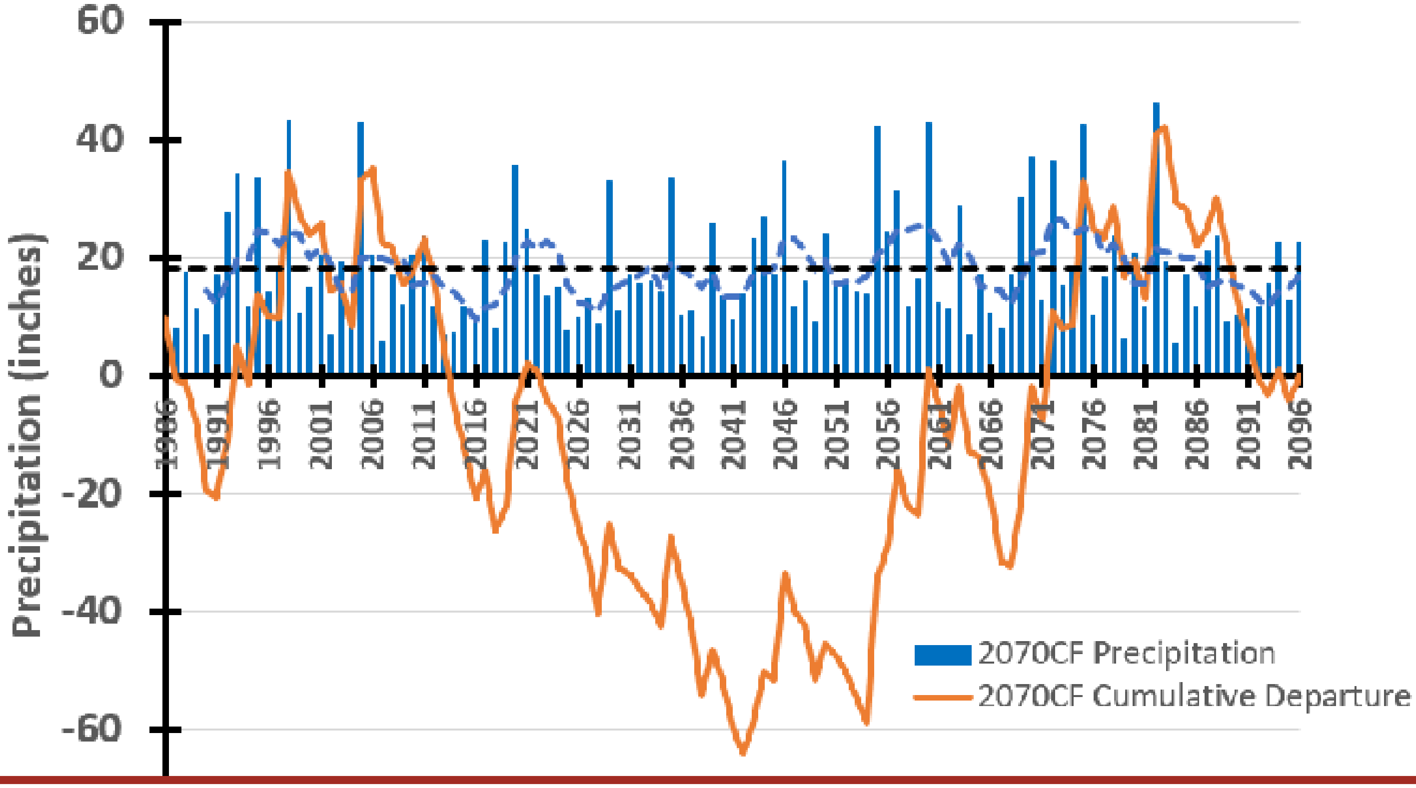
FILLMORE BASIN

Groundwater Sustainability Plan
Final



December 16, 2021

Prepared for

Fillmore and Piru Basins
Groundwater Sustainability Agency

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Certification

This groundwater sustainability plan was prepared in accordance with generally accepted professional hydrogeologic principles and practices. This document makes no other warranties, either expressed or implied, as to the professional advice or data included in it. This document has not been prepared for use by parties or projects other than those named or described herein. It may not contain sufficient information for other parties or purposes.

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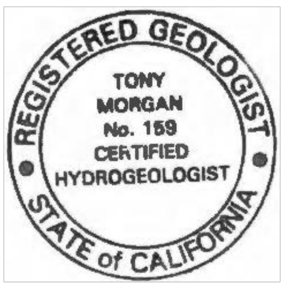

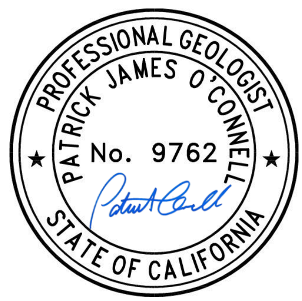

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Acronyms and Abbreviations

AB	assembly bill
ADCP	acoustic doppler current profiler
AF	acre-feet
AFY	acre-feet per year
Ag	agriculture
AMI	automated (or advanced) metering infrastructure
APN	assessor parcel number
B	boron
Basin	Fillmore subbasin of the Santa Clara River Valley Basin
bgs	below ground surface
BMP	best management practice
BOS	bottom of screen (perforations)
CA	California
CalGEM	California Geologic Energy Management Division (formerly DOGGR)
CASGEM	California Statewide Groundwater Elevation Monitoring
CCR	California Code of Regulations
CDFW	California Department of Fish and Wildlife
CDPH	California Department of Public Health
cfs	cubic feet per second
CIMIS	California Irrigation Management Information System
Cl	chloride
COC	chemical of concern
CWC	California Water Code
DBS&A	Daniel B. Stephens & Associates, Inc.
DDW	[SWRCB] Division of Drinking Water
DEM	digital elevation model
DOGGR	Division of Oil, Gas, and Geothermal Resources (reorganized as CalGEM)
DQO	data quality objective
DTSC	[CA] Department of Toxic Substances Control
DTW	depth to water
DWR	[CA] Department of Water Resources
DWUs	downstream water users

EGM96	Earth Gravitational Model of 1996
ENSO	El Niño Southern Oscillation
ESA	Endangered Species Act of 1973
ET	evapotranspiration
ET_0	reference evapotranspiration
FCGMA	Fox Canyon Groundwater Management Agency
FERC	Federal Energy Regulation Commission
FICO	Farmers Irrigation Company
FPBGSA	Fillmore and Piru Basins Groundwater Sustainability Agency
GAMA	[USGS] Groundwater Ambient Monitoring & Assessment program
GIS	geographic information system
GPS	global positioning system
GSP	groundwater sustainability plan
HASP	health and safety plan
HCM	hydrogeologic conceptual model
Hwy	[CA] State Highway
Hydrodata	[VCWPD] hydrologic data server
ID	identification
InSAR	Interferometric Synthetic Aperture Radar
IRWM	Integrated Regional Water Management
IRWMP	Integrated Regional Water Management Plan
LARWQCB	Los Angeles Regional Water Quality Control Board
LiDAR	light detection and ranging
LNAPL	light nonaqueous-phase liquid
M&I	municipal and industrial
MCL	maximum contaminant level
MOU	memorandum of understanding
MS4	municipal separate storm sewer system
msl	above mean sea level
NAD	North American Datum
NAVD88	North American Vertical Datum of 1988
NCCAG	natural communities commonly associated with groundwater
ND	non-detect
NDVI	Normalized Difference Vegetation Index
NDMI	Normalized Difference Moisture Index

NGVD29	National Geodetic Vertical Datum of 1929
NMFS	National Marine Fisheries Service
NO_3	nitrate
NWIS	National Water Information System
OFR	open file report
PBP	priority basin project
PDO	Pacific Decadal Oscillation
Prop 1	Proposition 1
psi	pounds per square inch
PSW	public supply well
PVC	polymerizing vinyl chloride
QA	quality assurance
QC	quality control
RASA	regional aquifer-system analysis
Reg.	SGMA Regulation
Regional Model	Ventura Regional Groundwater Flow Model
RMSE	root mean squared error
RP	reference point (elevation)
RWQCB	[CA] Regional Water Quality Control Board
SAP	sampling and analysis plan
SCE	Southern California Edison
SCVGSA	Santa Clarita Valley Groundwater Sustainability Agency
SCV Water	Santa Clarita Valley Water Agency
SFEI	San Francisco Estuary Institute
SGMA	[CA] Sustainable Groundwater Management Act of 2014
SO_4	sulfate
SUM	summation
SWL	static water level
SWN	[CA DWR] state well number
SWP	[CA] State Water Project
SWRCB	[CA] State Water Resource Control Board
TD	total depth
TDS	total dissolved solids
TFR	total filterable residue
TMDL	total maximum daily load

TNC	The Nature Conservancy
TOS	top of screen (perforations)
URL	uniform resource locator (web address)
U.S. DOT	U.S. Department of Transportation
U.S. EPA	U.S. Environmental Protection Agency
USFWS	U.S. Fish and Wildlife Services
USGS	U.S. Geological Survey
United	United Water Conservation District
VC	Ventura County
VCWPD	Ventura County Watershed Protection District
VCWD 16	Ventura County Waterworks District Number 16
VRSD	Ventura Regional Sanitation District
WCVC	Watersheds Coalition of Ventura County
WGS84	world geodetic system 1984
WL	water level
WLE	water level elevation
WQ	water quality
WRP	water reclamation plant
WWTP	wastewater treatment plant
WY	water year
WYT	water year type (DWR)

Executive Summary

The Fillmore Basin (the Basin) is managed (along with the upslope Piru Basin) by the Fillmore and Piru Basins Groundwater Sustainability Agency (the Agency). The Basin is planned to remain sustainable over the Sustainable Groundwater Management Act (SGMA) implementation and sustainability period based on the current understanding of historical, current (2019), and projected (2022 through 2072) groundwater conditions in relation to the sustainability indicators specified in SGMA. A sustainability indicator refers to any of the effects caused by groundwater conditions occurring throughout the basin that, when significant and unreasonable, cause undesirable results. The Agency, with consideration of feedback from active stakeholder engagement, has identified and planned for the prevention of significant and unreasonable undesirable results.

Four of the six sustainability indicators apply to the Basin (with identified undesirable results to avoid):

- Chronic lowering of groundwater levels (retain sufficient water levels to protect water well ability to pump and sustain key groundwater dependent ecosystems [GDEs] in rising groundwater areas following drought periods)
- Reduction of groundwater in storage (groundwater pumping that does not chronically reduce the volume of groundwater in storage)
- Land subsidence (prevent inelastic [non-recoverable] land elevation declines, due to groundwater pumping, that interfere with critical infrastructure [e.g., canals, roads, and utilities])
- Degraded water quality (avoid projects or management actions that degrade water quality beyond historical conditions)

The Agency has benefited from the historical groundwater monitoring and management that has taken place in the Fillmore Basin. The hydrology of the Basin has been quantified over several decades with mandatory self-reporting of groundwater extractions being a required element of groundwater management since the 1980s. Monitoring of groundwater levels and water quality by United Water Conservation District (United) and/or Ventura County Watershed Protection District (VCWPD) has been a staple in the Basin for several decades.

The Basin is characterized by declining water levels during drought periods that recover during subsequent normal to wet periods. The Basin benefits from the discharge of treated wastewater treatment plant effluent from the upstream Valencia treatment plant in the East Valley Santa Clarita Basin to the Santa Clara River. This effluent flows down valley (to the west) toward the Piru and Fillmore Basins and serves to recharge the aquifers beneath these basins and help stabilize groundwater elevations.

Consequently, the Fillmore Basin exhibits a repetitive, cyclic behavior in water levels that is characteristic of a sustainable basin. There is no evidence of chronic, long-term declines in water levels.

The relationship between water level changes and changes in groundwater storage indicates that the absence of chronic, long-term declines in water level also excludes the potential for long-term declines in groundwater storage.

The primary areas of GDEs in the Basin are located at the Fillmore/Piru Basin boundary and the Fillmore/Santa Paula Basin boundary. The GDEs are supported by rising groundwater in these areas with the upstream and downstream reaches of the Santa Clara River being losing reaches and consequently dry for many months of the year.

Depletion of interconnected surface water and groundwater by groundwater extraction has been identified in the Fillmore Basin using the recently developed groundwater flow model. The model helped the Agency determine how water levels during prolonged drought periods were impacted by the drought itself versus how those water levels were altered by groundwater extraction. Modeling assisted in identifying that the water levels were likely to decline below critical water levels for vegetative GDEs in prolonged droughts even with extensive (~50 percent) reductions in groundwater extraction.

Water quality changes in the Basin are not expected due to the implementation of this groundwater sustainability plan (GSP). Major anthropogenic water quality challenges have not been identified in the Basin. The Agency does not have regulatory authority over water quality; however, it is committed to continuing the extension of the water level and water quality program that has been in place for many years, and will work cooperatively with regulatory agencies that have authority over water quality issues.

Seawater intrusion is not applicable to this basin. The Fillmore Basin is located several miles inland and at an elevation substantially higher than the coastline.

The Agency has elected to develop and implement a mitigation plan for the impact groundwater extractions have in exacerbating the water declines associated with prolonged drought periods. The details of the plan will be developed in consultation with the California Department of Fish and Wildlife (CDFW) and stakeholders and memorialized in a mitigation plan that will describe how, when, and where the Agency will provide supplemental water from a deep water supply well to the Cienega Springs restoration project during a prolonged drought. This restoration project has the potential to be a seed reservoir/bank that can be important to the revegetation of GDE areas impacted by droughts.

1. Introduction

This groundwater sustainability plan (GSP) covers the Fillmore Basin (the Basin) located in Ventura County, California in the Santa Clara River Valley. This GSP was developed with extensive stakeholder engagement to ensure that the interests of the beneficial users and uses of groundwater were taken into consideration as the program to achieve sustainability was being established.

1.1 Purpose of the Groundwater Sustainability Plan

In 2014, the State of California enacted the Sustainable Groundwater Management Act (SGMA). This law requires that groundwater basins in California designated as medium or high priority be managed sustainably. The Fillmore subbasin was assigned a High priority status by the Department of Water Resources (DWR). The Fillmore and Piru Basin Groundwater Sustainability Agency (FPGSA or the Agency) was formed, and its directors have elected to prepare a GSP and to use awarded grant funds to support the sustainable management effort.

Satisfying the requirements of SGMA generally requires four basic activities:

- Forming one or multiple groundwater sustainability agency(ies) (GSAs) to fully cover a basin
- Developing one or multiple groundwater sustainability plan(s) (GSPs) that fully cover the basin
- Implementing the GSP and managing to achieve quantifiable objectives
- Regular reporting to DWR

This document fulfills the GSP requirement for the Fillmore Basin. This GSP describes the Basin, develops quantifiable management objectives that account for the interests of the areas beneficial groundwater uses and users, and identifies a group of projects and management actions that will allow the Basin to achieve sustainability within 20 years of plan adoption.

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

This GSP is a planning document. The numbers in this GSP are not meant to be the basis for final determinations of individual water rights or safe yield. This GSP also does not define water rights, and none of the numbers in the GSP should be considered definitive for water rights determination purposes. The GSP does, however, take into consideration the beneficial uses and users of groundwater resources in the Basin.

1.2 Sustainability Goal

The FPBGSA board of directors approved their guiding principles at the November 2019 board meeting. These principles describe commitments and common interests that combined leadership from the FPBGSA have agreed on as a way to influence current and future compliance with the SGMA. The FPBGSA Joint Exercise of Powers Agreement (JPA) (Appendix A) is the legal foundational document for the GSA. These guiding principles are intended to be consistent with and in furtherance of the JPA. In the event of a conflict between the JPA and these principles, the JPA takes precedence.

Furthermore, the FPBGSA will act in support of the following mission statement and strategies:

> Mission Statement: The Fillmore and Piru Basins Groundwater Sustainability Agency safeguards the sustainability of the Fillmore and Piru basins through locally tailored management of groundwater resources to protect and sustain the environment, local residents and communities, agriculture, and the economy.
>
> FPBGSA Strategies:
>
> 1. Prepare and implement a Groundwater Sustainability Plan (GSP) as described in the Sustainable Groundwater Management Act (SGMA).
>
> 2. Establish standards and criteria for sustainable groundwater conditions and management within the Basin.
>
> 3. Implement groundwater management policies, regulations, and projects of the GSP consistent with the authorities granted under SGMA.
>
> 4. Monitor groundwater resources as prescribed in the GSP, assess changes in the groundwater basin using best available models and data, and adjust or modify management practices when needed to achieve or maintain sustainability.

5. Report annually and as needed to the FPBGSA Board of Directors and public on groundwater uses and conditions in the Basin.

6. Ensure local resident and stakeholder voices including Federal and State recognized tribes are heard through effective public engagement that invites deliberation, collaboration, and action on groundwater management issues of common importance.

1.3 Agency Information (Reg. § 354.6)

The Fillmore Basin GSP has been developed under the direction of the FPBGSA. Contact information for the FPBGSA is as follows:

Fillmore and Piru Basins Groundwater Sustainability Agency
P.O. Box 1110
Fillmore, CA 93016
Website: www.fpbgsa.org
ATTN: Anthony Emmert, Executive Director
805-525-4431
tonye@Unitedwater.org

1.3.1 Organization and Management Structure of the Groundwater Sustainability Agency

The FPBGSA Board of Directors is composed of a single appointed representative from each of the following public agencies and stakeholder entities:

- Public agencies
  - County of Ventura
  - City of Ventura
  - United Water Conservation District (United)
- Stakeholder entities
  - Fillmore Basin Pumpers Association
  - Piru Basin Pumpers Association
  - Environmental organizations

The County of Ventura Board of Supervisors appoints a supervisor to the FPBGSA Board of Directors.

The City of Fillmore represents the municipal water users of the largest city in the Fillmore Basin. The City of Fillmore City Council appoints a councilperson as its representative to the FPBGSA Board of Directors.

United is a special district that is charged with managing, protecting, conserving, and enhancing the water resources of the Santa Clara River, its tributaries, and associated aquifers. The Fillmore and Piru Basins are located within the United service area. The United Board of Directors appoints one of its members as its representative to the FPBGSA Board of Directors.

The Fillmore Basin Pumpers Association represents the groundwater water extractors in that basin. The association is open to all groundwater extractors (i.e., municipal, domestic, irrigation, industrial). The stakeholders of the Fillmore Basin Pumpers Association appoint one of its members as its representative to the FPBGSA Board of Directors.

The Piru Basin Pumpers Association represents the groundwater water extractors in that basin. The Association is open to all groundwater extractors (i.e., municipal, domestic, irrigation, industrial). The stakeholders of the Piru Basin Pumpers Association appoint one of its members as its representative to the FPBGSA Board of Directors.

The interests of environmental organizations engaged in the enhancement or protection of the environment over the Fillmore Basin or Piru Basin, or both, are represented by the Environmental Stakeholder Director. This director is nominated by the Santa Clara River Environmental Groundwater Committee, which consists of the following organizations: The Nature Conservancy, Friends of the Santa Clara River, California Trout, Wishtoyo Foundation, Keep the Sespe Wild, Santa Clara River Watershed Conservancy, Sierra Club, Central Coast Alliance United for a Sustainable Economy (CAUSE), Citizen for Responsible Oil and Gas (CFROG), Surfrider Foundation, Los Padres Forest Watch, and National Audubon Society.

The supporting staff to the FPBGSA board of directors includes the following:

- Contract legal counsel.
- Contract Executive Director that oversees the routine operations of the FPBGSA and is currently an employee of United.
- Contract Clerk of the Board who is currently an employee of United.
- Groundwater modeling services are provided by United Water Resources Department personnel.

- Contract GSP/technical staff are provided by Daniel B. Stephens & Associates, Inc.

1.3.2 Legal Authority of the GSA

The FPBGSA JPA (Appendix A) is the legal foundational document for the FPBGSA.

