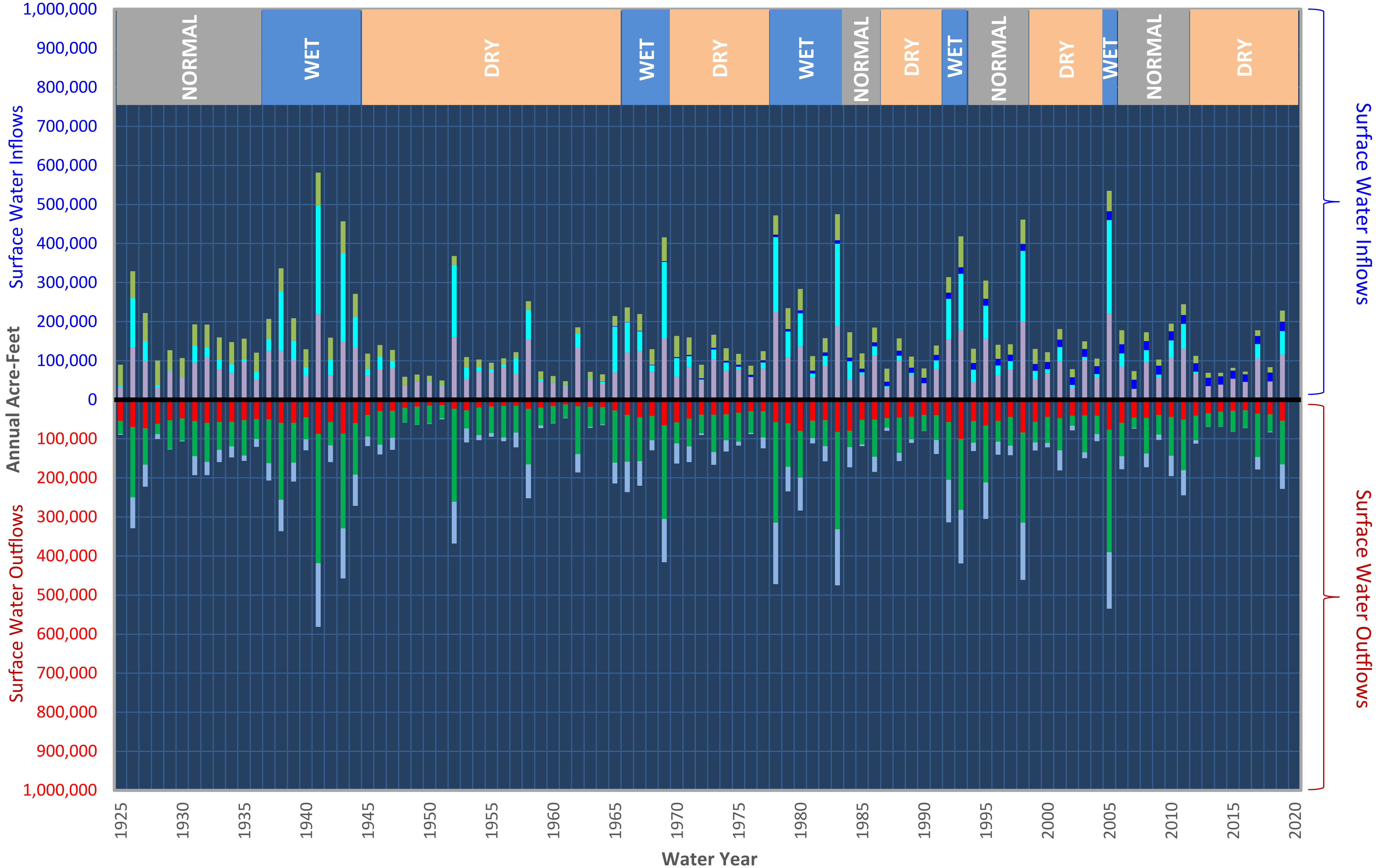
FIGURE 3-1

Historical Surface Water Budget (Water Years 1925-2019)

Water Budget Development for the Santa Clara River Valley East Groundwater Subbasin

DRAFT



LEGEND

- Precipitation
- Stream Inflows
- Point-Source Flows to Streams
- Net Inflow from Groundwater
- Non-Storm Flow at County Line
- ET and Storm Outflows
- Groundwater Recharge from Streams and Rainfall

NOTES

This projected water budget is developed by projecting the 1925-2019 historical hydrology forward in time.
ET: evapotranspiration

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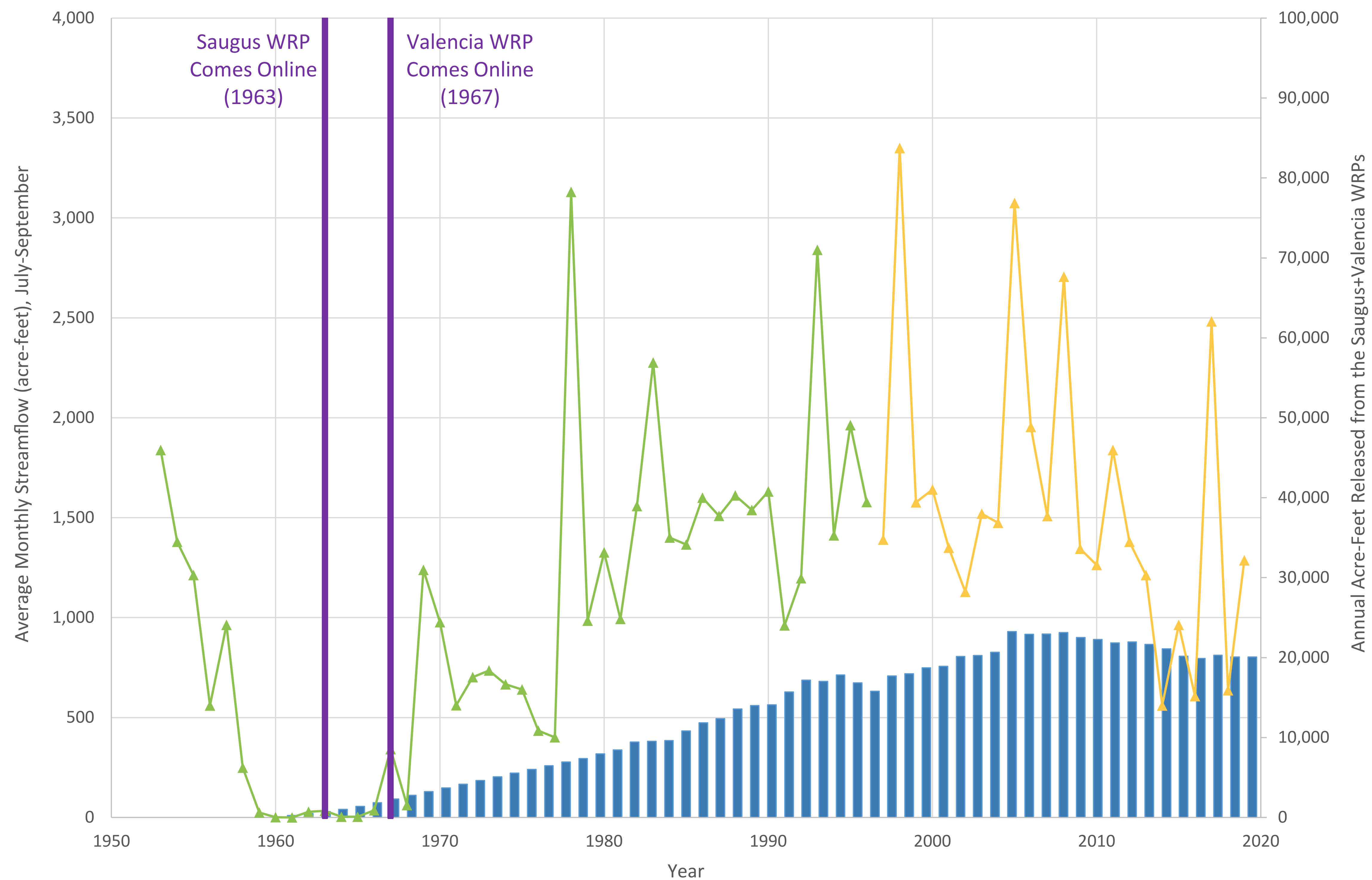

FIGURE 3-2

Historically Measured Annual WRP Flow Volumes and Summer-Season Streamflow Volumes in the Santa Clara River at the LA/Ventura County Line and Piru Stream Gages

Water Budget Development for the Santa Clara River Valley East Groundwater Subbasin

DRAFT

LEGEND

- Annual WRP Discharge Volume (Saugus+Valencia)
- LA/Ventura County Line Stream Gage
- Piru Stream Gage

NOTES
LA: Los Angeles
WRP: water reclamation plant

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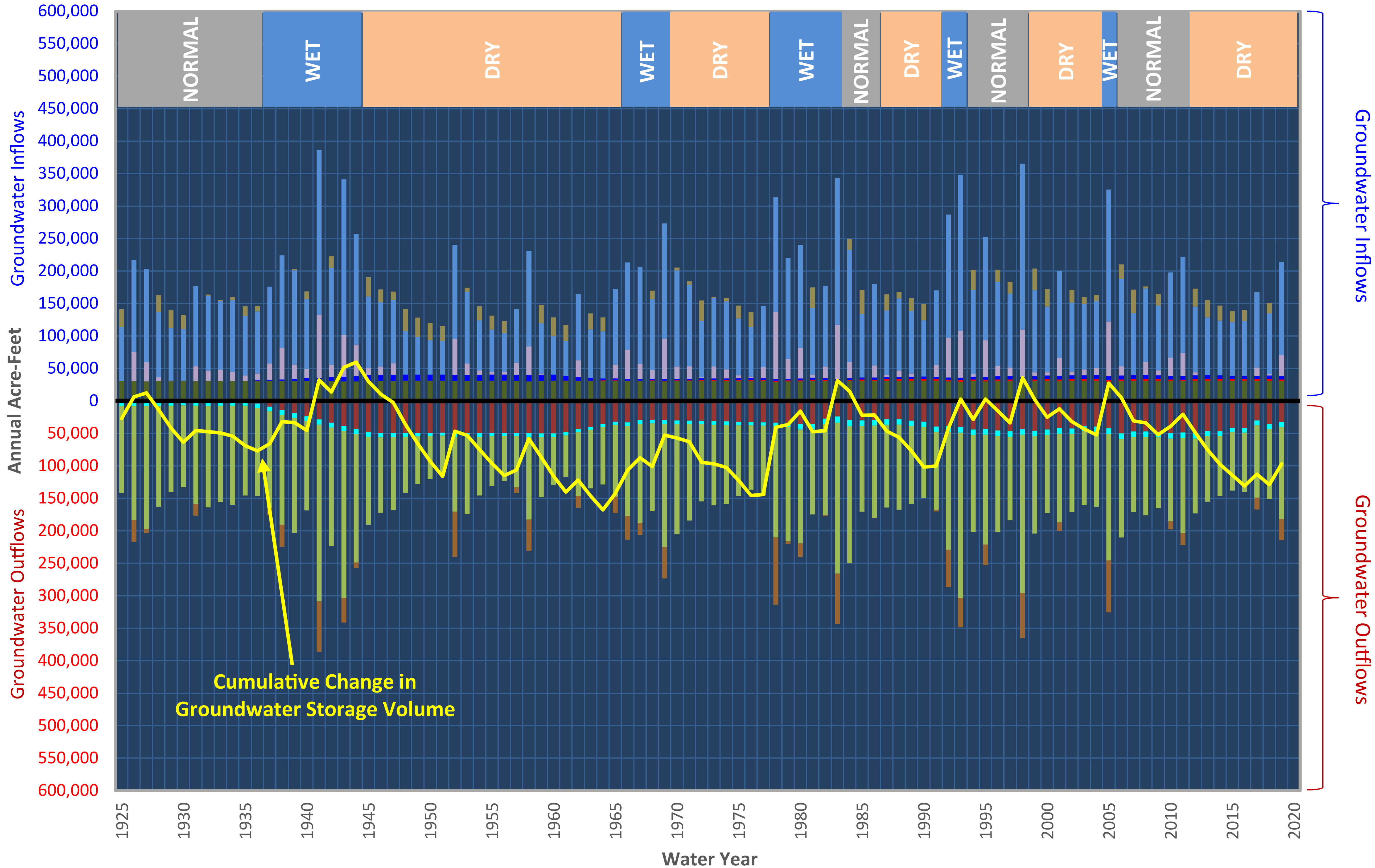

FIGURE 3-3

Historical Groundwater Budget (Water Years 1925-2019)

Water Budget Development for the Santa Clara River Valley East Groundwater Subbasin

DRAFT

LEGEND

- Stream Gains
- Stream Losses
- Precipitation
- Ag+Muni Irrigation
- Subsurface Inflow in Tributaries
- Septic
- Pumping
- ET
- Groundwater Storage Increase
- Groundwater Storage Reduction

NOTES

This projected water budget is developed by projecting the 1925-2019 historical hydrology forward in time.
Ag: agriculture
Muni: municipal
ET: evapotranspiration

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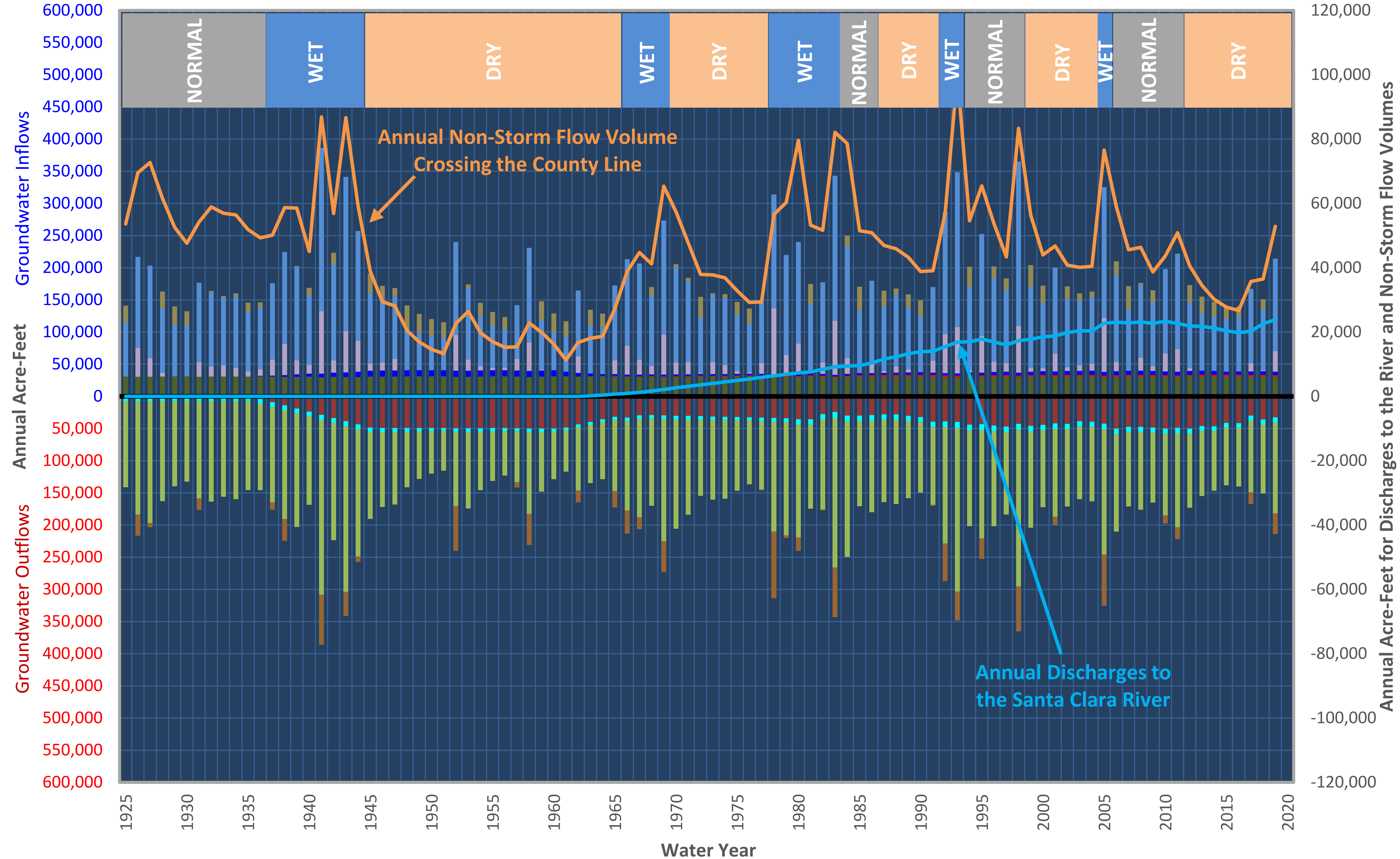

FIGURE 3-4

Historical Groundwater Budget and Annual Non-Storm Flows at the LA/Ventura County Line

Water Budget Development for the Santa Clara River Valley East Groundwater Subbasin

DRAFT

LEGEND

- Stream Gains
- Stream Losses
- Precipitation
- Ag+Muni Irrigation
- Subsurface Inflow in Tributaries
- Septic
- Pumping
- ET
- Groundwater Storage Increase
- Groundwater Storage Reduction

NOTES

This projected water budget is developed by projecting the 1925-2019 historical hydrology forward in time.
Ag: agriculture
Muni: municipal
ET: evapotranspiration

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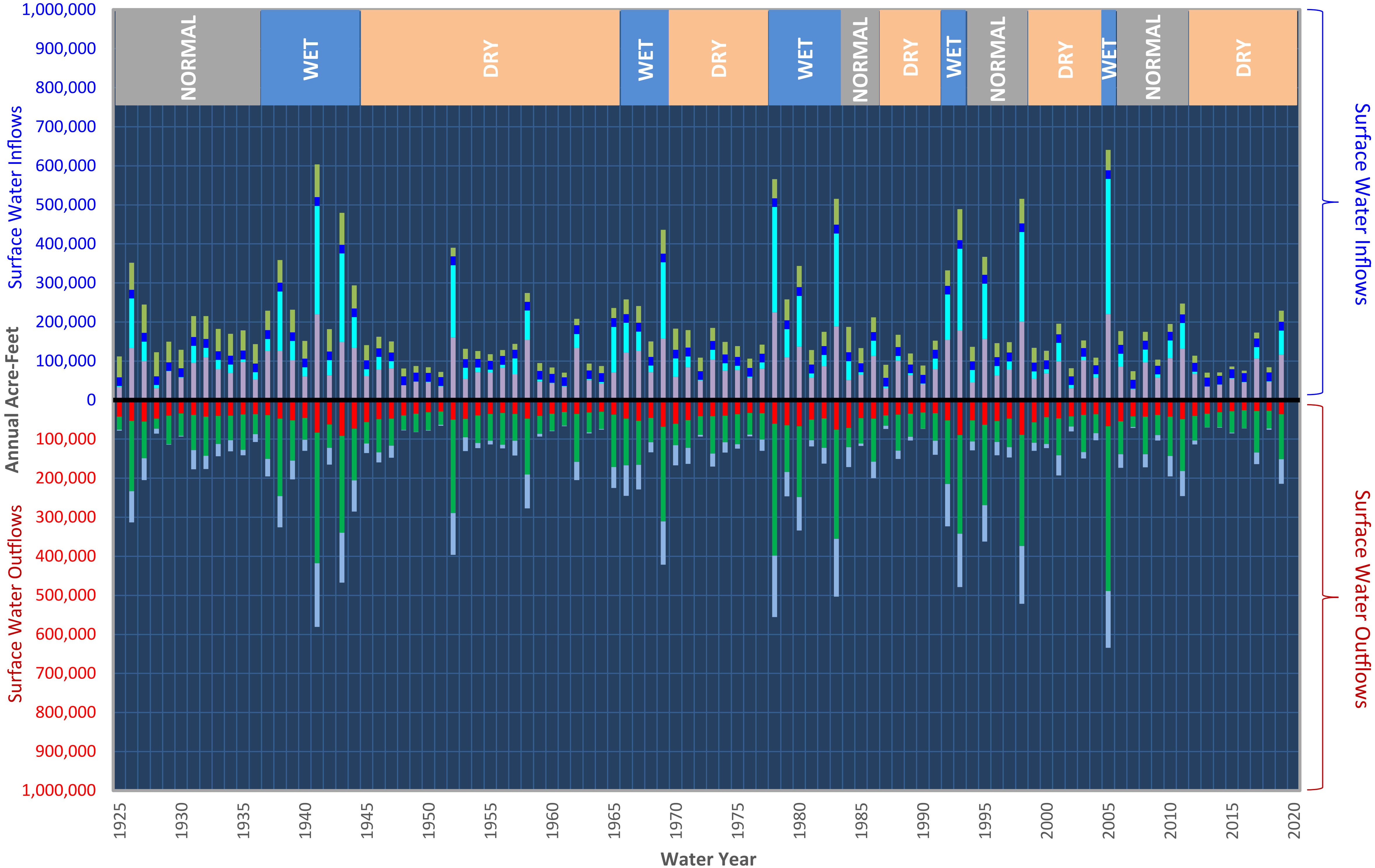

FIGURE 4-1

Current Surface Water Budget Under the 2014 Level of Development

Water Budget Development for the Santa Clara River Valley East Groundwater Subbasin

DRAFT

LEGEND

- Precipitation
- Stream Inflows
- Point-Source Flows to Streams
- Net Inflow from Groundwater
- Non-Storm Flow at County Line
- ET and Storm Outflows
- Groundwater Recharge from Streams and Rainfall

NOTES

This projected water budget is developed by projecting the 1925-2019 historical hydrology forward in time.
ET: evapotranspiration

GSI Water Solutions, Inc.

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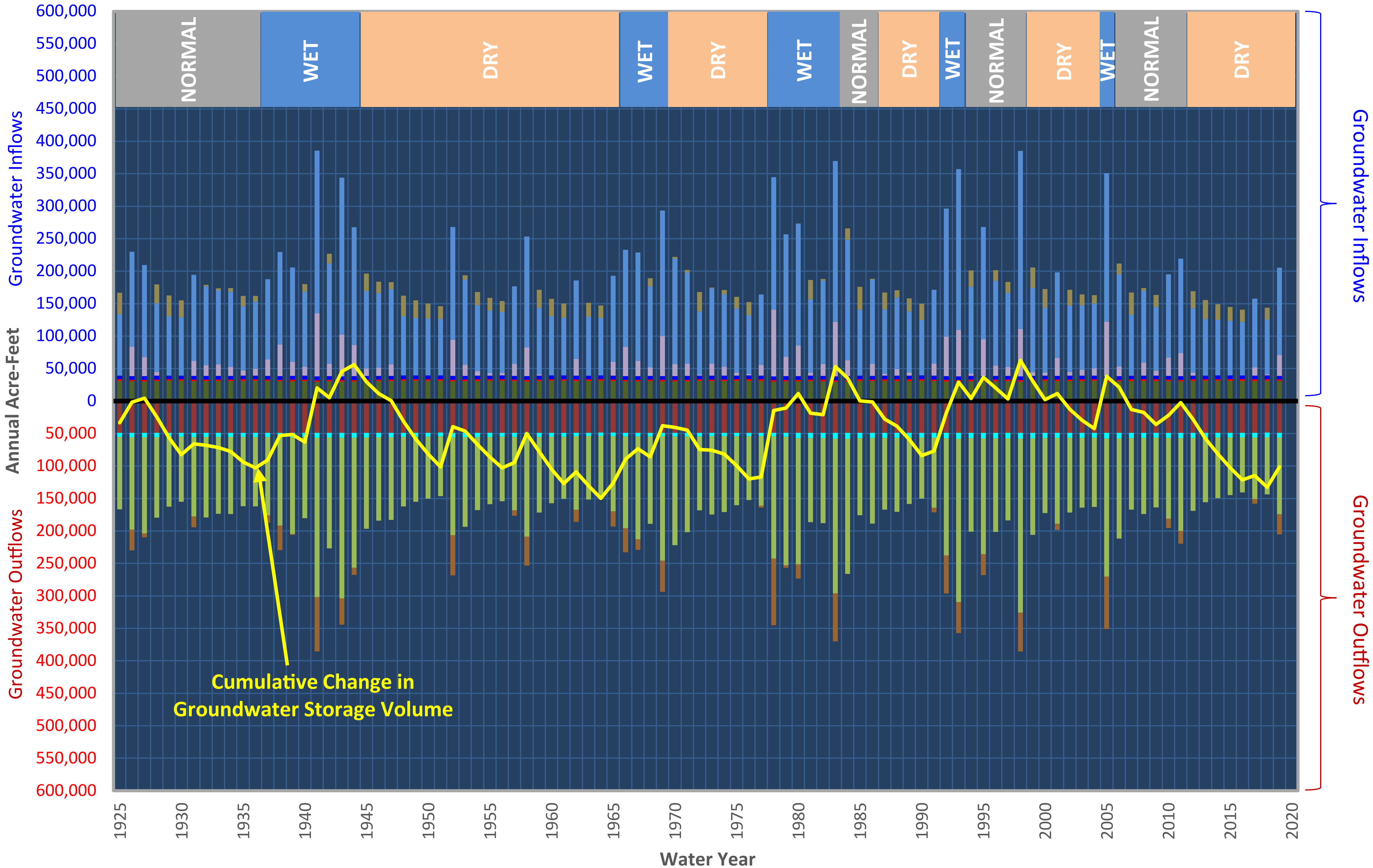

FIGURE 4-2

Current Groundwater Budget Under the 2014 Level of Development

Water Budget Development for the Santa Clara River Valley East Groundwater Subbasin

DRAFT

LEGEND

- Stream Gains
- Stream Losses
- Precipitation
- Ag+Muni Irrigation
- Subsurface Inflow in Tributaries
- Septic
- Pumping
- ET
- Groundwater Storage Increase
- Groundwater Storage Reduction

NOTES

This projected water budget is developed by projecting the 1925-2019 historical hydrology forward in time.
Ag: agriculture
Muni: municipal
ET: evapotranspiration

GSI Water Solutions, Inc.

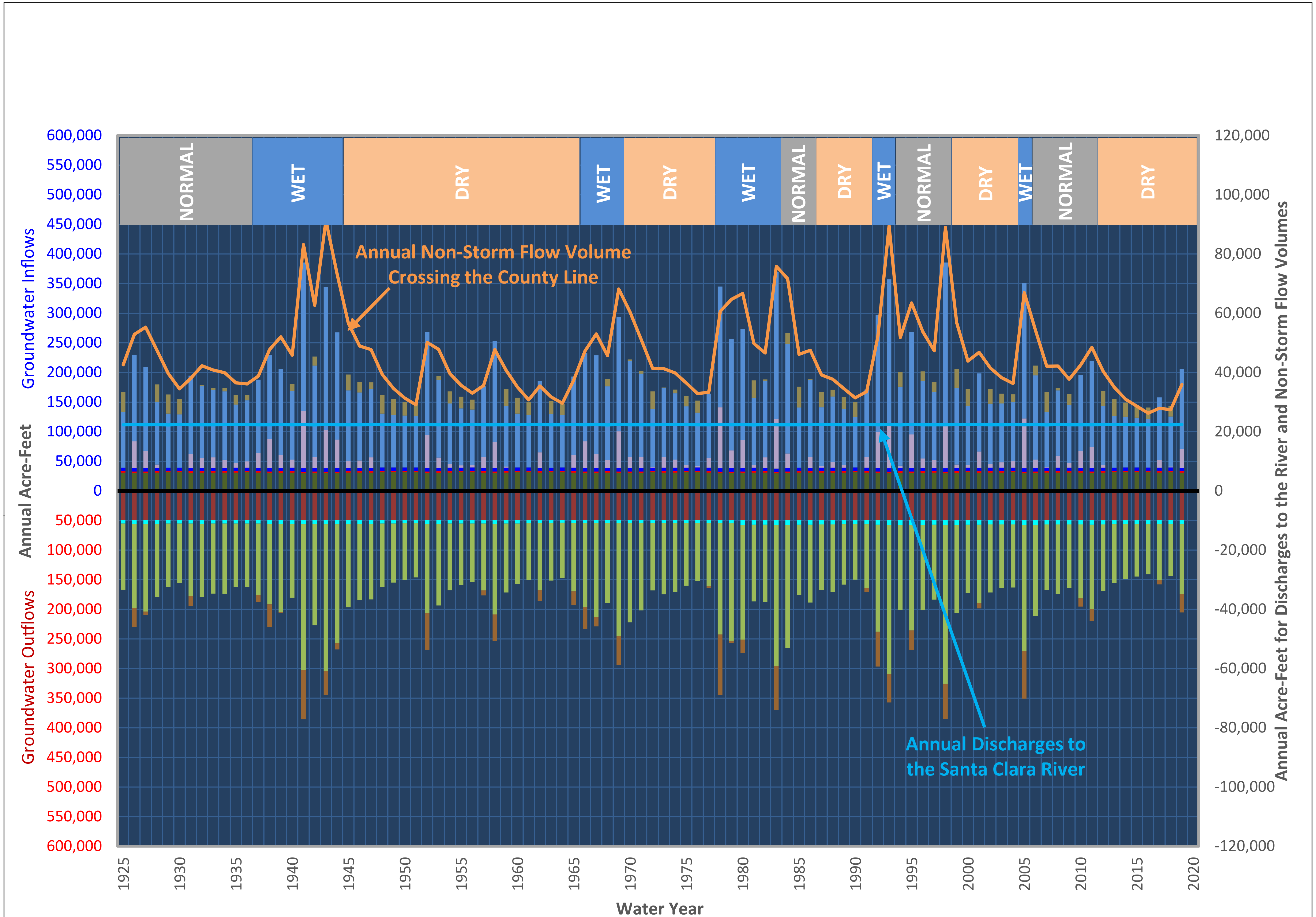

FIGURE 4-3

Projected Groundwater Budget and Annual Non-Storm Flows at the LA/Ventura County Line Under the 2014 Level of Development

Water Budget Development for the Santa Clara River Valley East Groundwater Subbasin

DRAFT

LEGEND

- Stream Gains
- Stream Losses
- Precipitation
- Ag+Muni Irrigation
- Subsurface Inflow in Tributaries
- Septic
- Pumping
- ET
- Groundwater Storage Increase
- Groundwater Storage Reduction

NOTES

This projected water budget is developed by projecting the 1925-2019 historical hydrology forward in time.
Ag: agriculture
Muni: municipal
ET: evapotranspiration

GSI Water Solutions, Inc.

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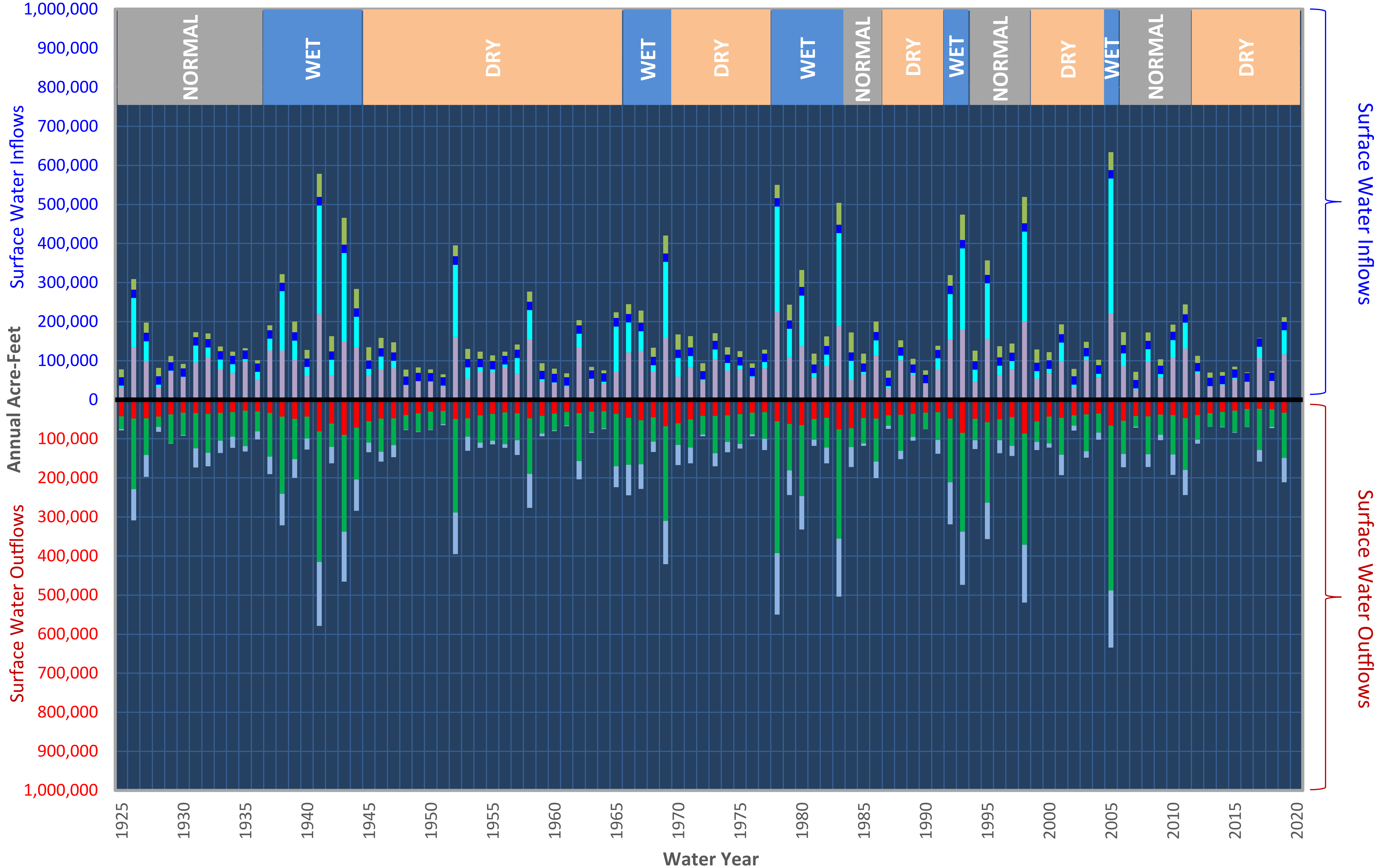

FIGURE 5-1

Projected Surface Water Budget Under Full Buildout Conditions Without Climate Change

Water Budget Development for the Santa Clara River Valley East Groundwater Subbasin

DRAFT

LEGEND

- Precipitation
- Stream Inflows
- Point-Source Flows to Streams
- Net Inflow from Groundwater
- Non-Storm Flow at County Line
- ET and Storm Outflows
- Groundwater Recharge from Streams and Rainfall

NOTES

This projected water budget is developed by projecting the 1925-2019 historical hydrology forward in time.
ET: evapotranspiration

GSI Water Solutions, Inc.

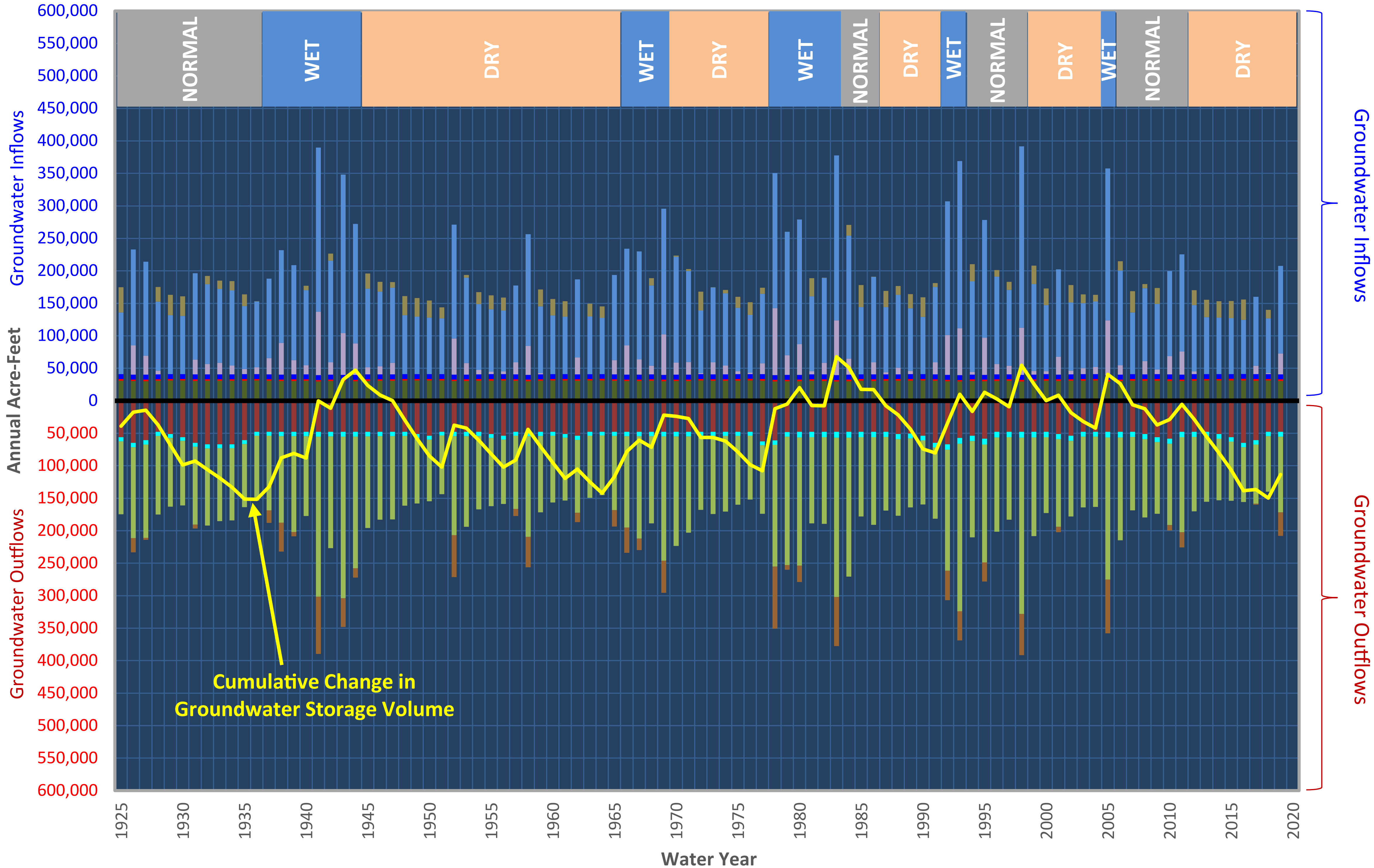

FIGURE 5-2

Projected Groundwater Budget Under Full Buildout Conditions Without Climate Change

Water Budget Development for the Santa Clara River Valley East Groundwater Subbasin

DRAFT

LEGEND

- Stream Gains
- Stream Losses
- Precipitation
- Ag+Muni Irrigation
- Subsurface Inflow in Tributaries
- Septic
- Pumping
- ET
- Groundwater Storage Increase
- Groundwater Storage Reduction

NOTES

This projected water budget is developed by projecting the 1925-2019 historical hydrology forward in time.
Ag: agriculture
Muni: municipal
ET: evapotranspiration

GSI Water Solutions, Inc.

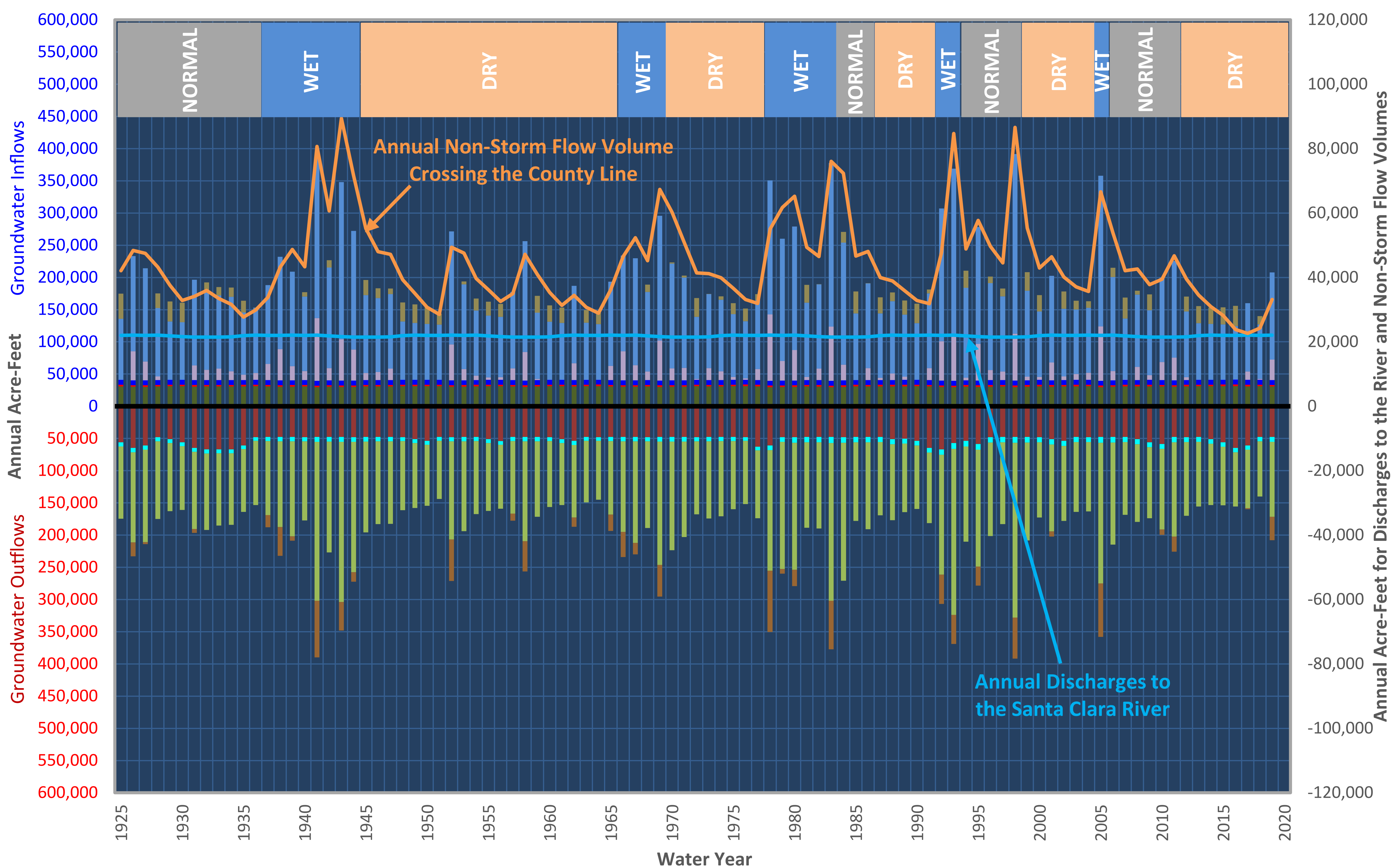

FIGURE 5-3

Projected Groundwater Budget and Annual Non-Storm Flows at the LA/Ventura County Line Under Full Buildout Conditions Without Climate Change

Water Budget Development for the Santa Clara River Valley East Groundwater Subbasin

DRAFT

LEGEND

- Stream Gains
- Stream Losses
- Precipitation
- Ag+Muni Irrigation
- Subsurface Inflow in Tributaries
- Septic
- Pumping
- ET
- Groundwater Storage Increase
- Groundwater Storage Reduction

NOTES

This projected water budget is developed by projecting the 1925-2019 historical hydrology forward in time.
Ag: agriculture
Muni: municipal
ET: evapotranspiration

GSI Water Solutions, Inc.

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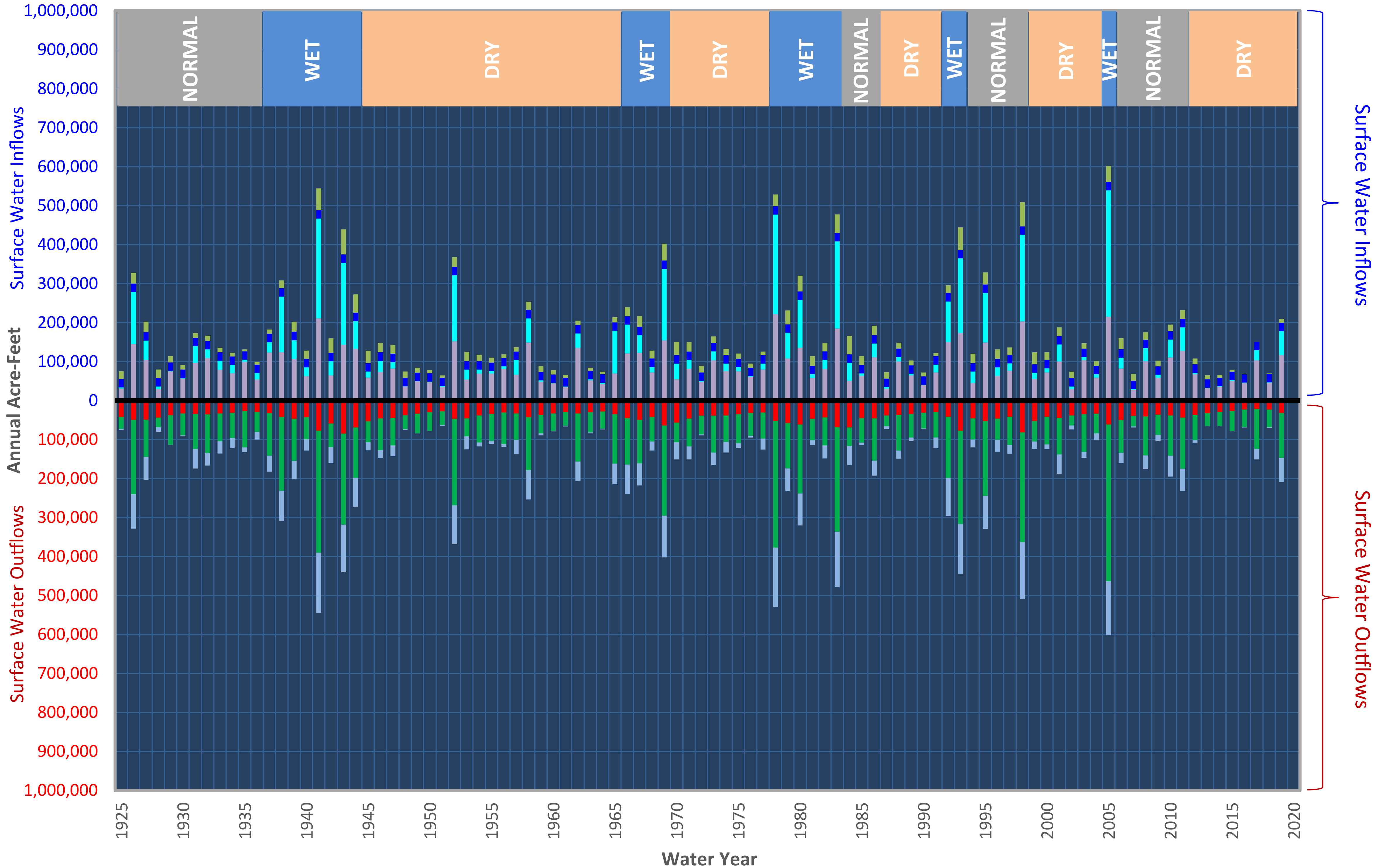


FIGURE 5-4

Projected Surface Water Budget for Year 2042 Under Full Buildout Conditions With 2030 Average Climate Change

Water Budget Development for the Santa Clara River Valley East Groundwater Subbasin

DRAFT

LEGEND

- Precipitation
- Stream Inflows
- Point-Source Flows to Streams
- Net Inflow from Groundwater
- Non-Storm Flow at County Line
- ET and Storm Outflows
- Groundwater Recharge from Streams and Rainfall

NOTES

This projected water budget is developed by projecting the 1925-2019 historical hydrology forward in time.

ET: evapotranspiration

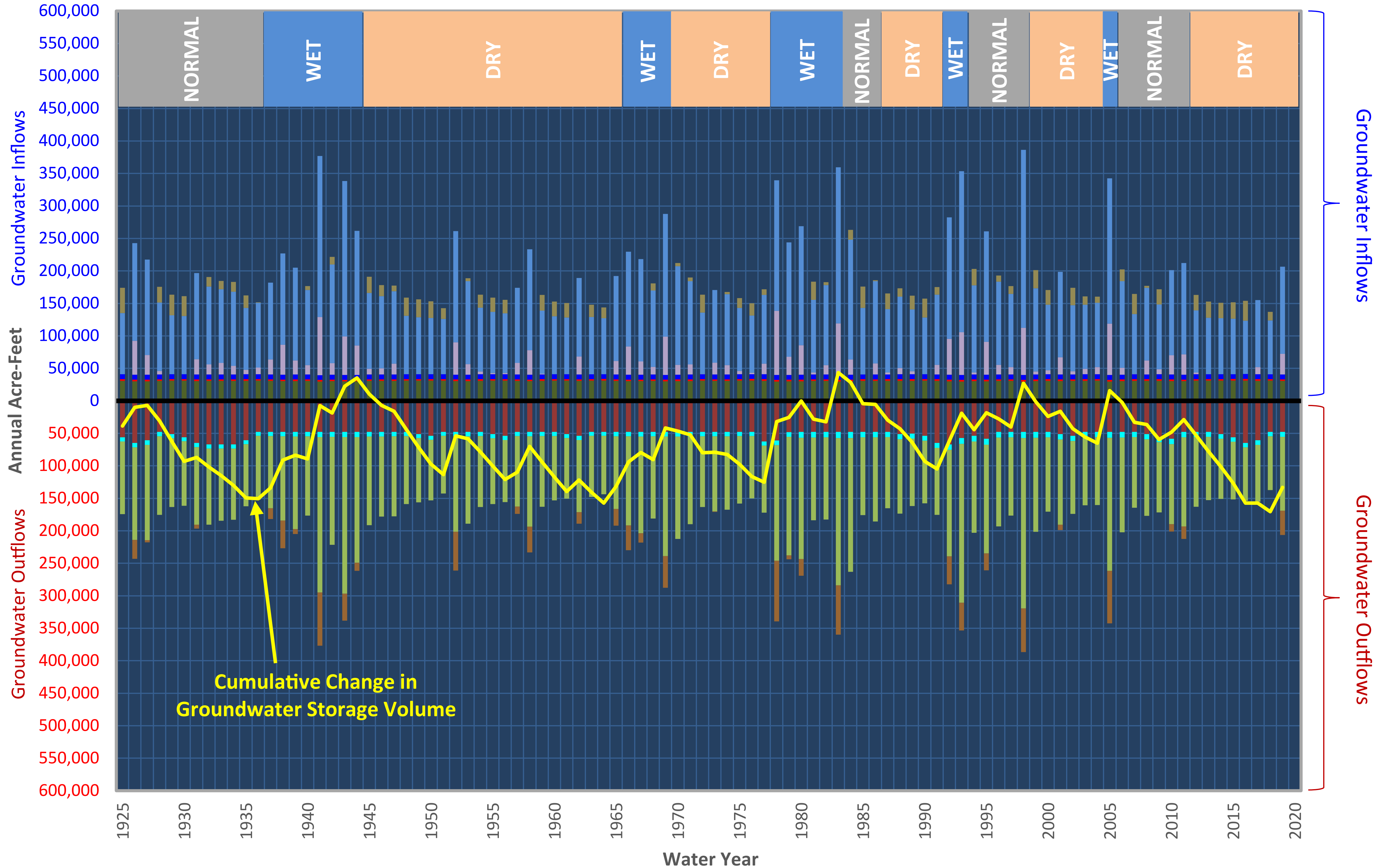
GSI Water Solutions, Inc.

FIGURE 5-5

Projected Groundwater Budget for Year 2042 Under Full Buildout Conditions With 2030 Average Climate Change

Water Budget Development for the Santa Clara River Valley East Groundwater Subbasin

DRAFT



LEGEND

- Stream Gains
- Stream Losses
- Precipitation
- Ag+Muni Irrigation
- Subsurface Inflow in Tributaries
- Septic
- Pumping
- ET
- Groundwater Storage Increase
- Groundwater Storage Reduction

NOTES

This projected water budget is developed by projecting the 1925-2019 historical hydrology forward in time.
Ag: agriculture
Muni: municipal
ET: evapotranspiration

GSI Water Solutions, Inc.

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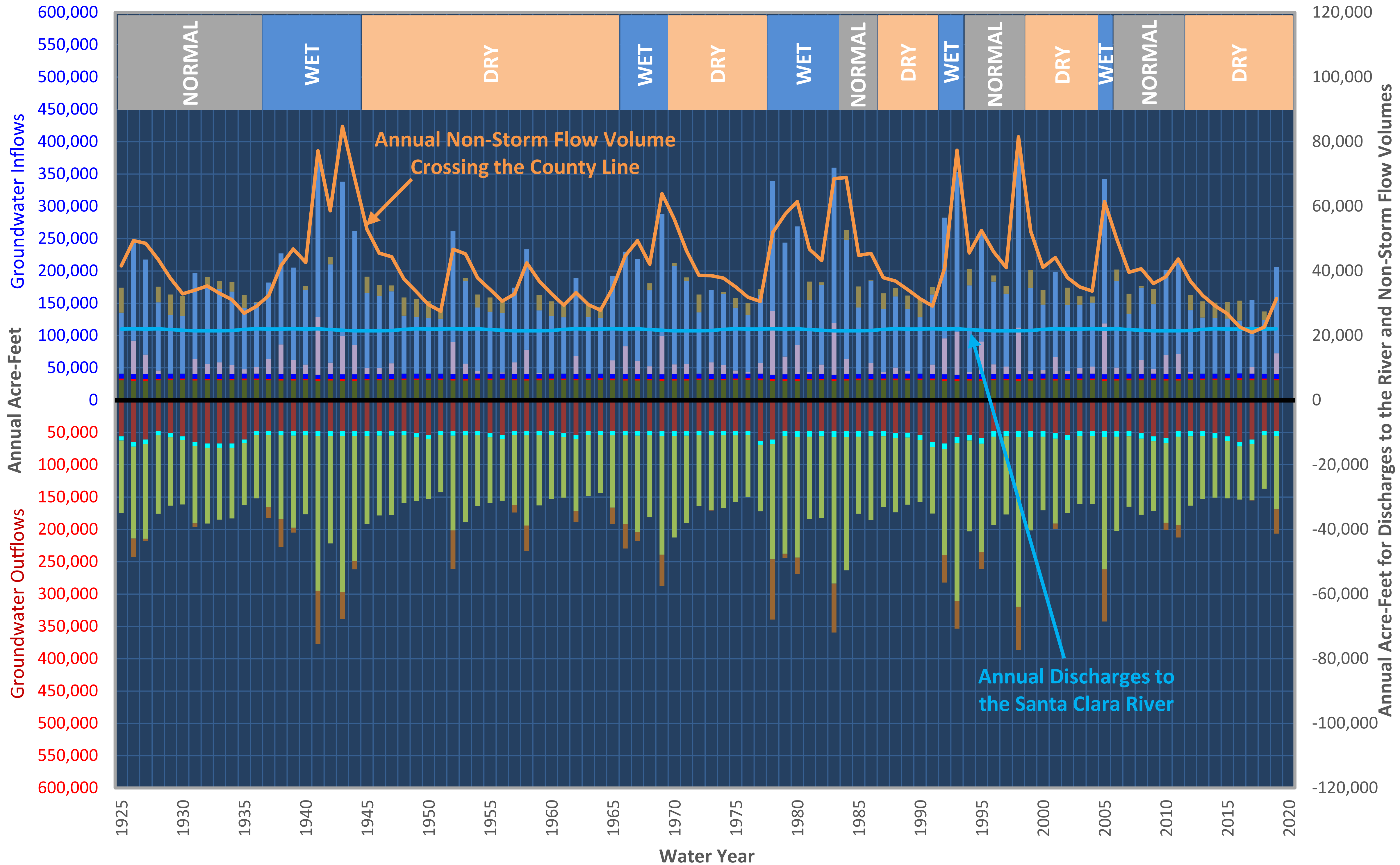

FIGURE 5-6

Projected Groundwater Budget and Annual Non-Storm Flows at the LA/Ventura County Line for Year 2042 Under Full Buildout Conditions With 2030 Average Climate Change

Water Budget Development for the Santa Clara River Valley East Groundwater Subbasin

DRAFT

LEGEND

- Stream Gains
- Stream Losses
- Precipitation
- Ag+Muni Irrigation
- Subsurface Inflow in Tributaries
- Septic
- Pumping
- ET
- Groundwater Storage Increase
- Groundwater Storage Reduction

NOTES

This projected water budget is developed by projecting the 1925-2019 historical hydrology forward in time.
Ag: agriculture
Muni: municipal
ET: evapotranspiration

GSI Water Solutions, Inc.

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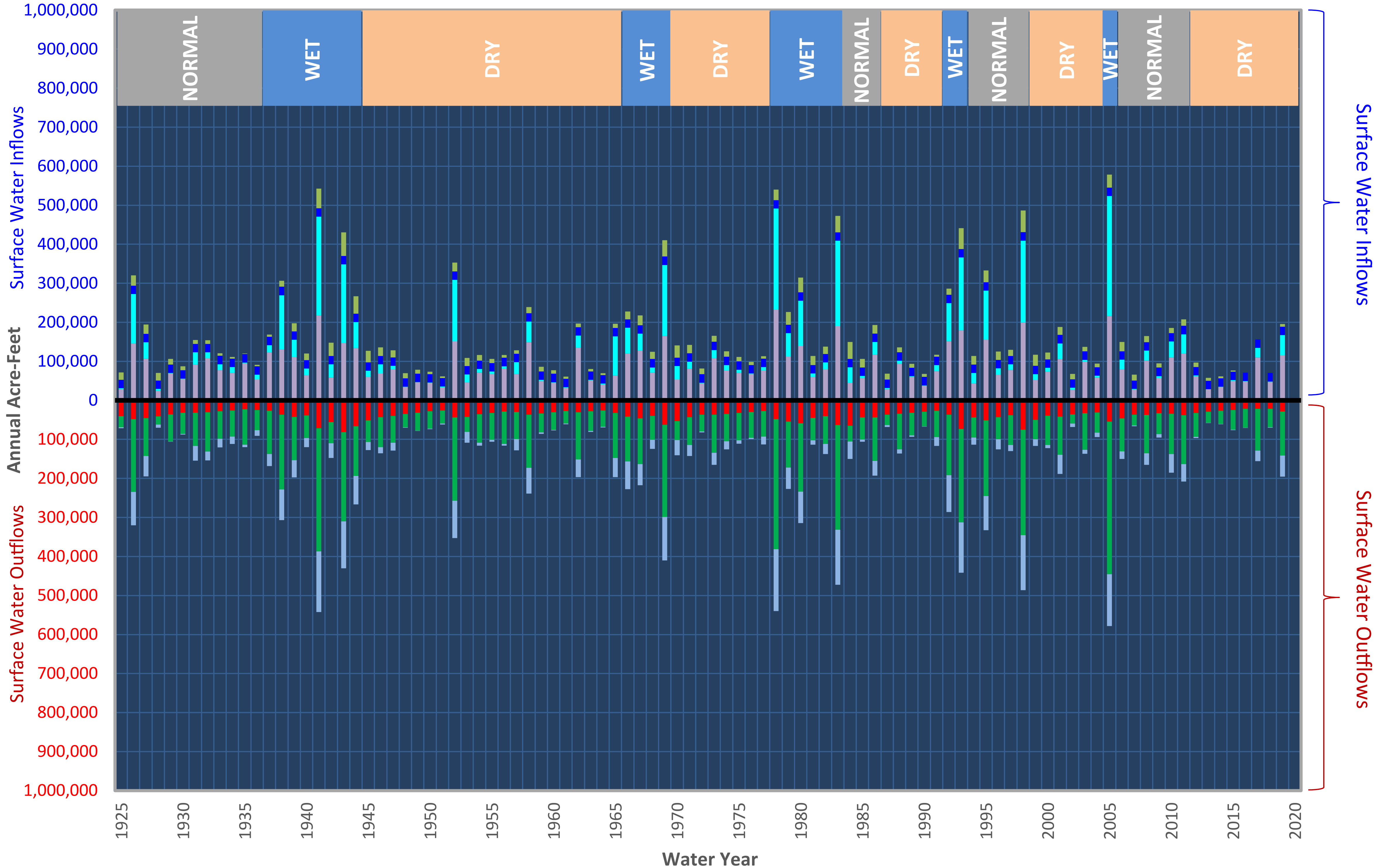

FIGURE 5-7

Projected Surface Water Budget for Year 2072 Under Full Buildout Conditions With 2070 Average Climate Change

Water Budget Development for the Santa Clara River Valley East Groundwater Subbasin

DRAFT

LEGEND

- Precipitation
- Stream Inflows
- Point-Source Flows to Streams
- Net Inflow from Groundwater
- Non-Storm Flow at County Line
- ET and Storm Outflows
- Groundwater Recharge from Streams and Rainfall

NOTES

This projected water budget is developed by projecting the 1925-2019 historical hydrology forward in time.
ET: evapotranspiration

GSI Water Solutions, Inc.

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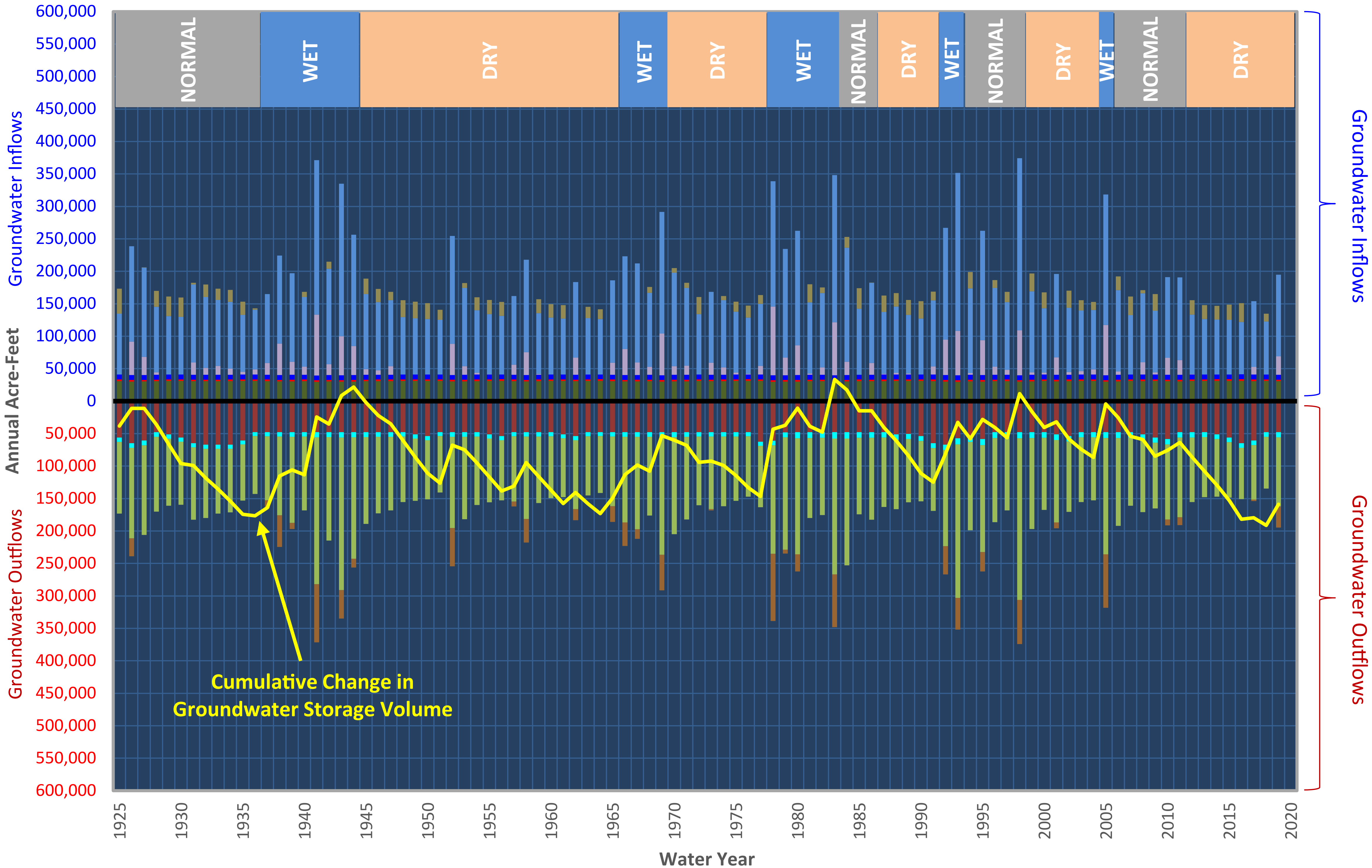

FIGURE 5-8

Projected Groundwater Budget for Year 2072 Under Full Buildout Conditions With 2070 Average Climate Change

Water Budget Development for the Santa Clara River Valley East Groundwater Subbasin

DRAFT

LEGEND

- Stream Gains
- Stream Losses
- Precipitation
- Ag+Muni Irrigation
- Subsurface Inflow in Tributaries
- Septic
- Pumping
- ET
- Groundwater Storage Increase
- Groundwater Storage Reduction

NOTES

This projected water budget is developed by projecting the 1925-2019 historical hydrology forward in time.
Ag: agriculture
Muni: municipal
ET: evapotranspiration

GSI Water Solutions, Inc.