1.3.3 Estimated Cost of Implementing the GSP and the GSA's Approach to Meet Costs

The estimated costs of implementing this GSP are under development by the FPBGSA board of directors and staff, and are dependent on the projects and management actions (Section 4). As detailed in other sections of this document, the Basin is in a sustainable condition, with only limited projects or management actions deemed appropriate for mitigating the impacts of groundwater extraction on groundwater dependent ecosystems (GDEs) during prolonged drought periods (Section 3 and Appendix J). The estimated costs of that mitigation program will be developed post-submittal of the GSP to DWR in January 2022 in consultation with the California Department of Fish and Wildlife (CDFW) and stakeholders. The FPBGSA board of directors will consider other actions (Section 3) that have the potential to augment the groundwater management program in the Basin, but are not necessarily needed to achieve sustainability.

The FPBGSA board of directors has typically financed its operation via a groundwater extraction charge (i.e., fee per feet/acre-foot of groundwater pumped). The agency has other financial mechanisms that could be employed, if needed (e.g., ad valorem charges). The FPBGSA board of directors are and will continue to explore grant opportunities, as well.

1.4 GSP Organization

This GSP is organized according to DWR's "GSP Annotated Outline" for standardized reporting (DWR, 2016). The Preparation Checklist for GSP Submittal is provided as Table 1.4-1 (DWR, 2016).

Table 1.4-1. Preparation Checklist for GSP Submittal
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GSP Regulations Section	Water Code Section	Requirement	Description	Section(s) or Page Number(s) in GSP
Article 3. Technical and Reporting Standards				
352.2		Monitoring Protocols	▪ Monitoring protocols adopted by the GSA for data collection and management ▪ Monitoring protocols that are designed to detect changes in groundwater levels, groundwater quality, inelastic surface subsidence for basins for which subsidence has been identified as a potential problem, and flow and quality of surface water that directly affect groundwater levels or quality or are caused by groundwater extraction in the basin	Section 3.5 Appendices F, J, K, and L
Article 5. Plan Contents, Subarticle 1. Administrative Information				
354.4		General Information	▪ Executive Summary ▪ List of references and technical studies	ES-1 Section 6
354.6		Agency Information	▪ GSA mailing address ▪ Organization and management structure ▪ Contact information of Plan Manager ▪ Legal authority of GSA ▪ Estimate of implementation costs	Section 1.3
354.8(a)	10727.2(a)(4)	Map(s)	▪ Area covered by GSP ▪ Adjudicated areas, other agencies within the basin, and areas covered by an Alternative ▪ Jurisdictional boundaries of federal or State land ▪ Existing land use designations ▪ Density of wells per square mile	Figures 2.1-2, 2.1-3, 2.1-5, 2.1-6, 2.1-7, 2.1-12, and 2.1-13

Table 1.4-1. Preparation Checklist for GSP Submittal
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GSP Regulations Section	Water Code Section	Requirement	Description	Section(s) or Page Number(s) in GSP
354.8(b)		Description of the Plan Area	Summary of jurisdictional areas and other features	Section 2.1
354.8(c) 354.8(d) 354.8(e)	10727.2(g)	Water Resource Monitoring and Management Programs	▪ Description of water resources monitoring and management programs ▪ Description of how the monitoring networks of those plans will be incorporated into the GSP ▪ Description of how those plans may limit operational flexibility in the basin ▪ Description of conjunctive use programs	Section 2.1.2 Section 3.5 Appendices J, K, and L
354.8(f)	10727.2(g)	Land Use Elements or Topic Categories of Applicable General Plans	▪ Summary of general plans and other land use plans ▪ Description of how implementation of the GSP may change water demands or affect achievement of sustainability and how the GSP addresses those effects ▪ Description of how implementation of the GSP may affect the water supply assumptions of relevant land use plans ▪ Summary of the process for permitting new or replacement wells in the basin ▪ Information regarding the implementation of land use plans outside the basin that could affect the ability of the Agency to achieve sustainable groundwater management	Section 2.2 Section 2.1.3.3 Section 2.1.3.4 Section 2.1.4.1 Section 2.1.4.3 Section 2.1.4.6 Section 2.1.4.10

Table 1.4-1. Preparation Checklist for GSP Submittal
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GSP Regulations Section	Water Code Section	Requirement	Description	Section(s) or Page Number(s) in GSP
354.8(g)	10727.4	Additional GSP Contents	Description of actions related to: ▪ Control of saline water intrusion ▪ Wellhead protection ▪ Migration of contaminated groundwater ▪ Well abandonment and well destruction program ▪ Replenishment of groundwater extractions ▪ Conjunctive use and underground storage ▪ Well construction policies ▪ Addressing groundwater contamination cleanup, recharge, diversions to storage, conservation, water recycling, conveyance, and extraction projects ▪ Efficient water management practices ▪ Relationships with State and federal regulatory agencies ▪ Review of land use plans and efforts to coordinate with land use planning agencies to assess activities that potentially create risks to groundwater quality or quantity ▪ Impacts on groundwater dependent ecosystems	Section 2.1.4
354.10		Notice and Communication	▪ Description of beneficial uses and users ▪ List of public meetings ▪ GSP comments and responses ▪ Decision-making process ▪ Public engagement ▪ Encouraging active involvement ▪ Informing the public on GSP implementation progress	Section 2.1.5 Appendices B, C

Table 1.4-1. Preparation Checklist for GSP Submittal
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GSP Regulations Section	Water Code Section	Requirement	Description	Section(s) or Page Number(s) in GSP
Article 5. Plan Contents, Subarticle 2. Basin Setting				
354.14		Hydrogeologic Conceptual Model	▪ Description of the Hydrogeologic Conceptual Model ▪ Two scaled cross-sections ▪ Map(s) of physical characteristics: topographic information, surficial geology, soil characteristics, surface water bodies, source and point of delivery for imported water supplies	Section 2.2 Appendix K Figures 2.2-2, 2.2-3, 2.2-8 through 2.2-11, 2.2-13, 2.2-14
354.14(c)(4)	10727.2(a)(5)	Map of Recharge Areas	Map delineating existing recharge areas that substantially contribute to the replenishment of the basin, potential recharge areas, and discharge areas	Figure 2.2-10
354.14(c)(4)	10727.2(d)(4)	Recharge Areas	Description of how recharge areas identified in the plan substantially contribute to the replenishment of the basin	Section 2.2 Appendices E, G, H, and I
354.16	10727.2(a)(1) 10727.2(a)(2)	Current and Historical Groundwater Conditions	▪ Groundwater elevation data ▪ Estimate of groundwater storage ▪ Seawater intrusion conditions ▪ Groundwater quality issues ▪ Land subsidence conditions ▪ Identification of interconnected surface water systems ▪ Identification of groundwater-dependent ecosystems	Appendix C, F, K, J Figure 2.2-16 www.fillmore-piru.gladata.com Section 2.2.2.2
354.18	10727.2(a)(3)	Water Budget Information	▪ Description of inflows, outflows, and change in storage ▪ Quantification of overdraft ▪ Estimate of sustainable yield ▪ Quantification of current, historical, and projected water budgets	Section 2.2.2, 2.2.3 Appendices E, G, H, and I

Table 1.4-1. Preparation Checklist for GSP Submittal
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GSP Regulations Section	Water Code Section	Requirement	Description	Section(s) or Page Number(s) in GSP
354.18	10727.2(d)(5)	Surface Water Supply	Description of surface water supply used or available for use for groundwater recharge or in-lieu use	Appendices G, I, H Section 2.2.1.4.4 2.2.1.5.7
354.20		Management Areas	▪ Reason for creation of each management area ▪ Minimum thresholds and measurable objectives for each management area ▪ Level of monitoring and analysis ▪ Explanation of how management of management areas will not cause undesirable results outside the management area ▪ Description of management areas	Sections 2.2.4, 3.3, 3.4
Article 5. Plan Contents, Subarticle 3. Sustainable Management Criteria				
354.24		Sustainability Goal	Description of the sustainability goal	Section 1.2 Appendix B
354.26		Undesirable Results	▪ Description of undesirable results ▪ Cause of groundwater conditions that would lead to undesirable results ▪ Criteria used to define undesirable results for each sustainability indicator ▪ Potential effects of undesirable results on beneficial uses and users of groundwater	Section 3 Appendix J

Table 1.4-1. Preparation Checklist for GSP Submittal
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GSP Regulations Section	Water Code Section	Requirement	Description	Section(s) or Page Number(s) in GSP
354.28	10727.2(d)(1) 10727.2(d)(2)	Minimum Thresholds	▪ Description of each minimum threshold and how they were established for each sustainability indicator ▪ Relationship for each sustainability indicator ▪ Description of how selection of the minimum threshold may affect beneficial uses and users of groundwater ▪ Standards related to sustainability indicators ▪ How each minimum threshold will be quantitatively measured	Section 3.3 Appendix J
354.30	10727.2(b)(1) 10727.2(b)(2) 10727.2(d)(1) 10727.2(d)(2)	Measurable Objectives	▪ Description of establishment of the measurable objectives for each sustainability indicator ▪ Description of how a reasonable margin of safety was established for each measurable objective ▪ Description of a reasonable path to achieve and maintain the sustainability goal, including a description of interim milestones	Section 3.4 Appendix J

Table 1.4-1. Preparation Checklist for GSP Submittal
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GSP Regulations Section	Water Code Section	Requirement	Description	Section(s) or Page Number(s) in GSP
Article 5. Plan Contents, Subarticle 4. Monitoring Networks				
354.34	10727.2(d)(1) 10727.2(d)(2) 10727.2(e) 10727.2(f)	Monitoring Networks	▪ Description of monitoring network ▪ Description of monitoring network objectives ▪ Description of how the monitoring network is designed to demonstrate groundwater occurrence, flow directions, and hydraulic gradients between principal aquifers and surface water features; estimate the change in annual groundwater in storage; monitor seawater intrusion; determine groundwater quality trends; identify the rate and extent of land subsidence; and calculate depletions of surface water caused by groundwater extractions ▪ Description of how the monitoring network provides adequate coverage of Sustainability Indicators ▪ Density of monitoring sites and frequency of measurements required to demonstrate short-term, seasonal, and long-term trends ▪ Scientific rational (or reason) for site selection ▪ Consistency with data and reporting standards ▪ Corresponding sustainability indicator, minimum threshold, measurable objective, and interim milestone	Section 3.5 Appendices K, L
354.36		Representative Monitoring	▪ Description of representative sites ▪ Demonstration of adequacy of using groundwater elevations as proxy for other sustainability indicators ▪ Adequate evidence demonstrating site reflects general conditions in the area	Section 3.5.3 Appendix K

Table 1.4-1. Preparation Checklist for GSP Submittal
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GSP Regulations Section	Water Code Section	Requirement	Description	Section(s) or Page Number(s) in GSP
354.38		Assessment and Improvement of Monitoring Network	▪ Review and evaluation of the monitoring network ▪ Identification and description of data gaps ▪ Description of steps to fill data gaps ▪ Description of monitoring frequency and density of sites	Appendix K Section 3.5.4, 5.4
Article 5. Plan Contents, Subarticle 5. Projects and Management Actions				
354.44		Projects and Management Actions	▪ Description of projects and management actions that will help achieve the basin's sustainability goal ▪ Measurable objective that is expected to benefit from each project and management action ▪ Circumstances for implementation ▪ Public noticing ▪ Permitting and regulatory process ▪ Time-table for initiation and completion, and the accrual of expected benefits ▪ Expected benefits and how they will be evaluated ▪ How the project or management action will be accomplished. If the projects or management actions rely on water from outside the jurisdiction of the Agency, an explanation of the source and reliability of that water shall be included. ▪ Legal authority required ▪ Estimated costs and plans to meet those costs ▪ Management of groundwater extractions and recharge	Section 4
354.44(b)(2)	10727.2(d)(3)		Overdraft mitigation projects and management actions	Section 4 (basin not in overdraft)

Table 1.4-1. Preparation Checklist for GSP Submittal Page 9 of 9

GSP Regulations Section	Water Code Section	Requirement	Description	Section(s) or Page Number(s) in GSP
Article 8. Interagency Agreements				
357.4	10727.6		▪ Coordination Agreements shall describe the following: A point of contact ▪ Responsibilities of each Agency Procedures for the timely exchange of information between Agencies ▪ Procedures for resolving conflicts between Agencies ▪ How the Agencies have used the same data and methodologies to coordinate GSPs ▪ How the GSPs implemented together satisfy the requirements of SGMA ▪ Process for submitting all Plans, Plan amendments, supporting information, all monitoring data and other pertinent information, along with annual reports and periodic evaluations ▪ A coordinated data management system for the basin ▪ Coordination agreements shall identify adjudicated areas within the basin, and any local agencies that have adopted an Alternative that has been accepted by the Department	www.fillmore-piru.gladata.com Section 4 Section 5 Section 1.3.3

2. Plan Area and Basin Setting

This section describes the plan area (e.g., land uses, zoning, jurisdictions, and planning areas) and the Basin setting (e.g., hydrogeological conceptual model and groundwater conditions).

2.1 Description of the Plan Area (Reg. § 354.8)

Each Plan shall include a description of the geographic areas covered, including the following information:
(a) One or more maps of the basin that depict the following, as applicable:
(1) The area covered by the Plan, delineating areas managed by the Agency as an exclusive Agency and any areas for which the Agency is not an exclusive Agency, and the name and location of any adjacent basins.
(2) Adjudicated areas, other Agencies within the basin, and areas covered by an Alternative.
(3) Jurisdictional boundaries of federal or state land (including the identity of the agency with jurisdiction over that land), tribal land, cities, counties, agencies with water management responsibilities, and areas covered by relevant general plans.
(4) Existing land use designations and the identification of water use sector and water source type.
(5) The density of wells per square mile, by dasymetric or similar mapping techniques, showing the general distribution of agricultural, industrial, and domestic water supply wells in the basin, including de minimis extractors, and the location and extent of communities dependent upon groundwater, utilizing data provided by the Department, as specified in Section 353.2, or the best available information.

2.1.1 Summary of Jurisdictional Areas and Other Features (Reg. § 354.8[b])

Each Plan shall include a description of the geographic areas covered, including the following information:
(b) A written description of the Plan area, including a summary of the jurisdictional areas and other features depicted on the map.

The Fillmore Basin is a subbasin (DWR Bulletin 118 No. 4-4.05) of the Santa Clara River Valley Basin, located within Ventura County, California (Figure 2.1-1) (DWR, 2006). The Basin is one of a series of subbasins, adjacent to the upslope Piru subbasin (No. 4-4.06) to the east and downslope (and adjudicated) Santa Paula subbasin (No. 4-4.04) to the west. In 2019, the Basin boundaries were modified for three components: (1) to align the western boundary with the adjudicated area of the adjacent Santa Paula subbasin, (2) to align the eastern boundary with adjacent Piru subbasin to match the location of a steep groundwater gradient inflection point, and (3) external boundaries were modified to follow geologic contacts per a qualified (Dibblee) map. The Basin area covers approximately 35.3 square miles (22,600 acres).

The Basin is under the jurisdiction of Ventura County (District 3) and United, with the exception of the Cities of Fillmore and Santa Paula and some federal and state controlled lands (Figure 2.1-2). The Basin is exclusively managed by the Agency, which also manages the Piru Basin (Figure 2.1-1). The Agency is a JPA composed of three local public agencies: (1) County of Ventura, (2) City of Fillmore, and (3) United. United and VCWPD have water resources and management jurisdiction over the entire Basin area, including the City of Fillmore. State controlled lands include the Fillmore State Fish Hatchery and Cienega Springs Ecological Reserve in the eastern portion of the Basin, which are under the jurisdiction of the CDFW. Surface water (e.g., streams) is subject to oversight by the State Water Resources Control Board (SWRCB). Federal controlled lands include streams (e.g., Santa Clara River and Sespe Creek) under the jurisdiction of the U.S. Fish and Wildlife Service (USFWS) and National Marine Fisheries Service (NMFS) per the Endangered Species Act (ESA), along with a minor portion of the Los Padres National Forest (along the northern boundary) that is under the jurisdiction of the U.S. Forest Service (USFS), an agency of the U.S. Department of Agriculture (USDA).

A map of agricultural and urban land use designations from the statewide 2018 crop mapping dataset (Land IQ, 2021) is shown on Figure 2.1-3. The majority of land use area in the Basin is agricultural, followed by urban (Table 2.1-1), with the exception of the majority of the Basin area not classified in the dataset. The predominant crop class in the Basin is citrus and subtropical (e.g., lemons and avocadoes), followed by truck nursery and berry (i.e., strawberry) crops, unclassified crops, and minor crops (i.e., young perennials, grain and hay crops, pasture, and deciduous fruits and nuts).

Table 2.1-1. Land Use Acreages in Fillmore Basin

Land Use	Acres	Percent of Land
Not classified	10,016	44%
Citrus and subtropical	8,523	38%
Truck nursery and berry crops	2,016	9%
Urban	1,435	6%
Unclassified	442	2%
Young perennial	105	0%
Grain and hay crops	26	0%
Pasture	14	0%
Deciduous fruits and nuts	7	0%

Crop classes and acreages are for those within the Basin from the 2018 Crop Mapping dataset (Land IQ, 2021) provided by DWR. "Not classified" represents the Basin area that was not assigned a land use classification.

Additionally, a map showing the distribution of disadvantaged communities (DACs) (provided by DWR as of 2018), domestic wells, and drinking water systems (provided by the SWRCB as of October 25, 2021) are included on Figure 2.1-4. The DACs are designated for U.S. Census geographies (e.g., places, tracts, and block groups) based on the Proposition 1 (Prop 1) 2016 Integrated Water Resources Management (IRWM). DACs constitute about 4,700 acres (21 percent) of the Basin, in the southwestern corner of the Basin (south of Hwy 126) and in the eastern portion of the Basin (north and south of the Santa Clara River and east of Bardsdale). The eastern portion of City of Fillmore is designated as DACs. The DACs are served by various individual well owners, water companies, and a municipality (i.e., the City of Fillmore).

The density of active water wells per square mile (i.e., per township range section) are shown on Figure 2.1-5 for agricultural wells, Figure 2.1-6 for domestic wells, and Figure 2.1-7 for municipal and industrial (M&I) wells. The highest densities of agricultural and domestic wells are in the vicinity of the Bardsdale community and toward the western Basin boundary near Santa Paula. The highest densities of M&I wells are found in the northern part of the City of Fillmore and near the eastern basin boundary with the Piru Basin. Wells used for industrial beneficial use have historically been associated with aquaculture at the Fillmore Fish Hatchery.

2.1.2 Water Resources Monitoring and Management Programs (Reg. § 354.8[c], 354.8[d], and 354.8[e])

Each Plan shall include a description of the geographic areas covered, including the following information:
(c) Identification of existing water resource monitoring and management programs, and description of any such programs the Agency plans to incorporate in its monitoring network or in development of its Plan. The Agency may coordinate with existing water resource monitoring and management programs to incorporate and adopt that program as part of the Plan.
(d) A description of how existing water resource monitoring or management programs may limit operational flexibility in the basin, and how the Plan has been developed to adapt to those limits.
(e) A description of conjunctive use programs in the basin.

The Basin has benefited from robust surface water and groundwater resources monitoring and management programs that have been in place since the 1980s. This GSP adopts the programs implemented by VCWPD, United, and the City of Fillmore as described in the following subsections.

2.1.2.1 Ventura County Watershed Protection District

VCWPD is a department within the Ventura County Public Works Agency (VCPWA) that provides for the control and conservation of flood and storm waters and for the protection of watercourses, watersheds, public highways, life, and property. The County of Ventura exercises water management and land use authority on land overlying the entire unincorporated county including Fillmore and Piru Basins. The VCWPD monitoring programs for groundwater levels and groundwater quality are shown on Figures 2.1-8 and 2.1-9, respectively. VCWPD monitors surface water flows in conjunction with the U.S. Geological Survey (USGS) at the recording stream gauges shown on Figure 2.1-10. More information on the VCWPD water resources monitoring program can be found in the Monitoring Program and Data Gaps technical memorandum (Appendix K).

2.1.2.2 United Water Conservation District

United is a special district that monitors and manages water resources of the Santa Clara River and its tributaries and associated aquifers of the Santa Clara River Valley and Coastal Basins. United is authorized under the California Water Code to conduct water resource investigations, acquire water rights, build facilities to store and recharge water, construct wells and pipelines for water deliveries, commence actions involving water rights and water use, and prevent interference with, or diminution of, stream/river flows and their associated natural subterranean supply of water (California Water Code, section 74500 et al.). United has robust surface water and groundwater resources monitoring and management programs. The United groundwater level and groundwater quality monitoring programs are shown on Figures 2.1-8 and 2.1-9, respectively. United monitors surface water flows at the in-stream measurement sites shown on Figure 2.1-10, as well as surface water quality at the sites shown on Figure 2.1-11. Details of the United water resources monitoring program are described in the Monitoring Program and Data Gaps technical memorandum (Appendix K).

Important United operated management programs for primarily groundwater replenishment purposes include conservation releases from Lake Piru through Santa Felicia Dam, flood flow releases from Castaic Lake, and State Water Project (SWP) imports via Pyramid Lake or Castaic Lake (United, 2017) (Figure 2.1-1). These are the most significant conjunctive use programs in the Basin. United is the lead member of a water conservation agreement between DWR and the Downstream Water Users (DWUs), which consist of United, Los Angeles County, FivePoint Holdings (formerly Newhall Land and Farming), and Santa Clarita Valley Water Agency (SCV Water). The program is designed to hold natural runoff from the Castaic Creek watershed in Castaic Lake for later release in a manner that allows the flows to percolate in the basins downstream of the dam, benefiting the DWUs. United takes the lead role for the DWUs in requesting the storage and release of flood flows, and in monitoring releases to make sure that flows benefit the DWUs in both Los Angeles and Ventura Counties. The conservation releases from Santa Felicia Dam are performed by United for groundwater replenishment purposes, and these releases are performed in a way that meets regulatory requirements. Releases of SWP water from Pyramid Lake are currently limited to 3,150 acre-feet per year (AFY) and to the period from November 1 through the end of February the following year. United is establishing relationships with other water purveyors, such as SCV Water, to diversify surface water supplies. These conjunctive use programs enable greater operational flexibility of groundwater resources in the Basin than would otherwise be possible.

2.1.2.3 City of Fillmore

The City of Fillmore is a local municipality that exercises water supply, water management, and land use authority within its boundaries. The City of Fillmore is within the jurisdiction of United, and is subject to pumping fees assessed to support groundwater activities in the Basin that include recharge and groundwater level monitoring. Potable water purveyed by the City of Fillmore is solely sourced from groundwater wells that they own and operate (about 2,000 AFY). The City of Fillmore has a final draft 2015 Urban Water Management Plan (UWMP) (AECOM, 2015) that identified no constraints on water sources (i.e., groundwater). The City of Fillmore has had a wastewater treatment plant (WWTP) in operation since 2009 (that replaced an older facility) that is Title 22 compliant for irrigation purposes and percolation into the groundwater basin at various locations throughout the City. The City of Fillmore produces an estimated 1,120 AFY of recycled water, which has reduced potable demand, and plans to expand to about 1,400 AFY by 2040.

2.1.2.4 State Water Resources Control Board

The SWRCB oversees two groundwater resource monitoring programs: (1) Groundwater Ambient Monitoring and Assessment (GAMA), California's comprehensive groundwater quality monitoring program created in 2000, and (2) GeoTracker, the State's data management system for sites that impact, or have the potential to impact, water quality in California, with an emphasis on groundwater. The data available on GAMA come from the existing monitoring programs of VCWPD and United. Supplemental groundwater level and water quality data from primarily shallow subsurface depths are available for some sites scattered throughout the Basin.

2.1.3 Land Use Elements or Topic Categories of Applicable General Plans (Reg. § 354.8[f])

Each Plan shall include a description of the geographic areas covered, including the following information:
(f) A plain language description of the land use elements or topic categories of applicable general plans that includes the following:
(1) A summary of general plans and other land use plans governing the basin.
(2) A general description of how implementation of existing land use plans may change water demands within the basin or affect the ability of the Agency to achieve sustainable groundwater management over the planning and implementation horizon, and how the Plan addresses those potential effects.
(3) A general description of how implementation of the Plan may affect the water supply assumptions of relevant land use plans over the planning and implementation horizon.
(4) A summary of the process for permitting new or replacement wells in the basin, including adopted standards in local well ordinances, zoning codes, and policies contained in adopted land use plans.
(5) To the extent known, the Agency may include information regarding the implementation of land use plans outside the basin that could affect the ability of the Agency to achieve sustainable groundwater management.

The County of Ventura exercises land use authority on unincorporated land in the Fillmore Basin, while the incorporated Cities of Fillmore and Santa Paula have land use authority within their boundaries. The City of Fillmore has its own General Plan adopted in 1988 (and updated in 2005) with a planning horizon of 2010. The City of Santa Paula has a 2040 General Plan that was adopted in March 2020. The Ventura County 2040 General Plan takes into consideration the city general plans. No county plans cover the Fillmore Basin.

Land use zoning designations come from the Ventura County 2040 General Plan (Ventura County, 2020). Land zoning in the Basin (Figure 2.1-12 and Table 2.1-2) is predominantly (58 percent) agricultural, followed by (33 percent) open space and (9 percent) urban.

Table 2.1-2. Land Zoning Acreages in Fillmore Basin

Land Use	Acres	Percent of Basin Area
Agricultural	13,115	58%
Open Space	7,438	33%
Urban	2,029	9%

Acreages are based on land zoning information from the Ventura County 2040 General Plan.

There are a couple of small areas of "agricultural - urban reserve" within and next to the City of Fillmore, as well as an "existing community - urban reserve" area immediately east of the City of Santa Paula jurisdiction.

Within Ventura County, greenbelt agreements exist between cities and the County to limit urban sprawl development in agricultural and/or open space areas within the unincorporated County (Figure 2.1-13). Through greenbelt agreements, cities commit to not annex any property within a greenbelt, while the County agrees to restrict development to uses consistent with existing zoning. The majority of the land outside the boundaries of the City of Fillmore within the Fillmore Basin is included within the boundaries of the Santa Paula-Fillmore Greenbelt. The eastern portion of the Basin is included in the Fillmore-Piru Greenbelt.

The Ventura County Save Open Space & Agricultural Resources (SOAR) ordinance is a series of voter initiatives that adopted individual jurisdictions to protect open space and agricultural land, originally in 1998. The SOAR ordinance requires countywide voter approval of any change to the general plan involving the agricultural, open space, or rural land use designations, or any changes to a general plan goal or policy related to those land use designations (Ventura County, 2020).

In addition to the County SOAR ordinance, most cities in the County, including the Cities of Fillmore and Santa Paula, have enacted SOAR ordinances/initiatives to establish voter-controlled urban growth boundaries, known as city urban restriction boundaries (CURBs). CURBs are lines around each city that require voter approval to allow city annexation and development of land outside of the CURB boundary (Figure 2.1-13). In November 2016, the voters of Ventura County and 8 of the County's 10 cities (including the City of Fillmore) renewed the SOAR ordinances and extended their controls through 2050.

In summary, agricultural and open space land zoning (Figure 2.1-12) are planned to be preserved, while urban (i.e., city) land use is planned to grow modestly (i.e., by about 800 AFY in additional groundwater demand per the City of Fillmore UWMP [AECOM, 2016]) within existing areas of communities.

2.1.3.1 Description of How Implementation of the GSP May Change Water Demands or Affect Achievement of Sustainability and How the GSP Addresses Those Effects

This GSP does not specify changes in water demands, but does plan for a modest increase in water demand for GDEs at the Cienega Springs Restoration Site, by allowing groundwater to be pumped from this area for soil moisture mitigation for GDEs during periods of drought (see Section 4.1).

2.1.3.2 Description of How Implementation of the GSP May Affect the Water Supply Assumptions of Relevant Land Use Plans

The implementation of this GSP does not intend to affect the water supply assumptions of relevant land use plans (i.e., the Ventura County 2040 General Plan).

2.1.3.3 Summary of the Process for Permitting New or Replacement Wells in the Basin

The process for permitting new or replacement wells in the Basin is under the jurisdiction of VCWPD and described in Ventura County Ordinance No. 4468. The Ventura County 2040 General Plan states that "The County shall coordinate with the local groundwater management agencies and local groundwater sustainability agencies to update County of Ventura Ordinance 4468 and related guidelines on the location, construction, and abandonment of water wells, if necessary" in the 2021-2040 time frame.

2.1.3.4 Information Regarding the Implementation of Land Use Plans Outside the Basin that Could Affect the Ability of the Agency to Achieve Sustainable Groundwater Management

Land use plan(s) covering the East Santa Clara River Valley subbasin (Figure 2-1.1) in Los Angeles County could have the greatest effect on the ability of the Agency to achieve sustainable groundwater management, due to treated wastewater effluent discharges from SCV Water to the Santa Clara River. These effluent discharges have historically contributed to perennial baseflow across the County Line that mitigate the impacts of droughts on groundwater levels/storage (see Appendix C in the Monitoring Program and Data Gaps technical memorandum for Fillmore and Piru Basins groundwater hydrographs). However, these flows contain elevated chloride concentrations that are a recognized source of groundwater quality degradation in the east Piru Basin (see Section 2.2.2.5.1).

2.1.4 Additional GSP Elements (Reg. § 354.8[g])

Each Plan shall include a description of the geographic areas covered, including the following information: (g) A description of any of the additional Plan elements included in Water Code Section 10727.4 that the Agency determines to be appropriate.

Water Code Section 10727.4 states that the GSP shall include, where appropriate and in collaboration with the appropriate local agencies, the following:

- Wellhead protection
  - Per the Ventura County Code of Ordinances, Division 4, Chapter 8, Article 1, Section 4812, "Wellhead protection area" means the surface and subsurface area surrounding a water well or well field that supplies a public water system through which contaminants are reasonably likely to migrate toward the water well or well field. Examples of wellhead protection areas include avoiding well construction in floodplain areas and shallow subsurface intervals where contamination (i.e., elevated nitrates) is known.
  - The Ventura County Code of Ordinances, Division 4, Chapter 8, Article 1, Section 4817.c.8 requires well seal inspection reports to include information on the method of protection of wellhead or open (engineering test) bore hole.
- Migration of contaminated groundwater
  - Potential migration of groundwater containing elevated chloride concentration in east Piru Basin along historical groundwater gradients in the direction of Fillmore Basin is of local concern (see Section 2.2.2.5); however, migration of contaminated groundwater is not a noteworthy concern in the Basin.

- Well abandonment and well destruction program
  - ◇ Well abandonment and well destruction are overseen by VCWPD per Ventura County Code of Ordinances, Division 4, Chapter 8, Article 1, Section 4812.
- Replenishment of groundwater extractions
  - ◇ Replenishment of groundwater extractions (beyond that provided by precipitation) is provided by United via Lake Piru releases and SWP water imports. Groundwater replenishment of these surface water flows are attained through Santa Clara River channel percolation. United owns property in Piru Basin that was historically used for groundwater replenishment (Piru Spreading Grounds), but has not been in operation for at least the past 10 years due to diversion permitting issues on Piru Creek.
- Conjunctive use and underground storage
  - ◇ Conjunctive use of surface water and groundwater is managed by United (i.e., via replenishment of groundwater supplies from Lake Piru releases and SWP water imports).
- Well construction policies
  - ◇ Well construction policies are specified per Ventura County Code of Ordinances, Division 4, Chapter 8, Article 1, Section 4812 and overseen by VCWPD.
- Groundwater contamination cleanup, recharge, diversions to storage, conservation, water recycling, conveyance, and extraction projects
  - ◇ Groundwater contamination cleanup consists of two open cases regarding light non-aqueous phase liquids (LNAPL; i.e., hydrocarbons) releases in the City of Fillmore: (1) a case (7-Eleven Store #38012 [T10000014273]) overseen by the Los Angeles Regional Water Quality Control Board (LARWQCB) and (2) a Superfund case (Pacific Coast Pipe Lines [56130038]) overseen by the U.S. Environmental Protection Agency (U.S. EPA) and the California Department of Toxic Substances Control (DTSC). Both contamination sites are considered to have insignificant impacts on beneficial uses of groundwater. These are described in more detail in Section 2.2.2.5.3.
  - ◇ Recharge projects include United surface water releases of natural runoff and imported water stored behind Santa Felicia Dam in Lake Piru. During most years, United also receives surface water runoff from Castaic Lake releases that flow through Santa Clara River Valley East basin (i.e., Santa Clarita) (Figure 2.1-1).

- ◇ Minimal (78 AFY on average) surface water diversion programs occur at two reported locations (Beans Ranch and Limoneira, the latter of which has reported zero diversions since 2012) near one another on a northern ungauged tributary within the Basin (see Table 2-7 in United, 2021a).
- ◇ The City of Fillmore discharges approximately 1,100 AFY on average to percolation ponds and has historically (between 1998 and 2007) discharged between 380 and 1,140 AFY to the Santa Clara River (see Table 2-9 in United, 2021a). The City of Fillmore has a recycled water program that currently produces about 1,000 AFY and is projected to reach approximately 1,400 AFY by 2040 (AECOM, 2016).

- Efficient water management practices
  - ◇ Efficient water management practices are encouraged in the Ventura County 2040 General Plan for agricultural land practices and municipal uses.
- Relationships with state and federal regulatory agencies
  - ◇ United has the necessary water rights from the SWRCB to divert water from Piru Creek for storage in Lake Piru and for generating hydropower at Santa Felicia Dam. United operates the Santa Felicia Dam Project under a Federal Energy Regulatory Commission (FERC) license. License requirements include habitat releases and migration releases for southern California steelhead. United funds USGS stream gaging stations upstream of the Basin in the Santa Clara River, Piru Creek, and at Lake Piru. USGS also maintains the Sespe Creek stream gaging station in Fillmore Basin. United is a SWP contractor and is able to import State Water via releases from Pyramid Lake or Castaic Lake.

2.1.4.1 *Land Use Plans and Efforts to Coordinate with Land Use Planning Agencies to Assess Activities That Potentially Create Risks to Groundwater Quality or Quantity*

Activities that potentially create risks to groundwater quality or quantity should be assessed in coordination with the 2040 Ventura County General Plan and Watersheds Coalition of Ventura County (WCVC) Integrated Regional Water Management Plan (IRWMP), along with the associated Lower Santa Clara River Watershed (LSCR) Salt and Nutrient Management Plan (SNMP) (LWA, 2015).

2.1.4.2 *Impacts on Groundwater Dependent Ecosystems*

GDEs depend on shallow groundwater occurrence. The health of GDEs varies with climate and groundwater conditions (e.g., bountiful shallow groundwater during wet periods and less groundwater availability during droughts). The historical and current GDE conditions are evaluated in Section 2.2.2.8. Based on the evaluation by Stillwater (2021a), the Cienega Riparian Complex GDE unit near the Fish Hatchery and Basin boundary with the Piru Basin is most susceptible to vegetation die off, due to a combination of effects of climatic and beneficial uses (i.e., groundwater pumping) on groundwater levels that are most significant during droughts. The FPBGSA proposes a mitigation project measure to protect this high priority GDE unit (see Section 4).

2.1.5 Notice and Communication (Reg. § 354.10)

Each Plan shall include a summary of information relating to notification and communication by the Agency with other agencies and interested parties including the following:
(a) A description of the beneficial uses and users of groundwater in the basin, including the land uses and property interests potentially affected by the use of groundwater in the basin, the types of parties representing those interests, and the nature of consultation with those parties.
(b) A list of public meetings at which the Plan was discussed or considered by the Agency.
(c) Comments regarding the Plan received by the Agency and a summary of any responses by the Agency.
(d) A communication section of the Plan that includes the following:
(1) An explanation of the Agency's decision-making process.
(2) Identification of opportunities for public engagement and a discussion of how public input and response will be used.
(3) A description of how the Agency encourages the active involvement of diverse social, cultural, and economic elements of the population within the basin.
(4) The method the Agency shall follow to inform the public about progress implementing the Plan, including the status of projects and actions.

2.1.5.1 Beneficial Uses and Users

SGMA identifies beneficial user/use categories to be considered in the GSP as follows:

> 10723.2. CONSIDERATION OF ALL INTERESTS OF ALL BENEFICIAL USES AND USERS OF GROUNDWATER
>
> The groundwater sustainability agency shall consider the interests of all beneficial uses and users of groundwater, as well as those responsible for implementing groundwater sustainability plans. These interests include, but are not limited to, all of the following:
>
> (a) Holders of overlying groundwater rights, including:
>
> (1) Agricultural users.
>
> (2) Domestic well owners.

(b) Municipal well operators.

(c) Public water systems.

(d) Local land use planning agencies.

(e) Environmental users of groundwater.

(f) Surface water users, if there is a hydrologic connection between surface and groundwater bodies.

(g) The federal government, including, but not limited to, the military and managers of federal lands.

(h) California Native American tribes.

(i) Disadvantaged communities, including, but not limited to, those served by private domestic wells or small community water systems.

(j) Entities listed in Section 10927 that are monitoring and reporting groundwater elevations in all or a part of a groundwater basin managed by the groundwater sustainability agency.

As described in Section 2.1.1, land use in the Basin is predominantly agricultural, followed by open space and urban. By acreage, agricultural use makes up the largest developed portion of the Basin.

Beneficial users and uses in the Basin include the following:

- Agricultural and domestic well owners
- The City of Fillmore (municipal well operator)
- United and a number of mutual water companies (public water systems)
- Santa Clara River GDEs, primarily the East Grove and Cienega Riparian Complex areas (see Section 2.2.2.8 for a summary and Appendix D for a detailed description)
- Ventura County and City of Fillmore planning departments
- Disadvantaged communities, located in the southwest and east portions of the Basin (including the eastern half of the City of Fillmore)

There are no California Native American tribal lands, federal lands with groundwater use, users of surface water with a hydrologic connection to groundwater, or monitoring and reporting entities (per SGMA Section 10927) within the Basin.

The following sections describe the FPBGSA's stakeholder representation, outreach, and engagement activities, and how these encourage active involvement of diverse stakeholder groups within the Basin.

2.1.5.2 *Beneficial User Representation*

The FPBGSA board represents beneficial users and uses as shown on Table 2.1-3.

Table 2.1-3. FPBGSA Stakeholder Representation

Board Director	Stakeholders/Beneficial Users and Uses
Ventura County Director	Ventura County, Ventura County Planning Division, disadvantaged communities in the County, domestic well owners, municipal and agricultural well operators
City of Fillmore Director	City of Fillmore, Fillmore Planning Department, disadvantaged communities within the City
United Director	United Water Conservation District, all groundwater users
Fillmore Pumpers Association Director	All well owners (including agricultural and domestic) within the Fillmore Basin
Piru Pumpers Association Director	All well owners (including agricultural and domestic) within the Piru Basin
Environmental Stakeholder Director	Environmental organizations engaged in the enhancement or protection of the environment over the Fillmore Basin or Piru Basin, or both, are represented by the Environmental Stakeholder Director. This Director is nominated by the Santa Clara River Environmental Groundwater Committee, which consists of the following organizations: CalTrout, The Nature Conservancy, Friends of the Santa Clara River, Wishtoyo Foundation, Keep the Sespe Wild, Santa Clara River Watershed Conservancy, Sierra Club, Central Coast Alliance United for a Sustainable Economy (CAUSE), Citizens for Responsible Oil and Gas (CFROG), Surfrider Foundation, Los Padres Forest Watch, and National Audubon Society

2.1.5.3 *Stakeholder Outreach and Engagement*

2.1.5.3.1 *Communications and Engagement Plan*

The FPBGSA made stakeholder engagement a priority during the entire GSP preparation process. At the outset of GSP development, the FPBGSA prepared a communications and engagement (C&E) plan to identify methods, resources, and tools for conducting stakeholder outreach and engagement consistent with SGMA requirements. The C&E plan is provided as Appendix B.