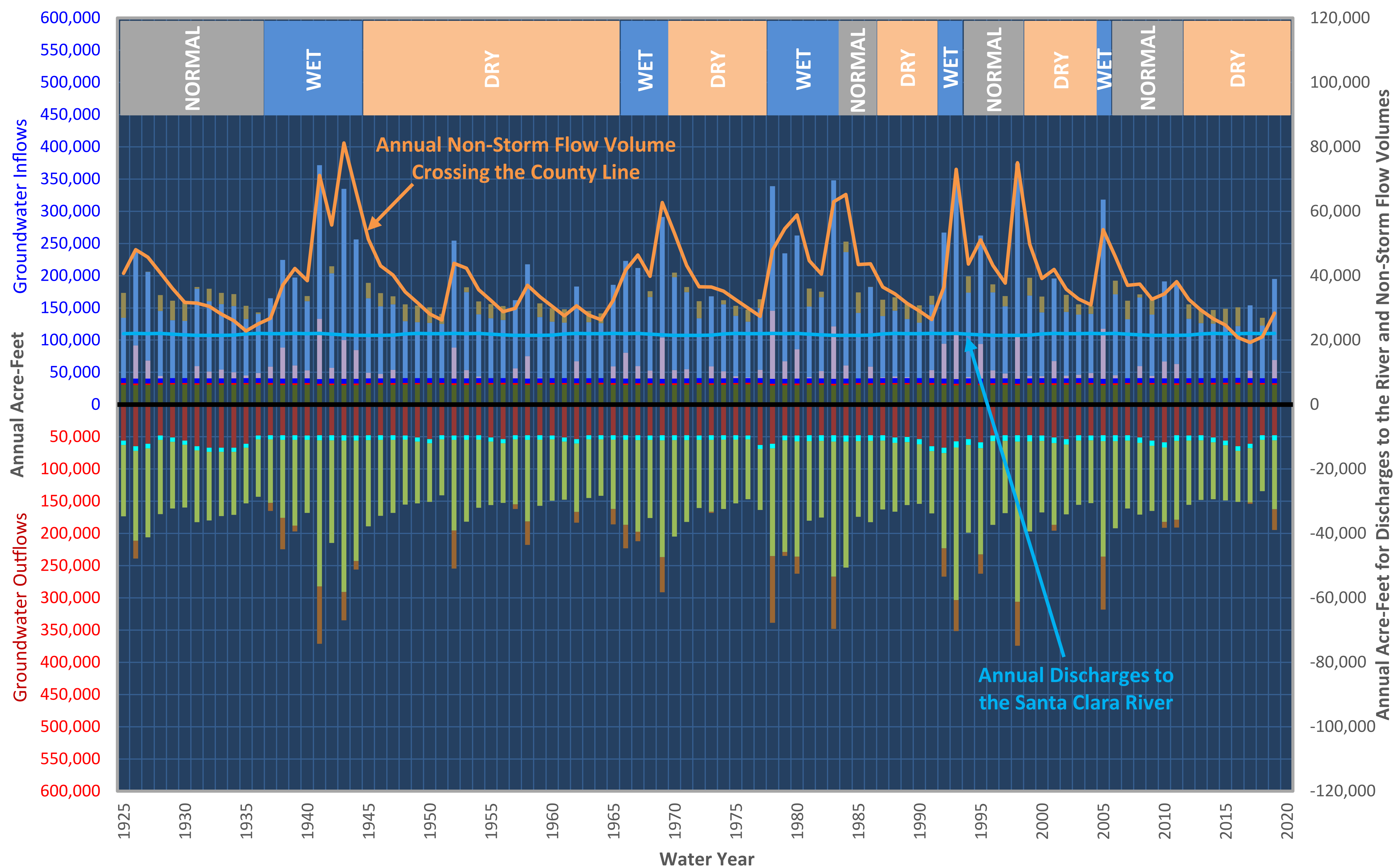

FIGURE 5-9

Historical Groundwater Budget and Annual Non-Storm Flows at the LA/Ventura County Line for Year 2072 Under Full Buildout Conditions With 2070 Average Climate Change

Water Budget Development for the Santa Clara River Valley East Groundwater Subbasin

DRAFT

LEGEND

- Stream Gains
- Stream Losses
- Precipitation
- Ag+Muni Irrigation
- Subsurface Inflow in Tributaries
- Septic
- Pumping
- ET
- Groundwater Storage Increase
- Groundwater Storage Reduction

NOTES

This projected water budget is developed by projecting the 1925-2019 historical hydrology forward in time.
Ag: agriculture
Muni: municipal
ET: evapotranspiration

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Appendices

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APPENDIX A

Locations of Agricultural Lands and Irrigation Supply Wells in 1947

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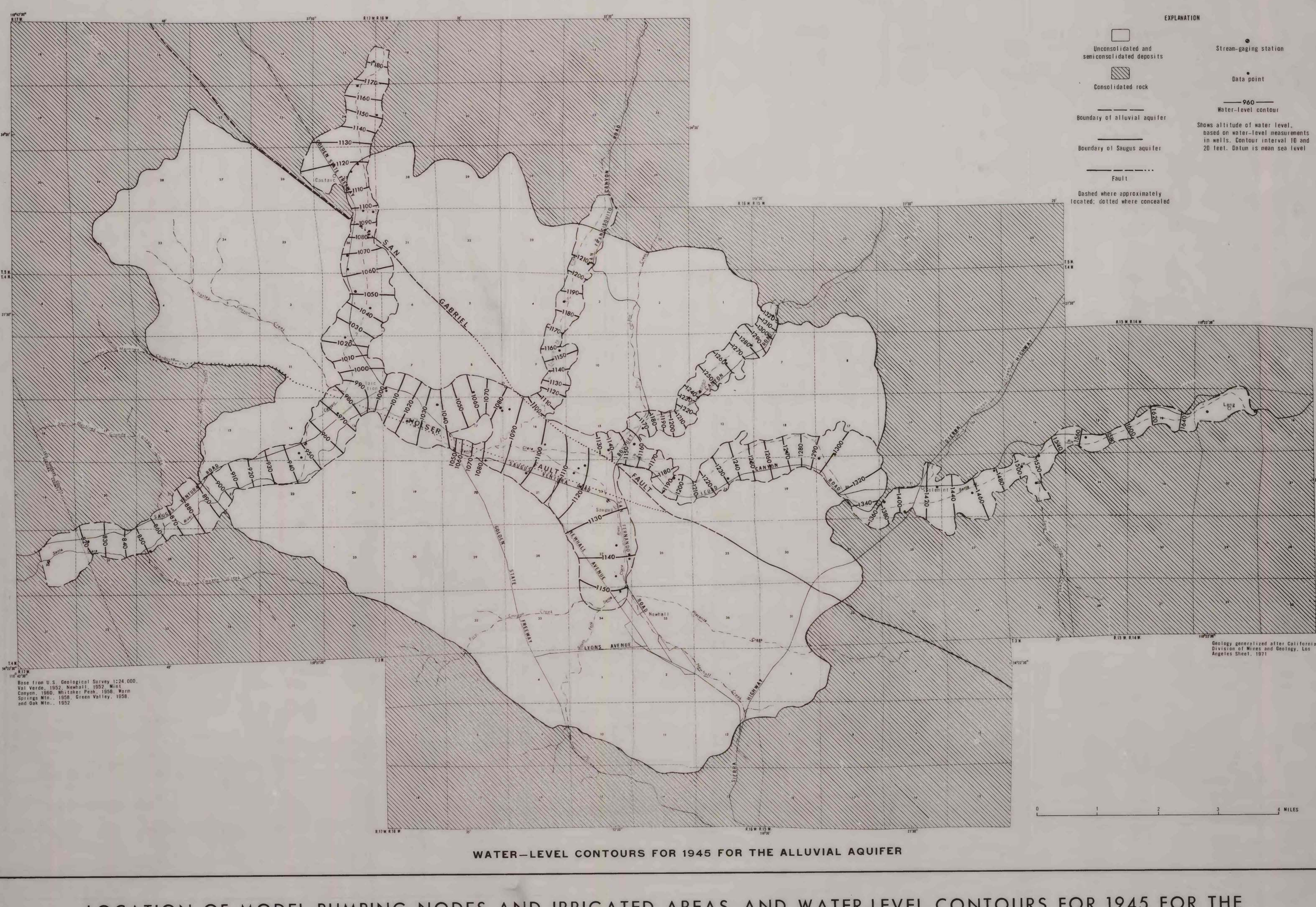
PREPARED IN COOPERATION WITH THE NEWHALL COUNTY WATER DISTRICT

LOCATION OF MODEL PUMPING NODES AND IRRIGATED AREAS



WATER—LEVEL CONTOURS FOR 1945 FOR THE ALLUVIAL AQUIFER

LOCATION OF MODEL PUMPING NODES AND IRRIGATED AREAS AND WATER-LEVEL CONTOURS FOR 1945 FOR THE ALLUVIAL AQUIFER IN THE SAUGUS-NEWHALL AREA, CALIFORNIA

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APPENDIX B

Annual Water Budget Tables: Historical Conditions

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Table B-1

Annual Surface Water Budget for Historical Conditions (Water Years 1925 through 2019)

Water Budget Development for the Santa Clara River Valley East Groundwater Subbasin

Water Year	In-Basin Precipitation	Stormwater Generated from In-Basin Precipitation	Stream Inflow (Santa Clara River)	Stream Inflow (Releases from Castaic Lake/ Lagoon)	Stream Inflow (Releases from Bouquet Reservoir)	Stream Inflow (Other Santa Clara River Tributaries)	Discharges to Santa Clara River from Saugus WRP	Discharges to Santa Clara River from Valencia WRP	Discharges to Santa Clara River from Groundwater Treatment Systems	Net Inflow from Groundwater	TOTAL SURFACE WATER INFLOW	Santa Clara River Non-Storm Outflow at LA/Ventura County Line	Groundwater Recharge from Precipitation	Groundwater Recharge from Ephemeral Streams	ET and Stormwater Outflow	TOTAL SURFACE WATER OUTFLOW
1925	33,042	33,042	1,418	1,471	0	0	0	0	0	53,775	89,706	53,620	0	2,889	33,197	89,706
1926	133,419	88,224	10,985	59,265	0	56,544	0	0	0	69,014	329,227	69,515	45,195	34,432	180,085	329,227
1927	100,190	70,932	3,573	14,351	0	31,678	0	0	0	72,468	222,261	72,697	29,258	26,886	93,420	222,261
1928	30,776	25,093	1,015	622	0	6,083	0	0	0	61,760	100,256	61,590	5,683	6,794	26,189	100,256
1929	73,314	73,314	602	523	0	0	0	0	0	52,740	127,179	52,576	0	1,125	73,478	127,179
1930	57,272	57,272	1,140	523	0	0	0	0	0	47,730	106,665	47,622	0	1,663	57,380	106,665
1931	95,197	72,289	4,027	13,673	0	26,054	0	0	0	53,843	192,793	54,223	22,908	25,732	89,931	192,793
1932	109,562	93,435	2,215	5,759	0	16,355	0	0	0	58,844	192,735	58,952	16,127	17,790	99,866	192,735
1933	78,871	61,171	1,742	7,264	0	15,050	0	0	0	56,787	159,714	56,930	17,700	13,706	71,378	159,714
1934	68,848	55,259	3,857	9,167	102	9,294	0	0	0	56,380	147,647	56,425	13,589	14,609	63,024	147,647
1935	98,241	90,203	407	1,465	111	4,366	0	0	0	51,918	156,508	51,876	8,038	5,696	90,899	156,508
1936	52,873	42,370	246	9,238	111	8,920	0	0	0	49,294	120,682	49,316	10,503	9,989	50,874	120,682
1937	126,250	101,192	3,857	9,167	111	17,379	0	0	0	49,936	206,700	50,109	25,058	19,793	111,741	206,700
1938	126,334	77,746	407	86,803	111	64,532	0	0	0	58,182	336,369	58,664	48,588	31,816	197,300	336,369
1939	101,596	79,664	11,336	7,899	111	30,288	0	0	0	57,741	208,970	58,572	21,932	26,283	102,183	208,970
1940	61,008	47,136	711	9,249	111	12,963	0	0	0	45,132	129,174	45,029	13,872	14,497	55,776	129,174
1941	219,669	122,351	37,844	101,811	111	138,049	0	0	0	84,018	581,501	86,927	97,318	65,925	331,331	581,501
1942	63,314	44,404	1,916	8,766	111	28,197	0	0	0	56,978	159,282	56,881	18,910	23,798	59,694	159,282
1943	149,184	84,937	33,737	99,911	111	92,611	0	0	0	81,613	457,168	86,636	64,247	63,884	242,401	457,168
1944	134,174	85,957	818	16,158	111	61,091	0	0	0	59,107	271,459	59,283	48,217	31,565	132,394	271,459
1945	61,176	49,947	1,449	5,759	111	10,791	0	0	0	39,107	118,393	38,907	11,229	13,306	54,950	118,393
1946	78,409	65,880	1,775	20,338	111	9,884	0	0	0	29,522	140,039	29,418	12,529	12,963	85,128	140,039
1947	80,966	63,195	1,130	488	111	17,113	0	0	0	28,073	127,881	28,156	17,771	13,067	68,887	127,881
1948	37,275	37,275	350	517	111	0	0	0	0	20,641	58,893	20,530	0	978	37,385	58,893
1949	46,752	46,752	281	523	111	0	0	0	0	17,005	64,672	16,956	0	915	46,801	64,672
1950	45,871	45,871	940	194	111	0	0	0	0	14,660	61,776	14,642	0	1,245	45,889	61,776
1951	34,298	34,298	775	1,333	111	0	0	0	0	13,278	49,795	13,270	0	2,219	34,306	49,795
1952	160,212	104,720	21,239	86,267	111	77,917	0	0	0	22,082	367,828	22,584	55,492	51,210	238,542	367,828
1953	54,382	36,903	2,250	1,554	111	24,542	0	0	0	26,298	109,138	26,367	17,479	18,109	47,183	109,138
1954	71,616	64,951	1,997	8,165	111	1,470	0	0	0	19,886	103,245	19,793	6,665	6,447	70,340	103,245
1955	70,149	66,388	1,268	5,793	111	582	0	0	0	17,032	94,935	16,993	3,761	5,762	68,419	94,935
1956	83,104	79,154	1,098	6,016	111	398	0	0	0	15,231	105,957	15,229	3,950	5,657	81,121	105,957
1957	66,039	47,704	906	20,338	111	19,156	0	0	0	15,351	121,900	15,381	18,335	19,451	68,733	121,900
1958	154,928	110,691	7,344	20,276	111	46,906	0	0	0	22,578	252,143	22,874	44,237	42,958	142,074	252,143
1959	47,882	45,980	1,777	817	111	2,027	0	0	0	20,005	72,619	19,922	1,902	4,724	46,071	72,619
1960	43,230	43,230	807	523	111	0	0	0	0	16,317	60,988	16,247	0	1,441	43,301	60,988
1961	34,677	34,677	979	523	111	0	0	0	0	11,404	47,693	11,311	0	1,613	34,769	47,693
1962	134,007	107,986	4,195	6,908	111	23,990	0	0	0	16,513	185,724	16,766	26,021	20,656	122,280	185,724
1963	51,406	51,354	1,159	967	111	48	187	0	0	17,877	71,755	18,073	52	2,285	51,345	71,755
1964	42,768	42,768	696	2,853	111	0	437	0	0	18,261	65,126	18,694	0	2,155	44,277	65,126
1965	71,153	49,441	433	86,180	111	29,809	687	0	0	26,169	214,542	27,246	21,712	31,819	133,765	214,542

Table B-1

Annual Surface Water Budget for Historical Conditions (Water Years 1925 through 2019)

Water Budget Development for the Santa Clara River Valley East Groundwater Subbasin

Water Year	In-Basin Precipitation	Stormwater Generated from In-Basin Precipitation	Stream Inflow (Santa Clara River)	Stream Inflow (Releases from Castaic Lake/ Lagoon)	Stream Inflow (Releases from Bouquet Reservoir)	Stream Inflow (Other Santa Clara River Tributaries)	Discharges to Santa Clara River from Saugus WRP	Discharges to Santa Clara River from Valencia WRP	Discharges to Santa Clara River from Groundwater Treatment Systems	Net Inflow from Groundwater	TOTAL SURFACE WATER INFLOW	Santa Clara River Non-Storm Outflow at LA/Ventura County Line	Groundwater Recharge from Precipitation	Groundwater Recharge from Ephemeral Streams	ET and Stormwater Outflow	TOTAL SURFACE WATER OUTFLOW
1966	121,007	75,997	9,236	7,020	111	60,619	937	0	0	37,417	236,347	38,837	45,010	33,049	119,450	236,347
1967	125,494	102,129	8,260	20,338	111	21,515	1,187	90	0	42,738	219,733	44,721	23,365	39,499	112,149	219,733
1968	71,531	58,292	2,008	488	111	14,180	1,437	281	0	39,443	129,479	41,201	13,239	13,043	61,996	129,479
1969	157,907	95,701	23,229	86,174	111	85,563	1,687	496	0	60,748	415,915	65,330	62,206	48,411	239,969	415,915
1970	59,833	41,323	4,404	21,342	111	21,060	1,937	711	0	54,201	163,599	57,387	18,510	33,158	54,544	163,599
1971	83,858	64,746	4,486	3,780	111	19,853	2,187	926	0	44,554	159,755	47,782	19,112	21,436	71,425	159,755
1972	49,267	47,794	1,564	811	111	140	2,437	1,141	0	34,520	89,991	37,950	1,473	2,626	47,943	89,991
1973	103,985	85,471	3,693	6,902	111	14,411	2,687	1,356	0	33,628	166,774	37,738	18,514	14,663	95,859	166,774
1974	75,432	61,739	1,674	10,206	111	8,061	2,937	1,571	0	32,300	132,292	36,871	13,693	15,372	66,357	132,292
1975	77,485	72,973	814	3,764	111	2,441	3,187	1,786	0	27,912	117,499	32,827	4,512	5,762	74,398	117,499
1976	57,654	55,351	259	0	111	229	3,437	2,001	0	23,866	87,556	29,228	2,303	599	55,427	87,556
1977	80,504	63,684	147	0	111	14,538	3,687	2,216	0	23,345	124,547	29,327	16,820	10,992	67,409	124,547
1978	224,449	121,463	21,288	22,293	111	148,404	3,937	2,431	0	49,112	472,025	56,595	102,986	54,803	257,641	472,025
1979	109,604	79,475	6,314	27,403	111	31,125	4,187	2,646	0	53,347	234,737	60,295	30,129	32,912	111,400	234,737
1980	136,984	89,796	11,607	14,786	111	58,191	4,511	2,808	0	54,528	283,526	79,622	47,188	37,373	119,343	283,526
1981	57,610	52,814	1,836	4,541	124	2,798	4,730	2,903	0	37,350	111,892	53,258	4,796	9,019	44,819	111,892
1982	86,792	68,847	3,802	6,471	109	15,625	5,200	3,238	0	36,683	157,920	51,670	17,945	21,318	66,987	157,920
1983	188,515	104,388	27,927	63,058	110	119,739	5,800	3,395	0	66,368	474,912	82,097	84,127	59,458	249,231	474,912
1984	51,574	26,971	1,372	8,992	109	36,494	5,823	3,625	0	64,869	172,858	78,622	24,603	27,042	42,591	172,858
1985	65,286	65,286	3,010	1,635	108	0	5,642	3,903	0	39,239	118,823	51,485	0	4,753	62,585	118,823
1986	112,958	94,399	4,169	5,624	108	14,139	5,868	4,554	0	37,531	184,951	50,888	18,559	20,815	94,688	184,951
1987	29,853	26,606	2,022	1,005	112	1,800	5,606	6,029	0	33,270	79,697	46,940	3,247	4,940	24,570	79,697
1988	101,049	90,978	4,031	4,544	111	3,435	5,171	7,119	0	31,710	157,170	45,878	10,071	11,721	89,500	157,170
1989	64,154	59,171	1,449	932	110	2,127	5,440	7,877	0	28,434	110,523	43,218	4,983	4,260	58,062	110,523
1990	41,636	41,636	217	532	113	0	5,594	8,278	0	23,751	80,121	38,807	0	862	40,452	80,121
1991	78,828	60,208	3,705	1,655	111	16,748	5,911	8,104	0	23,844	138,907	39,073	18,620	17,338	63,876	138,907
1992	154,677	93,651	3,510	18,681	108	81,720	5,903	9,556	0	39,599	313,754	57,019	61,026	47,801	147,908	313,754
1993	178,451	106,498	24,328	22,246	108	97,420	6,796	10,022	0	79,281	418,651	99,983	71,953	65,209	181,506	418,651
1994	45,536	41,672	19,954	6,255	107	5,189	7,556	9,460	0	36,889	130,946	54,608	3,864	17,134	55,341	130,946
1995	156,731	99,912	634	7,062	110	76,517	7,841	9,970	0	46,171	305,036	65,474	56,819	36,146	146,597	305,036
1996	62,558	46,697	3,026	6,957	108	15,028	6,417	10,526	0	36,117	140,737	53,756	15,861	17,885	53,235	140,737
1997	77,738	64,428	2,072	10,647	105	8,936	6,052	9,932	0	26,727	142,209	43,419	13,310	11,531	73,949	142,209
1998	201,137	128,358	35,204	47,365	100	97,591	6,186	11,096	0	62,719	461,398	83,307	72,779	74,439	230,873	461,398
1999	54,843	49,190	2,087	8,994	117	7,971	6,317	11,458	0	38,040	129,827	56,354	5,653	14,827	52,993	129,827
2000	68,135	63,321	2,204	7,563	108	501	6,019	12,492	0	24,936	121,958	43,951	4,814	6,432	66,761	121,958
2001	99,226	71,641	3,880	2,695	108	29,199	6,373	12,468	0	27,157	181,107	46,782	27,585	24,181	82,559	181,107
2002	30,776	25,093	1,015	0	106	6,083	6,279	13,566	0	20,461	78,285	40,785	5,683	6,278	25,539	78,285
2003	102,056	92,930	1,088	3,019	108	3,626	5,266	15,167	0	19,210	149,540	40,106	9,126	5,867	94,441	149,540
2004	56,982	45,918	30	1,063	107	7,671	4,364	15,941	0	19,640	105,797	40,410	11,064	6,989	47,335	105,797
2005	219,962	135,800	37,844	91,241	47	111,067	4,624	18,137	0	52,027	534,948	76,616	84,162	60,612	313,558	534,948
2006	86,291	71,887	4,712	17,844	53	10,033	5,211	17,839	0	35,690	177,674	58,978	14,404	18,654	85,637	177,674

Table B-1
Annual Surface Water Budget for Historical Conditions (Water Years 1925 through 2019)
Water Budget Development for the Santa Clara River Valley East Groundwater Subbasin

Water Year	In-Basin Precipitation	Stormwater Generated from In-Basin Precipitation	Stream Inflow (Santa Clara River)	Stream Inflow (Releases from Castaic Lake/ Lagoon)	Stream Inflow (Releases from Bouquet Reservoir)	Stream Inflow (Other Santa Clara River Tributaries)	Discharges to Santa Clara River from Saugus WRP	Discharges to Santa Clara River from Valencia WRP	Discharges to Santa Clara River from Groundwater Treatment Systems	Net Inflow from Groundwater	TOTAL SURFACE WATER INFLOW	Santa Clara River Non-Storm Outflow at LA/Ventura County Line	Groundwater Recharge from Precipitation	Groundwater Recharge from Ephemeral Streams	ET and Stormwater Outflow	TOTAL SURFACE WATER OUTFLOW
2007	27,422	26,733	645	0	55	225	5,661	17,153	0	22,589	73,751	45,589	689	925	26,547	73,751
2008	96,940	76,786	1,286	10,579	62	18,080	5,544	17,633	0	22,722	172,845	46,360	20,154	15,161	91,171	172,845
2009	57,192	49,796	159	2,552	119	4,727	5,679	16,974	0	15,772	103,174	38,677	7,396	6,629	50,472	103,174
2010	107,549	79,348	1,059	10,185	127	32,972	5,461	16,849	1,099	19,818	195,119	43,688	28,201	23,756	99,474	195,119
2011	131,113	95,681	4,465	22,247	131	36,536	5,593	16,401	693	27,551	244,730	50,871	35,432	29,255	129,171	244,730
2012	67,381	62,933	1,094	709	73	2,719	5,662	16,228	0	18,580	112,447	40,615	4,448	4,572	62,812	112,447
2013	34,716	34,716	0	0	43	0	5,701	16,081	0	12,647	69,188	34,529	0	43	34,616	69,188
2014	38,701	38,701	215	0	33	0	6,033	15,232	0	8,820	69,033	30,172	0	248	38,613	69,033
2015	53,962	53,962	65	0	36	0	5,862	14,586	0	7,150	81,661	27,800	0	101	53,760	81,661
2016	45,578	45,481	22	0	34	5	5,600	14,225	0	6,707	72,171	26,685	97	61	45,329	72,171
2017	107,046	94,125	10,551	19,581	48	5,751	5,703	14,564	4	15,019	178,267	35,708	12,921	19,198	110,440	178,267
2018	46,753	45,103	0	0	62	176	5,485	14,577	2,532	13,689	83,274	36,453	1,650	238	44,933	83,274
2019	116,061	84,034	3,102	19,231	60	37,583	5,195	14,931	3,700	28,335	228,197	52,878	32,027	30,947	112,346	228,197
Min	**27,422**	**25,093**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**6,707**	**47,693**	**11,311**	**0**	**43**	**24,570**	**47,693**
Max	**224,449**	**135,800**	**37,844**	**101,811**	**131**	**148,404**	**7,841**	**18,137**	**3,700**	**84,018**	**581,501**	**99,983**	**102,986**	**74,439**	**331,331**	**581,501**
Average	**87,602**	**67,019**	**5,173**	**14,741**	**93**	**24,154**	**2,809**	**4,974**	**85**	**36,035**	**175,666**	**44,905**	**20,583**	**18,823**	**91,355**	**175,666**
Percent of Total	**50%**		**3%**	**8%**	**0.05%**	**14%**	**2%**	**3%**	**0.05%**	**21%**	**100%**	**25%**	**12%**	**11%**	**52%**	**100%**

All yearly, minimum, maximum, and average values are in units of acre-feet per year (AFY).

Abbreviations: WRP = water reclamation plant ET = evapotranspiration

Note: Blue font means inflow to surface water, purple font means internal surface flow process, and red font means surface water outflow.

Note: The "percent of total" values are calculated from the average values of the individual and total water budget terms.

Note: For WRPs, the statistics are for all years, including years before they were present.

Note: All values are from historical data, except the following:

The internal flow term *Stormwater Generated from In-Basin Precipitation* is the difference between the basin-wide rainfall volume and the volume of streamflow percolation to groundwater from ephemeral streams.

The inflow term *Net Inflow from Groundwater* is computed by the SFR package in MODFLOW-USG and represents the net flux of groundwater into all streams basin-wide.

The outflow term *Santa Clara River Non-Storm Outflow at LA/Ventura County Line* is calculated by the SFR and CHD packages in MODFLOW-USG.

The outflow term *Groundwater Recharge from Precipitation* is calculated by the SCV Recharge Compiler and is provided as input to the RCH package in MODFLOW-USG.

The outflow term *Groundwater Recharge from Ephemeral Streams* is calculated by the SCV Recharge Compiler and is provided as input to the RCH package in MODFLOW-USG.

The outflow term *ET and Stormwater Outflow* is calculated from the balance of all other terms in this surface water budget.