The FPBGSA compiled a stakeholder list including beneficial users (including all United rate payers/well owners in the Basins) and other interested parties. It notified the public about GSP development status and upcoming stakeholder workshops and board meetings on the GSP using the following methods:

- E-mails and mailings to the stakeholder list
- Social media postings on the FPBGSA Facebook page (https://www.facebook.com/FPBGSA/)
- Updates on the Agency's website (https://www.fpbgsa.org/)
- Information provided at meetings held by other local agencies and organizations, described further below

2.1.5.3.2 Stakeholder Workshops and Engagement at Board Meetings During GSP Development

Stakeholder education, engagement, and input opportunities were provided at numerous FPBGSA board meetings and stakeholder workshops throughout GSP development, beginning in July 2019 and continuing through adoption of the GSP in December 2021. See Appendix C for a list of these meetings and the topics discussed at each meeting.

Seven stakeholder workshops covered the following topics (in addition to a GSP update at each workshop):

- June 25, 2020
  - Introduction to SGMA
  - Hydrogeological conditions
  - Groundwater model
  - Water budget
- October 1, 2020
  - Sustainable management criteria (SMCs) definitions
  - Potential criteria for the Fillmore and Piru Basins
- December 9, 2020
  - Groundwater model results

  - Groundwater model technical session
- March 18, 2021
  - GDE technical report
  - Draft SMCs
- April 1, 2021
  - GDE technical report
  - Draft SMCs
- September 17, 2021: Draft GSPs
- September 23, 2021: Draft GSPs

Board meetings in the early stages of GSP development included educational and informational presentations on the following topics:

- Roles and responsibilities of the GSA and Board
- Groundwater model
- SMCs
- GDE
- Water budget
- Future conditions

Basin setting information was presented as it was developed to allow for early input from Stakeholders and the FPBGSA Board. Draft technical reports and data were made available for public review early in the process.

Development of SMCs began in an ad hoc committee. The committee prepared a strawman SMC matrix that was presented to the board for consideration in November 2020. The board considered stakeholder input and deliberated on the development and selection of appropriate SMCs for each of sustainability indicator in numerous Board meetings (in addition to the March and April workshops listed above) through June 2021 (see Appendix C for a list of these meetings).

2.1.5.3.3 FPBGSA Website

The FPBGSA maintains its website to provide a transparent and comprehensive resource and record as well as educational information, including the following:

- Information about the Agency, the entities comprising the GSA (Ventura County, City of Fillmore, and United), its Board of Directors, stakeholder representation
- Agency administrative documents (JPA, bylaws, budget, DWR grant application)
- Agency contact information (phone number and e-mail form)
- SGMA information and resource documents
- Notice of board of directors meetings and stakeholder workshops
- Meeting materials, including agendas, board packets, minutes, and presentations, and recordings of online meetings
- Technical reports
- Database (https://fillmore-piru.gladata.com/)

2.1.5.3.4 Other Outreach, Engagement, and Local Meetings

In addition to the FPBGSA's outreach and public meetings listed in Appendix C, each board director and the Agency's executive director provided education and updates about the FPBGSA at meetings held by other local agencies and organizations, including the following:

- Ventura County Director: The Ventura County Director provided updates and information about the FPBGSA and GSP development at meetings of the following entities:
  - ◇ Ventura County Board of Supervisors
  - ◇ Ventura County Watersheds Coalition/Integrated Regional Water Management (IRWM)
  - ◇ Santa Clara River Watershed Committee
- United Director: The United FPBGSA Director provided updates and information about the FPBGSA and GSP development at:
  - ◇ United public board meetings and Water Resources Committee meetings.
  - ◇ Farm Bureau of Ventura County monthly board meetings.

  He also gave regular updates of FPBGSA activities to the stakeholders he works with and represents, typically prior to and following FPBGSA board meetings.

- City of Fillmore Director: City of Fillmore FPBGSA Board Directors provided GSP updates at each Fillmore City Council meeting and announced FPBGSA stakeholder-specific meetings scheduled by the board to get input from the community. Outreach also included communication One Step a la Vez, a nonprofit organization in Fillmore, providing background information on GSP technical memoranda and SMCs and encouraging their submittal of comments.
- Fillmore and Piru Pumpers Associations Stakeholder Directors: The Fillmore and Piru Basin Pumpers Associations Directors, as presidents of these associations, conducted outreach to and encouraged the involvement of all well-owners (including domestic well owners in DACs) in GSP development. The pumpers associations were established in 2016 for this purpose. During formation of the associations, repeated outreach was conducted to all well owners, including:
  - ◇ Multiple letters from the associations and from United invited well owners to informational meetings and to join the associations.
  - ◇ Members of the associations' boards of directors used a United well map to identify well owners who were not yet members and contacted them directly.
  - ◇ Association membership information was available at public meetings about the GSA held by United.
  - ◇ Information and contact information for the pumpers associations was included United mailings with FPBGSA invoices.

  Since their formation, they have held monthly board of directors meetings to inform and update their members about FPBGSA activities and progress on the GSPs, as well as soliciting their input and feedback. At least annually, they held membership meetings which included presentations and updates from United, Consulting Hydrogeologist Bryan Bondy, FPBGSA Executive Director Tony Emmert, and the associations' legal counsel.

  Pumpers association meetings were in the form of open discussion to ensure all members questions were answered and concerns were heard, documented and addressed. Board members (representing small pumpers, large pumpers, mutual water companies and other pumping interests) continually engage in one-on-one discussions with pumper stakeholders to answer questions and solicit feedback. This feedback is then shared with association presidents. Updates on the GSP were also provided through board members at Mutual Water Company meetings.

- Environmental Stakeholder Director: The Environmental Stakeholder Director engaged with the following organizations about the FPBGSA and GSP development:
  - Santa Clara River Environmental Groundwater Committee
  - Friends of the Santa Clara River
  - Santa Clara River Watershed Committee
  - Santa Clara River Steelhead Coalition
  - Greater Ventura County Groundwater Sustainability Agency Environmental Stakeholder Collaborative
  - California Non-Governmental Groundwater Collaborative
  - Watersheds Coalition of Ventura County Integrated Regional Water Management Program (Disadvantaged Community stakeholder outreach and education meetings - "WaterTalks" Meetings)
  - Fox Canyon Groundwater Facilitated Process
- Executive Director: The FPBGSA's executive director attended numerous local organization and community meetings throughout the GSP's preparation to provide information and updates. He also coordinated with agencies managing upstream and downstream basins and regulatory agencies. These outreach and coordination meetings included the following:
  - Santa Clara River Watershed Committee meetings: six meetings per year, every other month, with an agendized update on groundwater sustainability agency issues
  - Community Water Talks: targeted outreach to disadvantaged communities in the watershed (sponsored by Watershed Coalition of Ventura County, Disadvantaged Communities Program)
    - Piru Community Water Talks (sponsored by Friends of the Santa Clara River): initial in-person public meeting, March 10, 2020
    - Fillmore Community Water Talks (sponsored by Friends of the Santa Clara River): initial Zoom public meeting, October 21, 2020
  - Fillmore and Piru Basins Pumpers Associations: updates to groundwater pumpers in the two basins, attended by invitation approximately once per year.
  - Coalition of Agriculture, Labor and Business of Ventura County: monthly coordination meetings with an agendized water update item.

- Santa Clarita Valley Water Agency and GSA: monthly coordination meetings with agencies managing the upstream basin, covering planning, projects development, permitting and implementation.
- Santa Paula Basin Pumpers Association: coordination with pumpers association representing downstream basin, attended by invitation approximately once per two years.
- CDFW: coordination with state regulatory agency, check-in meeting with South Coast Region regulatory manager twice per month
- United Water Resources Committee: coordination with committee, staff, and stakeholders, approximately 11 meetings per year (monthly) with an agendized update on groundwater sustainability agency issues.

2.1.5.3.5 Comments and Responses on the Draft GSP

A draft GSP was completed on August 9, 2021. Public comments were received during a 60-day review period, from August 9 through October 9, 2021. The document was accessible in electronic format at the FPBGSA website and paper copies were available at the Fillmore Library, Piru Community Center, and United office. Two stakeholder workshops on the draft GSP were held during the public review period. At these workshops, stakeholders received a presentation on the contents and conclusions of the draft GSP and had an opportunity to ask questions and provide their comments. No comments on draft GSP were received at the workshop; attendees opted to submit their comments in writing. Comments on the draft GSP and responses to those comments are provided in Appendix C.

Early drafts of the technical memoranda (Appendices D, E-1, E-2, F, G, K, and M) were released for public review as they became available during GSP preparation. The technical memoranda provided in this draft GSP were revised in response to comments received on those early drafts, as appropriate. Responses to comments on these early drafts are also provided in Appendix C.

2.1.5.4 Decisions-Making Process

Key to the FPBGSA's decision-making process is its transparent deliberation of decisions at board meetings and extensive opportunity for public education and input, as described above, on issues before the board.

The FPBGSA board receives information, deliberates, takes public comment, and makes decisions about the GSP at its official meetings. The board operates and provides notice for these meetings consistent with the Brown Act (California Government Code 54950 et seq.).

The FPBGSA is governed by a JPA. The JPA and the Agency's bylaws set forth voting procedures that used to make decisions on the GSP and its implementation (JPA Section 9,2 and bylaws Section 3.4).

According to these procedures, voting by the board of directors is made on the basis of one vote for each director, provided, however, that if the matter to be voted on exclusively concerns one of the Basins and not the other, the pumper stakeholder director representing pumper interests in the unaffected Basin may participate in board discussions of the matter but shall not vote on the matter. All decisions of the board require the affirmative vote of at least four directors, unless one or more directors is absent or conflicted from voting on the matter, or a pumper stakeholder director is prohibited from voting per this section, in which case a decision of the board requires the affirmative vote of at least three directors.

The FPBGSA has developed a set of guiding principles that describe commitments and common interests Agency leaders have agreed to follow as they implement SGMA. These guiding principles are posted on the Agency's website (https://s29420.pcdn.co/wp-content/uploads/2019/11/2019-11-21-FPBGSA-Guiding-Principles-FINAL-Approved-on-11-21-19.pdf). They include general principles of understanding and specific principles related to governance, communication and education, funding and finances, and SGMA implementation and sustainability. A key principle related to stakeholder involvement in the GSP process is:

> The FPBGSA will have an open, transparent process for GSP development and SGMA implementation. Extensive outreach is a priority of FPBGSA members to inform Beneficial Users about implementation and potential effects of SGMA, and to ensure the FPBGSA is informed of all Beneficial User input as a means to support GSA decision-making.

2.1.5.5 Informing and Engaging the Public During GSP Implementation

The FPBGSA will continue to use the methods identified above to inform the public about progress implementing the GSP, including the status of projects and actions, and to incorporate public input as an integral element of its decision-making process.

2.2 Basin Setting

This section describes the physical setting, hydrogeologic characteristics, and historical, current, and projected conditions of the Basin, including the identification of data gaps and levels of uncertainty, which comprise the basin setting that serves as the basis for defining and assessing reasonable sustainable management criteria and projects and management actions.

2.2.1 Hydrogeologic Conceptual Model (Reg. § 354.14)

The Fillmore Basin is a subbasin (4-004.05) of the greater Santa Clara River Valley Basin (DWR, 2006), which is within the tectonically active Transverse Ranges geomorphic province and the Santa Clara River Watershed (Hydrologic Unit [HU]-8), one of the northernmost watersheds within the South Coast Hydrologic Region of California (Figure 2.1-1). The hydrogeology of the Basin is described in detail in reports by California Department of Public Works (1933), DWR (1974a and 1974b), SWRB (1956), Mann (1959), Mukae and Turner (1975), Hanson et al. (2003), and United (2021a). The hydrogeologic conceptual model (HCM) for the Basin is described beginning with the regional geologic setting, followed by descriptions of the aquifers and aquitards, and lastly, the surface features of the Basin.

2.2.1.1 Regional Geologic and Structural Setting (Reg. § 354.14[b][1])

The Transverse Ranges are one of the most rapidly rising regions on earth due to north-to-south compression associated with the San Andreas Fault (CGS, 2002), which has resulted in the east-to-west trending series of mountain ridges and valleys that are oblique to the predominant northwest-to southeast trend of coastal California. The history of ongoing faulting and folding has resulted in the complex synclinal structure of the Ventura basin that encompasses the Basin (Yeats et al., 1981). The mountains are composed of a variety of consolidated and unconsolidated marine and terrestrial sedimentary and volcanic rocks of Late Cretaceous to Quaternary in age (Figure 2.2-1) (Hanson et al., 2003). Similarly, the subbasins of the Santa Clara River Valley basin are filled with a mixture of consolidated (deeper, Tertiary and older) marine deposits and unconsolidated (shallower, Quaternary) terrestrial and coastal deposits. The unconsolidated Quaternary material is classified into (water bearing) aquifers and aquitards, while the consolidated Tertiary and older material is considered (non-water-bearing) bedrock.

The surface expression of these various deposits is shown with detailed (Dibblee) quadrangle geologic maps on Figure 2.2-2. Many of the formations found in the mountain ranges that bound the Basin—Topatopa Mountains to the north and South Mountain anticline to the south—have been folded to the degree of overturned bedding and offset by reverse/thrust faults. The sedimentary rocks of Cretaceous age are exposed in the Topatopa Mountains north of the groundwater basin (Hanson et al., 2003). A simplified geologic map is shown on Figure 2.2-3, based on the following:

- The geologic formation groupings of the Southern California Regional Aquifer-System Analysis (RASA) program (Predmore et al.,1996)
- Faulting information from Dibblee and Nichols and Buchanan-Banks (1974)
- Structural information from CGS (2012)

The most prominent faults near the Basin are (1) the San Cayetano (thrust) Fault, oriented parallel to the northern Basin boundary and (2) the Oak Ridge (reverse) Fault, oriented parallel to the southern Basin boundary. Both faults are covered by a thin amount of recent alluvium (SWRB, 1956). These faults offset the mountainous terrain upward and toward one another (i.e., toward the centerline of the Basin), and have effectively dropped the Basin bedrock along the Santa Clara River synclinal structure that has provided capacity for the deposition of Saugus Formation (upper San Pedro Formation) over 5,000 feet thick in the Basin (Mann, 1959).

2.2.1.2 Lateral Basin Boundaries (Reg. § 354.14[b][2])

The Dibblee geologic maps (Figure 2.2-2), along with analysis of aerial photographs, were used by DWR and the Agency to modify Bulletin 118 basin boundaries for this Basin and neighboring Santa Paula and Piru basins (DWR, 2018a). The Basin is bounded at the north and south by the contacts between unconsolidated alluvium and the exposed bedrock. Bedrock to the north comprises marine Las Posas Sands and Pico Formation. Along the northern Basin boundary, comparison of the Saugus Formation and Las Posas Formation mapped by Dibblee (Figure 2.2-2) with the San Pedro Formation mapped per the RASA Program (Figure 2.2-3) reveals why the entire San Pedro Formation is not included in the Basin.

Faults located along the former Bulletin 118 (DWR, 2006) Basin boundaries have been determined to significantly limit or divert groundwater flow. The Oak Ridge Fault to the south has been identified by (Mukae and Turner, 1975; Mann, 1959) to restrict groundwater flow in the Basin. An unnamed fault located in the northern part of the Basin, along the contact between San Pedro Formation and alluvium (Figure 2.2-3), has also been observed to restrict groundwater flow based on evaluation of groundwater level hydrographs during development of this Plan (see Section 2.2.1.4.3) (United, 2021a).

2.2.1.3 Definable Bottom of the Basin (Reg. § 354.14[b][3])

The upper Cretaceous and Tertiary consolidated formations are virtually non-water-bearing, and form the base of the Basin (Hanson et al., 2003). Mann (1959) considers the depth to the bottom of the water bearing deposits (i.e., the San Pedro Formation) to be about 5,000 feet below ground surface (bgs). Hanson et al. (2003) stated that the depth to the bottom of water bearing deposits is at least 2,000 ft at the axis of the Santa Clara syncline. Overall, there is uncertainty in how deep water bearing deposits occur in the Basin, but this does not have a material impact of this Plan's ability to ensure sustainable conditions because water wells are typically constructed less than 2,000 feet bgs and the substantial changes in groundwater storage (i.e., the water table fluctuations) occur at shallower depths. The deepest water well in the Basin was drilled to 2,018 feet bgs and perforated to 1,820 feet bgs in the City of Fillmore area (United, 2021a).

The bottom of the principal aquifer is based on the depth to the bottom of Aquifer System (Zone) B per the United (2021a) HCM.

2.2.1.4 Principal Aquifers and Aquitards (Reg. § 354.14[b][4])

As defined in the SGMA Regulations (Reg. § 351[aa]), principal aquifers are "aquifers or aquifer systems that store, transmit, and yield significant or economic quantities of groundwater to wells, springs, or surface water systems." The SGMA regulations provide local agencies with discretion to determine what constitutes "significant or economic" when identifying the principal aquifer(s) in a basin. In this GSP, one principal aquifer is designated for the Basin, corresponding to Aquifer Zones A and B (referred to as Aquifer Systems A and B in United [2021a]) as shown on Figure 2.2-4, while Aquifer Zone C is considered a non-principal aquifer in the Basin because relatively little groundwater is pumped from this zone. For purposes of this GSP, aquifer "systems" as labeled in United (2021a) are considered aquifer "zones." These zones and aquifer designations are described further in the following subsections.

2.2.1.4.1 Formation Names (Reg. § 354.14[b][4][A])

The geologic formations pertinent to the Basin are categorized as water-bearing (alluvium and the Saugus [upper San Pedro] Formation) and non-water-bearing (e.g., Pico Formation). Water-bearing means that significant and economical quantities of groundwater, with sufficient water quality, can be extracted from these formations. Non-water-bearing describes deposits that do not produce groundwater of sufficient quantity or quality to meet typical water demands. The geologic formations are subdivided into hydrostratigraphic units (strata or layers) (Figure 2.2-4), which are grouped into aquifer zones based on the HCM (developed by and presented in United

[2021a]) and further grouped into the principal aquifer (Zones A and B) and the non-principal aquifer (Zone C). Descriptions of each hydrostratigraphic unit from youngest to oldest (i.e., generally shallowest to deepest) are provided below.

The surficial deposits and colluvium unit (United [2021a] model layer 1) (Figure 2.2-4) exists along the flanks of the basins and is generally absent in the vicinity of the Santa Clara River channel. Lithology is characterized by interbedded, poorly sorted surficial deposits including colluvium, landslide deposits, and alluvial fan material. Thickness ranges from 0 to about 360 feet. During prolonged droughts, this unit becomes dewatered in the upper reaches of the Santa Clara River (Hanson et al., 2003).

The recent alluvium (United [2021a] model layer 3) (Figure 2.2-4) lies at the base of the Holocene deposits and consists of sand and gravels, with some finer-grained interbeds, deposited by the Santa Clara River and its major tributaries. The basal deposits range in thickness from less than 10 to 190 feet, and are a major source of water to wells in the Piru and Fillmore Basins.