Table B-2

Annual Groundwater Budget for Historical Conditions (Water Years 1925 through 2019)

Water Budget Development for the Santa Clara River Valley East Groundwater Subbasin

Water Year	Recharge from Precipitation (a)	Recharge from Streams (b)	Subsurface Inflow Beneath Castaic Dam (c)	Subsurface Inflow Beneath Santa Clara River and Other Tributaries (d)	Septic System Recharge (e)	Recharge of Applied Water (f)	TOTAL INFLOW TO GROUNDWATER (g)	Groundwater Pumping (h)	Riparian Evapo-transpiration (i)	Groundwater Discharge to Streams (j)	TOTAL OUTFLOW FROM GROUNDWATER (k)	Change in GW Storage (l)	Cumulative Change in GW Storage (m)
1925	0	83,121	1,676	29,334	0	0	114,131	0	7,259	134,007	141,266	-27,135	-27,135
1926	45,195	141,309	1,676	28,643	0	0	216,822	0	7,663	175,891	183,554	33,268	6,133
1927	29,258	143,697	1,676	28,589	0	0	203,220	0	7,810	189,280	197,090	6,130	12,263
1928	5,683	100,478	1,680	29,113	0	0	136,954	0	7,553	155,444	162,997	-26,043	-13,780
1929	0	80,920	1,676	29,409	0	0	112,005	0	7,262	132,535	139,796	-27,791	-41,571
1930	0	79,411	1,676	29,459	0	0	110,547	0	7,103	125,479	132,582	-22,035	-63,606
1931	22,908	123,116	1,676	28,955	0	0	176,655	0	7,353	151,228	158,581	18,074	-45,532
1932	16,127	115,172	1,680	28,995	0	0	161,974	0	7,513	156,226	163,739	-1,765	-47,297
1933	17,700	105,367	1,676	29,026	0	0	153,769	0	7,442	148,448	155,890	-2,120	-49,417
1934	13,589	110,628	1,676	29,069	0	0	154,962	0	7,484	152,399	159,883	-4,921	-54,338
1935	8,038	92,036	1,676	29,260	0	0	131,010	0	7,336	138,258	145,594	-14,584	-68,923
1936	10,503	95,491	1,680	29,383	0	797	137,855	3,911	7,231	134,796	145,939	-8,083	-77,006
1937	25,058	118,521	1,676	28,997	0	1,750	176,001	8,844	7,341	148,664	164,849	11,153	-65,854
1938	48,588	142,816	1,676	28,674	0	2,702	224,456	13,776	7,569	169,182	190,527	33,929	-31,925
1939	21,932	145,248	1,676	28,870	0	3,655	201,380	18,709	7,488	176,706	202,903	-1,523	-33,448
1940	13,872	107,201	1,680	29,111	0	4,607	156,472	23,641	7,177	137,836	168,654	-12,183	-45,631
1941	97,318	253,636	1,676	28,005	0	5,559	386,195	28,574	7,970	271,729	308,273	77,922	32,291
1942	18,910	149,266	1,676	28,626	0	6,512	204,988	33,506	7,497	182,446	223,449	-18,461	13,830
1943	64,247	239,678	1,676	28,272	0	7,464	341,337	38,439	7,788	257,408	303,635	37,703	51,533
1944	48,217	170,386	1,680	28,391	0	8,416	257,091	43,371	7,601	197,927	248,899	8,192	59,724
1945	11,229	109,559	1,676	28,973	0	9,369	160,806	48,304	6,950	135,360	190,614	-29,808	29,916
1946	12,529	99,472	1,676	29,082	0	9,524	152,283	49,325	6,563	116,031	171,919	-19,636	10,280
1947	17,771	97,585	1,676	29,054	0	9,524	155,610	49,325	6,312	112,591	168,228	-12,618	-2,338
1948	0	66,696	1,680	29,522	0	9,524	107,422	49,325	5,691	86,360	141,375	-33,953	-36,291
1949	0	57,734	1,676	29,537	0	9,524	98,471	49,265	5,127	73,824	128,216	-29,745	-66,036
1950	0	52,852	1,676	29,558	0	9,524	93,610	49,259	4,616	66,267	120,142	-26,532	-92,568
1951	0	51,172	1,676	29,559	0	9,524	91,931	49,039	4,204	62,231	115,473	-23,542	-116,110
1952	55,492	144,480	1,680	28,795	0	9,524	239,971	49,392	5,809	115,352	170,553	69,418	-46,692
1953	17,479	110,312	1,676	28,848	0	9,524	167,838	49,636	6,129	118,500	174,265	-6,427	-53,120
1954	6,665	77,136	1,676	29,263	0	9,524	124,264	49,475	5,702	90,575	145,753	-21,489	-74,609
1955	3,761	65,500	1,676	29,400	0	9,524	109,861	49,310	5,249	76,770	131,330	-21,469	-96,078
1956	3,950	59,640	1,680	29,554	0	9,524	104,348	49,134	4,812	69,213	123,159	-18,811	-114,888
1957	18,335	83,076	1,676	29,109	0	9,524	141,720	49,332	4,868	78,976	133,176	8,544	-106,344
1958	44,237	147,039	1,676	28,528	0	9,524	231,003	49,813	6,080	126,658	182,550	48,453	-57,891
1959	1,902	77,232	1,676	29,161	0	9,524	119,494	49,825	5,756	92,512	148,093	-28,599	-86,490
1960	0	58,814	1,680	29,546	0	9,524	99,565	50,037	5,119	73,691	128,847	-29,282	-115,772
1961	0	54,087	1,676	29,531	59	7,123	92,476	48,298	4,704	63,879	116,881	-24,405	-140,177
1962	26,021	102,197	1,676	29,118	78	5,544	164,634	43,539	4,738	98,054	146,331	18,303	-121,874

Table B-2

Annual Groundwater Budget for Historical Conditions (Water Years 1925 through 2019)

Water Budget Development for the Santa Clara River Valley East Groundwater Subbasin

Water Year	Recharge from Precipitation (a)	Recharge from Streams (b)	Subsurface Inflow Beneath Castaic Dam (c)	Subsurface Inflow Beneath Santa Clara River and Other Tributaries (d)	Septic System Recharge (e)	Recharge of Applied Water (f)	TOTAL INFLOW TO GROUNDWATER (g)	Groundwater Pumping (h)	Riparian Evapo-transpiration (i)	Groundwater Discharge to Streams (j)	TOTAL OUTFLOW FROM GROUNDWATER (k)	Change in GW Storage (l)	Cumulative Change in GW Storage (m)
1963	52	74,584	1,676	29,412	239	4,332	110,295	39,815	4,611	90,176	134,602	-24,307	-146,181
1964	0	72,250	1,680	29,604	404	3,082	107,021	35,627	4,576	88,356	128,559	-21,539	-167,720
1965	21,712	116,234	1,676	29,192	639	3,073	172,525	31,698	5,087	110,584	147,369	25,156	-142,564
1966	45,010	134,639	1,676	28,679	815	2,601	213,420	32,820	5,356	139,007	177,183	36,237	-106,327
1967	23,365	149,259	1,676	28,735	905	2,589	206,529	29,539	5,725	152,497	187,761	18,768	-87,559
1968	13,239	109,030	1,680	29,034	948	2,620	156,551	28,949	5,552	135,430	169,931	-13,380	-100,939
1969	62,206	177,241	1,676	28,505	974	2,645	273,247	29,395	5,876	189,578	224,849	48,398	-52,541
1970	18,510	148,355	1,676	28,772	1,004	2,668	200,985	30,163	5,911	169,398	205,471	-4,487	-57,028
1971	19,112	125,111	1,676	28,855	1,033	2,690	178,477	30,291	5,723	148,229	184,243	-5,766	-62,794
1972	1,473	86,586	1,680	29,434	1,066	2,710	122,950	30,736	5,451	118,480	154,667	-31,718	-94,511
1973	18,514	104,982	1,676	29,195	1,092	2,736	158,195	31,170	5,425	123,947	160,542	-2,348	-96,859
1974	13,693	104,835	1,676	29,237	1,122	2,759	153,321	31,654	5,477	121,764	158,895	-5,574	-102,433
1975	4,512	87,135	1,676	29,451	1,151	2,781	126,707	32,098	5,263	109,285	146,645	-19,939	-122,372
1976	2,303	75,803	1,680	29,671	1,184	2,801	113,442	32,532	5,020	99,070	136,621	-23,180	-145,551
1977	16,820	94,437	1,676	29,366	1,210	2,827	146,336	33,016	5,006	106,790	144,812	1,524	-144,027
1978	102,986	176,837	1,676	28,202	1,240	2,850	313,791	33,461	5,776	171,146	210,383	103,408	-40,620
1979	30,129	155,623	1,676	28,487	1,274	2,876	220,064	33,894	5,975	176,058	215,928	4,137	-36,483
1980	47,188	158,358	1,680	28,593	1,452	2,919	240,191	35,438	8,470	175,513	219,421	20,770	-15,714
1981	4,796	102,516	1,676	29,223	1,680	3,235	143,126	35,448	8,457	130,847	174,752	-31,626	-47,340
1982	17,945	124,459	1,676	29,070	1,389	2,825	177,363	27,456	8,521	139,823	175,799	1,564	-45,775
1983	84,127	225,659	1,676	28,053	1,226	2,431	343,172	23,942	9,252	232,569	265,764	77,408	31,633
1984	24,603	173,024	1,680	28,608	1,749	3,145	232,809	29,744	9,160	210,851	249,754	-16,945	14,688
1985	0	97,920	1,676	29,283	2,013	3,162	134,054	29,827	8,478	132,406	170,710	-36,657	-21,969
1986	18,559	125,270	1,676	29,068	2,175	3,186	179,934	29,208	8,593	141,986	179,787	147	-21,822
1987	3,247	99,592	1,676	29,298	2,373	3,185	139,370	27,927	8,442	127,922	164,291	-24,921	-46,743
1988	10,071	111,098	1,680	29,314	2,437	3,365	157,965	27,955	8,416	131,087	167,459	-9,494	-56,237
1989	4,983	95,760	1,676	29,386	2,432	3,747	137,984	30,340	8,202	119,934	158,476	-20,492	-76,729
1990	0	86,667	1,676	29,550	2,432	3,954	124,279	32,015	7,833	109,556	149,404	-25,125	-101,854
1991	18,620	114,545	1,676	29,200	2,432	3,623	170,096	39,417	7,865	121,051	168,333	1,762	-100,092
1992	61,026	189,670	1,680	28,472	2,439	3,689	286,976	38,825	8,668	181,468	228,961	58,015	-42,077
1993	71,953	240,414	1,676	28,124	2,432	3,695	348,294	39,696	9,264	254,486	303,445	44,849	2,772
1994	3,864	129,414	1,676	28,967	2,432	4,115	170,467	43,830	8,825	149,169	201,824	-31,357	-28,585
1995	56,819	158,922	1,676	28,591	2,432	4,156	252,596	43,060	8,996	168,947	221,004	31,592	3,008
1996	15,861	129,771	1,680	29,053	2,439	4,760	183,564	45,315	8,676	148,003	201,994	-18,430	-15,423
1997	13,310	113,416	1,676	29,173	2,432	5,217	165,223	46,714	8,341	128,612	183,667	-18,444	-33,866
1998	72,779	255,415	1,676	28,283	2,432	4,616	365,201	42,768	9,172	243,695	295,635	69,566	35,700
1999	5,653	126,284	1,676	28,983	2,432	5,184	170,211	45,714	8,815	149,497	204,026	-33,815	1,885
2000	4,814	101,269	1,680	29,449	2,439	5,546	145,197	44,123	8,347	119,773	172,242	-27,045	-25,160

Table B-2

Annual Groundwater Budget for Historical Conditions (Water Years 1925 through 2019)

Water Budget Development for the Santa Clara River Valley East Groundwater Subbasin

Water Year	Recharge from Precipitation (a)	Recharge from Streams (b)	Subsurface Inflow Beneath Castaic Dam (c)	Subsurface Inflow Beneath Santa Clara River and Other Tributaries (d)	Septic System Recharge (e)	Recharge of Applied Water (f)	TOTAL INFLOW TO GROUNDWATER (g)	Groundwater Pumping (h)	Riparian Evapo-transpiration (i)	Groundwater Discharge to Streams (j)	TOTAL OUTFLOW FROM GROUNDWATER (k)	Change in GW Storage (l)	Cumulative Change in GW Storage (m)
2001	27,585	133,957	1,676	28,985	2,432	5,609	200,244	41,793	8,412	136,934	187,139	13,105	-12,055
2002	5,683	105,981	1,676	29,259	2,432	6,159	151,189	42,587	8,243	120,163	170,993	-19,803	-31,859
2003	9,126	100,028	1,676	29,406	2,432	5,989	148,657	38,452	8,134	113,372	159,959	-11,302	-43,160
2004	11,064	103,172	1,680	29,420	2,439	6,289	154,064	39,262	8,056	115,823	163,141	-9,077	-52,237
2005	84,162	203,171	1,676	28,205	2,432	5,835	325,481	42,195	8,944	194,585	245,723	79,758	27,521
2006	14,404	134,383	1,676	28,848	2,432	6,274	188,018	50,058	8,731	151,419	210,208	-22,190	5,331
2007	689	94,325	1,676	29,428	2,432	6,557	135,107	47,152	8,105	115,989	171,246	-36,139	-30,808
2008	20,154	113,470	1,680	29,327	2,439	6,348	173,418	47,079	8,157	121,032	176,267	-2,849	-33,657
2009	7,396	99,819	1,676	29,407	2,432	6,041	146,771	48,251	7,892	108,962	165,106	-18,334	-51,991
2010	28,201	130,945	1,676	29,065	2,432	5,529	197,847	49,739	8,108	127,006	184,853	12,995	-38,997
2011	35,432	148,209	1,676	28,771	2,432	5,490	222,010	48,580	8,474	146,505	203,559	18,452	-20,545
2012	4,448	101,254	1,680	29,404	2,439	5,917	145,142	49,708	8,105	115,262	173,075	-27,934	-48,478
2013	0	88,588	1,676	29,568	2,432	6,387	128,651	46,113	7,685	101,192	154,990	-26,339	-74,817
2014	0	84,399	1,676	29,602	2,432	5,865	123,973	46,467	7,221	92,971	146,658	-22,685	-97,503
2015	0	82,741	1,676	29,610	2,432	4,726	121,184	41,177	7,093	89,790	138,060	-16,876	-114,379
2016	97	84,502	1,680	29,699	2,439	5,004	123,421	41,741	7,108	91,148	139,996	-16,575	-130,954
2017	12,921	115,491	1,676	29,294	2,432	5,434	167,249	29,910	7,809	111,313	149,032	18,217	-112,737
2018	1,650	93,929	1,676	29,466	2,432	5,638	134,791	35,972	7,672	107,380	151,024	-16,233	-128,969
2019	32,027	143,832	1,676	28,953	2,432	5,250	214,169	32,358	8,325	141,220	181,902	32,267	-96,702
Min	**0**	**51,172**	**1,676**	**28,005**	**0**	**0**	**91,931**	**0**	**4,204**	**62,231**	**115,473**	**-36,657**	**---**
Max	**102,986**	**255,415**	**1,680**	**29,699**	**2,439**	**9,524**	**386,195**	**50,058**	**9,264**	**271,729**	**308,273**	**103,408**	**---**
Average	**20,583**	**118,175**	**1,677**	**29,070**	**1,141**	**4,685**	**175,331**	**33,880**	**7,082**	**135,387**	**176,349**	**-1,018**	**---**
Percent of Total	**12%**	**67%**	**1.0%**	**17%**	**0.7%**	**2.7%**	**100%**	**19%**	**4%**	**77%**	**100%**	**---**	**---**

All yearly, minimum, maximum, and average values are in units of acre-feet per year (AFY).

Abbreviations: ET = evapotranspiration GW = groundwater SNMP = Salt Nutrient Management Plan (GSSI, 2016)

Note: The "percent of total" values are calculated from the average values of the individual and total water budget terms.

Notes:
(a) Computed by the SCV Recharge Compiler
(b) Computed by the SCV Recharge Compiler and the SFR package in MODFLOW-USG
(c) Estimated and provided as input to the WEL package in MODFLOW-USG
(d) Computed by the GHB package in MODFLOW-USG
(e) Computed by the SCV Recharge Compiler, based on estimates from the SNMP
(f) Computed by the SCV Recharge Compiler, based on acreages and plant water demands
(g) Total of items (a) through (f)
(h) From data (1980-2019) or estimated (1922-1979)
(i) Computed by the EVT package in MODFLOW-USG
(j) Computed by the SFR package in MODFLOW-USG
(k) Total of items (h) through (j)
(l) Total inflow minus total outflow
(m) Rolling sum of annual changes in groundwater storage

APPENDIX C

Annual Water Budget Tables: Current Conditions

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Table C-1
Annual Surface Water Budget for Current Conditions (Under the 2014 Level of Development)
Water Budget Development for the Santa Clara River Valley East Groundwater Subbasin

Water Year	In-Basin Precipitation	Stormwater Generated from In-Basin Precipitation	Stream Inflow (Santa Clara River)	Stream Inflow (Releases from Castaic Lake/ Lagoon)	Stream Inflow (Releases from Bouquet Reservoir)	Stream Inflow (Other Santa Clara River Tributaries)	Discharges to Santa Clara River from Saugus WRP	Discharges to Santa Clara River from Valencia WRP	Discharges to Santa Clara River from Groundwater Treatment Systems	Net Inflow from Groundwater	TOTAL SURFACE WATER INFLOW	Santa Clara River Non-Storm Outflow at LA/Ventura County Line	Groundwater Recharge from Precipitation	Groundwater Recharge from Ephemeral Streams	ET and Stormwater Outflow	TOTAL SURFACE WATER OUTFLOW
1925	33,042	33,042	1,418	1,471	111	0	5,004	16,813	500	20,243	78,602	42,581	0	3,000	33,021	78,602
1926	133,419	88,224	10,985	59,265	111	56,544	5,004	16,813	500	30,571	313,213	52,821	45,195	34,534	180,663	313,213
1927	100,190	70,932	3,573	14,351	111	31,678	5,004	16,813	500	32,932	205,152	55,257	29,258	26,994	93,643	205,152
1928	30,776	25,093	1,015	622	111	6,083	5,018	16,860	501	24,927	85,913	47,366	5,683	6,905	25,959	85,913
1929	73,314	73,314	602	523	111	0	5,004	16,813	500	17,263	114,130	39,598	0	1,236	73,295	114,130
1930	57,272	57,272	1,140	523	111	0	5,004	16,813	500	12,141	93,504	34,470	0	1,774	57,260	93,504
1931	95,197	72,289	4,027	13,673	111	26,054	5,004	16,813	500	15,649	177,028	37,965	22,908	25,840	90,315	177,028
1932	109,562	93,435	2,215	5,759	111	16,355	5,018	16,860	501	19,870	176,251	42,268	16,127	17,898	99,958	176,251
1933	78,871	61,171	1,742	7,264	111	15,050	5,004	16,813	500	18,507	143,862	40,804	17,700	13,814	71,544	143,862
1934	68,848	55,259	3,857	9,167	111	9,294	5,004	16,813	500	17,586	131,179	39,899	13,589	14,618	63,073	131,179
1935	98,241	90,203	407	1,465	111	4,366	5,004	16,813	500	14,160	141,068	36,512	8,038	5,696	90,822	141,068
1936	52,873	42,370	246	9,238	111	8,920	5,018	16,860	501	13,671	107,438	36,074	10,503	9,989	50,872	107,438
1937	126,250	101,192	3,857	9,167	111	17,379	5,004	16,813	500	16,460	195,541	38,761	25,058	19,793	111,929	195,541
1938	126,334	77,746	407	86,803	111	64,532	5,004	16,813	500	25,468	325,972	47,717	48,588	31,816	197,850	325,972
1939	101,596	79,664	11,336	7,899	111	30,288	5,004	16,813	500	29,734	203,280	52,003	21,932	26,283	103,062	203,280
1940	61,008	47,136	711	9,249	111	12,963	5,018	16,860	501	23,399	129,820	45,813	13,872	14,497	55,638	129,820
1941	219,669	122,351	37,844	101,811	111	138,049	5,004	16,813	500	61,275	581,076	83,210	97,318	65,925	334,623	581,076
1942	63,314	44,404	1,916	8,766	111	28,197	5,004	16,813	500	40,321	164,942	62,634	18,910	23,798	59,601	164,942
1943	149,184	84,937	33,737	99,911	111	92,611	5,004	16,813	500	69,627	467,499	91,286	64,247	63,884	248,082	467,499
1944	134,174	85,957	818	16,158	111	61,091	5,018	16,860	501	50,760	285,491	73,142	48,217	31,565	132,567	285,491
1945	61,176	49,947	1,449	5,759	111	10,791	5,004	16,813	500	34,229	135,832	56,562	11,229	13,306	54,735	135,832
1946	78,409	65,880	1,775	20,338	111	9,884	5,004	16,813	500	26,576	159,410	48,895	12,529	12,963	85,022	159,410
1947	80,966	63,195	1,130	488	111	17,113	5,004	16,813	500	25,315	147,440	47,667	17,771	13,067	68,935	147,440
1948	37,275	37,275	350	517	111	0	5,018	16,860	501	16,868	77,500	39,295	0	978	37,227	77,500
1949	46,752	46,752	281	523	111	0	5,004	16,813	500	12,274	82,258	34,602	0	915	46,741	82,258
1950	45,871	45,871	940	194	111	0	5,004	16,813	500	9,024	78,457	31,347	0	1,245	45,865	78,457
1951	34,298	34,298	775	1,333	111	0	5,004	16,813	500	6,745	65,579	29,086	0	2,219	34,274	65,579
1952	160,212	104,720	21,239	86,267	111	77,917	5,018	16,860	501	27,998	396,122	50,150	55,492	51,210	239,270	396,122
1953	54,382	36,903	2,250	1,554	111	24,542	5,004	16,813	500	25,485	130,642	47,787	17,479	18,109	47,267	130,642
1954	71,616	64,951	1,997	8,165	111	1,470	5,004	16,813	500	17,250	122,926	39,580	6,665	6,447	70,233	122,926
1955	70,149	66,388	1,268	5,793	111	582	5,004	16,813	500	13,280	113,500	35,633	3,761	5,762	68,344	113,500
1956	83,104	79,154	1,098	6,016	111	398	5,018	16,860	501	10,588	123,694	32,997	3,950	5,657	81,090	123,694
1957	66,039	47,704	906	20,338	111	19,156	5,004	16,813	500	13,237	142,103	35,539	18,335	19,451	68,778	142,103
1958	154,928	110,691	7,344	20,276	111	46,906	5,004	16,813	500	25,477	277,360	47,727	44,237	42,958	142,437	277,360
1959	47,882	45,980	1,777	817	111	2,027	5,004	16,813	500	18,291	93,222	40,659	1,902	4,724	45,937	93,222
1960	43,230	43,230	807	523	111	0	5,018	16,860	501	12,617	79,667	35,039	0	1,441	43,187	79,667
1961	34,677	34,677	979	523	111	0	5,004	16,813	500	8,407	67,014	30,733	0	1,613	34,668	67,014
1962	134,007	107,986	4,195	6,908	111	23,990	5,004	16,813	500	13,119	204,647	35,406	26,021	20,656	122,563	204,647
1963	51,406	51,354	1,159	967	111	48	5,004	16,813	500	9,326	85,334	31,675	52	2,285	51,321	85,334
1964	42,768	42,768	696	2,853	111	0	5,018	16,860	501	7,212	76,019	29,618	0	2,155	44,246	76,019
1965	71,153	49,441	433	86,180	111	29,809	5,004	16,813	500	15,014	225,017	37,284	21,712	31,819	134,202	225,017

Table C-1

Annual Surface Water Budget for Current Conditions (Under the 2014 Level of Development)

Water Budget Development for the Santa Clara River Valley East Groundwater Subbasin

Water Year	In-Basin Precipitation	Stormwater Generated from In-Basin Precipitation	Stream Inflow (Santa Clara River)	Stream Inflow (Releases from Castaic Lake/ Lagoon)	Stream Inflow (Releases from Bouquet Reservoir)	Stream Inflow (Other Santa Clara River Tributaries)	Discharges to Santa Clara River from Saugus WRP	Discharges to Santa Clara River from Valencia WRP	Discharges to Santa Clara River from Groundwater Treatment Systems	Net Inflow from Groundwater	TOTAL SURFACE WATER INFLOW	Santa Clara River Non-Storm Outflow at LA/Ventura County Line	Groundwater Recharge from Precipitation	Groundwater Recharge from Ephemeral Streams	ET and Stormwater Outflow	TOTAL SURFACE WATER OUTFLOW
1966	121,007	75,997	9,236	7,020	111	60,619	5,004	16,813	500	25,038	245,348	47,269	45,010	33,049	120,019	245,348
1967	125,494	102,129	8,260	20,338	111	21,515	5,004	16,813	500	30,789	228,824	53,011	23,365	39,499	112,950	228,824
1968	71,531	58,292	2,008	488	111	14,180	5,018	16,860	501	23,253	133,950	45,668	13,239	13,043	62,000	133,950
1969	157,907	95,701	23,229	86,174	111	85,563	5,004	16,813	500	46,225	421,526	68,206	62,206	48,411	242,703	421,526
1970	59,833	41,323	4,404	21,342	111	21,060	5,004	16,813	500	38,205	167,272	60,462	18,510	33,158	55,143	167,272
1971	83,858	64,746	4,486	3,780	111	19,853	5,004	16,813	500	28,774	163,179	51,122	19,112	21,436	71,509	163,179
1972	49,267	47,794	1,564	811	111	140	5,018	16,860	501	18,940	93,212	41,373	1,473	2,626	47,740	93,212
1973	103,985	85,471	3,693	6,902	111	14,411	5,004	16,813	500	18,921	170,341	41,226	18,514	14,663	95,938	170,341
1974	75,432	61,739	1,674	9,167	111	8,061	5,004	16,813	500	17,485	134,247	39,793	13,693	12,755	68,006	134,247
1975	77,485	72,973	814	7,162	111	2,441	5,004	16,813	500	14,038	124,367	36,388	4,512	6,900	76,567	124,367
1976	57,654	55,351	259	1,732	111	229	5,018	16,860	501	10,415	92,778	32,826	2,303	2,145	55,505	92,778
1977	80,504	63,684	147	1,236	111	14,538	5,004	16,813	500	11,032	129,884	33,337	16,820	12,134	67,594	129,884
1978	224,449	121,463	21,288	100,395	111	148,404	5,004	16,813	500	38,382	555,347	60,558	102,986	54,486	337,317	555,347
1979	109,604	79,475	6,314	34,822	111	31,125	5,004	16,813	500	42,343	246,636	64,709	30,129	32,622	119,175	246,636
1980	136,984	89,796	11,607	60,076	111	58,191	5,018	16,860	501	44,547	333,895	66,675	47,188	38,449	181,584	333,895
1981	57,610	52,814	1,836	6,338	111	2,798	5,004	16,813	500	27,358	118,368	49,781	4,796	10,807	52,984	118,368
1982	86,792	68,847	3,802	9,548	111	15,625	5,004	16,813	500	24,398	162,593	46,598	17,945	22,167	75,883	162,593
1983	188,515	104,388	27,927	90,597	111	119,739	5,004	16,813	500	54,424	503,630	75,819	84,127	64,398	279,286	503,630
1984	51,574	26,971	1,372	10,417	111	36,494	5,018	16,860	501	49,176	171,523	71,656	24,603	26,360	48,903	171,523
1985	65,286	65,286	3,010	3,214	111	0	5,004	16,813	500	23,685	117,623	46,132	0	6,335	65,156	117,623
1986	112,958	94,399	4,169	20,700	111	14,139	5,004	16,813	500	25,240	199,634	47,480	18,559	23,225	110,369	199,634
1987	29,853	26,606	2,022	1,004	111	1,800	5,004	16,813	500	16,738	73,845	39,123	3,247	4,938	26,537	73,845
1988	101,049	90,978	4,031	4,544	111	3,435	5,018	16,860	501	15,296	150,845	37,682	10,071	11,597	91,495	150,845
1989	64,154	59,171	1,449	932	111	2,127	5,004	16,813	500	12,206	103,296	34,547	4,983	4,261	59,505	103,296
1990	41,636	41,636	217	532	111	0	5,004	16,813	500	9,054	73,867	31,403	0	860	41,605	73,867
1991	78,828	60,208	3,705	6,908	111	16,748	5,004	16,813	500	11,247	139,865	33,512	18,620	16,936	70,797	139,865
1992	154,677	93,651	3,510	30,381	111	81,720	5,018	16,860	501	30,251	323,029	52,125	61,026	46,821	163,057	323,029
1993	178,451	106,498	24,328	87,136	111	97,420	5,004	16,813	500	68,743	478,506	89,465	71,953	64,109	252,979	478,506
1994	45,536	41,672	19,954	6,467	111	5,189	5,004	16,813	500	29,384	128,958	51,814	3,864	18,882	54,399	128,958
1995	156,731	99,912	634	64,358	111	76,517	5,004	16,813	500	41,599	362,267	63,467	56,819	36,435	205,545	362,267
1996	62,558	46,697	3,026	6,585	111	15,028	5,018	16,860	501	31,311	140,998	53,733	15,861	17,800	53,604	140,998
1997	77,738	64,428	2,072	10,600	111	8,936	5,004	16,813	500	25,013	146,786	47,329	13,310	12,926	73,221	146,786
1998	201,137	128,358	35,204	96,386	111	97,591	5,004	16,813	500	68,872	521,619	89,004	72,779	75,473	284,363	521,619
1999	54,843	49,190	2,087	8,478	111	7,971	5,004	16,813	500	34,346	130,153	56,836	5,653	15,428	52,236	130,153
2000	68,135	63,321	2,204	8,329	111	501	5,018	16,860	501	21,406	123,065	43,872	4,814	5,896	68,483	123,065
2001	99,226	71,641	3,880	13,806	111	29,199	5,004	16,813	500	24,615	193,155	46,824	27,585	24,552	94,194	193,155
2002	30,776	25,093	1,015	720	111	6,083	5,004	16,813	500	19,123	80,145	41,483	5,683	7,003	25,976	80,145
2003	102,056	92,930	1,088	4,304	111	3,626	5,004	16,813	500	15,885	149,387	38,232	9,126	7,446	94,583	149,387
2004	56,982	45,918	30	1,938	111	7,671	5,018	16,860	501	13,836	102,947	36,227	11,064	7,144	48,511	102,947
2005	219,962	135,800	37,844	197,521	111	111,067	5,004	16,813	500	45,570	634,392	66,962	84,162	61,562	421,706	634,392
2006	86,291	71,887	4,712	17,768	111	10,033	5,004	16,813	500	31,854	173,086	54,235	14,404	19,644	84,803	173,086

Table C-1

Annual Surface Water Budget for Current Conditions (Under the 2014 Level of Development)

Water Budget Development for the Santa Clara River Valley East Groundwater Subbasin

Water Year	In-Basin Precipitation	Stormwater Generated from In-Basin Precipitation	Stream Inflow (Santa Clara River)	Stream Inflow (Releases from Castaic Lake/ Lagoon)	Stream Inflow (Releases from Bouquet Reservoir)	Stream Inflow (Other Santa Clara River Tributaries)	Discharges to Santa Clara River from Saugus WRP	Discharges to Santa Clara River from Valencia WRP	Discharges to Santa Clara River from Groundwater Treatment Systems	Net Inflow from Groundwater	TOTAL SURFACE WATER INFLOW	Santa Clara River Non-Storm Outflow at LA/Ventura County Line	Groundwater Recharge from Precipitation	Groundwater Recharge from Ephemeral Streams	ET and Stormwater Outflow	TOTAL SURFACE WATER OUTFLOW
2007	27,422	26,733	645	1,049	111	225	5,004	16,813	500	19,647	71,416	42,068	689	2,030	26,630	71,416
2008	96,940	76,786	1,286	13,179	111	18,080	5,018	16,860	501	19,892	171,866	42,191	20,154	13,076	96,446	171,866
2009	57,192	49,796	159	3,651	111	4,727	5,004	16,813	500	15,387	103,544	37,734	7,396	6,645	51,769	103,544
2010	107,549	79,348	1,059	11,126	111	32,972	5,004	16,813	500	20,275	195,410	42,449	28,201	24,029	100,731	195,410
2011	131,113	95,681	4,465	25,027	111	36,536	5,004	16,813	500	26,347	245,916	48,471	35,432	29,158	132,855	245,916
2012	67,381	62,933	1,094	1,586	111	2,719	5,018	16,860	501	18,024	113,294	40,461	4,448	5,487	62,899	113,294
2013	34,716	34,716	0	281	111	0	5,004	16,813	500	12,596	70,021	34,972	0	392	34,657	70,021
2014	38,701	38,701	215	836	111	0	5,004	16,813	500	8,621	70,800	30,974	0	1,162	38,664	70,800
2015	53,962	53,962	65	2,510	111	0	5,004	16,813	500	6,244	85,209	28,575	0	1,766	54,868	85,209
2016	45,578	45,481	22	818	111	5	5,018	16,860	501	3,840	72,753	26,235	97	956	45,466	72,753
2017	107,046	94,125	10,551	12,244	111	5,751	5,004	16,813	500	5,630	163,650	27,918	12,921	16,556	106,254	163,650
2018	46,753	45,103	0	1,324	111	176	5,004	16,813	500	5,046	75,727	27,371	1,650	1,474	45,232	75,727
2019	116,061	84,034	3,102	21,189	111	37,583	5,004	16,813	500	13,766	214,129	35,919	32,027	30,488	115,695	214,129
Min	**27,422**	**25,093**	**0**	**194**	**111**	**0**	**5,004**	**16,813**	**500**	**3,840**	**65,579**	**26,235**	**0**	**392**	**25,959**	**65,579**
Max	**224,449**	**135,800**	**37,844**	**197,521**	**111**	**148,404**	**5,018**	**16,860**	**501**	**69,627**	**634,392**	**91,286**	**102,986**	**75,473**	**421,706**	**634,392**
Average	**87,602**	**67,019**	**5,173**	**20,055**	**111**	**24,154**	**5,007**	**16,824**	**500**	**23,760**	**183,188**	**46,008**	**20,583**	**19,057**	**97,539**	**183,188**
Percent of Total	**48%**		**3%**	**11%**	**0.1%**	**13%**	**3%**	**9%**	**0.3%**	**13%**	**100%**	**25%**	**11%**	**11%**	**53%**	**100%**

All yearly, minimum, maximum, and average values are in units of acre-feet per year (AFY).

Abbreviations: WRP = water reclamation plant ET = evapotranspiration

Note: Blue font means inflow to surface water, purple font means internal surface flow process, and red font means surface water outflow.

Note: The "percent of total" values are calculated from the average values of the individual and total water budget terms.

Note: For WRPs, the statistics are for all years, including years before they were present.

Note: This water budget is developed by projecting the historical hydrology of water years 1925 through 2019 forward in time for the 2014 level of development. All values are from historical data, except the following:

The internal flow term *Stormwater Generated from In-Basin Precipitation* is the difference between the basin-wide rainfall volume and the volume of streamflow percolation to groundwater from ephemeral streams.

The inflow term *Net Inflow from Groundwater* is computed by the SFR package in MODFLOW-USG and represents the net flux of groundwater into all streams basin-wide.

The outflow term *Santa Clara River Non-Storm Outflow at LA/Ventura County Line* is calculated by the SFR and CHD packages in MODFLOW-USG.

The outflow term *Groundwater Recharge from Precipitation* is calculated by the SCV Recharge Compiler and is provided as input to the RCH package in MODFLOW-USG.

The outflow term *Groundwater Recharge from Ephemeral Streams* is calculated by the SCV Recharge Compiler and is provided as input to the RCH package in MODFLOW-USG.

The outflow term *ET and Stormwater Outflow* is calculated from the balance of all other terms in this surface water budget.

Table C-2

Annual Groundwater Budget for Current Conditions (Under the 2014 Level of Development)

Water Budget Development for the Santa Clara River Valley East Groundwater Subbasin

Water Year	Recharge from Precipitation (a)	Recharge from Streams (b)	Subsurface Inflow Beneath Castaic Dam (c)	Subsurface Inflow Beneath Santa Clara River and Other Tributaries (d)	Septic System Recharge (e)	Recharge of Applied Water (f)	TOTAL INFLOW TO GROUNDWATER (g)	Groundwater Pumping (h)	Riparian Evapo-transpiration (i)	Groundwater Discharge to Streams (j)	TOTAL OUTFLOW FROM GROUNDWATER (k)	Change in GW Storage (l)	Cumulative Change in GW Storage (m)
1925	0	94,274	1,676	29,315	2,432	5,749	133,446	48,731	6,659	111,517	166,907	-33,461	-33,461
1926	45,195	146,184	1,676	28,642	2,432	5,749	229,878	48,731	6,975	142,221	197,927	31,951	-1,510
1927	29,258	141,984	1,676	28,597	2,432	5,749	209,697	48,731	7,047	147,922	203,700	5,997	4,487
1928	5,683	106,091	1,680	29,111	2,439	5,742	150,747	48,758	6,801	124,112	179,672	-28,925	-24,438
1929	0	91,339	1,676	29,400	2,432	5,749	130,595	48,731	6,498	107,366	162,595	-32,000	-56,438
1930	0	89,781	1,676	29,445	2,432	5,749	129,084	48,731	6,283	100,149	155,163	-26,079	-82,517
1931	22,908	132,693	1,676	28,954	2,432	5,749	194,412	48,731	6,510	122,502	177,744	16,668	-65,849
1932	16,127	121,727	1,680	29,004	2,439	5,742	176,719	48,758	6,660	123,699	179,117	-2,398	-68,247
1933	17,700	113,524	1,676	29,037	2,432	5,749	170,118	48,731	6,587	118,217	173,535	-3,417	-71,664
1934	13,589	115,651	1,676	29,087	2,432	5,749	168,184	48,731	6,600	118,619	173,950	-5,766	-77,430
1935	8,038	98,343	1,676	29,276	2,432	5,749	145,513	48,731	6,396	106,807	161,934	-16,421	-93,852
1936	10,503	103,291	1,680	29,392	2,439	5,742	153,048	48,758	6,386	106,973	162,117	-9,069	-102,921
1937	25,058	123,747	1,676	29,010	2,432	5,749	187,671	48,731	6,538	120,414	175,683	11,988	-90,933
1938	48,588	142,471	1,676	28,692	2,432	5,749	229,608	48,731	6,875	136,123	191,729	37,879	-53,054
1939	21,932	145,254	1,676	28,886	2,432	5,749	205,929	48,731	6,975	148,706	204,411	1,518	-51,536
1940	13,872	115,784	1,680	29,117	2,439	5,742	168,634	48,758	6,799	124,686	180,243	-11,609	-63,145
1941	97,318	250,458	1,676	28,010	2,432	5,749	385,643	48,731	7,623	245,808	302,162	83,480	20,335
1942	18,910	154,306	1,676	28,633	2,432	5,749	211,705	48,731	7,345	170,828	226,903	-15,198	5,137
1943	64,247	241,813	1,676	28,274	2,432	5,749	344,191	48,731	7,649	247,556	303,936	40,254	45,391
1944	48,217	181,265	1,680	28,398	2,439	5,742	267,741	48,758	7,608	200,460	256,827	10,914	56,306
1945	11,229	119,583	1,676	28,975	2,432	5,749	169,644	48,731	7,176	140,505	196,412	-26,768	29,538
1946	12,529	114,735	1,676	29,076	2,432	5,749	166,197	48,731	6,951	128,348	184,030	-17,832	11,705
1947	17,771	115,309	1,676	29,045	2,432	5,749	171,982	48,731	6,855	127,556	183,142	-11,160	545
1948	0	91,106	1,680	29,505	2,439	5,742	130,472	48,758	6,533	106,996	162,288	-31,816	-31,271
1949	0	88,565	1,676	29,516	2,432	5,749	127,938	48,731	6,300	99,924	154,955	-27,017	-58,288
1950	0	87,619	1,676	29,536	2,432	5,749	127,012	48,731	6,123	95,398	150,253	-23,241	-81,528
1951	0	87,067	1,676	29,536	2,432	5,749	126,460	48,669	5,982	91,593	146,244	-19,784	-101,312
1952	55,492	174,140	1,680	28,775	2,439	5,742	268,268	48,757	6,843	150,929	206,529	61,739	-39,573
1953	17,479	130,781	1,676	28,838	2,432	5,749	186,955	48,731	6,792	138,157	193,680	-6,725	-46,298
1954	6,665	101,844	1,676	29,248	2,432	5,749	147,614	48,731	6,566	112,647	167,944	-20,330	-66,627
1955	3,761	96,308	1,676	29,380	2,432	5,749	139,306	48,731	6,405	103,826	158,962	-19,656	-86,283
1956	3,950	94,167	1,680	29,531	2,439	5,742	137,510	48,745	6,279	99,098	154,122	-16,612	-102,895
1957	18,335	119,244	1,676	29,089	2,432	5,749	176,525	48,731	6,412	113,030	168,173	8,352	-94,543
1958	44,237	170,672	1,676	28,512	2,432	5,749	253,279	48,731	6,878	153,191	208,801	44,478	-50,065
1959	1,902	102,601	1,676	29,147	2,432	5,749	143,506	48,731	6,633	116,167	171,530	-28,024	-78,089
1960	0	91,101	1,680	29,525	2,439	5,742	130,488	48,758	6,326	102,277	157,362	-26,875	-104,964
1961	0	88,763	1,676	29,511	2,432	5,749	128,131	48,731	6,092	95,558	150,382	-22,251	-127,215
1962	26,021	120,866	1,676	29,115	2,432	5,749	185,860	48,731	5,515	113,329	167,575	18,285	-108,930

Table C-2
Annual Groundwater Budget for Current Conditions (Under the 2014 Level of Development)
Water Budget Development for the Santa Clara River Valley East Groundwater Subbasin

Water Year	Recharge from Precipitation (a)	Recharge from Streams (b)	Subsurface Inflow Beneath Castaic Dam (c)	Subsurface Inflow Beneath Santa Clara River and Other Tributaries (d)	Septic System Recharge (e)	Recharge of Applied Water (f)	TOTAL INFLOW TO GROUNDWATER (g)	Groundwater Pumping (h)	Riparian Evapo-transpiration (i)	Groundwater Discharge to Streams (j)	TOTAL OUTFLOW FROM GROUNDWATER (k)	Change in GW Storage (l)	Cumulative Change in GW Storage (m)
1963	52	90,588	1,676	29,417	2,432	5,749	129,914	48,730	5,162	97,629	151,520	-21,606	-130,536
1964	0	88,583	1,680	29,599	2,439	5,742	128,043	48,656	5,025	93,640	147,321	-19,278	-149,814
1965	21,712	132,354	1,676	29,181	2,432	5,749	193,104	48,666	5,528	115,550	169,744	23,360	-126,454
1966	45,010	149,522	1,676	28,659	2,432	5,749	233,048	48,731	5,686	141,511	195,928	37,120	-89,334
1967	23,365	166,992	1,676	28,700	2,432	5,749	228,914	48,731	5,819	158,282	212,832	16,082	-73,251
1968	13,239	124,411	1,680	28,989	2,439	5,742	176,501	48,758	5,692	134,622	189,072	-12,571	-85,823
1969	62,206	193,044	1,676	28,448	2,432	5,749	293,555	48,731	5,941	190,858	245,530	48,025	-37,798
1970	18,510	162,223	1,676	28,722	2,432	5,749	219,312	48,731	5,955	167,270	221,956	-2,644	-40,442
1971	19,112	140,139	1,676	28,791	2,432	5,749	197,898	48,731	5,819	147,477	202,027	-4,129	-44,571
1972	1,473	97,490	1,680	29,368	2,439	5,742	138,192	48,758	5,596	113,803	168,158	-29,966	-74,537
1973	18,514	116,073	1,676	29,122	2,432	5,749	173,566	48,731	5,580	120,331	174,642	-1,076	-75,613
1974	13,693	111,995	1,676	29,155	2,432	5,749	164,700	48,731	5,554	116,725	171,010	-6,310	-81,923
1975	4,512	98,967	1,676	29,370	2,432	5,749	142,706	48,731	5,448	106,104	160,282	-17,576	-99,500
1976	2,303	90,204	1,680	29,595	2,439	5,742	131,962	48,758	5,255	98,473	152,487	-20,524	-120,024
1977	16,820	108,121	1,676	29,290	2,432	5,749	164,088	48,731	5,265	107,019	161,015	3,073	-116,951
1978	102,986	204,034	1,676	28,104	2,432	5,749	344,982	48,731	5,902	187,931	242,564	102,418	-14,533
1979	30,129	188,410	1,676	28,384	2,432	5,749	256,780	48,731	6,035	198,132	252,897	3,883	-10,650
1980	47,188	187,900	1,680	28,489	2,439	5,742	273,439	48,801	8,528	193,998	251,328	22,111	11,461
1981	4,796	112,817	1,676	29,125	2,432	5,749	156,595	48,731	8,453	129,368	186,553	-29,958	-18,497
1982	17,945	128,679	1,676	28,976	2,432	5,749	185,457	48,689	8,325	130,910	187,924	-2,467	-20,964
1983	84,127	247,958	1,676	27,982	2,432	5,749	369,924	48,731	9,185	237,984	295,899	74,024	53,060
1984	24,603	185,378	1,680	28,568	2,439	5,742	248,410	48,801	9,026	208,194	266,021	-17,611	35,449
1985	0	101,611	1,676	29,224	2,432	5,749	140,691	48,731	8,290	118,961	175,982	-35,290	159
1986	18,559	129,589	1,676	28,997	2,432	5,749	187,002	48,689	8,274	131,604	188,567	-1,565	-1,406
1987	3,247	98,788	1,676	29,232	2,432	5,749	141,124	48,731	7,985	110,588	167,304	-26,181	-27,587
1988	10,071	110,120	1,680	29,256	2,439	5,742	159,307	48,801	7,936	113,819	170,556	-11,249	-38,836
1989	4,983	93,908	1,676	29,333	2,432	5,749	138,081	48,731	7,693	101,853	158,277	-20,196	-59,032
1990	0	85,639	1,676	29,505	2,432	5,749	125,000	48,689	7,423	93,833	149,946	-24,946	-83,977
1991	18,620	113,591	1,676	29,164	2,432	5,749	171,231	48,731	7,595	107,901	164,228	7,004	-76,973
1992	61,026	197,162	1,680	28,432	2,439	5,742	296,481	48,801	8,364	180,593	237,759	58,723	-18,251
1993	71,953	247,288	1,676	28,063	2,432	5,749	357,161	48,731	9,031	251,922	309,684	47,477	29,226
1994	3,864	133,344	1,676	28,863	2,432	5,749	175,928	48,689	8,599	143,846	201,135	-25,207	4,019
1995	56,819	172,958	1,676	28,455	2,432	5,749	268,089	48,731	8,867	178,122	235,720	32,369	36,388
1996	15,861	130,708	1,680	28,932	2,439	5,742	185,362	48,801	8,641	144,218	201,661	-16,299	20,089
1997	13,310	114,461	1,676	29,051	2,432	5,749	166,678	48,731	8,375	126,548	183,654	-16,975	3,114
1998	72,779	274,567	1,676	28,184	2,432	5,749	385,387	48,689	9,147	267,966	325,803	59,584	62,698
1999	5,653	129,468	1,676	28,884	2,432	5,749	173,862	48,731	8,752	148,386	205,868	-32,006	30,692
2000	4,814	99,825	1,680	29,340	2,439	5,742	143,840	48,801	8,214	115,335	172,350	-28,510	2,182

Table C-2

Annual Groundwater Budget for Current Conditions (Under the 2014 Level of Development)

Water Budget Development for the Santa Clara River Valley East Groundwater Subbasin

Water Year	Recharge from Precipitation (a)	Recharge from Streams (b)	Subsurface Inflow Beneath Castaic Dam (c)	Subsurface Inflow Beneath Santa Clara River and Other Tributaries (d)	Septic System Recharge (e)	Recharge of Applied Water (f)	TOTAL INFLOW TO GROUNDWATER (g)	Groundwater Pumping (h)	Riparian Evapo-transpiration (i)	Groundwater Discharge to Streams (j)	TOTAL OUTFLOW FROM GROUNDWATER (k)	Change in GW Storage (l)	Cumulative Change in GW Storage (m)
2001	27,585	132,015	1,676	28,858	2,432	5,749	198,314	48,731	8,261	132,077	189,069	9,245	11,427
2002	5,683	102,670	1,676	29,143	2,432	5,749	147,352	48,689	8,019	114,789	171,498	-24,145	-12,719
2003	9,126	99,095	1,676	29,339	2,432	5,749	147,417	48,731	7,894	107,534	164,159	-16,742	-29,461
2004	11,064	99,927	1,680	29,381	2,439	5,742	150,233	48,801	7,730	106,619	163,150	-12,917	-42,378
2005	84,162	228,801	1,676	28,142	2,432	5,749	350,962	48,731	8,864	212,809	270,404	80,558	38,180
2006	14,404	142,098	1,676	28,723	2,432	5,749	195,082	48,689	8,725	154,308	211,722	-16,641	21,539
2007	689	92,841	1,676	29,300	2,432	5,749	132,687	48,731	8,086	110,458	167,275	-34,588	-13,049
2008	20,154	110,449	1,680	29,228	2,439	5,742	169,692	48,801	8,022	117,265	174,088	-4,397	-17,446
2009	7,396	98,273	1,676	29,328	2,432	5,749	144,854	48,731	7,797	107,015	163,543	-18,689	-36,136
2010	28,201	128,305	1,676	28,993	2,432	5,749	195,356	48,689	8,043	124,551	181,284	14,072	-22,064
2011	35,432	145,588	1,676	28,668	2,432	5,749	219,545	48,731	8,390	142,778	199,900	19,646	-2,418
2012	4,448	99,590	1,680	29,284	2,439	5,742	143,183	48,801	8,068	112,126	168,995	-25,812	-28,230
2013	0	87,052	1,676	29,487	2,432	5,749	126,396	48,731	7,637	99,256	155,623	-29,227	-57,457
2014	0	85,729	1,676	29,567	2,432	5,749	125,152	48,689	7,370	93,188	149,247	-24,095	-81,552
2015	0	84,370	1,676	29,599	2,432	5,749	123,826	48,731	7,205	88,848	144,784	-20,958	-102,510
2016	97	82,170	1,680	29,699	2,439	5,742	121,827	48,781	7,006	85,054	140,842	-19,015	-121,525
2017	12,921	105,851	1,676	29,315	2,432	5,749	157,944	48,712	7,241	94,925	150,877	7,067	-114,457
2018	1,650	84,530	1,676	29,504	2,432	5,749	125,541	48,620	7,119	88,102	143,840	-18,299	-132,756
2019	32,027	134,551	1,676	28,992	2,432	5,749	205,427	48,731	7,686	117,829	174,247	31,181	-101,576
Min	**0**	**82,170**	**1,676**	**27,982**	**2,432**	**5,742**	**121,827**	**48,620**	**5,025**	**85,054**	**140,842**	**-35,290**	
Max	**102,986**	**274,567**	**1,680**	**29,699**	**2,439**	**5,749**	**385,643**	**48,801**	**9,185**	**267,966**	**325,803**	**102,418**	
Average	**20,583**	**128,498**	**1,677**	**29,028**	**2,434**	**5,747**	**187,966**	**48,734**	**7,101**	**133,201**	**189,036**	**-1,069**	
Percent of Total	**11%**	**69%**	**1%**	**15%**	**1%**	**3%**	**100%**	**26%**	**4%**	**70%**	**100%**		

All yearly, minimum, maximum, and average values are in units of acre-feet per year (AFY).

Abbreviations: ET = evapotranspiration GW = groundwater SNMP = Salt Nutrient Management Plan (GSSI, 2016)

Note: The "percent of total" values are calculated from the average values of the individual and total water budget terms.

Note: This water budget is developed by projecting the historical hydrology of water years 1925 through 2019 forward in time for the 2014 level of development.

Notes:
(a) Computed by the SCV Recharge Compiler
(b) Computed by the SCV Recharge Compiler and the SFR package in MODFLOW-USG
(c) Estimated and provided as input to the WEL package in MODFLOW-USG
(d) Computed by the GHB package in MODFLOWUSG
(e) Computed by the SCV Recharge Compiler, based on estimates from the SNMP
(f) Computed by the SCV Recharge Compiler, based on acreages and plant water demands
(g) Total of items (a) through (f)
(h) From 2014 groundwater usage data
(i) Computed by the EVT package in MODFLOWUSG
(j) Computed by the SFR package in MODFLOWUSG
(k) Total of items (h) through (j)
(l) Total inflow minus total outflow
(m) Rolling sum of annual changes in groundwater storage

APPENDIX D

Annual Water Budget Tables: Projected Conditions without Climate Change

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Table D-1
Annual Projected Surface Water Budget for Full Buildout Conditions Without Climate Change
Water Budget Development for the Santa Clara River Valley East Groundwater Subbasin

Water Year	In-Basin Precipitation	Stormwater Generated from In-Basin Precipitation	Stream Inflow (Santa Clara River)	Stream Inflow (Releases from Castaic Lake/ Lagoon)	Stream Inflow (Releases from Bouquet Reservoir)	Stream Inflow (Other Santa Clara River Tributaries)	Discharges to Santa Clara River from Saugus WRP	Discharges to Santa Clara River from Valencia WRP	Discharges to Santa Clara River from Groundwater Treatment Systems	Net Inflow from Groundwater	TOTAL SURFACE WATER INFLOW	Santa Clara River Non-Storm Outflow at LA/Ventura County Line	Groundwater Recharge from Precipitation	Groundwater Recharge from Ephemeral Streams	ET and Stormwater Outflow	TOTAL SURFACE WATER OUTFLOW
1925	33,042	33,042	1,418	1,471	111	0	5,004	15,994	500	20,582	78,122	42,106	0	3,000	33,016	78,122
1926	133,419	88,224	10,985	59,265	111	56,544	5,004	15,994	500	26,924	308,746	48,363	45,195	34,534	180,655	308,746
1927	100,190	70,932	3,573	14,351	111	31,678	5,004	15,994	500	25,999	197,400	47,485	29,258	26,994	93,663	197,400
1928	30,776	25,093	1,015	622	111	6,083	5,018	16,052	501	21,598	81,775	43,212	5,683	6,905	25,976	81,775
1929	73,314	73,314	602	523	111	0	5,004	15,994	500	16,064	112,112	37,569	0	1,236	73,306	112,112
1930	57,272	57,272	1,140	523	111	0	5,004	15,994	500	11,363	91,907	32,875	0	1,774	57,258	91,907
1931	95,197	72,289	4,027	13,673	111	26,054	5,004	15,994	500	12,605	173,165	34,106	22,908	25,840	90,311	173,165
1932	109,562	93,435	2,215	5,759	111	16,355	5,018	16,052	501	14,352	169,926	35,938	16,127	17,898	99,963	169,926
1933	78,871	61,171	1,742	7,264	111	15,050	5,004	15,994	500	11,943	136,479	33,422	17,700	13,814	71,542	136,479
1934	68,848	55,259	3,857	9,167	111	9,294	5,004	15,994	500	10,153	122,927	31,648	13,589	14,618	63,073	122,927
1935	98,241	90,203	407	1,465	111	4,366	5,004	15,994	500	6,157	132,245	27,671	8,038	5,696	90,841	132,245
1936	52,873	42,370	246	9,238	111	8,920	5,018	16,052	501	8,339	101,298	29,915	10,503	9,989	50,891	101,298
1937	126,250	101,192	3,857	9,167	111	17,379	5,004	15,994	500	12,380	190,642	33,855	25,058	19,793	111,936	190,642
1938	126,334	77,746	407	86,803	111	64,532	5,004	15,994	500	21,766	321,451	43,187	48,588	31,816	197,859	321,451
1939	101,596	79,664	11,336	7,899	111	30,288	5,004	15,994	500	27,279	200,006	48,716	21,932	26,283	103,075	200,006
1940	61,008	47,136	711	9,249	111	12,963	5,018	16,052	501	21,708	127,320	43,303	13,872	14,497	55,649	127,320
1941	219,669	122,351	37,844	101,811	111	138,049	5,004	15,994	500	59,606	578,588	80,710	97,318	65,925	334,636	578,588
1942	63,314	44,404	1,916	8,766	111	28,197	5,004	15,994	500	39,156	162,958	60,640	18,910	23,798	59,611	162,958
1943	149,184	84,937	33,737	99,911	111	92,611	5,004	15,994	500	68,579	465,631	89,403	64,247	63,884	248,097	465,631
1944	134,174	85,957	818	16,158	111	61,091	5,018	16,052	501	49,988	283,911	71,548	48,217	31,565	132,582	283,911
1945	61,176	49,947	1,449	5,759	111	10,791	5,004	15,994	500	33,741	134,525	55,243	11,229	13,306	54,747	134,525
1946	78,409	65,880	1,775	20,338	111	9,884	5,004	15,994	500	26,534	158,549	48,024	12,529	12,963	85,033	158,549
1947	80,966	63,195	1,130	488	111	17,113	5,004	15,994	500	25,663	146,969	47,189	17,771	13,067	68,942	146,969
1948	37,275	37,275	350	517	111	0	5,018	16,052	501	17,657	77,480	39,271	0	978	37,232	77,480
1949	46,752	46,752	281	523	111	0	5,004	15,994	500	13,508	82,673	35,011	0	915	46,747	82,673
1950	45,871	45,871	940	194	111	0	5,004	15,994	500	9,217	77,831	30,724	0	1,245	45,862	77,831
1951	34,298	34,298	775	1,333	111	0	5,004	15,994	500	7,012	65,027	28,529	0	2,219	34,280	65,027
1952	160,212	104,720	21,239	86,267	111	77,917	5,018	16,052	501	28,022	395,338	49,349	55,492	51,210	239,287	395,338
1953	54,382	36,903	2,250	1,554	111	24,542	5,004	15,994	500	26,081	130,418	47,559	17,479	18,109	47,271	130,418
1954	71,616	64,951	1,997	8,165	111	1,470	5,004	15,994	500	18,159	123,016	39,666	6,665	6,447	70,238	123,016
1955	70,149	66,388	1,268	5,793	111	582	5,004	15,994	500	14,653	114,054	36,181	3,761	5,762	68,350	114,054
1956	83,104	79,154	1,098	6,016	111	398	5,018	16,052	501	10,921	123,218	32,524	3,950	5,657	81,087	123,218
1957	66,039	47,704	906	20,338	111	19,156	5,004	15,994	500	13,506	141,553	34,981	18,335	19,451	68,785	141,553
1958	154,928	110,691	7,344	20,276	111	46,906	5,004	15,994	500	25,758	276,821	47,175	44,237	42,958	142,451	276,821
1959	47,882	45,980	1,777	817	111	2,027	5,004	15,994	500	19,301	93,413	40,847	1,902	4,724	45,940	93,413
1960	43,230	43,230	807	523	111	0	5,018	16,052	501	13,758	79,999	35,368	0	1,441	43,190	79,999
1961	34,677	34,677	979	523	111	0	5,004	15,994	500	9,843	67,631	31,346	0	1,613	34,672	67,631
1962	134,007	107,986	4,195	6,908	111	23,990	5,004	15,994	500	12,985	203,694	34,453	26,021	20,656	122,563	203,694
1963	51,406	51,354	1,159	967	111	48	5,004	15,994	500	9,220	84,408	30,745	52	2,285	51,326	84,408
1964	42,768	42,768	696	2,853	111	0	5,018	16,052	501	7,313	75,312	28,906	0	2,155	44,251	75,312
1965	71,153	49,441	433	86,180	111	29,809	5,004	15,994	500	14,728	223,912	36,169	21,712	31,819	134,211	223,912

Table D-1
Annual Projected Surface Water Budget for Full Buildout Conditions Without Climate Change
Water Budget Development for the Santa Clara River Valley East Groundwater Subbasin

Water Year	In-Basin Precipitation	Stormwater Generated from In-Basin Precipitation	Stream Inflow (Santa Clara River)	Stream Inflow (Releases from Castaic Lake/ Lagoon)	Stream Inflow (Releases from Bouquet Reservoir)	Stream Inflow (Other Santa Clara River Tributaries)	Discharges to Santa Clara River from Saugus WRP	Discharges to Santa Clara River from Valencia WRP	Discharges to Santa Clara River from Groundwater Treatment Systems	Net Inflow from Groundwater	TOTAL SURFACE WATER INFLOW	Santa Clara River Non-Storm Outflow at LA/Ventura County Line	Groundwater Recharge from Precipitation	Groundwater Recharge from Ephemeral Streams	ET and Stormwater Outflow	TOTAL SURFACE WATER OUTFLOW
1966	121,007	75,997	9,236	7,020	111	60,619	5,004	15,994	500	25,075	244,567	46,489	45,010	33,049	120,018	244,567
1967	125,494	102,129	8,260	20,338	111	21,515	5,004	15,994	500	30,917	228,134	52,303	23,365	39,499	112,967	228,134
1968	71,531	58,292	2,008	488	111	14,180	5,018	16,052	501	23,633	133,522	45,235	13,239	13,043	62,004	133,522
1969	157,907	95,701	23,229	86,174	111	85,563	5,004	15,994	500	46,216	420,699	67,360	62,206	48,411	242,722	420,699
1970	59,833	41,323	4,404	21,342	111	21,060	5,004	15,994	500	38,854	167,102	60,283	18,510	33,158	55,151	167,102
1971	83,858	64,746	4,486	3,780	111	19,853	5,004	15,994	500	29,381	162,967	50,904	19,112	21,436	71,516	162,967
1972	49,267	47,794	1,564	811	111	140	5,018	16,052	501	19,821	93,285	41,441	1,473	2,626	47,744	93,285
1973	103,985	85,471	3,693	6,902	111	14,411	5,004	15,994	500	19,719	170,319	41,197	18,514	14,663	95,946	170,319
1974	75,432	61,739	1,674	9,167	111	8,061	5,004	15,994	500	18,390	134,333	39,871	13,693	12,755	68,014	134,333
1975	77,485	72,973	814	7,162	111	2,441	5,004	15,994	500	15,085	124,595	36,611	4,512	6,900	76,572	124,595
1976	57,654	55,351	259	1,732	111	229	5,018	16,052	501	11,570	93,126	33,171	2,303	2,145	55,508	93,126
1977	80,504	63,684	147	1,236	111	14,538	5,004	15,994	500	10,444	128,478	31,941	16,820	12,134	67,583	128,478
1978	224,449	121,463	21,288	100,395	111	148,404	5,004	15,994	500	33,729	549,874	55,072	102,986	54,486	337,331	549,874
1979	109,604	79,475	6,314	34,822	111	31,125	5,004	15,994	500	40,231	243,705	61,753	30,129	32,622	119,201	243,705
1980	136,984	89,796	11,607	60,076	111	58,191	5,018	16,052	501	43,732	332,272	65,194	47,188	38,449	181,441	332,272
1981	57,610	52,814	1,836	6,338	111	2,798	5,004	15,994	500	27,787	117,977	49,344	4,796	10,807	53,031	117,977
1982	86,792	68,847	3,802	9,548	111	15,625	5,004	15,994	500	25,119	162,495	46,457	17,945	22,167	75,926	162,495
1983	188,515	104,388	27,927	90,597	111	119,739	5,004	15,994	500	55,601	503,988	76,051	84,127	64,398	279,412	503,988
1984	51,574	26,971	1,372	10,417	111	36,494	5,018	16,052	501	50,689	172,228	72,344	24,603	26,360	48,920	172,228
1985	65,286	65,286	3,010	3,214	111	0	5,004	15,994	500	25,015	118,134	46,610	0	6,335	65,189	118,134
1986	112,958	94,399	4,169	20,700	111	14,139	5,004	15,994	500	26,704	200,279	48,072	18,559	23,225	110,422	200,279
1987	29,853	26,606	2,022	1,004	111	1,800	5,004	15,994	500	18,443	74,731	39,983	3,247	4,938	26,563	74,731
1988	101,049	90,978	4,031	4,544	111	3,435	5,018	16,052	501	17,351	152,092	38,891	10,071	11,597	91,534	152,092
1989	64,154	59,171	1,449	932	111	2,127	5,004	15,994	500	14,403	104,674	35,890	4,983	4,261	59,540	104,674
1990	41,636	41,636	217	532	111	0	5,004	15,994	500	11,248	75,242	32,817	0	860	41,565	75,242
1991	78,828	60,208	3,705	6,908	111	16,748	5,004	15,994	500	10,362	138,161	31,840	18,620	16,936	70,765	138,161
1992	154,677	93,651	3,510	30,381	111	81,720	5,018	16,052	501	26,954	318,924	47,799	61,026	46,821	163,279	318,924
1993	178,451	106,498	24,328	87,136	111	97,420	5,004	15,994	500	64,822	473,766	84,685	71,953	64,109	253,018	473,766
1994	45,536	41,672	19,954	6,467	111	5,189	5,004	15,994	500	27,248	126,003	48,855	3,864	18,882	54,403	126,003
1995	156,731	99,912	634	64,358	111	76,517	5,004	15,994	500	36,716	356,565	57,706	56,819	36,435	205,604	356,565
1996	62,558	46,697	3,026	6,585	111	15,028	5,018	16,052	501	28,167	137,046	49,707	15,861	17,800	53,678	137,046
1997	77,738	64,428	2,072	10,600	111	8,936	5,004	15,994	500	23,087	144,041	44,539	13,310	12,926	73,266	144,041
1998	201,137	128,358	35,204	96,386	111	97,591	5,004	15,994	500	67,397	519,324	86,616	72,779	75,473	284,457	519,324
1999	54,843	49,190	2,087	8,478	111	7,971	5,004	15,994	500	33,740	128,729	55,364	5,653	15,428	52,284	128,729
2000	68,135	63,321	2,204	8,329	111	501	5,018	16,052	501	21,278	122,129	42,903	4,814	5,896	68,516	122,129
2001	99,226	71,641	3,880	13,806	111	29,199	5,004	15,994	500	25,058	192,779	46,394	27,585	24,552	94,248	192,779
2002	30,776	25,093	1,015	720	111	6,083	5,004	15,994	500	18,599	78,802	40,152	5,683	7,003	25,964	78,802
2003	102,056	92,930	1,088	4,304	111	3,626	5,004	15,994	500	15,593	148,276	37,087	9,126	7,446	94,617	148,276
2004	56,982	45,918	30	1,938	111	7,671	5,018	16,052	501	14,064	102,367	35,619	11,064	7,144	48,540	102,367
2005	219,962	135,800	37,844	197,521	111	111,067	5,004	15,994	500	46,101	634,104	66,544	84,162	61,562	421,836	634,104
2006	86,291	71,887	4,712	17,768	111	10,033	5,004	15,994	500	32,337	172,750	53,871	14,404	19,644	84,831	172,750

Table D-1

Annual Projected Surface Water Budget for Full Buildout Conditions Without Climate Change

Water Budget Development for the Santa Clara River Valley East Groundwater Subbasin

Water Year	In-Basin Precipitation	Stormwater Generated from In-Basin Precipitation	Stream Inflow (Santa Clara River)	Stream Inflow (Releases from Castaic Lake/ Lagoon)	Stream Inflow (Releases from Bouquet Reservoir)	Stream Inflow (Other Santa Clara River Tributaries)	Discharges to Santa Clara River from Saugus WRP	Discharges to Santa Clara River from Valencia WRP	Discharges to Santa Clara River from Groundwater Treatment Systems	Net Inflow from Groundwater	TOTAL SURFACE WATER INFLOW	Santa Clara River Non-Storm Outflow at LA/Ventura County Line	Groundwater Recharge from Precipitation	Groundwater Recharge from Ephemeral Streams	ET and Stormwater Outflow	TOTAL SURFACE WATER OUTFLOW
2007	27,422	26,733	645	1,049	111	225	5,004	15,994	500	20,492	71,443	42,071	689	2,030	26,652	71,443
2008	96,940	76,786	1,286	13,179	111	18,080	5,018	16,052	501	21,149	172,316	42,589	20,154	13,076	96,496	172,316
2009	57,192	49,796	159	3,651	111	4,727	5,004	15,994	500	16,247	103,585	37,787	7,396	6,645	51,757	103,585
2010	107,549	79,348	1,059	11,126	111	32,972	5,004	15,994	500	18,068	192,383	39,413	28,201	24,029	100,740	192,383
2011	131,113	95,681	4,465	25,027	111	36,536	5,004	15,994	500	25,429	244,179	46,684	35,432	29,158	132,906	244,179
2012	67,381	62,933	1,094	1,586	111	2,719	5,018	16,052	501	17,926	112,389	39,535	4,448	5,487	62,919	112,389
2013	34,716	34,716	0	281	111	0	5,004	15,994	500	12,940	69,546	34,477	0	392	34,678	69,546
2014	38,701	38,701	215	836	111	0	5,004	15,994	500	9,435	70,796	30,950	0	1,162	38,684	70,796
2015	53,962	53,962	65	2,510	111	0	5,004	15,994	500	6,701	84,847	28,235	0	1,766	54,845	84,847
2016	45,578	45,481	22	818	111	5	5,018	16,052	501	2,197	70,302	23,805	97	956	45,445	70,302
2017	107,046	94,125	10,551	12,244	111	5,751	5,004	15,994	500	1,244	158,445	22,626	12,921	16,556	106,341	158,445
2018	46,753	45,103	0	1,324	111	176	5,004	15,994	500	2,806	72,668	24,265	1,650	1,474	45,278	72,668
2019	116,061	84,034	3,102	21,189	111	37,583	5,004	15,994	500	11,864	211,408	33,165	32,027	30,488	115,727	211,408
Min	**27,422**	**25,093**	**0**	**194**	**111**	**0**	**5,004**	**15,994**	**500**	**1,244**	**65,027**	**22,626**	**0**	**392**	**25,964**	**65,027**
Max	**224,449**	**135,800**	**37,844**	**197,521**	**111**	**148,404**	**5,018**	**16,052**	**501**	**68,579**	**634,104**	**89,403**	**102,986**	**75,473**	**421,836**	**634,104**
Average	**87,602**	**67,019**	**5,173**	**20,055**	**111**	**24,154**	**5,007**	**16,008**	**500**	**22,961**	**181,572**	**44,374**	**20,583**	**19,057**	**97,558**	**181,572**
Percent of Total	**48%**		**3%**	**11%**	**0.1%**	**13%**	**3%**	**9%**	**0.3%**	**13%**	**100%**	**24%**	**11%**	**11%**	**54%**	**100%**

All yearly, minimum, maximum, and average values are in units of acre-feet per year (AFY).