According to Hanson et al. (2003), there are few, if any, clay layers separating the shallow and recent alluvium in the Basin, allowing groundwater to move freely between the two units. The United (2021a) HCM depicts a discontinuous aquitard that separates surficial deposits (model layer 1) and recent (younger) alluvium (model layer 3). This interpretation by United (2021a) is supported by fine-grained material logged at about 80 to 100 feet bgs in the Fillmore area and observed groundwater level differences (i.e., groundwater levels monitored in nested wells, MW-55A/B, at the Former Pacific Pipelines Superfund Site).

The older alluvium lithologic unit (United [2021a] model layer 5) (equivalent of Mugu aquifer [Mukae and Turner, 1975] in the Coastal basins [Hanson et al., 2003]) is composed of the basal part of the unnamed upper Pleistocene deposits. The older alluvium is similar material to the underlying Saugus (upper San Pedro) Formation because the Santa Clara River was the primary source of sediment for both deposits; however, there is an erosional gap (unconformity) that separates the two formations. The older alluvium is differentiated from the Saugus Formation because it is less indurated and relatively undisturbed (Hanson et al., 2003). The older alluvium extends from about 200 to 400 feet bgs and consists of sand and gravel interbedded with silt and clay. In the subbasins downriver from the Basin, the silt and clay layers retard the vertical movement of water through the Mugu aquifer and confine or partly confine the aquifer (Hanson et al., 2003). This confining characteristic associated with the Coastal Plain basins is the basis for separating United (2021a) Aquifer Zone A (younger alluvium) from Aquifer Zone B (older alluvium); however, these aquifers are considered hydraulically connected (merged) in the Basin based on similar heads modelled in both zones in United (2021a). Wells perforated in the older alluvium and the underlying Saugus Formation obtain most of their water from the shallower older alluvium (Hanson et al., 2003).

The Saugus Formation (equivalent of Hueneme aquifers in Coastal basins)—beneath the Santa Clara River Valley subbasins mapped by Dibblee (1988, 1990a, 1990b, 1991, 1992a, 1992b, 1992c, and 1992d) and Dibblee and Ehrenspeck (1990)—consists of lenticular layers of sand, gravel, silt, and clay of marine and continental origin. The sediments constituting the aquifers have experienced considerable folding, faulting, and erosion since deposition. These deposits are divided into upper (United [2021a] model layer 7) and lower (United [2021a] model layer 9) units of the Saugus Formation, based on data from electric logs, which show a decrease in electrical resistivity at the contact between the aquifers (Hanson et al., 2003) that is attributed to the presence of fine-grained (aquitard) deposits. In areas of the Basin that have been uplifted since deposition (e.g., Basin boundaries with neighboring sub-basins), much of the sediments have been removed by erosion.

United (2021a) conceptualizes these various deposits with three aquifer zones—A, B, and C—in the Santa Paula, Fillmore, and Piru Basins (Figure 2.2-4); however, the hydraulic properties of the hydrostratigraphic units are less stratified in the Fillmore Basin. Aquifer System A is considered merged with Aquifer System B in the Basin as a result of facies change in the depositional environments, where more clays of continuous extent have deposited at the lower (e.g., Oxnard, Mound and Santa Paula) subbasins of the Santa Clara River Valley basin and less fine-grained (aquitard) material and more coarse-grained (aquifer) material deposited in the upper (e.g., Fillmore and Piru) subbasins as a result of higher energy processes (i.e., flood flows) that occur closer to the source rock material (i.e., mountains of the Santa Clara River Watershed). United (2021a) simulates head differences on the order of about 0 to 20 feet between the A and B zones and the C zone (less at the Basin boundary with Piru basin and more toward the Basin boundary with the Santa Paula Basin); therefore, for this GSP, the hydrostratigraphic units are grouped into a principal aquifer comprising aquifer zones A and B.

2.2.1.4.2 Physical Properties (Reg. § 354.14[b][4][B])

The thickness of the principal aquifer varies between 300 and 700 feet, shallowest toward the southern Basin boundary and deeper toward the western, northern, and eastern Basin boundaries. For the majority of the Basin area, groundwater is considered unconfined in the principal aquifer with the exception of (1) an aquitard (United [2021a] model layer 8) that semiconfines the non-principal aquifer (model layers 9 and 10) and (2) a semi-continuous aquitard (model layer 2) that occurs at shallow depths within the principal aquifer. The layer 2 aquitard exists near the flanks of the Basin and is generally absent near the stream channels. This layer has been observed to induce vertical head gradients between groundwater that occurs in model layer 1 from that in model layer 3 in the Pole Creek Fan area, based on groundwater level measurements from a nested monitor well (MW-55A/B) at the Pacific Coast Pipeline Superfund site (Figure 4 from Trihydro, 2021). The hydrostratigraphy from United (2021a) is described in cross-sectional view from upstream to downstream below.

The Piru-Fillmore Basin Boundary cross section (Figure 2.2-5) (United, 2021a) depicts the following:

> At the Piru-Fillmore basin boundary, the basin narrows in the area upstream of the Fillmore Fish Hatchery. A deposit of finer-grained material of relatively limited extent, mapped as Layer 6, separates the alluvial aquifers from the underlying Upper Saugus/San Pedro Formation, as identified in log signatures from wells (named using each well's State Well Number [SWN]): 04N19W33M08S, 04N19W33F01S, and 04N19W33D05S. This change in stratigraphy, as well as the constriction of the basin, contributes to groundwater being discharged in the SCR as surface flow. A thinner, less extensive deposit of finer-grained material (Layer 4) was also identified in the resistivity log of well 04N19W32L02S, separating the alluvial aquifers.

This change in stratigraphy, as well as the constriction of the basin, contributes to groundwater being discharged in the Santa Clara River as surface flow.

The Fillmore Basin Hwy 126 cross section (Figure 2.2-6) (United, 2021a) shows a transition along the synclinal axis of the Basin from vertically contiguous coarse-grained (aquifer) deposits (Alluvium and the San Pedro Formation) in the eastern central part of the Basin near City of Fillmore, to alternating stacks of these aquifer deposits separated by aquitard layers toward the Santa Paula basin boundary. There is an area of relatively recent structural uplift, designated as the Sespe Upland (Mann, 1959), west of the Sespe Creek channel and north of the Santa Clara River channel (United, 2021a). Here, at the base of slope of the upland, the alluvial deposits of Sespe Creek and the Santa Clara River are interfingered and transition to finer-grained sediments and interbedded minor clays deposited by tributaries and minor drainages, most notably the Timber Canyon and Boulder Canyon drainages (United, 2021a). Well data show recent alluvial deposits and colluvium (model layer 1), derived from the steep northern tributaries, that is over 350 feet thick in some areas (Chevron S 15, API: 1110046) (United, 2021a). These sediments overlie an aquitard of variable thickness (Layer 6), and the Upper Saugus/San Pedro Formation (United, 2021a). Layers 3 and 5 are notably not present, a result of deposition of fan deposits from Timber and Boulder Canyons and the uplift creating a barrier restricting the river channel to the southern portion of the basin (United, 2021a). Near the mouth of Pole Creek, a thick deposit of interbedded and poorly-sorted clay and cobbles was observed in the lithologic log of well 04N19W30H01S (United, 2021a). This assemblage of poorly stratified material is interpreted to be alluvial fan and fanglomerate deposits of significant thickness (up to 480 feet), but relatively limited extent (United, 2021a). The deposit thins radially, was not identified in wells to the west or northwest (approximately 1 mile away), and was mapped as an aquitard (Layer 2) (United, 2021a).

The Santa Paula–Fillmore Basin Boundary cross section (Figure 2.2-7) (United, 2021a) shows a similar east-to-west transition from interconnected alluvium and San Pedro Formation deposits, on the south side of the Santa Clara River, to these formations being separated by aquitard layers, near the basins boundary, that are encountered at depths of about 150 feet bgs for the shallow aquitard (Layer 4) that separates the overlying recent river alluvium from the older alluvium, and about 300 feet bgs for the intermediate aquitard (Layer 6) that separates the overlying Older Alluvium from the San Pedro Formation. Near the mapped boundary between the Fillmore and Santa Paula Basins, the valley again narrows, and finer-grained deposits of varying thickness and extent were identified between both the alluvial aquifers and the Upper Saugus/San Pedro Formation. A shallow clay layer (Layer 2) of limited extent was identified east-northeast of the Fillmore–Santa Paula Basin boundary. Aquitard material designated as Layer 4, which is observed to be thickest in the central portion of the Santa Paula Basin, is mapped as extending upstream across the boundary and into the western portion of the Fillmore Basin. The aquitard material separating the older alluvium aquifer from the Saugus/San Pedro Formation (Layer 6) has a similar depositional extent near the active river channel, but extends northeast to Sespe Creek, underlying the Sespe Upland area.

Hydraulic properties of each of these formations are estimated per the calibrated groundwater flow model developed by United (2021a) and summarized in Table 2.2-1. Horizontal hydraulic conductivity (K_h), a measure of the ease of ability for aquifer material to transmit groundwater laterally (in feet per day [ft/d]), is generally higher in the shallower deposits that occur upstream and along the channels of the Santa Clara River and Sespe Creek. The lowest K_h materials are found along the Basin boundaries, farther from the high-energy depositional environment of the stream channels. All deposits have a uniform anisotropy value of 10, representing the ratio of hydraulic conductivity in the horizontal direction (K_h) versus the hydraulic conductivity in the vertical direction (K_v), meaning that groundwater flows 10 times more easily laterally compared to vertically. Specific yield (S_y), the volumetric fraction of saturated material that yields groundwater under gravity forces (i.e., unconfined aquifer conditions), is generally also higher in the shallower deposits. The SWRB (1956) considered the average S_y of the Basin to be 0.12. The aquifer and aquitard deposits have a uniform specific storage (S_s) value of 0.00001 (Table 2.2-1).

Table 2.2-1. Hydraulic Properties of Fillmore Basin

Aquifer	United (2021a) Aquifer Zone	K_h (ft/d)		S_y	
		Aquifer	Aquitard	Aquifer	Aquitard
Principal aquifer	A	10–800	0.1	0.15	0.05–0.15
	B	1–400	0.1–1	0.1–0.15	0.05
Non-principal aquifer	C	1–100	0.01	0.05–0.1	0.05

Source of hydraulic properties: United (2021a).
ft/d = Feet per day

2.2.1.4.3 Structural Properties (Reg. § 354.14[b][4][C])

The structural properties of the Basin include the predominant east-to-west oriented Santa Clara Syncline (Figure 2.2-3), localized uplift north the Santa Clara River referred to as the Sespe Upland (Mann, 1959), faults that restrict groundwater flow, and constrictions in aquifer material at the Basin boundaries with upgradient Piru Basin and downgradient Santa Paula Basin. An anticline is mapped by Dibblee (Figure 2.2-2) along older alluvium that is exposed at land surface just north of the Santa Clara River in the southern extent of the Sespe Uplands.

An unnamed fault has been identified in the Sespe Uplands, oriented southwest-to-northeast between two fault traces mapped along the base of the San Pedro (Saugus) Formation foothills near Timber Canyon (Figure 2.2-3), based on a sharp (about 200-foot) drop in groundwater levels observed between two adjacent wells (04N20W31H02S and 04N20W31H04S) perforated at similar depths on either side of this feature, which implies that this fault restricts groundwater flow. The degree of flow restriction by this fault may not be as significant as inferred from the difference in groundwater elevations because there is an approximate 120-foot difference in land surface elevation between the two wells. Fault traces with similar east-to-west orientation are mapped further north up Timber Canyon (Figure 2.2-3); however, their significance in regards to groundwater flow is not known. Another unnamed fault trace is mapped in the Bardsdale area (Figure 2.2-3), but is not known to have a significant impact on groundwater levels or flow.

2.2.1.4.4 General Water Quality (Reg. § 354.14[b][4][D])

The general water quality characteristics of groundwater in the Basin have been classified by Mann (1959) into four areas:

- Youngest alluvium of Santa Clara River and Sespe Creek
- Pole Creek Fan (City of Fillmore area)
- South side of Santa Clara River
- Sespe Upland

Water is typically calcium sulfate in character, although some groundwater in the Sespe Uplands is calcium bicarbonate in character (DWR, 2006). Data from 9 public supply wells show a total dissolved solids (TDS) content range of 660 to 1,590 milligrams per liter (mg/L), with an average of 967 mg/L. Historical water quality impairments have involved elevated nitrate concentrations (due to agricultural return flows), urban stormwater runoff and wastewater effluents (that tend to concentrate salts in groundwater) and leaking underground storage tanks (LUSTs). Some specific water quality issues are related to sulfate and boron.

Overall, groundwater quality in the youngest alluvium of Santa Clara River and Sespe Creek is relatively consistent near the upslope Basin boundaries and becomes more variable as water flows along the channels (mainstems). The young permeable alluvial deposits permit high rates of groundwater flow. This groundwater has similar characteristics of the surface waters that percolate into the shallow aquifer. The quality of the surface water that percolates from the Santa Clara River varies depending on whether or not stormflows are present. During stormflows, chemical concentrations are low and the freshwater replenishes the groundwater. Groundwater mixing with other chemical processes, such as interaction with sediment and leaching of salts from irrigation activities, causes certain chemical characteristics of the groundwater to increase. As groundwater flows through the Basin, from the Piru Basin boundary to the Santa Paula Basin, water quality generally degrades due to the accumulation of salts; however, this water quality is still sufficient for the designated beneficial uses of groundwater. When this groundwater discharges (rises) to above ground surface and becomes surface water, the surface water quality closely resembles that of groundwater.

In the Pole Creek Fan area (City of Fillmore area), between Sespe Creek and the Santa Clara River, limited flushing of groundwater occurs by percolation from flood flows (Mann, 1959). Poor quality water in this area, notably high TDS, nitrate, and fluoride, has been attributed to native groundwater of the San Pedro Formation. This poor water quality was been observed to encrust wells with mineralization initially, but improves over time with pumping. This indicates groundwater is replenished by other sources, likely younger and fresher groundwater from the alluvium.

South of the Santa Clara River in the Bardsdale area, groundwater quality in the broad alluvial flat has been degraded in places from Section 9 of Township 3 North (T3N) and Range 20 West (R20W) to Section 6 of T3N-R19W by irrigation return flows and possibly oil field brines, as indicated by elevated calcium, sulfate, and nitrate (Mann, 1959). High fluoride and boron have been identified in certain wells.

In the Sespe Upland area, north of the Santa Clara River, most wells are perforated in the San Pedro Formation, which is conceptualized to exchange little groundwater with the alluvium, except possibly from Sespe Creek in the reach northwest of the City of Fillmore (Mann, 1959). The water type is calcium bicarbonate. Here, groundwater quality contains little mineral content, yet high fluoride and nitrate content. This water quality is suitable for irrigation (agricultural) uses, but less so for domestic purposes. Shallow wells (completed above the San Pedro Formation) have encountered high sulfate groundwater. The high nitrate may be associated with either the native water of the San Pedro Formation or irrigation return flows. Irrigation return flows have been identified as the cause of water quality degradation in the western Basin boundary area, especially in the northwest quarter of Section 12 of T3N-R21W, characterized by elevated sulfate, nitrate, and chloride (with low fluoride and boron).

2.2.1.4.5 Primary Beneficial Uses (Reg. § 354.14[b][4][E])

Groundwater is beneficially used in two primary forms: (1) pumping for agricultural, domestic, municipal and industrial users and (2) evapotranspiration (ET) by vegetation (i.e., GDEs). Beneficial pumping uses in the Basin are designated in Chapter 2 of the Basin Plan for the Coastal Watersheds of Los Angeles and Ventura Counties (LARWQCB, 1994). The average annual water demand reported for each beneficial use category that pumps groundwater is included in Table 2.2-2.

Table 2.2-2. Average Reported Pumping Rate per Year per Beneficial Use and Principal Aquifer in Fillmore Basin

Aquifer	Agricultural	Domestic	Industrial [a]	Municipal	Total	Percent of Total
Principal (Zones A and B)	23,107	2,881	4,264	1,913	32,164	73%
Principal/Zone C	5,011	5	0	0	5,016	11%
Zone C	405	8	0	0	413	1%
Unknown	6,229	221	0	0	6,450	15%
Total	34,752	3,114	4,264	1,913	44,043	—
Percent of Total	79%	7%	10%	4%	—	100%

Average pumping rate is in acre-feet per calendar year (AFY), based on records collected between 2015 and 2019.
Principal/Zone C designation represents wells that are perforated in both the Principal Aquifer and Aquifer Zone C. The relative contributions from the principal aquifer versus Zone C is uncertain, but more groundwater is likely sourced from the principal aquifer based on the generally more permeable hydraulic properties of Zones A and B and common observation of water wells sourcing a major portion of flow from the upper perforated intervals (Hanson et al., 2003).
Unknown principal aquifer designation represents wells without screen depth information and/or total depth of casing or borehole.
[a] The majority of industrial groundwater use is associated with pumping at the Fillmore Fish Hatchery.

GDE beneficial uses are considered to occur where GDE units have been identified by Stillwater (2021a) (Appendix D), as described in Section 2.2.2.8. Water demand associated with ET by GDE units is considered to be sourced from the shallow depths of the principal aquifer. The typical annual groundwater demand of GDEs is estimated by the ET component of the United (2021a and 2021e) groundwater flow model and discussed in greater detail in Section 2.2.3.2.2.

2.2.1.5 *Physical Characteristics of the Basin (Reg. § 354.14[d])*

The following subsections discuss physical characteristics of the Basin focusing on land surface features.

2.2.1.5.1 *Topography (Reg. § 354.14[d][1])*

The Basin is within the Santa Clara River Watershed (Figure 2.1-1), which has a total area of 1,625 square miles and a channel length (for the Santa Clara River) of approximately 83 miles that flows from headwaters on the north slope of the San Gabriel Mountains, near Acton Valley in the east to the Pacific Ocean in the west. The Basin (Figure 2.2-8) is bounded by the Topatopa Mountains to the north and South Mountain to the south. The highest peaks are to the north—Santa Paula Peak and San Cayetano Mountain (Figure 2.2-8). The land surface topography of the Basin can be classified by three smaller scale (HUC-10) watersheds:

- Sespe Creek

- Middle Santa Clara River
- Lower Santa Clara River

These watersheds drain various amounts of runoff from land into tributaries, which ultimately discharge into the Santa Clara River. The surface water hydrology is discussed in more detail in Section 2.2.1.5.5.

2.2.1.5.2 Surficial Geology (Reg. § 354.14[d][2])

Detailed and generalized surficial geologic maps are shown on Figures 2.2-2 and 2.2-3, respectively, and discussed in Section 2.2.1.1.

2.2.1.5.3 Soil Characteristics (Reg. § 354.14[d][3])

The Basin land surface is primarily composed of permeable soils, as shown by green (Group A) and blue (Group B) hydrologic soil group areas on Figure 2.2-9 (NRCS, 2009). The most permeable material occurs along the Santa Clara River and its various tributaries (see Section 2.2.1.5.5 for more discussion about surface water bodies). These soil groups are conducive to recharge of surface water into the groundwater system.

2.2.1.5.4 Recharge and Discharge Areas (Reg. § 354.14[d][4])

Groundwater recharge and discharge areas within the Basin are shown on Figure 2.2-10. The areas that typically contribute recharge of surface water to the groundwater system in the Basin coincide with the following:

- Infiltration of runoff along the channels of the Santa Clara River, Sespe Creek, and associated tributaries
- Return flows from agricultural and municipal and industrial land use (e.g., irrigation and leaking pipes)
- Infiltration of WWTP treated effluent into percolation ponds at the southern edge of the City of Fillmore

Groundwater discharge areas occur at the Basin boundaries with upstream Piru Basin and downstream Santa Paula Basin, where constrictions in the volume of water-bearing deposits elevate groundwater levels to intersect and occur above the invert (lowest) elevation along the Santa Clara River channel, resulting in rising groundwater conditions (i.e., surface water). Water budget estimates of each of the recharge (inflow) and discharge (outflow) components are described in Section 2.2.3.