Abbreviations: WRP = water reclamation plant ET = evapotranspiration

Note: Blue font means inflow to surface water, purple font means internal surface flow process, and red font means surface water outflow.

Note: The "percent of total" values are calculated from the average values of the individual and total water budget terms.

Note: This water budget is developed by projecting the historical hydrology of water years 1925 through 2019 forward in time for full buildout conditions.

All values are from historical data or the water uses associated with the full buildout scenario, except the following:

The internal flow term *Stormwater Generated from In-Basin Precipitation* is the difference between the basin-wide rainfall volume and the volume of streamflow percolation to groundwater from ephemeral streams.

The inflow term *Net Inflow from Groundwater* is computed by the SFR package in MODFLOW-USG and represents the net flux of groundwater into all streams basin-wide.

The outflow term *Santa Clara River Non-Storm Outflow at LA/Ventura County Line* is calculated by the SFR and CHD packages in MODFLOW-USG.

The outflow term *Groundwater Recharge from Precipitation* is calculated by the SCV Recharge Compiler and is provided as input to the RCH package in MODFLOW-USG.

The outflow term *Groundwater Recharge from Ephemeral Streams* is calculated by the SCV Recharge Compiler and is provided as input to the RCH package in MODFLOW-USG.

The outflow term *ET and Stormwater Outflow* is calculated from the balance of all other terms in this surface water budget.

Table D-2

Annual Projected Groundwater Budget for Full Buildout Conditions Without Climate Change

Water Budget Development for the Santa Clara River Valley East Groundwater Subbasin

Water Year	Recharge from Precipitation (a)	Recharge from Streams (b)	Subsurface Inflow Beneath Castaic Dam (c)	Subsurface Inflow Beneath Santa Clara River and Other Tributaries (d)	Septic System Recharge (e)	Recharge of Applied Water (f)	TOTAL INFLOW TO GROUNDWATER (g)	Groundwater Pumping (h)	Riparian Evapo-transpiration (i)	Groundwater Discharge to Streams (j)	TOTAL OUTFLOW FROM GROUNDWATER (k)	Change in GW Storage (l)	Cumulative Change in GW Storage (m)
1925	0	94,816	1,676	29,279	2,432	7,487	135,691	55,865	6,445	112,398	174,708	-39,017	-39,017
1926	45,195	147,678	1,676	28,606	2,432	7,487	233,075	64,730	6,691	140,068	211,489	21,585	-17,432
1927	29,258	144,659	1,676	28,567	2,432	7,487	214,080	60,765	6,706	143,664	211,135	2,945	-14,487
1928	5,683	106,052	1,680	29,093	2,439	7,481	152,427	47,820	6,503	120,744	175,067	-22,640	-37,127
1929	0	90,821	1,676	29,382	2,432	7,487	131,798	51,029	6,228	105,649	162,906	-31,108	-68,235
1930	0	89,547	1,676	29,423	2,432	7,487	130,565	55,865	5,993	99,136	160,994	-30,429	-98,664
1931	22,908	133,050	1,676	28,930	2,432	7,487	196,483	64,730	6,114	119,815	190,659	5,823	-92,840
1932	16,127	122,429	1,680	28,979	2,439	7,481	179,135	67,060	6,186	118,883	192,129	-12,994	-105,835
1933	17,700	113,944	1,676	29,016	2,432	7,487	172,256	67,000	6,055	112,074	185,128	-12,873	-118,707
1934	13,589	115,670	1,676	29,070	2,432	7,487	169,925	67,000	6,026	111,206	184,232	-14,307	-133,014
1935	8,038	96,904	1,676	29,264	2,432	7,487	145,801	60,765	5,752	97,365	163,882	-18,081	-151,095
1936	10,503	101,346	1,680	29,388	2,439	7,481	152,838	47,820	5,878	99,696	153,395	-557	-151,652
1937	25,058	122,283	1,676	29,008	2,432	7,487	187,944	47,793	6,113	114,870	168,776	19,169	-132,483
1938	48,588	143,124	1,676	28,694	2,432	7,487	232,002	47,793	6,601	133,075	187,469	44,532	-87,951
1939	21,932	146,428	1,676	28,889	2,432	7,487	208,844	47,793	6,735	147,425	201,952	6,892	-81,059
1940	13,872	115,640	1,680	29,117	2,439	7,481	170,229	47,820	6,551	122,851	177,222	-6,992	-88,051
1941	97,318	252,844	1,676	28,013	2,432	7,487	389,770	47,793	7,488	246,525	301,806	87,963	-87
1942	18,910	156,356	1,676	28,637	2,432	7,487	215,498	47,793	7,211	171,714	226,718	-11,220	-11,307
1943	64,247	243,925	1,676	28,275	2,432	7,487	348,041	47,793	7,551	248,620	303,964	44,078	32,771
1944	48,217	184,005	1,680	28,397	2,439	7,481	272,219	47,820	7,511	202,428	257,759	14,460	47,230
1945	11,229	120,686	1,676	28,970	2,432	7,487	172,480	47,793	7,046	141,121	195,961	-23,481	23,749
1946	12,529	114,837	1,676	29,066	2,432	7,487	168,027	47,793	6,797	128,407	182,996	-14,970	8,780
1947	17,771	115,577	1,676	29,031	2,432	7,487	173,974	47,793	6,693	128,172	182,658	-8,684	96
1948	0	90,495	1,680	29,487	2,439	7,481	131,582	47,820	6,336	107,174	161,330	-29,747	-29,651
1949	0	88,323	1,676	29,497	2,432	7,487	129,415	51,029	6,118	100,916	158,064	-28,649	-58,300
1950	0	86,884	1,676	29,513	2,432	7,487	127,992	53,860	5,859	94,857	154,576	-26,583	-84,883
1951	0	85,530	1,676	29,514	2,432	7,487	126,640	47,793	5,737	90,323	143,854	-17,214	-102,097
1952	55,492	175,473	1,680	28,753	2,439	7,481	271,317	47,820	6,662	152,285	206,768	64,550	-37,548
1953	17,479	131,456	1,676	28,817	2,432	7,487	189,347	47,793	6,611	139,427	193,830	-4,483	-42,031
1954	6,665	101,354	1,676	29,227	2,432	7,487	148,842	47,793	6,371	113,067	167,231	-18,390	-60,421
1955	3,761	96,213	1,676	29,356	2,432	7,487	140,925	51,029	6,233	105,104	162,366	-21,441	-81,862
1956	3,950	93,744	1,680	29,504	2,439	7,481	138,798	53,907	6,017	99,007	158,930	-20,132	-101,994
1957	18,335	118,491	1,676	29,063	2,432	7,487	177,484	47,793	6,176	112,546	166,515	10,970	-91,025
1958	44,237	172,037	1,676	28,488	2,432	7,487	256,357	47,793	6,739	154,836	209,368	46,989	-44,036
1959	1,902	102,689	1,676	29,124	2,432	7,487	145,310	47,793	6,462	117,266	171,521	-26,210	-70,246
1960	0	90,246	1,680	29,501	2,439	7,481	131,347	47,820	6,127	102,564	156,511	-25,163	-95,409
1961	0	88,241	1,676	29,485	2,432	7,487	129,321	51,029	5,930	96,472	153,431	-24,110	-119,520
1962	26,021	120,212	1,676	29,094	2,432	7,487	186,922	53,860	6,161	112,541	172,562	14,360	-105,159

Table D-2

Annual Projected Groundwater Budget for Full Buildout Conditions Without Climate Change

Water Budget Development for the Santa Clara River Valley East Groundwater Subbasin

Water Year	Recharge from Precipitation (a)	Recharge from Streams (b)	Subsurface Inflow Beneath Castaic Dam (c)	Subsurface Inflow Beneath Santa Clara River and Other Tributaries (d)	Septic System Recharge (e)	Recharge of Applied Water (f)	TOTAL INFLOW TO GROUNDWATER (g)	Groundwater Pumping (h)	Riparian Evapo-transpiration (i)	Groundwater Discharge to Streams (j)	TOTAL OUTFLOW FROM GROUNDWATER (k)	Change in GW Storage (l)	Cumulative Change in GW Storage (m)
1963	52	88,716	1,676	29,405	2,432	7,487	129,769	47,793	5,935	95,652	149,379	-19,611	-124,770
1964	0	86,426	1,680	29,588	2,439	7,481	127,614	47,820	5,770	91,584	145,174	-17,561	-142,330
1965	21,712	131,089	1,676	29,170	2,432	7,487	193,567	47,793	6,383	113,999	168,175	25,392	-116,938
1966	45,010	148,666	1,676	28,652	2,432	7,487	233,924	47,793	6,611	140,693	195,097	38,827	-78,111
1967	23,365	166,143	1,676	28,692	2,432	7,487	229,795	47,793	6,810	157,561	212,165	17,630	-60,481
1968	13,239	123,767	1,680	28,980	2,439	7,481	177,587	47,820	6,647	134,358	188,825	-11,239	-71,719
1969	62,206	193,318	1,676	28,441	2,432	7,487	295,560	47,793	7,127	191,123	246,043	49,517	-22,203
1970	18,510	162,792	1,676	28,713	2,432	7,487	221,610	47,793	7,160	168,488	223,440	-1,830	-24,033
1971	19,112	140,245	1,676	28,781	2,432	7,487	199,733	47,793	6,949	148,191	202,933	-3,200	-27,233
1972	1,473	96,399	1,680	29,356	2,439	7,481	138,828	47,820	6,516	113,594	167,930	-29,102	-56,335
1973	18,514	115,032	1,676	29,109	2,432	7,487	174,250	47,793	6,494	120,089	174,375	-125	-56,460
1974	13,693	110,807	1,676	29,141	2,432	7,487	165,236	47,793	6,458	116,442	170,693	-5,456	-61,917
1975	4,512	97,697	1,676	29,354	2,432	7,487	143,159	47,793	6,295	105,882	159,970	-16,811	-78,728
1976	2,303	88,544	1,680	29,577	2,439	7,481	132,024	47,820	6,053	97,969	151,843	-19,819	-98,546
1977	16,820	107,055	1,676	29,271	2,432	7,487	164,741	62,624	5,978	105,365	173,967	-9,226	-107,772
1978	102,986	207,951	1,676	28,088	2,432	7,487	350,620	60,895	7,043	187,194	255,131	95,489	-12,283
1979	30,129	189,929	1,676	28,374	2,432	7,487	260,028	47,961	7,344	197,538	252,844	7,184	-5,099
1980	47,188	191,749	1,680	28,470	2,439	7,481	279,007	47,919	8,656	197,032	253,607	25,400	20,301
1981	4,796	115,502	1,676	29,102	2,432	7,487	160,994	47,793	8,336	132,481	188,609	-27,615	-7,314
1982	17,945	130,688	1,676	28,951	2,432	7,487	189,179	47,735	8,207	133,640	189,581	-402	-7,716
1983	84,127	253,840	1,676	27,957	2,432	7,487	377,519	47,793	9,163	245,043	301,999	75,520	67,804
1984	24,603	189,492	1,680	28,546	2,439	7,481	254,241	47,881	8,966	213,821	270,668	-16,427	51,377
1985	0	103,429	1,676	29,199	2,432	7,487	144,223	47,793	8,178	122,109	178,080	-33,857	17,520
1986	18,559	131,453	1,676	28,968	2,432	7,487	190,576	47,735	8,167	134,932	190,833	-257	17,263
1987	3,247	100,050	1,676	29,202	2,432	7,487	144,095	47,793	7,853	113,555	169,201	-25,106	-7,843
1988	10,071	112,062	1,680	29,224	2,439	7,481	162,957	51,123	7,841	117,817	176,782	-13,824	-21,668
1989	4,983	96,310	1,676	29,298	2,432	7,487	142,186	50,232	7,601	106,452	164,286	-22,100	-43,767
1990	0	87,951	1,676	29,469	2,432	7,487	129,016	53,776	7,280	98,339	159,395	-30,379	-74,146
1991	18,620	115,892	1,676	29,129	2,432	7,487	175,236	64,730	7,296	109,318	181,344	-6,108	-80,255
1992	61,026	205,952	1,680	28,400	2,439	7,481	306,978	67,114	8,192	186,086	261,393	45,585	-34,669
1993	71,953	257,250	1,676	28,043	2,432	7,487	368,842	57,137	8,946	257,963	324,047	44,796	10,126
1994	3,864	139,650	1,676	28,846	2,432	7,487	183,955	53,776	8,497	148,016	210,289	-26,335	-16,208
1995	56,819	181,436	1,676	28,442	2,432	7,487	278,292	58,495	8,706	181,717	248,918	29,375	13,166
1996	15,861	134,653	1,680	28,926	2,439	7,481	191,040	47,881	8,449	145,020	201,349	-10,309	2,857
1997	13,310	116,826	1,676	29,045	2,432	7,487	170,776	47,793	8,174	126,987	182,954	-12,178	-9,321
1998	72,779	279,171	1,676	28,181	2,432	7,487	391,726	47,735	9,076	271,095	327,906	63,820	54,500
1999	5,653	133,387	1,676	28,881	2,432	7,487	179,516	47,793	8,650	151,699	208,142	-28,627	25,873
2000	4,814	101,401	1,680	29,332	2,439	7,481	147,146	47,881	8,048	116,783	172,712	-25,566	307

Table D-2

Annual Projected Groundwater Budget for Full Buildout Conditions Without Climate Change

Water Budget Development for the Santa Clara River Valley East Groundwater Subbasin

Water Year	Recharge from Precipitation (a)	Recharge from Streams (b)	Subsurface Inflow Beneath Castaic Dam (c)	Subsurface Inflow Beneath Santa Clara River and Other Tributaries (d)	Septic System Recharge (e)	Recharge of Applied Water (f)	TOTAL INFLOW TO GROUNDWATER (g)	Groundwater Pumping (h)	Riparian Evapo-transpiration (i)	Groundwater Discharge to Streams (j)	TOTAL OUTFLOW FROM GROUNDWATER (k)	Change in GW Storage (l)	Cumulative Change in GW Storage (m)
2001	27,585	134,399	1,676	28,845	2,432	7,487	202,424	51,029	8,171	134,905	194,105	8,318	8,625
2002	5,683	104,896	1,676	29,124	2,432	7,487	151,298	53,802	7,829	116,492	178,123	-26,824	-18,199
2003	9,126	100,300	1,676	29,323	2,432	7,487	150,344	47,793	7,682	108,447	163,922	-13,578	-31,777
2004	11,064	100,897	1,680	29,365	2,439	7,481	152,926	47,881	7,514	107,817	163,212	-10,286	-42,063
2005	84,162	233,947	1,676	28,127	2,432	7,487	357,832	47,793	8,775	218,486	275,053	82,779	40,715
2006	14,404	145,831	1,676	28,709	2,432	7,487	200,539	47,735	8,640	158,524	214,898	-14,359	26,357
2007	689	94,465	1,676	29,284	2,432	7,487	136,033	47,793	7,935	112,926	168,654	-32,621	-6,264
2008	20,154	112,468	1,680	29,208	2,439	7,481	173,430	51,123	7,914	120,541	179,578	-6,148	-12,412
2009	7,396	100,648	1,676	29,303	2,432	7,487	148,943	55,865	7,659	110,250	173,774	-24,832	-37,244
2010	28,201	130,982	1,676	28,967	2,432	7,487	199,745	58,436	7,802	125,020	191,259	8,486	-28,758
2011	35,432	149,928	1,676	28,646	2,432	7,487	225,602	47,793	8,251	146,200	202,245	23,357	-5,400
2012	4,448	101,963	1,680	29,267	2,439	7,481	147,278	47,881	7,886	114,402	170,169	-22,891	-28,291
2013	0	87,814	1,676	29,470	2,432	7,487	128,879	47,793	7,411	100,362	155,566	-26,687	-54,978
2014	0	86,856	1,676	29,548	2,432	7,487	127,999	50,977	7,167	95,129	153,273	-25,274	-80,252
2015	0	86,007	1,676	29,576	2,432	7,487	127,178	55,865	6,980	90,941	153,785	-26,607	-106,860
2016	97	82,998	1,680	29,676	2,439	7,481	124,370	64,844	6,655	84,239	155,738	-31,368	-138,227
2017	12,921	106,160	1,676	29,292	2,432	7,487	159,969	60,765	6,733	90,848	158,346	1,623	-136,605
2018	1,650	84,207	1,676	29,484	2,432	7,487	126,938	47,735	6,722	85,539	139,996	-13,058	-149,663
2019	32,027	135,208	1,676	28,976	2,432	7,487	207,807	47,793	7,355	116,584	171,732	36,075	-113,588
Min	**0**	**82,998**	**1,676**	**27,957**	**2,432**	**7,481**	**124,370**	**47,735**	**5,737**	**84,239**	**139,996**	**-39,017**	
Max	**102,986**	**279,171**	**1,680**	**29,676**	**2,439**	**7,487**	**391,726**	**67,114**	**9,163**	**271,095**	**327,906**	**95,489**	
Average	**20,583**	**129,755**	**1,677**	**29,011**	**2,434**	**7,486**	**190,945**	**51,373**	**7,109**	**133,659**	**192,141**	**-1,196**	
Percent of Total	**11%**	**68%**	**1%**	**15%**	**1%**	**4%**	**100%**	**27%**	**3%**	**70%**	**100%**		

All yearly, minimum, maximum, and average values are in units of acre-feet per year (AFY).

Abbreviations: ET = evapotranspiration GW = groundwater SNMP = Salt Nutrient Management Plan (GSSI, 2016)

Note: The "percent of total" values are calculated from the average values of the individual and total water budget terms.

Note: This water budget is developed by projecting the historical hydrology of water years 1925 through 2019 forward in time for full buildout conditions.

Notes:
(a) Computed by the SCV Recharge Compiler
(b) Computed by the SCV Recharge Compiler and the SFR package in MODFLOW-USG
(c) Estimated and provided as input to the WEL package in MODFLOW-USG
(d) Computed by the GHB package in MODFLOWUSG
(e) Computed by the SCV Recharge Compiler, based on estimates from the SNMP
(f) Computed by the SCV Recharge Compiler, based on acreages and plant water demands
(g) Total of items (a) through (f)
(h) Groundwater usage for full buildout conditions
(i) Computed by the EVT package in MODFLOWUSG
(j) Computed by the SFR package in MODFLOWUSG
(k) Total of items (h) through (j)
(l) Total inflow minus total outflow
(m) Rolling sum of annual changes in groundwater storage

APPENDIX E

Annual Water Budget Tables: Projected Conditions with 2030 Climate Change

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Table E-1

Annual Projected Surface Water Budget for Year 2042 Conditions (Full Buildout With 2030 Climate Change)

Water Budget Development for the Santa Clara River Valley East Groundwater Subbasin

Water Year	In-Basin Precipitation	Stormwater Generated from In-Basin Precipitation	Stream Inflow (Santa Clara River)	Stream Inflow (Releases from Castaic Lake/ Lagoon)	Stream Inflow (Releases from Bouquet Reservoir)	Stream Inflow (Other Santa Clara River Tributaries)	Discharges to Santa Clara River from Saugus WRP	Discharges to Santa Clara River from Valencia WRP	Discharges to Santa Clara River from Groundwater Treatment Systems	Net Inflow from Groundwater	TOTAL SURFACE WATER INFLOW	Santa Clara River Non-Storm Outflow at LA/Ventura County Line	Groundwater Recharge from Precipitation	Groundwater Recharge from Ephemeral Streams	ET and Stormwater Outflow	TOTAL SURFACE WATER OUTFLOW
1925	31,091	31,091	1,337	1,388	111	0	5,004	15,994	500	20,022	75,447	41,545	0	2,836	31,066	75,447
1926	144,707	92,505	10,361	55,895	111	67,649	5,004	15,994	500	27,909	328,129	49,338	52,202	36,017	190,572	328,129
1927	104,207	73,786	3,370	13,536	111	32,927	5,004	15,994	500	27,065	202,714	48,550	30,421	27,677	96,066	202,714
1928	29,175	23,946	957	588	111	5,582	5,018	16,052	501	21,889	79,874	43,506	5,229	6,467	24,671	79,874
1929	75,258	75,258	568	494	111	0	5,004	15,994	500	16,172	114,101	37,678	0	1,173	75,249	114,101
1930	56,258	56,258	1,075	494	111	0	5,004	15,994	500	11,379	90,815	32,891	0	1,680	56,244	90,815
1931	96,685	73,059	3,798	12,896	111	26,185	5,004	15,994	500	12,585	173,757	34,085	23,626	25,558	90,489	173,757
1932	109,414	93,902	2,089	5,430	111	14,179	5,018	16,052	501	13,766	166,560	35,355	15,512	16,460	99,233	166,560
1933	78,846	61,071	1,643	6,851	111	15,014	5,004	15,994	500	11,588	135,551	33,068	17,775	13,505	71,204	135,551
1934	70,556	57,393	3,638	8,645	111	8,628	5,004	15,994	500	9,622	122,698	31,117	13,163	13,855	64,564	122,698
1935	99,570	92,543	384	1,383	111	3,227	5,004	15,994	500	5,388	131,561	26,902	7,027	4,680	92,952	131,561
1936	53,763	43,526	232	8,713	111	7,940	5,018	16,052	501	7,508	99,837	29,083	10,237	9,202	51,315	99,837
1937	122,990	100,066	3,638	8,645	111	14,546	5,004	15,994	500	10,918	182,345	32,397	22,924	17,899	109,126	182,345
1938	124,549	78,594	384	81,869	111	59,773	5,004	15,994	500	20,208	308,392	41,634	45,955	31,303	189,500	308,392
1939	106,975	85,136	10,692	7,451	111	29,678	5,004	15,994	500	25,339	201,743	46,799	21,839	25,400	107,705	201,743
1940	62,866	48,402	671	8,723	111	13,335	5,018	16,052	501	20,996	128,273	42,589	14,464	14,566	56,653	128,273
1941	210,544	121,089	35,693	96,024	111	124,435	5,004	15,994	500	56,070	544,374	77,203	89,455	64,614	313,102	544,374
1942	64,786	46,872	1,807	8,269	111	26,262	5,004	15,994	500	37,163	159,896	58,651	17,914	22,715	60,616	159,896
1943	143,398	83,974	31,819	94,232	111	84,025	5,004	15,994	500	63,914	438,997	84,739	59,424	61,615	233,220	438,997
1944	132,540	87,528	772	15,240	111	54,937	5,018	16,052	501	47,047	272,217	68,610	45,012	30,059	128,536	272,217
1945	58,848	49,943	1,367	5,430	111	8,928	5,004	15,994	500	31,374	127,556	52,876	8,905	12,001	53,775	127,556
1946	73,483	63,969	1,674	19,183	111	7,595	5,004	15,994	500	24,040	147,584	45,532	9,514	11,381	81,157	147,584
1947	82,423	65,974	1,066	461	111	14,392	5,004	15,994	500	22,815	142,766	44,348	16,449	11,388	70,581	142,766
1948	36,078	36,078	330	489	111	0	5,018	16,052	501	15,841	74,419	37,452	0	930	36,038	74,419
1949	49,487	49,487	265	494	111	0	5,004	15,994	500	12,067	83,922	33,569	0	870	49,483	83,922
1950	47,460	47,460	886	184	111	0	5,004	15,994	500	8,093	78,233	29,598	0	1,181	47,453	78,233
1951	34,877	34,877	731	1,258	111	0	5,004	15,994	500	6,012	64,487	27,527	0	2,100	34,859	64,487
1952	151,981	102,311	20,031	81,364	111	67,797	5,018	16,052	501	25,331	368,186	46,694	49,670	49,823	221,999	368,186
1953	53,741	37,490	2,122	1,467	111	22,181	5,004	15,994	500	23,786	124,906	45,265	16,251	16,963	46,427	124,906
1954	69,281	64,808	1,884	7,701	111	474	5,004	15,994	500	16,292	117,240	37,798	4,473	5,311	69,659	117,240
1955	69,020	66,995	1,196	5,462	111	193	5,004	15,994	500	12,768	110,247	34,294	2,025	5,222	68,706	110,247
1956	80,958	79,139	1,035	5,672	111	163	5,018	16,052	501	9,069	118,579	30,670	1,819	5,268	80,821	118,579
1957	66,395	48,592	854	19,183	111	17,918	5,004	15,994	500	11,378	137,337	32,856	17,803	18,375	68,303	137,337
1958	149,010	111,048	6,927	19,124	111	35,810	5,004	15,994	500	21,066	253,546	42,503	37,962	37,144	135,937	253,546
1959	48,395	47,226	1,676	771	111	1,065	5,004	15,994	500	15,350	88,866	36,885	1,169	3,621	47,191	88,866
1960	44,366	44,366	761	494	111	0	5,018	16,052	501	11,332	78,635	32,938	0	1,366	44,331	78,635
1961	35,053	35,053	923	494	111	0	5,004	15,994	500	7,962	66,041	29,463	0	1,528	35,050	66,041
1962	135,292	107,618	3,957	6,515	111	26,136	5,004	15,994	500	11,812	205,320	33,278	27,674	21,389	122,979	205,320
1963	52,137	52,102	1,093	913	111	33	5,004	15,994	500	8,101	83,885	29,623	35	2,150	52,077	83,885
1964	42,559	42,559	656	2,692	111	0	5,018	16,052	501	6,261	73,850	27,852	0	2,088	43,910	73,850
1965	69,427	48,643	409	81,281	111	28,102	5,004	15,994	500	13,312	214,140	34,757	20,784	31,862	126,737	214,140

Table E-1
Annual Projected Surface Water Budget for Year 2042 Conditions (Full Buildout With 2030 Climate Change)
Water Budget Development for the Santa Clara River Valley East Groundwater Subbasin

Water Year	In-Basin Precipitation	Stormwater Generated from In-Basin Precipitation	Stream Inflow (Santa Clara River)	Stream Inflow (Releases from Castaic Lake/ Lagoon)	Stream Inflow (Releases from Bouquet Reservoir)	Stream Inflow (Other Santa Clara River Tributaries)	Discharges to Santa Clara River from Saugus WRP	Discharges to Santa Clara River from Valencia WRP	Discharges to Santa Clara River from Groundwater Treatment Systems	Net Inflow from Groundwater	TOTAL SURFACE WATER INFLOW	Santa Clara River Non-Storm Outflow at LA/Ventura County Line	Groundwater Recharge from Precipitation	Groundwater Recharge from Ephemeral Streams	ET and Stormwater Outflow	TOTAL SURFACE WATER OUTFLOW
1966	121,559	78,280	8,711	6,619	111	57,661	5,004	15,994	500	23,226	239,385	44,651	43,279	32,215	119,241	239,385
1967	122,629	102,232	7,790	19,183	111	18,096	5,004	15,994	500	27,962	217,269	49,347	20,397	36,204	111,321	217,269
1968	71,997	60,083	1,894	461	111	11,832	5,018	16,052	501	20,480	128,345	42,083	11,914	11,415	62,934	128,345
1969	154,954	96,025	21,909	81,276	111	79,336	5,004	15,994	500	42,774	401,858	63,953	58,929	47,725	231,251	401,858
1970	54,753	39,692	4,153	20,130	111	15,448	5,004	15,994	500	34,634	150,727	56,066	15,061	29,293	50,308	150,727
1971	81,893	66,122	4,231	3,565	111	14,526	5,004	15,994	500	24,718	150,542	46,245	15,771	17,529	70,997	150,542
1972	48,269	47,759	1,475	766	111	39	5,018	16,052	501	16,975	89,206	38,589	510	2,392	47,715	89,206
1973	103,371	85,492	3,483	6,510	111	12,816	5,004	15,994	500	17,052	164,841	38,534	17,879	13,639	94,788	164,841
1974	76,278	62,197	1,579	8,645	111	8,447	5,004	15,994	500	16,284	132,842	37,767	14,081	12,490	68,504	132,842
1975	75,399	70,518	768	6,756	111	2,821	5,004	15,994	500	13,540	120,893	35,064	4,881	6,976	73,971	120,893
1976	60,610	58,482	244	1,635	111	207	5,018	16,052	501	10,271	94,650	31,870	2,128	2,062	58,591	94,650
1977	79,698	63,111	139	1,167	111	13,958	5,004	15,994	500	9,057	125,628	30,555	16,587	11,716	66,769	125,628
1978	221,621	122,929	20,078	94,690	111	140,369	5,004	15,994	500	30,488	528,855	51,840	98,692	53,506	324,817	528,855
1979	108,300	80,561	5,955	32,842	111	26,834	5,004	15,994	500	35,974	231,515	57,498	27,739	29,880	116,398	231,515
1980	136,097	90,643	10,947	56,660	111	54,881	5,018	16,052	501	40,058	320,325	61,511	45,454	36,815	176,545	320,325
1981	57,682	54,915	1,732	5,976	111	2,197	5,004	15,994	500	25,162	114,357	46,698	2,767	9,857	55,035	114,357
1982	80,878	66,383	3,586	9,005	111	10,985	5,004	15,994	500	21,883	147,946	43,268	14,495	18,651	71,532	147,946
1983	184,868	105,194	26,340	85,447	111	111,746	5,004	15,994	500	47,880	477,889	68,544	79,674	61,613	268,059	477,889
1984	51,073	27,449	1,294	9,826	111	34,676	5,018	16,052	501	47,287	165,838	68,956	23,624	25,711	47,547	165,838
1985	63,407	63,407	2,839	3,031	111	0	5,004	15,994	500	23,240	114,126	44,833	0	5,981	63,312	114,126
1986	111,502	94,287	3,932	19,524	111	11,478	5,004	15,994	500	24,006	192,051	45,404	17,215	20,962	108,471	192,051
1987	30,828	27,926	1,907	946	111	1,213	5,004	15,994	500	16,353	72,856	37,891	2,902	4,181	27,883	72,856
1988	100,444	90,654	3,802	4,287	111	2,975	5,018	16,052	501	15,334	148,524	36,880	9,790	10,814	91,040	148,524
1989	64,725	59,956	1,367	881	111	1,842	5,004	15,994	500	12,740	103,164	34,226	4,769	3,949	60,219	103,164
1990	40,067	40,067	205	503	111	0	5,004	15,994	500	9,815	72,199	31,381	0	819	39,999	72,199
1991	72,136	57,721	3,494	6,515	111	10,352	5,004	15,994	500	7,585	121,691	29,099	14,415	12,798	65,379	121,691
1992	150,554	95,046	3,310	28,655	111	71,698	5,018	16,052	501	19,752	295,652	40,958	55,508	42,479	156,707	295,652
1993	173,445	107,517	22,945	82,183	111	86,407	5,004	15,994	500	57,606	444,195	77,345	65,928	61,061	239,861	444,195
1994	45,418	42,313	18,820	6,099	111	4,027	5,004	15,994	500	24,000	119,973	45,605	3,105	17,370	53,893	119,973
1995	149,132	98,467	598	60,699	111	65,629	5,004	15,994	500	31,379	329,046	52,451	50,665	33,910	192,021	329,046
1996	63,283	48,540	2,854	6,212	111	12,731	5,018	16,052	501	24,334	131,095	45,887	14,743	15,974	54,491	131,095
1997	76,355	64,910	1,954	9,997	111	6,973	5,004	15,994	500	19,546	136,435	41,034	11,445	11,314	72,642	136,435
1998	203,354	130,854	33,203	90,908	111	97,770	5,004	15,994	500	62,172	509,016	81,538	72,500	73,891	281,088	509,016
1999	55,114	50,629	1,968	7,997	111	6,281	5,004	15,994	500	30,660	123,630	52,278	4,485	14,086	52,781	123,630
2000	72,262	66,227	2,079	7,855	111	714	5,018	16,052	501	19,493	124,084	41,107	6,035	5,947	70,995	124,084
2001	100,475	73,908	3,659	13,022	111	26,581	5,004	15,994	500	22,831	188,177	44,177	26,567	23,238	94,194	188,177
2002	29,780	25,158	957	681	111	4,681	5,004	15,994	500	16,372	74,081	37,929	4,622	5,866	25,664	74,081
2003	103,792	95,199	1,026	4,060	111	2,981	5,004	15,994	500	13,588	147,056	35,081	8,593	6,901	96,482	147,056
2004	58,694	47,820	28	1,829	111	7,061	5,018	16,052	501	12,222	101,517	33,779	10,874	6,603	50,261	101,517
2005	214,970	135,873	35,693	186,293	111	102,164	5,004	15,994	500	40,917	601,646	61,522	79,097	59,489	401,538	601,646
2006	82,147	71,884	4,444	16,759	111	6,789	5,004	15,994	500	28,350	160,099	49,901	10,263	16,216	83,718	160,099

Table E-1

Annual Projected Surface Water Budget for Year 2042 Conditions (Full Buildout With 2030 Climate Change)

Water Budget Development for the Santa Clara River Valley East Groundwater Subbasin

Water Year	In-Basin Precipitation	Stormwater Generated from In-Basin Precipitation	Stream Inflow (Santa Clara River)	Stream Inflow (Releases from Castaic Lake/ Lagoon)	Stream Inflow (Releases from Bouquet Reservoir)	Stream Inflow (Other Santa Clara River Tributaries)	Discharges to Santa Clara River from Saugus WRP	Discharges to Santa Clara River from Valencia WRP	Discharges to Santa Clara River from Groundwater Treatment Systems	Net Inflow from Groundwater	TOTAL SURFACE WATER INFLOW	Santa Clara River Non-Storm Outflow at LA/Ventura County Line	Groundwater Recharge from Precipitation	Groundwater Recharge from Ephemeral Streams	ET and Stormwater Outflow	TOTAL SURFACE WATER OUTFLOW
2007	27,473	27,119	609	989	111	41	5,004	15,994	500	18,002	68,723	39,571	354	1,750	27,048	68,723
2008	101,332	79,939	1,213	12,431	111	19,297	5,018	16,052	501	19,208	175,163	40,654	21,393	13,118	99,998	175,163
2009	58,369	50,629	150	3,444	111	4,522	5,004	15,994	500	14,570	102,663	36,107	7,740	6,450	52,367	102,663
2010	110,766	81,089	999	10,492	111	34,331	5,004	15,994	500	16,874	195,071	38,221	29,677	24,401	102,773	195,071
2011	127,643	96,271	4,211	23,605	111	32,455	5,004	15,994	500	22,351	231,874	43,651	31,372	25,956	130,895	231,874
2012	67,659	65,085	1,032	1,497	111	808	5,018	16,052	501	15,177	107,854	36,783	2,574	3,448	65,049	107,854
2013	32,661	32,661	0	267	111	0	5,004	15,994	500	10,865	65,402	32,395	0	378	32,629	65,402
2014	35,672	35,672	202	790	111	0	5,004	15,994	500	7,696	65,969	29,209	0	1,103	35,657	65,969
2015	49,851	49,851	61	2,367	111	0	5,004	15,994	500	5,254	79,142	26,781	0	1,753	50,608	79,142
2016	45,326	45,326	21	771	111	0	5,018	16,052	501	996	68,796	22,594	0	903	45,299	68,796
2017	103,894	92,961	9,951	11,549	111	3,842	5,004	15,994	500	-426	150,419	20,964	10,933	15,582	102,940	150,419
2018	45,660	45,627	0	1,249	111	12	5,004	15,994	500	1,184	69,714	22,634	33	1,290	45,757	69,714
2019	116,786	84,849	2,926	19,985	111	38,095	5,004	15,994	500	10,117	209,517	31,426	31,937	30,379	115,775	209,517
Min	**27,473**	**23,946**	**0**	**184**	**111**	**0**	**5,004**	**15,994**	**500**	**-426**	**64,487**	**20,964**	**0**	**378**	**24,671**	**64,487**
Max	**221,621**	**135,873**	**35,693**	**186,293**	**111**	**140,369**	**5,018**	**16,052**	**501**	**63,914**	**601,646**	**84,739**	**98,692**	**73,891**	**401,538**	**601,646**
Average	**86,793**	**67,529**	**4,879**	**18,915**	**111**	**22,102**	**5,007**	**16,008**	**500**	**20,637**	**174,953**	**42,062**	**19,264**	**17,993**	**95,635**	**174,953**
Percent of Total	**50%**		**3%**	**11%**	**0.1%**	**13%**	**3%**	**9%**	**0.3%**	**12%**	**100%**	**24%**	**11%**	**10%**	**55%**	**100%**

All yearly, minimum, maximum, and average values are in units of acre-feet per year (AFY).

Abbreviations: WRP = water reclamation plant ET = evapotranspiration DWR= California Department of Water Resources

Note: Blue font means inflow to surface water, purple font means internal surface flow process, and red font means surface water outflow.

Note: The "percent of total" values are calculated from the average values of the individual and total water budget terms.

Note: This water budget is developed by projecting the historical hydrology of water years 1925 through 2019 forward in time for full buildout conditions with 2030 climate change.

All values are from historical data, the water uses associated with the full buildout scenario, and DWR's 2030 climate change factors, except the following:

The internal flow term *Stormwater Generated from In-Basin Precipitation* is the difference between the basin-wide rainfall volume and the volume of streamflow percolation to groundwater from ephemeral streams.

The inflow term *Net Inflow from Groundwater* is computed by the SFR package in MODFLOW-USG and represents the net flux of groundwater into all streams basin-wide.

The outflow term *Santa Clara River Non-Storm Outflow at LA/Ventura County Line* is calculated by the SFR and CHD packages in MODFLOW-USG.

The outflow term *Groundwater Recharge from Precipitation* is calculated by the SCV Recharge Compiler and is provided as input to the RCH package in MODFLOW-USG.

The outflow term *Groundwater Recharge from Ephemeral Streams* is calculated by the SCV Recharge Compiler and is provided as input to the RCH package in MODFLOW-USG.

The outflow term *ET and Stormwater Outflow* is calculated from the balance of all other terms in this surface water budget.

Table E-2

Annual Projected Groundwater Budget for Year 2042 Conditions (Full Buildout With 2030 Climate Change)

Water Budget Development for the Santa Clara River Valley East Groundwater Subbasin

Water Year	Recharge from Precipitation (a)	Recharge from Streams (b)	Subsurface Inflow Beneath Castaic Dam (c)	Subsurface Inflow Beneath Santa Clara River and Other Tributaries (d)	Septic System Recharge (e)	Recharge of Applied Water (f)	TOTAL INFLOW TO GROUNDWATER (g)	Groundwater Pumping (h)	Riparian Evapo-transpiration (i)	Groundwater Discharge to Streams (j)	TOTAL OUTFLOW FROM GROUNDWATER (k)	Change in GW Storage (l)	Cumulative Change in GW Storage (m)
1925	0	94,399	1,676	29,287	2,432	7,487	135,282	55,865	6,693	111,585	174,143	-38,861	-38,861
1926	52,202	150,531	1,676	28,549	2,432	7,487	242,878	64,730	6,990	142,423	214,143	28,735	-10,126
1927	30,421	147,074	1,676	28,536	2,432	7,487	217,626	60,765	7,031	146,462	214,257	3,369	-6,758
1928	5,229	105,574	1,680	29,095	2,439	7,481	151,499	47,820	6,795	120,996	175,612	-24,113	-30,870
1929	0	90,868	1,676	29,380	2,432	7,487	131,843	51,029	6,500	105,867	163,396	-31,553	-62,423
1930	0	89,502	1,676	29,424	2,432	7,487	130,521	55,865	6,249	99,201	161,315	-30,794	-93,217
1931	23,626	132,441	1,676	28,934	2,432	7,487	196,597	64,730	6,370	119,468	190,569	6,028	-87,189
1932	15,512	119,914	1,680	29,006	2,439	7,481	176,033	67,060	6,428	117,221	190,709	-14,676	-101,865
1933	17,775	113,281	1,676	29,026	2,432	7,487	171,678	67,000	6,296	111,365	184,661	-12,983	-114,848
1934	13,163	114,003	1,676	29,097	2,432	7,487	167,858	67,000	6,255	109,770	183,025	-15,167	-130,015
1935	7,027	94,955	1,676	29,301	2,432	7,487	142,878	60,765	5,953	95,663	162,380	-19,502	-149,517
1936	10,237	99,715	1,680	29,406	2,439	7,481	150,959	47,820	6,081	98,021	151,922	-963	-150,481
1937	22,924	118,286	1,676	29,059	2,432	7,487	181,864	47,793	6,298	111,305	165,396	16,468	-134,013
1938	45,955	140,676	1,676	28,734	2,432	7,487	226,961	47,793	6,798	129,581	184,172	42,789	-91,224
1939	21,839	142,716	1,676	28,905	2,432	7,487	205,056	47,793	6,957	142,654	197,404	7,651	-83,572
1940	14,464	115,497	1,680	29,118	2,439	7,481	170,679	47,820	6,791	121,927	176,539	-5,860	-89,432
1941	89,455	247,843	1,676	28,082	2,432	7,487	376,975	47,793	7,742	239,299	294,834	82,141	-7,291
1942	17,914	151,860	1,676	28,677	2,432	7,487	210,047	47,793	7,444	166,309	221,546	-11,499	-18,790
1943	59,424	238,940	1,676	28,329	2,432	7,487	338,288	47,793	7,798	241,238	296,829	41,459	22,669
1944	45,012	176,528	1,680	28,464	2,439	7,481	261,604	47,820	7,743	193,516	249,079	12,525	35,194
1945	8,905	116,730	1,676	29,029	2,432	7,487	166,259	47,793	7,256	136,103	191,151	-24,892	10,302
1946	9,514	110,825	1,676	29,138	2,432	7,487	161,073	47,793	6,979	123,484	178,256	-17,183	-6,882
1947	16,449	111,447	1,676	29,094	2,432	7,487	168,586	47,793	6,857	122,874	177,523	-8,937	-15,819
1948	0	89,676	1,680	29,511	2,439	7,481	130,786	47,820	6,511	104,587	158,918	-28,132	-43,951
1949	0	87,610	1,676	29,511	2,432	7,487	128,717	51,029	6,300	98,807	156,136	-27,419	-71,370
1950	0	86,269	1,676	29,524	2,432	7,487	127,389	53,860	6,041	93,181	153,083	-25,694	-97,063
1951	0	84,891	1,676	29,525	2,432	7,487	126,012	47,790	5,916	88,803	142,509	-16,497	-113,560
1952	49,670	171,139	1,680	28,817	2,439	7,481	261,226	47,820	6,853	146,647	201,321	59,906	-53,655
1953	16,251	127,478	1,676	28,867	2,432	7,487	184,191	47,793	6,799	134,300	188,891	-4,701	-58,355
1954	4,473	98,146	1,676	29,281	2,432	7,487	143,495	47,793	6,549	109,127	163,469	-19,974	-78,330
1955	2,025	94,024	1,676	29,402	2,432	7,487	137,046	51,029	6,393	101,570	158,992	-21,946	-100,276
1956	1,819	91,852	1,680	29,544	2,439	7,481	134,816	53,895	6,157	95,653	155,705	-20,889	-121,165
1957	17,803	115,482	1,676	29,108	2,432	7,487	173,988	47,793	6,311	108,486	162,589	11,399	-109,766
1958	37,962	155,229	1,676	28,633	2,432	7,487	233,419	47,793	6,810	139,151	193,754	39,665	-70,101
1959	1,169	96,920	1,676	29,200	2,432	7,487	138,885	47,793	6,538	108,649	162,979	-24,094	-94,195
1960	0	88,929	1,680	29,528	2,439	7,481	130,057	47,820	6,256	98,896	152,973	-22,915	-117,111
1961	0	87,116	1,676	29,504	2,432	7,487	128,215	51,029	6,075	93,550	150,654	-22,438	-139,549
1962	27,674	120,739	1,676	29,090	2,432	7,487	189,098	53,860	6,352	111,162	171,373	17,725	-121,824

Table E-2

Annual Projected Groundwater Budget for Year 2042 Conditions (Full Buildout With 2030 Climate Change)

Water Budget Development for the Santa Clara River Valley East Groundwater Subbasin

Water Year	Recharge from Precipitation (a)	Recharge from Streams (b)	Subsurface Inflow Beneath Castaic Dam (c)	Subsurface Inflow Beneath Santa Clara River and Other Tributaries (d)	Septic System Recharge (e)	Recharge of Applied Water (f)	TOTAL INFLOW TO GROUNDWATER (g)	Groundwater Pumping (h)	Riparian Evapo-transpiration (i)	Groundwater Discharge to Streams (j)	TOTAL OUTFLOW FROM GROUNDWATER (k)	Change in GW Storage (l)	Cumulative Change in GW Storage (m)
1963	35	88,054	1,676	29,417	2,432	7,487	129,101	47,793	6,115	94,005	147,913	-18,811	-140,635
1964	0	85,909	1,680	29,599	2,439	7,481	127,108	47,797	5,951	90,083	143,831	-16,723	-157,358
1965	20,784	130,572	1,676	29,186	2,432	7,487	192,137	47,784	6,586	112,021	166,391	25,746	-131,612
1966	43,279	146,159	1,676	28,685	2,432	7,487	229,719	47,793	6,827	137,170	191,790	37,929	-93,683
1967	20,397	157,340	1,676	28,773	2,432	7,487	218,105	47,793	7,004	149,098	203,894	14,211	-79,472
1968	11,914	117,254	1,680	29,050	2,439	7,481	169,818	47,820	6,798	126,320	180,938	-11,120	-90,592
1969	58,929	188,718	1,676	28,504	2,432	7,487	287,745	47,793	7,310	183,766	238,869	48,877	-41,715
1970	15,061	151,903	1,676	28,814	2,432	7,487	207,373	47,793	7,303	157,244	212,340	-4,966	-46,682
1971	15,771	127,940	1,676	28,897	2,432	7,487	184,204	47,793	7,044	135,129	189,966	-5,762	-52,444
1972	510	94,380	1,680	29,404	2,439	7,481	135,894	47,820	6,648	108,963	163,431	-27,536	-79,980
1973	17,879	112,185	1,676	29,150	2,432	7,487	170,810	47,793	6,642	115,598	170,032	777	-79,202
1974	14,081	109,294	1,676	29,161	2,432	7,487	164,131	47,793	6,623	113,088	167,503	-3,372	-82,575
1975	4,881	97,223	1,676	29,360	2,432	7,487	143,059	47,793	6,469	103,787	158,049	-14,990	-97,565
1976	2,128	87,870	1,680	29,590	2,439	7,481	131,188	47,820	6,226	96,079	150,126	-18,938	-116,503
1977	16,587	105,772	1,676	29,288	2,432	7,487	163,242	62,624	6,145	103,112	171,881	-8,639	-125,141
1978	98,692	200,998	1,676	28,140	2,432	7,487	339,426	60,895	7,199	177,980	246,073	93,352	-31,789
1979	27,739	176,108	1,676	28,442	2,432	7,487	243,884	47,961	7,520	182,202	237,684	6,200	-25,589
1980	45,454	183,399	1,680	28,522	2,439	7,481	268,975	47,919	8,894	186,642	243,454	25,521	-68
1981	2,767	111,992	1,676	29,147	2,432	7,487	155,501	47,793	8,570	127,297	183,659	-28,158	-28,226
1982	14,495	123,231	1,676	29,050	2,432	7,487	178,371	47,735	8,375	126,463	182,572	-4,201	-32,427
1983	79,674	240,342	1,676	28,063	2,432	7,487	359,674	47,793	9,396	226,609	283,797	75,877	43,450
1984	23,624	184,367	1,680	28,585	2,439	7,481	248,176	47,881	9,255	205,942	263,078	-14,902	28,548
1985	0	102,409	1,676	29,222	2,432	7,487	143,226	47,793	8,430	119,668	175,891	-32,665	-4,117
1986	17,215	126,446	1,676	29,028	2,432	7,487	184,284	47,735	8,389	129,490	185,614	-1,330	-5,448
1987	2,902	97,393	1,676	29,253	2,432	7,487	141,143	47,793	8,042	109,565	165,400	-24,257	-29,705
1988	9,790	109,774	1,680	29,258	2,439	7,481	160,422	51,123	8,031	114,294	173,448	-13,027	-42,732
1989	4,769	94,989	1,676	29,326	2,432	7,487	140,679	50,232	7,793	103,780	161,806	-21,126	-63,858
1990	0	87,327	1,676	29,486	2,432	7,487	128,408	53,776	7,483	96,323	157,583	-29,175	-93,033
1991	14,415	108,342	1,676	29,213	2,432	7,487	163,565	64,730	7,417	103,129	175,276	-11,711	-104,744
1992	55,508	186,771	1,680	28,509	2,439	7,481	282,388	67,114	8,228	164,043	239,385	43,003	-61,741
1993	65,928	247,795	1,676	28,134	2,432	7,487	353,452	57,137	9,134	244,340	310,611	42,841	-18,900
1994	3,105	134,066	1,676	28,904	2,432	7,487	177,670	53,776	8,669	140,696	203,141	-25,471	-44,371
1995	50,665	170,063	1,676	28,547	2,432	7,487	260,870	58,495	8,857	167,532	234,885	25,986	-18,386
1996	14,743	128,173	1,680	29,003	2,439	7,481	183,519	47,881	8,612	136,532	193,024	-9,505	-27,891
1997	11,445	112,372	1,676	29,116	2,432	7,487	164,528	47,793	8,310	120,603	176,706	-12,178	-40,068
1998	72,500	274,210	1,676	28,219	2,432	7,487	386,524	47,735	9,327	262,491	319,553	66,972	26,903
1999	4,485	128,134	1,676	28,936	2,432	7,487	173,150	47,793	8,877	144,708	201,378	-28,228	-1,325
2000	6,035	100,861	1,680	29,346	2,439	7,481	147,842	47,881	8,274	114,406	170,561	-22,719	-24,044

Table E-2

Annual Projected Groundwater Budget for Year 2042 Conditions (Full Buildout With 2030 Climate Change)

Water Budget Development for the Santa Clara River Valley East Groundwater Subbasin

Water Year	Recharge from Precipitation (a)	Recharge from Streams (b)	Subsurface Inflow Beneath Castaic Dam (c)	Subsurface Inflow Beneath Santa Clara River and Other Tributaries (d)	Septic System Recharge (e)	Recharge of Applied Water (f)	TOTAL INFLOW TO GROUNDWATER (g)	Groundwater Pumping (h)	Riparian Evapo-transpiration (i)	Groundwater Discharge to Streams (j)	TOTAL OUTFLOW FROM GROUNDWATER (k)	Change in GW Storage (l)	Cumulative Change in GW Storage (m)
2001	26,567	131,722	1,676	28,888	2,432	7,487	198,773	51,029	8,394	131,315	190,738	8,035	-16,009
2002	4,622	101,746	1,676	29,182	2,432	7,487	147,146	53,802	8,007	112,252	174,061	-26,915	-42,924
2003	8,593	98,515	1,676	29,356	2,432	7,487	148,059	47,793	7,861	105,202	160,856	-12,797	-55,721
2004	10,874	99,115	1,680	29,395	2,439	7,481	150,984	47,881	7,685	104,734	160,300	-9,316	-65,037
2005	79,097	223,493	1,676	28,207	2,432	7,487	342,392	47,793	8,993	204,921	261,707	80,685	15,648
2006	10,263	133,654	1,676	28,822	2,432	7,487	184,335	47,735	8,772	145,788	202,295	-17,960	-2,312
2007	354	92,497	1,676	29,330	2,432	7,487	133,777	47,793	8,067	108,749	164,609	-30,832	-33,144
2008	21,393	111,827	1,680	29,221	2,439	7,481	174,040	51,123	8,093	117,917	177,134	-3,093	-36,237
2009	7,740	99,809	1,676	29,318	2,432	7,487	148,461	55,865	7,837	107,928	171,630	-23,168	-59,405
2010	29,677	130,960	1,676	28,963	2,432	7,487	201,195	58,436	8,019	123,433	189,889	11,306	-48,099
2011	31,372	140,596	1,676	28,761	2,432	7,487	212,326	47,793	8,433	136,991	193,216	19,109	-28,990
2012	2,574	95,553	1,680	29,362	2,439	7,481	139,089	47,881	7,967	107,283	163,130	-24,041	-53,031
2013	0	86,869	1,676	29,494	2,432	7,487	127,959	47,793	7,552	97,356	152,701	-24,742	-77,774
2014	0	85,946	1,676	29,562	2,432	7,487	127,104	50,977	7,338	92,539	150,854	-23,750	-101,524
2015	0	85,276	1,676	29,587	2,432	7,487	126,459	55,865	7,164	88,778	151,807	-25,348	-126,872
2016	0	82,099	1,680	29,686	2,439	7,481	123,385	64,844	6,836	82,193	153,873	-30,488	-157,361
2017	10,933	103,255	1,676	29,327	2,432	7,487	155,110	60,765	6,883	87,246	154,894	216	-157,144
2018	33	82,649	1,676	29,515	2,432	7,487	123,793	47,735	6,884	82,543	137,162	-13,369	-170,513
2019	31,937	133,926	1,676	28,997	2,432	7,487	206,456	47,793	7,539	113,664	168,996	37,460	-133,053
Min	**0**	**82,099**	**1,676**	**28,063**	**2,432**	**7,481**	**123,385**	**47,735**	**5,916**	**82,193**	**137,162**	**-38,861**	
Max	**98,692**	**274,210**	**1,680**	**29,686**	**2,439**	**7,487**	**386,524**	**67,114**	**9,396**	**262,491**	**319,553**	**93,352**	
Average	**19,264**	**125,987**	**1,677**	**29,053**	**2,434**	**7,486**	**185,900**	**51,373**	**7,297**	**128,631**	**187,301**	**-1,401**	
Percent of Total	**10%**	**68%**	**1%**	**16%**	**1%**	**4%**	**100%**	**27%**	**4%**	**69%**	**100%**		

All yearly, minimum, maximum, and average values are in units of acre-feet per year (AFY).

Abbreviations: ET = evapotranspiration GW = groundwater SNMP = Salt Nutrient Management Plan (GSSI, 2016)

Note: The "percent of total" values are calculated from the average values of the individual and total water budget terms.

Note: This water budget is developed by projecting the historical hydrology of water years 1925 through 2019 forward in time for full buildout conditions.

Notes:
(a) Computed by the SCV Recharge Compiler; includes 2030 climate change
(b) Computed by the SCV Recharge Compiler and the SFR package in MODFLOW-USG
(c) Estimated and provided as input to the WEL package in MODFLOW-USG
(d) Computed by the GHB package in MODFLOW-USG
(e) Computed by the SCV Recharge Compiler, based on estimates from the SNMP
(f) Computed by the SCV Recharge Compiler, based on acreages and plant water demands
(g) Total of items (a) through (f)
(h) Groundwater usage for full buildout conditions
(i) Computed by the EVT package in MODFLOW-USG with 2030 climate change factors for ET demands
(j) Computed by the SFR package in MODFLOW-USG
(k) Total of items (h) through (j)
(l) Total inflow minus total outflow
(m) Rolling sum of annual changes in groundwater storage

APPENDIX F

Annual Water Budget Tables: Projected Conditions with 2070 Climate Change

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Table F-1
Annual Projected Surface Water Budget for Year 2072 Conditions (Full Buildout With 2070 Climate Change)
Water Budget Development for the Santa Clara River Valley East Groundwater Subbasin

Water Year	In-Basin Precipitation	Stormwater Generated from In-Basin Precipitation	Stream Inflow (Santa Clara River)	Stream Inflow (Releases from Castaic Lake/ Lagoon)	Stream Inflow (Releases from Bouquet Reservoir)	Stream Inflow (Other Santa Clara River Tributaries)	Discharges to Santa Clara River from Saugus WRP	Discharges to Santa Clara River from Valencia WRP	Discharges to Santa Clara River from Groundwater Treatment Systems	Net Inflow from Groundwater	TOTAL SURFACE WATER INFLOW	Santa Clara River Non-Storm Outflow at LA/Ventura County Line	Groundwater Recharge from Precipitation	Groundwater Recharge from Ephemeral Streams	ET and Stormwater Outflow	TOTAL SURFACE WATER OUTFLOW
1925	28,313	28,313	1,262	1,308	111	0	5,004	15,994	500	19,175	71,667	40,699	0	2,681	28,288	71,667
1926	145,718	94,155	9,777	52,745	111	63,777	5,004	15,994	500	26,614	320,239	48,046	51,563	34,286	186,344	320,239
1927	106,792	78,616	3,180	12,773	111	26,066	5,004	15,994	500	24,232	194,652	45,724	28,176	23,656	97,096	194,652
1928	24,383	20,675	903	556	111	3,347	5,018	16,052	501	19,231	70,103	40,844	3,708	4,695	20,856	70,103
1929	69,044	69,044	536	468	111	0	5,004	15,994	500	14,542	106,199	36,046	0	1,115	69,038	106,199
1930	54,282	54,282	1,014	468	111	0	5,004	15,994	500	10,178	87,552	31,689	0	1,593	54,269	87,552
1931	90,996	71,975	3,584	12,169	111	16,495	5,004	15,994	500	9,934	154,787	31,446	19,021	18,762	85,558	154,787
1932	107,814	97,468	1,971	5,126	111	8,313	5,018	16,052	501	8,872	153,778	30,462	10,346	12,074	100,896	153,778
1933	77,450	64,065	1,550	6,466	111	6,998	5,004	15,994	500	6,553	120,627	28,046	13,385	8,546	70,649	120,627
1934	70,591	61,375	3,433	8,159	111	3,117	5,004	15,994	500	4,518	111,427	26,012	9,216	9,456	66,743	111,427
1935	94,575	90,446	362	1,305	111	658	5,004	15,994	500	1,348	119,857	22,850	4,129	2,436	90,442	119,857
1936	53,441	45,394	219	8,222	111	3,806	5,018	16,052	501	3,429	90,800	25,002	8,047	6,078	51,673	90,800
1937	122,692	104,563	3,433	8,159	111	7,132	5,004	15,994	500	5,333	168,357	26,818	18,129	12,888	110,522	168,357
1938	130,281	82,109	362	77,255	111	61,532	5,004	15,994	500	15,612	306,650	37,039	48,172	30,441	190,998	306,650
1939	111,325	91,206	10,089	7,030	111	26,618	5,004	15,994	500	20,795	197,466	42,276	20,119	24,392	110,679	197,466
1940	64,141	51,704	633	8,231	111	8,253	5,018	16,052	501	16,822	119,762	38,425	12,437	10,647	58,253	119,762
1941	217,867	124,277	33,681	90,612	111	128,697	5,004	15,994	500	49,951	542,417	71,100	93,590	61,672	316,056	542,417
1942	58,322	41,681	1,705	7,801	111	24,182	5,004	15,994	500	34,225	147,844	55,712	16,641	21,726	53,766	147,844
1943	146,893	86,753	30,026	88,922	111	82,539	5,004	15,994	500	60,375	430,364	81,192	60,140	59,940	229,091	430,364
1944	133,590	88,944	728	14,380	111	51,971	5,018	16,052	501	44,503	266,855	66,065	44,646	28,972	127,172	266,855
1945	60,195	51,413	1,290	5,126	111	9,192	5,004	15,994	500	29,842	127,254	51,342	8,782	11,896	55,234	127,254
1946	68,715	62,017	1,580	18,102	111	3,951	5,004	15,994	500	21,611	135,568	43,113	6,698	8,929	76,827	135,568
1947	79,064	66,061	1,006	434	111	7,668	5,004	15,994	500	18,673	128,454	40,208	13,003	6,979	68,265	128,454
1948	34,003	34,003	311	462	111	0	5,018	16,052	501	13,359	69,817	34,964	0	884	33,969	69,817
1949	46,066	46,066	250	468	111	0	5,004	15,994	500	10,153	78,546	31,654	0	829	46,063	78,546
1950	44,336	44,336	836	173	111	0	5,004	15,994	500	6,642	73,596	28,145	0	1,120	44,331	73,596
1951	33,451	33,451	690	1,186	111	0	5,004	15,994	500	4,758	61,693	26,272	0	1,987	33,434	61,693
1952	150,904	102,928	18,902	76,777	111	62,052	5,018	16,052	501	22,423	352,740	43,836	47,976	47,732	213,195	352,740
1953	45,812	32,644	2,003	1,384	111	17,031	5,004	15,994	500	20,839	108,678	42,327	13,168	14,559	38,625	108,678
1954	70,975	68,289	1,777	7,267	111	265	5,004	15,994	500	14,145	116,038	35,650	2,686	4,970	72,733	116,038
1955	67,574	67,053	1,128	5,156	111	51	5,004	15,994	500	10,769	106,288	32,295	521	4,942	68,530	106,288
1956	81,087	81,087	977	5,355	111	0	5,018	16,052	501	7,246	116,347	28,844	0	4,965	82,537	116,347
1957	67,245	51,954	806	18,102	111	11,862	5,004	15,994	500	8,440	128,065	29,923	15,291	13,790	69,061	128,065
1958	149,178	114,203	6,536	18,046	111	27,816	5,004	15,994	500	15,590	238,775	37,050	34,975	31,313	135,437	238,775
1959	49,340	48,382	1,582	729	111	769	5,004	15,994	500	11,920	85,949	33,449	958	3,191	48,352	85,949
1960	45,357	45,357	718	468	111	0	5,018	16,052	501	8,916	77,141	30,516	0	1,297	45,328	77,141
1961	32,135	32,135	871	468	111	0	5,004	15,994	500	6,039	61,122	27,539	0	1,450	32,133	61,122
1962	134,641	108,165	3,734	6,149	111	21,553	5,004	15,994	500	9,205	196,890	30,680	26,476	19,221	120,513	196,890
1963	50,811	50,787	1,031	861	111	20	5,004	15,994	500	6,262	80,593	27,781	24	2,023	50,765	80,593
1964	40,038	40,038	619	2,541	111	0	5,018	16,052	501	4,713	69,593	26,303	0	2,025	41,266	69,593
1965	63,274	44,891	386	76,700	111	23,439	5,004	15,994	500	10,977	196,385	32,428	18,383	30,383	115,191	196,385