2.2.1.5.5 Climate

Climate conditions, namely precipitation and temperature, have a significant effect on the occurrence of surface water and groundwater. The climate type of the Basin region is classified as "Csb (warm-summer Mediterranean)," based on the updated Köppen-Geiger global climate classification system (United, 2021a), where summers are generally warm and dry and winters are cool with variable precipitation (sometimes wet). Precipitation in the Santa Clara River watershed (and much of California) varies due to phenomena, namely the Pacific Decadal Oscillation (PDO) and El Niño Southern Oscillation (ENSO), that vary over different time scales. The PDO tends to drive wet and dry periods—characterized by positive and negative PDO index values, respectively—on the decadal (i.e., 10s of years) scale, while ENSO tends to drive wet ("El Niño") and dry ("La Niña") periods on cycles less than 10 years. The longest drought period on record in the region (based on reconstructed tree ring and precipitation data) was 44 years, from 1841 through 1884 (Hanson et al., 2003). Projected climate change is expected to exhibit more frequent and severe droughts and intense wet periods.

2.2.1.5.6 Surface Water Bodies (Reg. § 354.14[d][5])

The primary surface water bodies in the Basin (Figure 2.2-11) comprise the mainstem Santa Clara River and its main tributary, Sespe Creek. The most significant tributary other than Sespe Creek is Pole Creek. All of the major tributaries to the Santa Clara River are gauged (United, 2017). There are several areas along the length of the Santa Clara River and Sespe Creek where surface water flow often percolates entirely, resulting in dry riverbed conditions (United, 2017), represented by the stream channel recharge areas shown on Figure 2.2-10 (United, 2021a). Flow in the Santa Clara River can be described as interrupted perennial (i.e., alternating reaches of perennial and intermittent) flow, with certain reaches being predictably wet or dry in most years (SFEI, 2011; Beller et al., 2016; United, 2017). United (2017) demonstrates this predictable pattern of dry reaches developing during dry years with their observations of wetted stream extents and associated surface water flow measurements between years 2011 and 2015 (Figure 2.2-12).

There are two general surface water flow conditions commonly associated with wet and dry periods: (1) storm flows and (2) base flows. During wet periods, precipitation and related surface water flow (including any conservation releases from Lake Piru and SWP deliveries) is the major source of groundwater recharge. Runoff from precipitation primarily occurs during winter and spring (December through April). The effect large storm flows have on the geometry of the Santa Clara River is evident by the wash deposits extent shown on Figure 2.2-11. During major storm events, the wetted area of the Santa Clara River expands to accommodate the flows that are orders of magnitude higher than typical baseflow conditions, leaving behind a scoured channel with most all vegetation stripped away and a reconfigured channel geometry for the river to flow through thereafter until the next major storm.

During dry periods, areas of rising groundwater near the Basin boundaries keep reaches of the Santa Clara River flowing (i.e., 2012 through 2015 conditions shown on Figure 2.2-12). Groundwater discharges to the surface at the western end of the Basin due to constrictions in the volume of aquifer material. This surface water flows perennially even during major droughts. Similar rising groundwater conditions occur at the western end of upstream Piru Basin, which causes groundwater to discharge from the Piru Basin as surface water into the Fillmore Basin, which eventually loses (recharges) back to the groundwater system. The manual surface water monitoring sites shown in red at both of these rising groundwater areas (Figure 2.2-11) are monitored by United. Flows measured here by United are used to estimate benefits (recharge) to the Basin during conservation and SWP releases and groundwater recharge/discharge rates (United, 2017).

Other notable surface water features include surface water diversions and recycled wastewater. A couple of minor surface water diversions are known to exist on Boulder Creek (Figure 2.2-13) in the Sespe Uplands area with annual diversion rates that have historically been reported in the range of 50 to 200 AFY (United, 2021a and 2021e), although only one diversion (Beans Ranch) continues to operate with an average reported diversion of 70 AFY (the other diversion by Limoneira has reported no diversions since 2012). A more significant surface water diversion (Fillmore Irrigation Company, which used to typically report more than 2,000 AFY in diversions) used to occur upstream up the Basin, on Sespe Creek, but has ceased since 2007. The City of Fillmore Water Reclamation Plant (WRP) discharges about two-thirds (i.e., 1,000 to 2,000 AFY) of its treated wastewater to percolation ponds (Figure 2.2-14). The remaining one-third of the WRP treated water is used to irrigate City of Fillmore landscape as recycled water. More details on these operations are provided in United (2021a and 2021e).

Beneficial users of surface water in the Basin are listed in the Basin Plan for the Coastal Watersheds of Los Angeles and Ventura Counties (LARWQCB, 1994) for various reaches of the Santa Clara River and Sespe Creek. The beneficial uses for aquatic features and groundwater vary between aquatic features, and include the following:

- Groundwater recharge (GWR)
- Freshwater replenishment (FRSH)

- Warm freshwater habitat (WARM)
- Cold freshwater habitat (COLD)
- Wildlife habitat (WILD)
- Preservation of biological habitats of special significance (BIOL)
- Support of habitat for rare, threatened, or endangered species (RARE)
- Warm and cold migration habitat (MIGR)
- Warmwater spawning habitat (SPWN)
- Wetland habitat (WET)
- Aquaculture (AQUA)

Beneficial uses include those that directly benefit groundwater conditions (e.g., GWR), those supported directly by groundwater via interconnected surface waters (e.g., FRSH, RARE [e.g., for support of southern California steelhead, California condor]), and those that apply to groundwater beneficial uses (i.e., AQUA).

2.2.1.5.7 Imported Water Supplies (Reg. § 354.14[d][6])

Imported water supplies from the SWP, operated by DWR, are significant yet variable sources of water that benefits the Basin after first flowing through and percolating into Piru Basin and/or Upper Santa Clara River Valley Basin, depending on the reservoir from which water is released. SWP imports generally come to the Basin via imports and releases from United's Santa Felicia Dam (Lake Piru). Occasionally, United may import SWP water via releases from Castaic Lake, which is above the Upper Santa Clara River Valley basin (Figure 2.1-1). Any imported water from Castaic Lake flows through and percolates in Upper Santa Clara Valley, prior to going through the same process through Piru Basin, before making it to the Basin (if at all). Based on monitoring during flood flow and SWP releases during 2017 and 2019, it is estimated that 5 to 20 percent of surface water that flows from Castaic Lake to the eastern boundary of Piru Basin is lost to (recharges) the Santa Clara River Valley East groundwater basin (United, personal communications).

Ventura County has a 20,000 AF allocation for SWP. United's share of the allocation is 5,000 AF (1,850 AF of which is used by Port Hueneme Water Agency). United's remaining 3,150 AF of water is permitted to be released from Pyramid Lake (Figure 2.1-1) into Lake Piru for eventual conservation releases into the Santa Clara River via Piru Creek (United, 2017). The full allocation is not received most years, but has been occasionally supplemented by purchase of a portion of the allocation belonging to either the City of Ventura or Casitas Municipal Water District to maximize deliveries to the County. Due to environmental constraints, United may only receive delivery of this SWP water from Pyramid Lake between November 1 and the end of February.

2.2.1.6 Data Gaps and Uncertainty (Reg. § 354.14[b][5])

Data gaps in the HCM comprise a lack of groundwater level data in the shallow groundwater of the principal aquifer along the streams (e.g., Santa Clara River and Sespe Creek). The shallow groundwater data gaps in the stream areas will be addressed with the installation of monitor wells by the Agency (per DWR Grant Funding) and installation of shallow monitor wells by the University of California Santa Barbara (UCSB) (Stillwater, 2021b). The surface water and groundwater model (United, 2021a and 2021e) has the potential to be refined in the future (i.e., grid density increased) in the GDE areas to better understand interconnectedness of surface waters and groundwater.

Limited data exist in surface water flow monitoring of the Santa Clara River at the Basin boundaries due to the difficulties of maintaining recording gaging stations on the River that flows with frequent sediment deposition and erosion events, braided stream channels, and large stream flow variability. United has consulted with the USGS in the past regarding augmenting the stream gauging locations along the SCR; however, there is a lack of suitable locations that would provide high-quality information (United, 2011 and 2016b). Additional stream gauging locations on the Santa Clara River are considered infeasible according to DWR and the USGS (United, 2011 and 2016b). United (2021a and 2021e) shows that groundwater model simulated surface water flows are somewhat well calibrated to limited rising groundwater flow measurements (collected during dry months between 2011 and 2019), but improvements can be made in the future with shallow groundwater level data collected at more locations.

2.2.2 Current and Historical Groundwater Conditions (Reg. § 354.16)

This section describes current and historical groundwater conditions pertaining to each of the six undesirable results specified by SGMA, along with current and historical climate conditions. Current groundwater conditions are represented by information available for water years 2016 through 2019 and historical conditions are represented by information available through water year 2015.

2.2.2.1 Climate

Precipitation is an important variable to consider when evaluating groundwater conditions because it is a major driver of inflows to the Basin. The longest measured precipitation record near the Basin is from Santa Paula gauges 245, 245a, and 245b, for which United has data going back to 1850 (Figure 2.2-15). On Figure 2.2-15, United (2021a) applies a five-year running moving average (red line) to annual precipitation (blue bars) to highlight trends in climate variability (i.e., wet and dry periods). Wet periods are indicated by years when the moving average is increasing or has plateaued at relatively high values of precipitation (i.e., above the historical average); and vice versa, dry periods are represented by declining periods or when the moving average remains relatively low (i.e., below average precipitation). The longer-term (decades long) and intermediate (about five-year long) wet and dry periods are consistent with the climate variability of the region (i.e., Section 2.2.1.5.5). Groundwater level hydrographs from wells with long-term records in the Basin (and the Piru Basin) show similar trends.

It is worth noting that other precipitation gauges exist (or used to exist) within Fillmore Basin and were used in groundwater modeling (United, 2021a,e), as listed below:

- VCWPD 171: active (since water year 1957)
- VCWPD 199A: active (since water year 2010)
- VCWPD 400: inactive (water years 1999 through 2014)
- VCWPD 039: inactive (July 1912 through October 21, 2009)

2.2.2.2 *Groundwater Elevation Data (Reg. § 354.16[a])*

Groundwater elevation data from the existing United and VCWPD monitoring networks are presented in map view, as contours (lines of equal value) of seasonal groundwater elevations in the principal aquifer, and as hydrographs at wells with long-term records. All of the groundwater elevation data are available on the FPBGSA online database and map viewer (https://fillmore-piru.gladata.com/). The contour maps are useful for understanding groundwater flow directions and how groundwater levels vary throughout the Basin during wet (e.g., winter and spring) and dry (e.g., summer and fall) seasons. Water flows from areas of higher groundwater elevations toward lower groundwater elevations. Long-term hydrographs are shown to illustrate how deep groundwater levels have historically declined during droughts and recovered following each drought.

- Contour Maps (Reg. § 354.16[a][1])
  - ◇ Contours of groundwater elevations throughout the principal aquifer are presented on Figures 2.2-16 and 2.2-17 to represent current seasonal high (spring 2019) and seasonal low (fall 2019) conditions, respectively. Groundwater generally flows to the west from

the northern, eastern, and southern Basin boundaries and ultimately discharges to the Santa Paula Basin. Some troughs in the water table are evident in (1) the Sespe area during both seasons, (2) the City of Fillmore during spring 2019, and (3) the Bardsdale area (both seasons)—indicative of groundwater pumping.

- Hydrographs (Reg. § 354.16[a][2])
  - A plate of long-term groundwater level hydrographs in map view (Figure 2.2-18) shows periods of stable Basin "full" conditions, interrupted by periods of water level declines and subsequent periods of recovery that are associated with drought cycles. The lowest groundwater elevations at the end of the recent five-year (2012 through 2016) drought are similar to historical lows of prior droughts (e.g., 1962, 1977, and 1990). Groundwater levels vary greatest (about 70 feet) in the northern (e.g., well 04N19W33D04S) and eastern (e.g., well 03N19W06D02S) portions of the Basin, and less so (about 40 feet) toward the western edge. Hydrographs for all wells in and near the Basin with water level data are included in Appendix K.
  - There is no evidence of chronic groundwater level declines based on the recovery of groundwater levels observed in the long-term groundwater level records, with the exception of an apparent gradual chronic groundwater level decline at the well (03N21W01P02S) nearest the Santa Paula Basin boundary. Hydrographs from nearby wells (e.g., 03N21W11E03S, 03N21W11F03S, 03N21W12E04S and 03N21W12E08S) within the Santa Paula basin exhibit similar apparent declining groundwater level trends, while these trends are not observed in other nearby wells in Fillmore Basin. This subtle decline in groundwater levels based on data collected between 1971 and 2019 is likely attributed to pumping in Santa Paula near the Basin boundary (Figure 12 from United, 2020b) and the long-term average pumping rate of 25,800 AFY in Santa Paula basin being slightly higher than the basin's safe yield, estimated to be in the range of 24,000 to 25,500 AFY (DBS&A, 2017; United, 2020a).

2.2.2.3 Change in Groundwater in Storage (Reg. § 354.16[b])

Water budget results are reported and evaluated as annual changes between fall (i.e., late September) groundwater conditions, which generally coincide with the beginning and end of each water year. A water year (i.e., 2019) is defined as the year duration between October 1 of the preceding calendar year (i.e., 2018) and September 30 of the reference calendar year (i.e., 2019). The change in groundwater in storage is positive or negative largely depending on the water year type (e.g., dry or wet). Evaluating changes in groundwater in storage based on differences between average fall groundwater levels (i.e., for each water year) is ideal for this GSP because flows are representative of the water year type and fall groundwater levels are the basis for evaluating undesirable results for this Basin (as further explained in Section 3).

Estimates of the annual and cumulative changes in volume of groundwater in storage in the Basin (Figure 2.2-19) are based on water budget results from the United (2021a and 2021e) calibrated groundwater flow model (Regional Model). The Regional Model was used to simulate groundwater levels and estimate changes in groundwater in storage for the 35 calendar year period, 1985 through 2019. The initial two water years of the historical groundwater water budget, 1986 and 1987, are not included because falling groundwater levels in the northern boundary area of the model indicate that the model was equilibrating from initial heads (Section 3.6 of United, 2021a) that were specified higher than available groundwater level data (e.g., well 04N20W26C02S from Figure 2.2-18) suggest is realistic. The Regional Model is considered an accurate method for estimating changes in groundwater in storage because it demonstrates an overall low error (i.e., a low average root-mean-squared error [RMSE]) between simulated and observed groundwater elevations that meets industry standards (i.e., RMSE less than 10 percent of the range of groundwater levels) and has been reviewed/approved by an expert panel (United, 2018, 2021a, and 2021e; Porcello et al., 2021).

The change in groundwater in storage estimates (Figure 2.2-19) includes estimates of annual Basin pumping and ET volumes and water year types designated by DWR for the Santa Clara River Watershed. Annual and cumulative changes in groundwater in storage show periods of decline during two five-year long) drought periods (e.g., 1987 through 1991 and 2012 through 2016, that are characterized by consecutive dry and critical (critically dry) water years. The Basin was able to recover fully (as demonstrated by the rebound in the cumulative change in groundwater in storage to zero) within two years of the late 1980s drought, due to two consecutive wet years. The difference of having several dry years (i.e., 1987 through 1991) during a drought versus several critical years (i.e., 2012 through 2019) during a drought—on groundwater in storage loss—is evident based on the more rapid rate of decline that occurred during the more recent, severe drought (even though average pumping during the recent drought was about 7,000 AFY [13 percent] less than that during the late 1980s drought). Climate trends since about 2000 indicate that the Basin (and greater southwestern U.S.) are in the midst of a long-term drought period, which means that full recovery from the recent severe drought may occur later rather than sooner. The historical, current, and projected Basin water budgets are described in Section 2.2.3, which demonstrate the Basin's ability for groundwater levels to recover in the context of climate change.

Pumping volumes per water year are estimated (using an inverse relationship with precipitation [United, 2021a]) because pumping volumes are reported to United on a semiannual calendar year basis. Use of meters generally results in lower reported pumping volumes than methods like crop coefficients, based on comparison of reported pumping volumes before and after a user switches to using a meter or electrical efficiency. Currently, over one-half of Basin groundwater pumping is reported using water meters; over one-third is reported using electrical meters, and a minor portion is reported using the crop factor method (United, 2016a).

2.2.2.4 Seawater Intrusion Conditions (Reg. § 354.16[c])

Seawater intrusion conditions are not applicable to this GSP because the Basin is about 15 miles inland from the Pacific Ocean and groundwater levels within the Basin have always been at least 170 feet above (approximate) mean sea level (feet msl) (i.e., the National Geodetic Vertical Datum of 1929 [NGVD29]).

2.2.2.5 Groundwater Quality Issues (Reg. § 354.16[d])

Groundwater quality in the Fillmore Basin is generally of a high quality and is consumed for a variety of beneficial uses in the Basin that include, but are not limited to, domestic, agricultural crop irrigation, industrial, and environmental uses. The FPBGSA does not have regulatory authority over groundwater quality and is not charged with improving groundwater quality in the Fillmore Basin. However, any potential projects or management actions implemented by the Agency must not degrade groundwater quality in the Basin. There are no unique water quality impacts to wells in the DACs (Figure 2.1-4), and the FPBGSA has committed to collaborating with the appropriate water quality regulatory agencies (e.g., the RWQCB and Division of Drinking Water [DDW]).

Historical and current groundwater issues in the Fillmore Basin (and relevant issues in the upgradient Piru Basin) are presented in this subsection. SGMA baseline 2015 (i.e., legislation enactment year) groundwater quality in the Basin is detailed in the 2014/2015 Piru and Fillmore Basins Biennial Groundwater Conditions Report (United, 2016a). An analysis of historical and short-term (2000 through 2018) groundwater quality trends can be found in the FPBGSA Monitoring Program and Data Gap technical memorandum (Appendix K). The monitoring network and sources of data collection in the Basin are described in Section 3.5.1.2.

2.2.2.5.1 Historical Chemicals of Concern

From 1951 to 1968, elevated concentrations of TDS, sulfate, chloride, and boron were recorded near the Ventura/Los Angeles County Line (in Piru Basin), and are generally attributed to the surface discharge of oil field brines prior to the enactment of the federal Clean Water Act (United, 2016a). However, high TDS and chloride persisted in the Santa Clara River in surface water sampled near the county line and in local groundwater after passage of the Clean Water Act.

The main water quality concern over the past couple of decades for agricultural users in Piru Basin (and to a lesser extent in the downgradient Fillmore Basin) has been impacts associated with Santa Clara River perennial surface water baseflows sourcing from Los Angeles County (United, 2016a). These baseflows percolate to groundwater in east Piru Basin and contain elevated chloride tertiary treated water from the Valencia Reclamation Plant that discharges to the Upper Santa Clara River. The elevated chloride concentrations in Valencia plant discharge in the Upper Santa Clara River are influenced by chloride in imported SWP water, as Castaic Lake Water Agency delivers SWP water to water retailers in the greater Santa Clarita area (United, 2016a).

Historically, water quality chemicals (analytes or constituents) of concern (COCs) in the Fillmore and Piru Basins have generally included, but are not necessarily limited to, the following analytes:

- TDS
- Sulfate
- Chloride
- Nitrate
- Boron

The U.S. EPA regulations and California Code of Regulations (CCR) identify maximum contaminant levels (MCLs) for drinking water for a wide range of chemicals. The U.S. EPA also provides secondary MCLs (non-enforceable guidelines) for contaminants that may cause cosmetic (e.g., skin or tooth discoloration) or aesthetic (e.g., taste, odor, or color) effects. The MCLs and secondary MCLs (where applicable) for the five COCs and additional potential COCs summarized in the following subsection are shown in Table 2.2-3.

Table 2.2-3. Selected U.S. EPA Primary and Secondary Standards (May 2009) and California Code of Regulations, Title 22 Maximum Contaminant Levels (February 2012)

Constituent	Chemical Formula	U.S. EPA MCL (mg/L [a])	CCR, Title 22 MCL (mg/L)
Gross alpha		15 pCi/L	—
Lead	Pb	0.015 [b]	—
Nitrate (as N)	N	10	10
Nitrate	NO_3	—	45
Selenium	Se	0.05	0.05
Uranium	U	0.03 (~20 pCi/L)	—
Boron	B		1 [c]
Chloride	Cl	250 [d]	—
Iron	Fe	0.3 [d]	—
Manganese	Mn	0.05 [d]	—
Sulfate	SO_4	250 [d]	—
TDS	TDS	500 [d]	—

[a] Unless otherwise noted.
[b] 0.015 mg/L (15 micrograms per liter [µg/L]) is the action level for lead; the public health goal is zero.
[c] California State notification level; boron is an unregulated chemical without an established MCL.
[d] Secondary MCL.
MCL = Maximum contaminant level
mg/L = Milligrams per liter
pCi/L = Picocuries per liter

The five primary historical COCs identified in this subsection have been used historically as water quality indicators of the "health" of the Fillmore and Piru Basins. Both United and VCWPD have traditionally reported on the trends of these analytes in annual or biennial reports, with the exception of boron, for which only United has systematically sampled and reported.

2.2.2.5.2 Distribution and Concentrations of COCs in Groundwater

This subsection describes the distribution and concentration of diffuse or natural groundwater quality in Fillmore Basin with respect to Title 22 MCLs and water quality objectives (WQOs) identified by the LARWQCB Basin Plan for the Coastal Watersheds of Los Angeles and Ventura Counties (LARWQCB, 1994).

The LARWQCB Basin Plan designates three areas (e.g., Figure 2.2-20) in the Fillmore Basin with varying WQOs for the five COCs:

- Pole Creek Fan area (east of Sespe Creek and includes the City of Fillmore)
- South side of Santa Clara River (includes Bardsdale)
- Remaining Fillmore area (generally west of Sespe Creek and north of Santa Clara River)

The 2015 maximum groundwater quality results (distribution and concentrations) with respect to the WQOs are discussed in this subsection. SGMA legislation was enacted into law on January 1, 2015, which resulted in 2015 as a SGMA starting point (potential baseline) year for California's groundwater basins, even though many basins had experienced antecedent drought conditions the previous three years. The 2014/2015 Piru and Fillmore Basins Biennial Groundwater Conditions Report Figures 31 through 35 (not duplicated in this GSP) show the maximum-recorded concentrations for TDS, sulfate, chloride, nitrate and boron, respectively, for wells sampled in the 2015 calendar year (United, 2016a). In addition, a summary of the trend analysis results (detailed in the FPBGSA Monitoring Program and Data Gap technical memorandum) is provided here with respect to the distribution of groundwater quality issues and historical maximum concentrations in the Basin. The trend analysis evaluated historical record sets for wells with sufficient data for the five historical primary COCs. Short-term trends identified are from available data since the year 2000, and long-term trends are from available data from 1983 to 2018. The water quality time-series graphs in Appendix K show historical concentrations and identified trends for 48 wells in Fillmore Basin. In addition to the five primary COCs, additional potential COCs were considered as part of the evaluation and are identified in this subsection.

- *Total dissolved solids (TDS):* TDS is the aggregate concentration of dissolved chemicals in water. TDS can be reported by either total filterable residue (TFR) or by summation (SUM), which is calculated by summing the mass of the major anions and cations in a water sample. TDS by SUM commonly yields a slightly higher value than the TDS by TFR. The wet chemistry evaporative method (i.e., TFR) is now the standard laboratory analysis for TDS, and is recommended method for water sample analysis in the basin. Historically, VCWPD reported TDS as SUM for the groundwater samples they collected, but have moved to reporting results as TFR in recent years.

  The secondary MCL for TDS (no Title 22 MCL) is 500 mg/L. The LARWQCB Basin Plan WQOs for TDS for each of the three designated areas in the Fillmore Basin are as follow:

  - Pole Creek Fan area (WQO limit = 2,000 mg/L)

- South side of Santa Clara River (WQO limit = 1,500 mg/L)
- Remaining Fillmore area (WQO limit = 1,000 mg/L)

Historical TDS concentrations in the Fillmore Basin range 152 to 7,029 mg/L in samples collected in the 1920s to 2018. Figure 31 from the 2014/2015 Piru and Fillmore Basins Biennial Groundwater Conditions Report shows 2015 maximum TDS SUM concentrations ranging 694 to 2,250 mg/L and TDS by TFR concentrations ranging 680 to 1,960 mg/L. Elevated TDS SUM concentration is shown in one well (1,870 mg/L) in the Pole Creek Fan area, but is below the WQO limit of 2,000 mg/L. TDS concentrations in two wells (2,210–2,250 mg/L) on the south side of the Santa Clara River are above the WQO of 1,500 mg/L. Several wells exceed the WQO of 1,000 mg/L for the remaining Fillmore area, with a maximum reported concentration of 1,430 mg/L. Note that the remaining Fillmore area WQO is the lowest objective of the three areas in the Basin.

The water quality time-series graphs for TDS in the FPBGSA Monitoring Program and Data Gap technical memorandum show historical concentrations of TDS by TFR and SUM laboratory results plotted as independent series, as an invalid trend may be inadvertently identified from plotting a combination of TFR and SUM results as a single series. However, a single short-term trend is reported for TDS and shown graphically on Figure 2.2-20 plotted in map view for the Fillmore and Piru Basins.

TDS short-term trend results show concentrations to be decreasing (improving) or relatively stable overall at 12 of 18 wells tested in Fillmore Basin. A total of 6 wells shown on Figure 2.2-20 did not meet the criteria for testing and were reported as "insufficient data" (these wells are included for ease of map comparison since at least one of the other primary chemical of concern include a reported trend).

The area of notable exception where TDS concentrations appear to be increasing in Fillmore Basin in the Pole Creek Fan area (including a few of the City of Fillmore wells) and in a shallow monitor well (labeled as -36MW104 on Figure 2.2-20) near Santa Clara River. Well -36MW104 served as an upgradient monitor well for the City of Fillmore's old WWTP (the new WWTP is located approximately 0.5 mile west of the old WWTP). TDS concentrations are routinely below the WQO in the Pole Creek Fan area, and the lack of reported impacts to drinking water wells implies that this is not currently a significant impact in the Basin. Continued monitoring will provide additional information on the significance of this localized trend if it persists into the future.

- *Sulfate:* The secondary MCL for sulfate (no Title 22 MCL) is 250 mg/L. The LARWQCB Basin Plan WQOs for sulfate for each of the three designated areas in the Fillmore Basin are as follow:

  - Pole Creek Fan area (WQO limit = 800 mg/L)
  - South side of Santa Clara River (WQO limit = 800 mg/L)
  - Remaining Fillmore area (WQO limit = 400 mg/L)

  Historical sulfate concentrations in the Fillmore Basin range 9 to 4,100 mg/L in samples collected in the 1920s to 2018. Figure 32 from the 2014/2015 Piru and Fillmore Basins Biennial Groundwater Conditions Report shows 2015 maximum sulfate concentrations ranging 190 to 1,010 mg/L. Elevated sulfate concentrations above the WQOs are shown in one well (936 mg/L) in the Pole Creek Fan area and two wells (980–1,010 mg/L) on the south side of the Santa Clara River. These are the same three wells with elevated TDS concentrations. Several wells exceed the WQO of 400 mg/L for the remaining Fillmore area, with a maximum reported concentration in this area of 630 mg/L. Note that the remaining Fillmore area WQO is the lowest objective of the three areas in the Basin.

  Sulfate is commonly the largest component of TDS in water samples collected in the Fillmore Basin, and therefore often tracks with a similar trend. This was a consideration when determining to plot TDS and sulfate on the same graph for each well in the figures included the FPBGSA Monitoring Program and Data Gap technical memorandum (Appendix K).

  Figure 2.2-21 shows sulfate short-term trend results plotted in map view for the Fillmore and Piru Basins. Sulfate short-term trend results show reported concentration to be decreasing or relatively stable overall (15 of 19 wells tested) in Fillmore Basin. The area of notable exception where sulfate concentrations appear to be increasing in Fillmore Basin is the Pole Creek Fan area and in a shallow monitor well (labeled as -36MW104 on Figure 2.2-21) near Santa Clara River (similar to TDS reported results). The significance of elevated sulfate in the Pole Creek Fan area to drinking water wells is unknown and there is a lack of reported impacts (if any). Expanded groundwater monitoring may be necessary in this localized area to provide additional information on the significance of this trend if it persists into the future.

- *Chloride:* The secondary MCL for chloride (no Title 22 MCL) is 250 mg/L. A lower value of 117 mg/L is locally recognized in the Basin as a toxicity threshold for avocados (CH2M Hill, 2006). The LARWQCB Basin Plan WQOs for chloride for each of the three designated areas in the Fillmore Basin are as follow:

- Pole Creek Fan area (WQO limit = 100 mg/L)
- South side of Santa Clara River (WQO limit = 100 mg/L)
- Remaining Fillmore area (WQO limit = 50 mg/L)

Historical chloride concentrations in the Fillmore Basin range ND (not detected) to 432 mg/L in samples collected in the 1920s to 2018. Figure 33 from the 2014/2015 Piru and Fillmore Basins Biennial Groundwater Conditions Report shows 2015 maximum chloride concentrations ranging 10 to 180 mg/L. Elevated chloride concentrations above the WQOs are shown in two wells (both 180 mg/L) on the south side of the Santa Clara River. Several wells exceed the WQO of 50 mg/L for the remaining Fillmore area with a maximum reported concentration in this area of 60 mg/L. Note that the remaining Fillmore area WQO the lowest objective of the three areas in the Basin.

Figure 2.2-22 shows chloride short-term trend results plotted in map view for the Fillmore and Piru Basins. Chloride short-term trend results show reported concentration to be increasing overall (13 of 20 wells tested) in Fillmore Basin and in the upgradient Piru Basin (14 of 25 wells tested). A number of wells in the Piru and Fillmore Basins had sufficient datasets for chloride seasonal variance trend analysis, but none of the water quality results analyzed showed a strong seasonal variance trend.

Much of the Santa Clara River high chloride base flows that enter Ventura County from Los Angeles County originate as discharge from the Valencia Reclamation Plant in Santa Clarita (United, 2016a) and other sources include urban and stormwater runoff (VCWPD, 2016). Long-term groundwater recharge to the Piru Basin of this water has been recognized to be degrading the groundwater in eastern Piru Basin. These high chloride groundwater concentrations have made a steady advance westward with groundwater flow down the Piru Basin (United, 2016a) toward Fillmore Basin. A chloride total maximum daily load (TMDL) for the Upper Santa Clara River was adopted in 2008, but the proposed TMDL actions to reduce and mitigate chloride impacts in the Piru Basin have not yet been fully implemented.

- *Nitrate:* The historical Title 22 MCL for nitrate (NO_3) is 45 mg/L. For U.S. EPA drinking water standards compliance, it is now required to be reported as nitrate as nitrogen (nitrate as N, MCL = 10 mg/L) but nitrate as NO_3 is reported here is for consistency for comparison with the LARWQCB Region's Basin Plan WQOs and United historical reporting in the Fillmore and

Piru Basins. Nitrate and nitrate as N can be approximately converted from one form to the other based on the atomic weight of nitrogen. The LARWQCB Region's Basin Plan WQOs for nitrate for each of the three designated areas in the Fillmore Basin are as follow:

- ◇ Pole Creek Fan area (WQO limit = 45 mg/L)
- ◇ South side of Santa Clara River (WQO limit = 45 mg/L)
- ◇ Remaining Fillmore area (WQO limit = 45 mg/L)

Historical nitrate concentrations in the Fillmore Basin range from non-detect to 428 mg/L in samples collected in the 1930s to 2018. Figure 34 from the 2014/2015 Piru and Fillmore Basins Biennial Groundwater Conditions Report shows 2015 maximum nitrate concentrations ranging 1.3 to 82.8 mg/L. Elevated nitrate concentrations above the WQOs are shown in one well (51.6 mg/L) on the south side of the Santa Clara River and three wells (62.9–82.8 mg/L) in the remaining Fillmore area.

The elevated nitrate concentrations in the remaining Fillmore area may be related to agricultural practices and/or septic systems. The shallow depths to water and correspondingly shallow wells in the south side of the Santa Clara River (Bardsdale area) make wells in this area somewhat vulnerable to near-surface nitrogen sources such as septic tanks and fertilizer. Deeper wells with improperly constructed sanitary seals or older wells with degraded seals can also make them vulnerable to near-surface contamination.

Figure 2.2-23 shows nitrate short-term trend results plotted in map view for the Fillmore and Piru Basins. Nitrate short-term trend results show reported concentration to be increasing or relatively stable overall (15 of 24 wells tested) in the Fillmore Basin. VCWPD reports that historically nitrate concentrations have been elevated in Fillmore Basin (VCWPD, 2016). Nitrate is a health concern and continued monitoring will provide additional information on the significance of this increasing trend if it persists into the future.

- *Boron:* The California state notification level for boron is 1 mg/L. It is an unregulated chemical without an established Title 22 MCL. The LARWQCB Basin Plan WQOs for boron for each of the three designated areas in the Fillmore basin are as follow:
  - ◇ Pole Creek Fan area (WQO limit = 1 mg/L)
  - ◇ South side of Santa Clara River (WQO limit = 1.1 mg/L)
  - ◇ Remaining Fillmore area (WQO limit = 0.7 mg/L)

Historical boron concentrations in the Fillmore Basin range ND to 8.6 mg/L in samples collected in the 1920s to 2018. Figure 35 from the 2014/15 Piru and Fillmore Basins Biennial Groundwater Conditions Report shows 2015 maximum chloride concentrations ranging from 0.1 to 1.4 mg/L. Elevated boron concentrations above the WQOs are shown in two wells (1.2– 1.4 mg/L) on the south side of the Santa Clara River. Several wells exceed the WQO of 0.7 mg/L for the remaining Fillmore area with a maximum reported concentration in this area of 1.1 mg/L (in two wells). Naturally occurring boron is already addressed by the City of Fillmore with treatment.

Figure 2.2-24 shows boron short-term trend results plotted in map view for the Fillmore and Piru Basins. As mentioned above, VCWPD does not routinely sample for boron in the basins, so there are fewer record sets that meet the criteria for trend analysis (shown as "Insufficient Data" on the figure) than for the other four primary COCs. Boron short-term trend results for Fillmore Basin show concentrations to be increasing in four wells (three of which are in the Pole Creek Fan area), decreasing in 2 wells and relatively stable in 13 wells. A total of 5 wells shown on the figure did not meet the criteria for testing and were reported as "insufficient data." Boron short-term trend results show reported concentration to be relatively stable overall (13 of 19 wells tested) in Fillmore Basin. Expanded monitoring will provide additional information on the significance of the increasing trend in the localized Pole Creek Fan area if it persists into the future.

- *Additional Potential COCs:* Additional potential COCs in the Fillmore Basin were identified in the FPBGSA Monitoring Program and Data Gap technical memorandum (Appendix K) from a review of available groundwater quality data, the most recent annual report of groundwater conditions (VCWPD, 2016), and Piru/Fillmore Basins Groundwater Conditions report (United, 2016a). These additional chemicals include the following:

  - Radiochemistry (gross alpha and uranium)
  - Selenium
  - Lead
  - Iron and manganese

  Systematic trend analysis was not performed for these analytes in the technical memorandum because sufficient datasets were not available or the chemical has not historically been raised as a prominent concern in the Fillmore and/or Piru Basins (i.e., iron and manganese). With the exception of iron and manganese concentration mapping, a wide evaluation time period window was required to assemble adequate analytical data for geospatial evaluation. Narrower time-period windows are preferred for comparative analysis from well to well than were used in the technical memorandum evaluation, but the exercise was useful in detecting potential areas in the Basins that may have elevated chemical concentrations that should be investigated further. The technical memorandum includes four figures (not duplicated in this GSP) that show maximum concentration plotted in map view.

Gross alpha is a measure of the overall radioactivity of radium and uranium in water. Alpha radiation exists in the soil and can also be present in the air and groundwater. These naturally occurring radioactive elements emit alpha particles as they decay, which can pose health risks when exposed to prolonged elevated levels. There are at least three wells known in Fillmore Basin that have reported elevated gross alpha (16.7–17.8 picocuries per liter [pCi/L]) or uranium (15.4–22.2 pCi/L). Additional radiochemistry sampling is likely appropriate in Fillmore Basin to corroborate sparse groundwater sample results and to determine the potential extent of elevated gross alpha and uranium in wells in Fillmore Basin.

There were no selenium groundwater quality samples from wells in Fillmore Basin with levels that exceed the primary MCL for drinking water of 0.05 mg/L (50 µg/L) from the available water quality sample record sets from 2005 to 2018. However, there are a few wells in the upgradient Piru Basin that have groundwater that exceeds the primary MCL.

A well in east Fillmore Basin has once reported lead above the U.S. EPA action level of 15 µg/L (the public health goal is 0 for lead in drinking water). This sample collected from the well in 2011 is somewhat suspect, as a sample collected the previous year was reported as non-detect for lead. Similarly, another well in Fillmore Basin had reported lead at concentrations over 15 times the U.S. EPA action level, with previous and subsequent samples reporting lead concentration as non-detect. It appears from the limited analysis in the technical memorandum that elevated concentration of lead in the Fillmore Basin is not common or widespread.

Iron and manganese are commonly considered together when evaluating groundwater sample results. The chemicals are often found at elevated concentration in older (more mineralized) groundwater accessed from deep wells, and are predominantly associated with aesthetic water quality concerns from a public health perspective.

There were no iron groundwater quality samples from wells in Fillmore Basin with levels that exceed the secondary MCL for drinking water of 0.3 mg/L from the available water quality sample record sets from 2015 to 2018. It appears from this limited analysis that elevated concentration of iron in the Fillmore Basin is not common or widespread.

Manganese at concentrations above the U.S. EPA secondary MCL of 0.05 mg/L was detected in 13 wells in Fillmore Basin from the available record sets from 2015 to 2018. Many of these wells with elevated manganese have bottom screened depths below 250 feet bgs, with the notable exception of elevated levels found in shallower wells located near the Santa Paula/ Fillmore Basins boundary.

2.2.2.5.3 *Point Sources of Groundwater Pollutants*

- *Wastewater Treatment Plants:* There is one WWTP in the Fillmore Basin (Figure 2.2-14) that discharges treated wastewater to percolation ponds near the north bank of the Santa Clara River.

  The City of Fillmore WWTP plant is located near the Santa Clara River east of Sespe Creek in the Fillmore Basin. In recent years, some 20 percent (180,000 gallons per day [gpd]) of the treated effluent is used for turf irrigation and other landscaping at two schools, a newly constructed green belt and the Two Rivers Park. The remaining 80 percent, or 720,000 gpd, is being discharged to percolation ponds (Water Quality Products, 2010, www.wqpmag.com). The chloride constituent of the percolated effluent in the Fillmore WWTP's ponds is not likely significantly impacting the groundwater quality of the basin (LWA, 2015).