Table F-1
Annual Projected Surface Water Budget for Year 2072 Conditions (Full Buildout With 2070 Climate Change)
Water Budget Development for the Santa Clara River Valley East Groundwater Subbasin

Water Year	In-Basin Precipitation	Stormwater Generated from In-Basin Precipitation	Stream Inflow (Santa Clara River)	Stream Inflow (Releases from Castaic Lake/ Lagoon)	Stream Inflow (Releases from Bouquet Reservoir)	Stream Inflow (Other Santa Clara River Tributaries)	Discharges to Santa Clara River from Saugus WRP	Discharges to Santa Clara River from Valencia WRP	Discharges to Santa Clara River from Groundwater Treatment Systems	Net Inflow from Groundwater	TOTAL SURFACE WATER INFLOW	Santa Clara River Non-Storm Outflow at LA/Ventura County Line	Groundwater Recharge from Precipitation	Groundwater Recharge from Ephemeral Streams	ET and Stormwater Outflow	TOTAL SURFACE WATER OUTFLOW
1966	120,292	80,241	8,220	6,249	111	51,068	5,004	15,994	500	20,246	227,684	41,689	40,051	30,990	114,954	227,684
1967	127,507	108,389	7,351	18,102	111	17,809	5,004	15,994	500	25,028	217,406	46,414	19,118	35,134	116,739	217,406
1968	70,811	58,656	1,787	434	111	11,322	5,018	16,052	501	18,221	124,257	39,824	12,155	10,920	61,358	124,257
1969	164,566	100,517	20,674	76,694	111	84,975	5,004	15,994	500	41,497	410,016	62,675	64,049	47,357	235,934	410,016
1970	53,142	39,909	3,919	18,996	111	11,575	5,004	15,994	500	31,719	140,959	53,156	13,233	26,176	48,394	140,959
1971	81,066	67,049	3,992	3,364	111	10,636	5,004	15,994	500	21,643	142,310	43,175	14,017	14,281	70,838	142,310
1972	43,165	43,165	1,392	722	111	0	5,018	16,052	501	14,944	81,905	36,554	0	2,225	43,126	81,905
1973	108,178	89,736	3,287	6,143	111	11,235	5,004	15,994	500	15,006	165,458	36,493	18,442	12,396	98,127	165,458
1974	76,492	65,487	1,490	8,159	111	4,209	5,004	15,994	500	13,678	125,637	35,167	11,005	9,925	69,541	125,637
1975	70,137	66,915	724	6,374	111	1,089	5,004	15,994	500	11,058	110,991	32,581	3,222	5,573	69,615	110,991
1976	66,950	65,809	231	1,542	111	93	5,018	16,052	501	8,344	98,841	29,939	1,141	1,888	65,874	98,841
1977	76,684	63,569	131	1,099	111	7,395	5,004	15,994	500	5,888	112,806	27,396	13,115	6,938	65,357	112,806
1978	232,979	126,908	18,946	89,352	111	150,184	5,004	15,994	500	26,699	539,769	48,035	106,071	52,701	332,963	539,769
1979	111,902	84,739	5,619	30,991	111	23,499	5,004	15,994	500	33,060	226,680	54,590	27,163	27,357	117,570	226,680
1980	138,856	93,140	10,330	53,467	111	52,667	5,018	16,052	501	37,432	314,434	58,872	45,716	35,169	174,677	314,434
1981	59,472	57,713	1,634	5,642	111	2,052	5,004	15,994	500	23,158	113,567	44,698	1,759	9,283	57,828	113,567
1982	79,722	68,452	3,384	8,497	111	5,392	5,004	15,994	500	19,057	137,661	40,489	11,270	14,611	71,290	137,661
1983	190,073	108,266	24,855	80,631	111	113,219	5,004	15,994	500	42,227	472,614	62,928	81,807	59,234	268,645	472,614
1984	44,383	23,783	1,221	9,272	111	29,741	5,018	16,052	501	43,481	149,781	65,234	20,600	23,762	40,185	149,781
1985	57,236	57,236	2,679	2,860	111	0	5,004	15,994	500	21,828	106,212	43,421	0	5,650	57,141	106,212
1986	116,671	98,530	3,710	18,424	111	10,486	5,004	15,994	500	22,264	193,164	43,656	18,141	19,721	111,646	193,164
1987	28,142	26,913	1,800	892	111	711	5,004	15,994	500	14,959	68,112	36,503	1,229	3,516	26,865	68,112
1988	93,613	90,814	3,588	4,044	111	285	5,018	16,052	501	12,772	135,984	34,334	2,799	7,780	91,071	135,984
1989	59,838	58,126	1,290	828	111	174	5,004	15,994	500	9,945	93,684	31,439	1,712	2,403	58,130	93,684
1990	37,701	37,701	193	475	111	0	5,004	15,994	500	7,527	67,505	29,087	0	779	37,639	67,505
1991	74,517	61,736	3,297	6,149	111	6,407	5,004	15,994	500	4,885	116,864	26,397	12,781	9,941	67,745	116,864
1992	151,406	97,076	3,124	27,040	111	67,463	5,018	16,052	501	15,363	286,079	36,581	54,330	39,882	155,285	286,079
1993	179,471	111,001	21,652	77,550	111	87,548	5,004	15,994	500	53,536	441,366	73,046	68,470	60,340	239,510	441,366
1994	43,370	40,753	17,759	5,757	111	3,329	5,004	15,994	500	22,032	113,857	43,646	2,617	16,155	51,439	113,857
1995	155,174	101,372	564	57,280	111	68,139	5,004	15,994	500	30,018	332,784	51,077	53,802	33,744	194,161	332,784
1996	64,958	52,488	2,693	5,860	111	8,405	5,018	16,052	501	21,668	125,267	43,251	12,470	12,979	56,567	125,267
1997	77,714	70,229	1,844	9,435	111	2,975	5,004	15,994	500	16,202	129,779	37,707	7,485	8,138	76,449	129,779
1998	199,453	130,094	31,332	85,784	111	92,628	5,004	15,994	500	55,573	486,378	75,044	69,359	71,708	270,267	486,378
1999	52,140	48,177	1,857	7,545	111	5,368	5,004	15,994	500	28,233	116,753	49,844	3,963	13,107	49,839	116,753
2000	73,524	70,531	1,962	7,414	111	294	5,018	16,052	501	17,534	122,410	39,153	2,993	5,378	74,886	122,410
2001	105,610	78,644	3,453	12,287	111	24,699	5,004	15,994	500	20,583	188,242	41,935	26,966	21,728	97,613	188,242
2002	27,005	23,049	903	641	111	3,642	5,004	15,994	500	14,260	68,060	35,815	3,956	4,982	23,307	68,060
2003	98,508	93,231	968	3,830	111	567	5,004	15,994	500	11,279	136,762	32,778	5,277	4,840	93,866	136,762
2004	58,587	50,726	27	1,725	111	2,903	5,018	16,052	501	9,384	94,308	30,951	7,861	3,764	51,732	94,308
2005	215,768	138,152	33,681	175,793	111	98,055	5,004	15,994	500	33,516	578,421	54,274	77,616	55,268	391,263	578,421
2006	78,861	73,845	4,194	15,814	111	5,086	5,004	15,994	500	24,329	149,893	45,886	5,016	14,340	84,650	149,893

Table F-1

Annual Projected Surface Water Budget for Year 2072 Conditions (Full Buildout With 2070 Climate Change)

Water Budget Development for the Santa Clara River Valley East Groundwater Subbasin

Water Year	In-Basin Precipitation	Stormwater Generated from In-Basin Precipitation	Stream Inflow (Santa Clara River)	Stream Inflow (Releases from Castaic Lake/ Lagoon)	Stream Inflow (Releases from Bouquet Reservoir)	Stream Inflow (Other Santa Clara River Tributaries)	Discharges to Santa Clara River from Saugus WRP	Discharges to Santa Clara River from Valencia WRP	Discharges to Santa Clara River from Groundwater Treatment Systems	Net Inflow from Groundwater	TOTAL SURFACE WATER INFLOW	Santa Clara River Non-Storm Outflow at LA/Ventura County Line	Groundwater Recharge from Precipitation	Groundwater Recharge from Ephemeral Streams	ET and Stormwater Outflow	TOTAL SURFACE WATER OUTFLOW
2007	27,537	27,458	574	934	111	7	5,004	15,994	500	15,450	66,111	37,009	79	1,626	27,397	66,111
2008	101,519	82,669	1,144	11,729	111	13,018	5,018	16,052	501	15,866	164,958	37,365	18,850	10,590	98,154	164,958
2009	56,392	52,785	141	3,249	111	2,491	5,004	15,994	500	11,116	94,999	32,662	3,607	4,632	54,098	94,999
2010	109,815	83,740	943	9,901	111	30,323	5,004	15,994	500	12,985	185,576	34,364	26,075	21,859	103,279	185,576
2011	119,845	97,173	3,974	22,274	111	23,262	5,004	15,994	500	16,776	207,739	38,134	22,672	21,831	125,102	207,739
2012	61,550	60,719	974	1,412	111	83	5,018	16,052	501	11,055	96,756	32,652	831	2,580	60,694	96,756
2013	28,356	28,356	0	250	111	0	5,004	15,994	500	7,730	57,945	29,247	0	361	28,337	57,945
2014	33,851	33,851	191	744	111	0	5,004	15,994	500	5,093	61,488	26,598	0	1,046	33,843	61,488
2015	49,593	49,593	58	2,233	111	0	5,004	15,994	500	3,121	76,614	24,635	0	1,740	50,239	76,614
2016	48,416	48,416	19	729	111	0	5,018	16,052	501	-758	70,089	20,829	0	859	48,401	70,089
2017	109,998	98,018	9,390	10,897	111	3,818	5,004	15,994	500	-2,115	153,597	19,288	11,980	15,042	107,287	153,597
2018	47,252	47,225	0	1,179	111	9	5,004	15,994	500	-441	69,608	20,998	27	1,269	47,313	69,608
2019	115,780	87,287	2,761	18,859	111	29,476	5,004	15,994	500	6,987	195,472	28,340	28,493	25,845	112,794	195,472
Min	**24,383**	**20,675**	**0**	**173**	**111**	**0**	**5,004**	**15,994**	**500**	**-2,115**	**57,945**	**19,288**	**0**	**361**	**20,856**	**57,945**
Max	**232,979**	**138,152**	**33,681**	**175,793**	**111**	**150,184**	**5,018**	**16,052**	**501**	**60,375**	**578,421**	**81,192**	**106,071**	**71,708**	**391,263**	**578,421**
Average	**86,297**	**68,342**	**4,604**	**17,849**	**111**	**19,884**	**5,007**	**16,008**	**500**	**17,702**	**167,964**	**39,133**	**17,956**	**16,230**	**94,644**	**167,964**
Percent of Total	**51%**		**3%**	**11%**	**0.1%**	**12%**	**3%**	**10%**	**0.3%**	**10%**	**100%**	**23%**	**11%**	**10%**	**56%**	**100%**

All yearly, minimum, maximum, and average values are in units of acre-feet per year (AFY).

Abbreviations: WRP = water reclamation plant ET = evapotranspiration DWR= California Department of Water Resources

Note: Blue font means inflow to surface water, purple font means internal surface flow process, and red font means surface water outflow.

Note: The "percent of total" values are calculated from the average values of the individual and total water budget terms.

Note: This water budget is developed by projecting the historical hydrology of water years 1925 through 2019 forward in time for full buildout conditions with 2070 climate change.

All values are from historical data, the water uses associated with the full buildout scenario, and DWR's 2070 climate change factors, except the following:

The internal flow term *Stormwater Generated from In-Basin Precipitation* is the difference between the basin-wide rainfall volume and the volume of streamflow percolation to groundwater from ephemeral streams.

The inflow term *Net Inflow from Groundwater* is computed by the SFR package in MODFLOW-USG and represents the net flux of groundwater into all streams basin-wide.

The outflow term *Santa Clara River Non-Storm Outflow at LA/Ventura County Line* is calculated by the SFR and CHD packages in MODFLOW-USG.

The outflow term *Groundwater Recharge from Precipitation* is calculated by the SCV Recharge Compiler and is provided as input to the RCH package in MODFLOW-USG.

The outflow term *Groundwater Recharge from Ephemeral Streams* is calculated by the SCV Recharge Compiler and is provided as input to the RCH package in MODFLOW-USG.

The outflow term *ET and Stormwater Outflow* is calculated from the balance of all other terms in this surface water budget.

Table F-2

Annual Projected Groundwater Budget for Year 2072 Conditions (Full Buildout With 2070 Climate Change)

Water Budget Development for the Santa Clara River Valley East Groundwater Subbasin

Water Year	Recharge from Precipitation (a)	Recharge from Streams (b)	Subsurface Inflow Beneath Castaic Dam (c)	Subsurface Inflow Beneath Santa Clara River and Other Tributaries (d)	Septic System Recharge (e)	Recharge of Applied Water (f)	TOTAL INFLOW TO GROUNDWATER (g)	Groundwater Pumping (h)	Riparian Evapo-transpiration (i)	Groundwater Discharge to Streams (j)	TOTAL OUTFLOW FROM GROUNDWATER (k)	Change in GW Storage (l)	Cumulative Change in GW Storage (m)
1925	0	93,928	1,676	29,298	2,432	7,487	134,821	55,865	6,985	110,422	173,272	-38,451	-38,451
1926	51,563	147,092	1,676	28,575	2,432	7,487	238,825	64,730	7,285	139,420	211,435	27,390	-11,061
1927	28,176	137,485	1,676	28,623	2,432	7,487	205,880	60,765	7,260	138,061	206,086	-206	-11,267
1928	3,708	100,653	1,680	29,175	2,439	7,481	145,136	47,820	7,016	115,189	170,025	-24,889	-36,156
1929	0	90,060	1,676	29,398	2,432	7,487	131,053	51,029	6,739	103,487	161,255	-30,202	-66,358
1930	0	88,806	1,676	29,436	2,432	7,487	129,837	55,865	6,492	97,391	159,748	-29,911	-96,270
1931	19,021	120,022	1,676	29,047	2,432	7,487	179,686	64,730	6,538	111,194	182,462	-2,776	-99,046
1932	10,346	109,442	1,680	29,177	2,439	7,481	160,564	67,060	6,507	106,240	179,807	-19,243	-118,289
1933	13,385	101,897	1,676	29,185	2,432	7,487	156,063	67,000	6,343	99,904	173,248	-17,185	-135,474
1934	9,216	102,974	1,676	29,245	2,432	7,487	153,031	67,000	6,281	98,036	171,317	-18,286	-153,760
1935	4,129	87,622	1,676	29,403	2,432	7,487	132,749	60,765	6,003	86,534	153,301	-20,552	-174,312
1936	8,047	91,714	1,680	29,514	2,439	7,481	140,874	47,820	6,104	89,065	142,989	-2,115	-176,427
1937	18,129	106,082	1,676	29,210	2,432	7,487	165,017	47,793	6,263	98,528	152,583	12,434	-163,993
1938	48,172	135,912	1,676	28,777	2,432	7,487	224,457	47,793	6,844	121,083	175,719	48,737	-115,256
1939	20,119	136,385	1,676	28,948	2,432	7,487	197,048	47,793	7,094	132,788	187,674	9,373	-105,882
1940	12,437	107,344	1,680	29,220	2,439	7,481	160,601	47,820	6,901	113,520	168,242	-7,641	-113,524
1941	93,590	238,076	1,676	28,116	2,432	7,487	371,378	47,793	7,968	226,355	282,116	89,262	-24,262
1942	16,641	146,836	1,676	28,718	2,432	7,487	203,790	47,793	7,685	159,335	214,812	-11,023	-35,285
1943	60,140	234,759	1,676	28,348	2,432	7,487	334,842	47,793	8,085	235,194	291,072	43,770	8,485
1944	44,646	171,490	1,680	28,504	2,439	7,481	256,240	47,820	8,031	187,021	242,872	13,367	21,852
1945	8,782	115,659	1,676	29,049	2,432	7,487	165,086	47,793	7,540	133,606	188,939	-23,853	-2,001
1946	6,698	105,086	1,676	29,228	2,432	7,487	152,608	47,793	7,206	117,767	172,766	-20,159	-22,159
1947	13,003	101,714	1,676	29,222	2,432	7,487	155,535	47,793	7,006	113,409	168,208	-12,673	-34,833
1948	0	88,390	1,680	29,544	2,439	7,481	129,533	47,820	6,695	100,864	155,379	-25,846	-60,679
1949	0	86,580	1,676	29,529	2,432	7,487	127,705	51,029	6,500	95,904	153,434	-25,729	-86,408
1950	0	85,469	1,676	29,538	2,432	7,487	126,603	53,860	6,250	90,991	151,100	-24,498	-110,906
1951	0	84,113	1,676	29,538	2,432	7,487	125,247	47,763	6,123	86,884	140,769	-15,523	-126,428
1952	47,976	166,016	1,680	28,853	2,439	7,481	254,445	47,820	7,087	140,707	195,614	58,832	-67,597
1953	13,168	120,776	1,676	28,944	2,432	7,487	174,482	47,793	7,015	127,056	181,864	-7,382	-74,979
1954	2,686	96,345	1,676	29,327	2,432	7,487	139,953	47,793	6,762	105,520	160,075	-20,121	-95,100
1955	521	92,515	1,676	29,440	2,432	7,487	134,073	51,029	6,592	98,343	155,965	-21,892	-116,992
1956	0	90,258	1,680	29,581	2,439	7,481	131,439	53,852	6,343	92,539	152,733	-21,294	-138,286
1957	15,291	105,973	1,676	29,226	2,432	7,487	162,085	47,793	6,423	100,624	154,840	7,245	-131,041
1958	34,975	142,321	1,676	28,786	2,432	7,487	217,677	47,793	6,907	126,598	181,298	36,379	-94,662
1959	958	93,829	1,676	29,256	2,432	7,487	135,638	47,793	6,673	102,559	157,025	-21,387	-116,049
1960	0	87,516	1,680	29,552	2,439	7,481	128,669	47,820	6,424	95,135	149,380	-20,711	-136,760
1961	0	85,931	1,676	29,521	2,432	7,487	127,047	51,029	6,261	90,520	147,810	-20,763	-157,523
1962	26,476	116,161	1,676	29,134	2,432	7,487	183,367	53,860	6,509	106,145	166,514	16,853	-140,670

Table F-2

Annual Projected Groundwater Budget for Year 2072 Conditions (Full Buildout With 2070 Climate Change)

Water Budget Development for the Santa Clara River Valley East Groundwater Subbasin

Water Year	Recharge from Precipitation (a)	Recharge from Streams (b)	Subsurface Inflow Beneath Castaic Dam (c)	Subsurface Inflow Beneath Santa Clara River and Other Tributaries (d)	Septic System Recharge (e)	Recharge of Applied Water (f)	TOTAL INFLOW TO GROUNDWATER (g)	Groundwater Pumping (h)	Riparian Evapo-transpiration (i)	Groundwater Discharge to Streams (j)	TOTAL OUTFLOW FROM GROUNDWATER (k)	Change in GW Storage (l)	Cumulative Change in GW Storage (m)
1963	24	86,863	1,676	29,439	2,432	7,487	127,921	47,793	6,297	91,103	145,193	-17,271	-157,942
1964	0	85,035	1,680	29,614	2,439	7,481	126,249	47,748	6,146	87,724	141,619	-15,370	-173,311
1965	18,383	126,813	1,676	29,235	2,432	7,487	186,026	47,752	6,782	107,407	161,941	24,085	-149,227
1966	40,051	142,674	1,676	28,750	2,432	7,487	223,071	47,793	7,053	131,930	186,776	36,295	-112,932
1967	19,118	152,501	1,676	28,831	2,432	7,487	212,045	47,793	7,248	142,394	197,435	14,611	-98,321
1968	12,155	113,947	1,680	29,082	2,439	7,481	166,784	47,820	7,028	121,249	176,097	-9,313	-107,634
1969	64,049	187,232	1,676	28,489	2,432	7,487	291,365	47,793	7,603	181,372	236,768	54,597	-53,037
1970	13,233	144,016	1,676	28,883	2,432	7,487	197,728	47,793	7,551	149,560	204,904	-7,175	-60,213
1971	14,017	119,856	1,676	28,978	2,432	7,487	174,446	47,793	7,250	127,217	182,260	-7,814	-68,027
1972	0	93,040	1,680	29,438	2,439	7,481	134,077	47,820	6,864	105,758	160,443	-26,366	-94,392
1973	18,442	108,984	1,676	29,183	2,432	7,487	168,204	47,793	6,862	111,594	166,249	1,955	-92,437
1974	11,005	103,525	1,676	29,255	2,432	7,487	155,381	47,793	6,818	107,279	161,890	-6,509	-98,947
1975	3,222	93,446	1,676	29,426	2,432	7,487	137,688	47,793	6,637	98,931	153,360	-15,672	-114,619
1976	1,141	86,413	1,680	29,618	2,439	7,481	128,771	47,820	6,404	92,869	147,093	-18,322	-132,940
1977	13,115	95,656	1,676	29,401	2,432	7,487	149,767	62,624	6,232	94,606	163,462	-13,695	-146,635
1978	106,071	193,026	1,676	28,147	2,432	7,487	338,839	60,895	7,361	167,024	235,280	103,559	-43,076
1979	27,163	167,422	1,676	28,474	2,432	7,487	234,654	47,961	7,782	173,125	228,868	5,786	-37,290
1980	45,716	176,629	1,680	28,559	2,439	7,481	262,505	47,919	9,210	178,893	236,022	26,483	-10,806
1981	1,759	109,584	1,676	29,175	2,432	7,487	152,113	47,793	8,886	123,459	180,138	-28,025	-38,831
1982	11,270	114,548	1,676	29,180	2,432	7,487	166,594	47,735	8,624	118,994	175,353	-8,759	-47,590
1983	81,807	226,535	1,676	28,147	2,432	7,487	348,083	47,793	9,691	209,528	267,011	81,072	33,482
1984	20,600	175,714	1,680	28,629	2,439	7,481	236,543	47,881	9,620	195,434	252,935	-16,391	17,091
1985	0	101,438	1,676	29,241	2,432	7,487	142,274	47,793	8,763	117,616	174,173	-31,899	-14,808
1986	18,141	123,452	1,676	29,064	2,432	7,487	182,251	47,735	8,716	125,995	182,445	-194	-15,001
1987	1,229	95,298	1,676	29,294	2,432	7,487	137,417	47,793	8,336	106,740	162,870	-25,453	-40,454
1988	2,799	102,043	1,680	29,389	2,439	7,481	145,832	51,123	8,248	107,035	166,407	-20,575	-61,029
1989	1,712	90,157	1,676	29,417	2,432	7,487	132,881	50,232	7,963	97,699	155,894	-23,013	-84,041
1990	0	85,950	1,676	29,513	2,432	7,487	127,058	53,776	7,685	92,698	154,159	-27,101	-111,142
1991	12,781	101,637	1,676	29,302	2,432	7,487	155,316	64,730	7,580	96,581	168,890	-13,575	-124,717
1992	54,330	172,367	1,680	28,590	2,439	7,481	266,887	67,114	8,296	147,848	223,258	43,628	-81,089
1993	68,470	243,542	1,676	28,137	2,432	7,487	351,744	57,137	9,435	236,738	303,310	48,434	-32,654
1994	2,617	130,389	1,676	28,934	2,432	7,487	173,535	53,776	8,954	136,266	198,997	-25,462	-58,116
1995	53,802	168,568	1,676	28,541	2,432	7,487	262,507	58,495	9,200	164,842	232,537	29,970	-28,146
1996	12,470	121,072	1,680	29,100	2,439	7,481	174,243	47,881	8,901	129,761	186,543	-12,300	-40,446
1997	7,485	104,070	1,676	29,236	2,432	7,487	152,387	47,793	8,489	112,134	168,416	-16,029	-56,474
1998	69,359	264,917	1,676	28,277	2,432	7,487	374,148	47,735	9,632	248,782	306,149	67,999	11,525
1999	3,963	124,708	1,676	28,974	2,432	7,487	169,240	47,793	9,190	139,834	196,817	-27,577	-16,052
2000	2,993	98,904	1,680	29,396	2,439	7,481	142,893	47,881	8,554	111,060	167,495	-24,602	-40,654

Table F-2

Annual Projected Groundwater Budget for Year 2072 Conditions (Full Buildout With 2070 Climate Change)

Water Budget Development for the Santa Clara River Valley East Groundwater Subbasin

Water Year	Recharge from Precipitation (a)	Recharge from Streams (b)	Subsurface Inflow Beneath Castaic Dam (c)	Subsurface Inflow Beneath Santa Clara River and Other Tributaries (d)	Septic System Recharge (e)	Recharge of Applied Water (f)	TOTAL INFLOW TO GROUNDWATER (g)	Groundwater Pumping (h)	Riparian Evapo-transpiration (i)	Groundwater Discharge to Streams (j)	TOTAL OUTFLOW FROM GROUNDWATER (k)	Change in GW Storage (l)	Cumulative Change in GW Storage (m)
2001	26,966	128,347	1,676	28,933	2,432	7,487	195,841	51,029	8,668	127,202	186,899	8,942	-31,712
2002	3,956	99,097	1,676	29,230	2,432	7,487	143,878	53,802	8,248	108,375	170,425	-26,547	-58,258
2003	5,277	93,205	1,676	29,429	2,432	7,487	139,506	47,793	8,068	99,644	155,505	-15,999	-74,257
2004	7,861	91,612	1,680	29,512	2,439	7,481	140,585	47,881	7,838	97,232	152,951	-12,366	-86,623
2005	77,616	200,727	1,676	28,332	2,432	7,487	318,271	47,793	9,105	178,975	235,872	82,399	-4,224
2006	5,016	125,523	1,676	28,915	2,432	7,487	171,049	47,735	8,946	135,512	192,193	-21,144	-25,368
2007	79	91,295	1,676	29,368	2,432	7,487	132,338	47,793	8,267	105,119	161,179	-28,842	-54,210
2008	18,850	106,231	1,680	29,304	2,439	7,481	165,985	51,123	8,284	111,507	170,914	-4,929	-59,139
2009	3,607	94,818	1,676	29,408	2,432	7,487	139,429	55,865	7,973	101,303	165,141	-25,712	-84,851
2010	26,075	124,402	1,676	29,062	2,432	7,487	191,135	58,436	8,128	115,528	182,093	9,042	-75,809
2011	22,672	127,601	1,676	28,941	2,432	7,487	190,809	47,793	8,436	122,546	178,775	12,034	-63,775
2012	831	91,224	1,680	29,454	2,439	7,481	133,109	47,881	8,019	99,699	155,599	-22,490	-86,265
2013	0	85,138	1,676	29,526	2,432	7,487	126,260	47,793	7,679	92,507	147,978	-21,718	-107,983
2014	0	84,402	1,676	29,582	2,432	7,487	125,579	50,977	7,501	88,449	146,926	-21,347	-129,330
2015	0	84,031	1,676	29,603	2,432	7,487	125,229	55,865	7,349	85,411	148,625	-23,396	-152,726
2016	0	80,674	1,680	29,699	2,439	7,481	121,973	64,844	7,022	79,057	150,923	-28,951	-181,677
2017	11,980	101,031	1,676	29,334	2,432	7,487	153,940	60,762	7,055	83,874	151,691	2,249	-179,428
2018	27	81,502	1,676	29,532	2,432	7,487	122,657	47,691	7,093	79,792	134,576	-11,919	-191,347
2019	28,493	125,662	1,676	29,083	2,432	7,487	194,833	47,793	7,702	106,805	162,300	32,534	-158,814
Min	**0**	**80,674**	**1,676**	**28,116**	**2,432**	**7,481**	**121,973**	**47,691**	**6,003**	**79,057**	**134,576**	**-38,451**	
Max	**106,071**	**264,917**	**1,680**	**29,699**	**2,439**	**7,487**	**374,148**	**67,114**	**9,691**	**248,782**	**306,149**	**103,559**	
Average	**17,956**	**120,650**	**1,677**	**29,113**	**2,434**	**7,486**	**179,315**	**51,371**	**7,495**	**122,122**	**180,987**	**-1,672**	
Percent of Total	**10%**	**68%**	**1%**	**16%**	**1%**	**4%**	**100%**	**28%**	**4%**	**68%**	**100%**		

All yearly, minimum, maximum, and average values are in units of acre-feet per year (AFY).

Abbreviations: ET = evapotranspiration GW = groundwater SNMP = Salt Nutrient Management Plan (GSSI, 2016)

Note: The "percent of total" values are calculated from the average values of the individual and total water budget terms.

Note: This water budget is developed by projecting the historical hydrology of water years 1925 through 2019 forward in time for full buildout conditions.

Notes:
(a) Computed by the SCV Recharge Compiler; includes 2070 climate change
(b) Computed by the SCV Recharge Compiler and the SFR package in MODFLOW-USG
(c) Estimated and provided as input to the WEL package in MODFLOW-USG
(d) Computed by the GHB package in MODFLOW-USG
(e) Computed by the SCV Recharge Compiler, based on estimates from the SNMP
(f) Computed by the SCV Recharge Compiler, based on acreages and plant water demands
(g) Total of items (a) through (f)
(h) Groundwater usage for full buildout conditions
(i) Computed by the EVT package in MODFLOW-USG with 2070 climate change factors for ET demands
(j) Computed by the SFR package in MODFLOW-USG
(k) Total of items (h) through (j)
(l) Total inflow minus total outflow
(m) Rolling sum of annual changes in groundwater storage