  The Piru WWTP is located near Hopper Creek and Highway 126 in the Piru Basin. The plant is operated by Ventura County Waterworks District No. 16 (VCWD 16). Improvements to the existing Piru WWTP were completed in March 2010 to satisfy LARWQCB permit requirements (United, 2016a). High chloride (approximately 150 mg/L) effluent percolated in the Piru WWTP ponds is likely not of sufficient volume to significantly impact the groundwater quality of the basin (LWA, 2015). VCWD 16 maintains that if all controllable sources of TDS and chloride were removed, the uncontrollable sources would still cause the levels of TDS and chloride to exceed the LARWQCB imposed discharge limits of 1,200 mg/L and 100 mg/L respectively (VCWD 16, 2016).

  There are also two upgradient large wastewater treatment plants operated by the Los Angeles County Sanitation Districts that discharge tertiary treated water to Upper Santa Clara River. The Saugus and Valencia WWTPs are part of the Santa Clarita Valley Joint

Sewerage System, which serves Santa Clarita and adjacent portions of unincorporated Los Angeles County.

The Saugus WWTP is located approximately 3.0 miles east of the Valencia WWTP. Both the Saugus and Valencia WWTPs discharge tertiary treated water directly into the Santa Clara River east of the Ventura/Los Angeles County line. Staff from the sanitation districts report that discharge from the Saugus WWTP commonly percolates entirely in the channel of the Santa Clara River in the reach downstream of the point of discharge, which implies that elevated chloride in the effluent is not directly impacting surface water or groundwater in the Basin.

The Valencia WWTP is located approximately 1.2 miles southeast of Castaic Junction on Interstate 5 (I-5), just north of Six Flags Magic Mountain and west of I-5. Chloride concentrations in the Santa Clara River near the Los Angeles County line are influenced by chloride in imported SWP water, as Castaic Lake Water Agency delivers SWP water to water retailers in the greater Santa Clarita area. Nearly 50 percent of the chloride load in wastewater discharges is from the chloride load in delivered water (LACSD, 2008). Additional chloride loading occurs during beneficial use of the delivered water, but loading was significantly reduced from a Los Angeles County Sanitation District managed campaign to successfully remove thousands of self-regenerating water softeners from the community. The effluent from the Valencia WWTP percolates in the eastern portion of the Piru Basin, and the elevated chloride values in the effluent do not directly impact the surface water or groundwater in the Fillmore Basin.

- *Toland Landfill:* The Toland Road Landfill is located in the foothills on the north side of the Fillmore Basin, approximately 4 miles west of the City of Fillmore and 2 miles north of Hwy 126. Ventura Regional Sanitation District (VRSD) operates the landfill under a conditional use permit from the County of Ventura. The containment systems for the facility and associated water quality monitoring is permitted and administered by the LARWQCB.

  The current landfill groundwater monitoring network consists of five monitor wells installed in March 2009 (TMW-1 through TMW-5) (VRSD, 2009). This monitoring network configuration accounts for the future build-out of the landfill. Monitoring has indicated no impacts to groundwater.

- *Other Point Sources:* Known contamination sites from SWRCB's GeoTracker and DTSC's Envirostor databases are shown on Figure 2.2-25. There is an active Superfund site identified by the U.S. EPA as the Pacific Coast Pipeline Fillmore, CA site that was originally identified in the late 1980s. From the EPA's website: "Improper disposal practices contaminated soil with lead and polycyclic aromatic hydrocarbons (PAHs) and contaminated groundwater with volatile organic compounds (VOCs). The site soil has been cleaned up and the most recent groundwater remedy has been operating since 2015." Additional information can be found at https://cumulis.epa.gov/supercpad/cursites/csitinfo.cfm?id=0901841. There is also an open site assessment case (as of 6/24/2020) for a LUST in Fillmore Basin identified on the GeoTracker website as 7-Eleven Store #38012 (T10000014273). Three shallow monitor wells were installed at the site in fall 2020.

These point sources of contamination involve light nonaqueous-phase liquids (LNAPLs), which do not tend to migrate deeper in aquifers. With this consideration and the lack of reported impacts to drinking water wells, these point sources of contamination are not considered significant impacts to beneficial users in the Basin.

2.2.2.5.4 Groundwater Quality Summary

The historical primary COCs are currently monitored for in the existing monitoring network. Based on the water quality information presented in the previous subsections, they will continue to be monitored in the Fillmore Basin. Expanded monitoring may provide additional information on the significance of identified recent generally basin-wide increasing trends (i.e., chloride and nitrate). Expanding the monitoring network to include a couple of additional monitor wells in the Pole Creek Fan area will also provide useful information for interpreting the significance of localized increasing recent trends in water quality concentrations (e.g., sulfate and boron). The additional potential COCs will be considered for expanded monitoring, as appropriate (e.g., additional groundwater sampling from existing wells surrounding known radiochemistry "hot spots").

The constituents described above may not be COCs for all aquifers in the Fillmore Basin; additional analysis should be included in the first five-year update to include appropriateness of monitoring for these constituents in all aquifers. The Agency is currently in the planning phase of constructing additional shallow (i.e., 100 feet deep) Aquifer Zone A monitor wells to augment the existing monitoring network. There is limited water quality data in Aquifer Zone C, as there are no wells completed discretely in Aquifer Zone C that are sampled; however, there are not many wells that access groundwater from Zone C.

A water quality monitoring network data gap exists in VCWPD's monitoring program. VCWPD annually samples production wells within the Basin in the fall, and does not currently sample for boron. They also do not always sample the same wells on their list. They historically have sampled a nearby well that is pumping if one of their core group wells is unavailable during their annual sampling event (VCWPD, 2020). It is important to sample the same wells from year to year and to collect at least a spring and fall sample each year. However, over a period of years that include both dry and wet precipitation years, if groundwater quality seasonal variability is demonstrated to be minimal in a particular well, annual sampling may be sufficient for GSP purposes.

There are no recognized water quality issues that critically impact the beneficial uses of groundwater in Fillmore Basin or the Human Right to Water (Assembly Bill [AB 685]). In addition, there are no known water quality issues associated with groundwater that discharges as surface water at the Basin boundaries. Appendix K did not identify any strong relationships between groundwater levels and water quality. Expanding the monitoring network to fill data gaps will provide additional data for analysis in the first GSP five-year update and decrease sustainable management criteria evaluation uncertainty in the Basin.

2.2.2.6 Land Subsidence (Reg. § 354.16[e])

Land subsidence is characterized by declines in ground surface elevation. Land subsidence typically occurs due to extraction of fluids (e.g., oil or water) from aquifers and aquitards that are not replenished. Land elevation declines can occur as elastic or inelastic subsidence. Elastic subsidence involves temporary and insignificant changes in land surface elevation that recover as water levels do, while inelastic subsidence is characterized by more significant, generally irreversible, land elevation declines due to compaction of clay (i.e., aquitard) materials as groundwater levels (pressure) in the subsurface decrease. Inelastic subsidence is considered an undesirable result in SGMA, particularly as it relates to groundwater pumping, as it indicates a loss of groundwater storage capacity and can pose risks to infrastructure (e.g., roads and canals).

Land subsidence conditions in the Basin region indicate a low risk of subsidence based on previous studies (Hanson et al., 2003; DWR, 2014) and evaluation of more recent datasets (i.e., Interferometric Synthetic Aperture Radar [InSAR]) (Appendix F). Numerical groundwater flow modeling by Hanson et al. (2003) simulated a maximum subsidence value of just over 0.1 foot (0.00098 foot per year [ft/yr]) of subsidence between 1891 and 1993 in the Basin area. DWR (2014) lists the Fillmore Basin with low potential for future subsidence. The cumulative change in land elevation from 2015 through 2019 (Figure 2.2-26), as measured with InSAR, is insignificant (less than the ±0.1 foot error range of DWR-provided datasets [Towill, 2021]). Annual land elevation changes are similarly insignificant (DBS&A, 2021b). These findings are consistent with the Basin HCM, which indicates that the Basin is composed largely of coarse-grained aquifer material, making it resistant to inelastic land subsidence.

2.2.2.7 Interconnected Surface Water Systems (Reg. § 354.16[f])

Two significant interconnected surface water systems have been identified along the Santa Clara River channel (Figure 2.2-27), at the Basin boundaries with (1) the Santa Paula Basin (i.e., East Grove or Willard Road area) and (2) the Piru Basin (i.e., Cienega and Fillmore Fish Hatchery area). These areas are commonly referred to as areas of rising groundwater, where streams are considered gaining flow from groundwater (Figure 2.2-28a). A distinguishing characteristic of these interconnected surface water systems is that the surface water is often entirely sourced from groundwater (i.e., during drier periods), and occasionally sourced from precipitation (storm) events as runoff (i.e., during wet periods). Even though storm event conditions are less frequent, when they occur, they tend to constitute the largest portion of annual streamflow (see Section 2.2.3 for surface water budget) and conservation releases from Lake Piru.

Surface water flows (Figure 2.2-29a) are estimated at these rising groundwater areas (Figures 2.2-10 and 2.2-11) based on strong empirical correlations (see Figures 2-7 and 2-8 from United, 2021a [Appendix E]) between groundwater level measurements and occasional instream (i.e., manual) surface water flow measurements made by United during dry periods (mostly between late spring and late fall). High flows (i.e., above 50 cubic feet per second [cfs]) vary significantly within small ranges of groundwater levels and are considered too sensitive to be considered reliable estimates; therefore, these estimates (that are limited to 50 cfs) typically underestimate annual flows, especially during wet years. This correlation is important for deriving estimates of continuous (i.e., monthly) surface water flow estimates along the Santa Clara River at the Basin boundaries because it is infeasible to install and maintain automated stream gauges in the Santa Clara River given its wide range of flow conditions (i.e., varying from no flow during droughts to intense floods that scour and reconfigure the channel geometry during wet years). Both rising groundwater areas show similar trends of higher flows during wetter periods and vice versa during drought periods; however, the Cienega area exhibits significantly more variability in high and low flows than the western Basin area (Willard Road in the East Grove) near the Santa Paula Basin. The Cienega area typically has more flow than Willard Road during above normal precipitation years, but less than Willard Road during below normal years. The Cienega area has been observed to go dry during these periods (i.e., 2014 to 2016) of drought (Figure 2.2-12).

The diversion of surface water and pumping of groundwater resources of the Santa Clara Valley River Basin since the late 1800s has resulted in streamflow depletion (Hanson et al., 2003); however, SGMA does not require the Basin to restore groundwater conditions to those prior to January 1, 2015. Depletions of the interconnected surface water flows (Figure 2.2-29b) due to groundwater pumping are estimated at these two rising groundwater areas with use of the Regional Model (United, 2021a and 2021e). Depletions are quantified by running two model scenarios: one with historical pumping rates and another with no pumping from the principal aquifer within a 1-mile band centered along the Santa Clara River channel (corresponding to hypothetical 50 percent reduction in Basin pumping), and subtracting the surface water flows associated with each scenario. Surface water flows are quantified based on groundwater levels simulated at the same two wells (04N19W25M01S and 03N20W02A01S) that are used to derive the correlation between surface water flows and groundwater levels. The Regional Model demonstrates excellent calibration of groundwater levels at these wells (United, 2021a and 2021e [Appendix E]).

Surface water depletion estimates (Figure 2.2-29b) at the two rising groundwater locations along the Santa Clara River (Figure 2.2-10) exhibit wide variability, ranging from zero depletion (when the rising groundwater ceases to flow during droughts) to up to 10 and 20 cfs at the Willard Road and Fish Hatchery areas, respectively. Overall, depletion rates of surface water at both sites are generally similar (about 4.25 cfs outside of droughts), except that rising groundwater at the Fish Hatchery area goes dry during severe droughts, even under a 50 percent pumping reduction scenario. The finding that surface water flows cease at the fish hatchery during droughts, even with pumping reduced by one-half, indicates that climate variability (i.e., less runoff and recharge due to less precipitation during droughts) is a significant factor that causes depletion of surface water during dry periods. These surface water depletions are summarized in Table 2.2-4 as AFY equivalents for comparison with water budgets (Section 2.2.3).

Data gaps remain regarding identifying the extent and timing of interconnectedness of other stream channel areas (e.g., Sespe Creek and central [losing reach] portions of the Santa Clara River), due to a lack of paired groundwater level and surface water level monitoring sites. Stream conditions here are considered to vary between all three stream conditions depicted on Figure 2.2-28. The significance of interconnected surface water and groundwater conditions at these areas is less than that of the two primary areas of rising groundwater because surface water exists in these reaches much less often (Figure 2.2-12), and therefore provides less opportunity for beneficial uses related to aquatic habitat or surface water diversions. The understanding of the groundwater and surface water interaction, and the calibration of the groundwater model, can be improved with the use of monitor wells installed closer to the areas of rising groundwater.

Table 2.2-4. Annual Depletions of Interconnected Surface Water in Fillmore Basin

Location of Santa Clara River	Depletion (AFY)			
	Minimum	Average	Median	Maximum
Fish Hatchery	0	2,900	2,900	5,900
Willard Road	2,300	3,400	3,000	6,600

Information is based on results from United (2021a and 2021e).
Statistics represent annual estimates from between water years 1988 and 2019, excluding zero depletion calculation results that occur at fish hatchery during high (≥50 cfs) surface water flows (e.g., 1998-1999).

2.2.2.8 Groundwater-Dependent Ecosystems (Reg. § 354.16[g])

Stillwater Sciences (Stillwater) was hired by the FPBGSA to identify significant GDE units in the Fillmore and Piru Basins. Stillwater (2021a) identified five GDE units in Fillmore Basin (Table 2.2-5 and Figure 2.2-30), two of which—Cienega Riparian Complex and East Grove Riparian Complex—are associated with the areas of rising groundwater. GDEs include terrestrial and aquatic habitats (Stillwater, 2021a).

The health of GDE units is monitored and evaluated using the Normalized Difference Vegetation Index (NDVI) and Normalized Difference Moisture Index (NDMI), along with depth to groundwater records form nearby wells, as described in Stillwater (2021a). NDVI and NDMI metrics track the relative health of vegetation based on the amount of chlorophyll (i.e., greenness) per unit area. The Stillwater (2021a) evaluation of data, representing conditions during the dry (July to September) season for years 1985 through 2018, revealed varying degrees of stress to the various GDE units during drought (e.g., early 1990s and 2012–2016) periods. In some areas (i.e., the Cienega), the NDVI/NDMI data indicate that vegetation health in GDE units has not recovered to conditions prior to the 2012 to 2016 drought. This finding is supported by recent research (Kibler, 2021; Kibler et al., 2021) that used a specific form of NDVI and groundwater level data to identify a “critical” water level (depth) that coincides with die-off of riparian forests that are primarily composed of cottonwood and willow species. This critical water level is defined as equivalent to 10 feet below baseline (fall 2011) groundwater elevations. These tree species are considered to have some of the deepest roots of vegetation in GDE units (besides that of the notorious invasive species *Arundo donax*), and therefore are strong indicators of GDE conditions.

Table 2.2-5. Groundwater-Dependent Ecosystem Unit Descriptions and Acreages in Fillmore Basin

GDE Unit	Description	Acres
Santa Clara River Riparian Shrubland	Riparian zone along the Santa Clara River; dominated by facultative phreatophytes and riparian shrubland habitat; occupies both Fillmore and Piru groundwater basins; characterized by lower density and low stature shrubs and is dominated by mulefat.	1,073
Cienega Riparian Complex	Historical Cienega complex located near the Fillmore Fish Hatchery. Unit occurs equally in both Fillmore and Piru groundwater basins. Unit is dominated by mulefat and giant reed of variable density throughout.	134
East Grove Riparian Complex	Historical East Grove complex located at the downstream end of the Fillmore Groundwater Basin; occupied by dense riparian forest dominated by mulefat, black cottonwood and red willow.	1,101
Tributary Riparian	Riparian habitat within tributaries to both Fillmore and Piru groundwater basins. Predominantly located to the north of the Santa Clara River draining the Topatopa mountain range. Unit is dominated by oaks and other hardwoods.	195
Sespe Creek Riparian	Riparian zone along Sespe Creek from the boundary of the Fillmore Groundwater Basin to Highway 126. Unit is dominated by mixed hardwood and low stature willows.	94

Source: Stillwater Sciences (2021a).

Stillwater (2021a) found no evidence of adverse biological responses to GDE units in relation to groundwater quality; however, GDE units are impacted by invasive species, namely *Arundo donax* and *Tamarisk spp.* (Table 2.2-6 and Figure 2.2-30). Invasive species are present throughout the Basin (Stillwater, 2021a). Removal of these invasive species, particularly *Arundo donax*, can have a two-fold benefit for the Basin GDE units: (1) opportunity for recolonization by native GDE vegetation and (2) reduced groundwater (i.e., ET) demand.

Table 2.2-6. Invasive Species in Fillmore Basin

Invasive Species	Acres
Arundo donax	254
Tamarisk spp. and other	18

Source: Stillwater (2021a).

There are no instream flow requirements specified for surface waters in the Basin. Critical habitat for threatened and endangered (under ESA) species per USFWS and NMFS designations are shown on Figure 2.2-31, with their extents summarized in Table 2.2-7. Species with substantial critical habitat area are the southwestern willow flycatcher (bird), listed by USFWS, and southern California steelhead (fish), listed by NMFS.

Table 2.2-7. Critical Habitat in Fillmore Basin

Common name Scientific name	Critical Habitat	
	USFWS (acres)	NMFS (miles)
California condor *Gymnogyps californianus*	2	—
Southwestern willow flycatcher *Empidonax traillii extimus*	2,472	—
Southern California steelhead *Oncorhynchus mykiss*	—	15.4

Source: Stillwater (2021a).

Habitat management and special-status species recovery plans have been implemented in the Fillmore and Piru Basins, and include protections for special-status species and associated habitats (Stillwater, 2021a). These plans include the following:

- Santa Clara River Enhancement and Management Plan (VCWPD and LADPW, 2005)
- Santa Clara River Upper Watershed Conservation Plan (TNC, 2006)
- Conservation Plan for the Lower Santa Clara River Watersheds and Surrounding Areas (TNC, 2008)
- Southern California Gas Company Multi-Species Habitat Conservation Plan (SoCal Gas, 2020)
- National Marine Fisheries Service Southern Steelhead Recovery Plan (NMFS, 2012)

In addition, United is currently preparing a habitat conservation plan for the Freeman Diversion Rehabilitation Project. The Fillmore and Piru Basins are included in the plan area.

2.2.3 Water Budget Information (Reg. § 354.18)

This GSP includes a water budget (reported in tabular and graphical form) for the Basin to provide an accounting and assessment of the total annual volumes of groundwater and surface water that enter and leave the Basin, including historical, current, and projected water budget conditions, and the change in the volume of water stored (Reg. § 354.18[a]). Surface water and groundwater flows are quantified using the historical (United, 2021a and 2021e) and projected

(United, 2021b) groundwater models, which have been reviewed by an expert panel (Porcello et al., 2021).

A water budget is a useful tool for tracking the components that contribute to or withdraw from the volume of water in storage, similar to how a bank account balance is monitored for cash deposits and withdraws. A schematic of the Basin water budget components is shown on Figure 2.2-32. A water budget is necessary to tabulate and sum total volumes of inflows (positive values) and outflows (negative values) of water to determine whether a basin experienced an overall (net) increase, decrease, or relatively little change in the volume of water in storage, according to the following equation:

$$Inflows + Outflows = Change\ in\ Water\ in\ Storage$$

The typical unit of measure for a water budget is AFY. A volume of 1 AF represents the volume of water that would be required to cover 1 acre of land (approximately the size of a football field) to a depth of 1 foot.

An important component of sustainability involves tracking the cumulative change in groundwater in storage, making sure that the amount of negative changes in groundwater in storage (i.e., during prolonged droughts) is not significantly greater than the total of positive changes in groundwater in storage (i.e., during following wet years). As long as the cumulative change in groundwater in storage balances out (i.e., the total of annual changes tends toward zero), the Basin can be considered to not be experiencing significant overdraft conditions (i.e., average inflows equal average outflows)—a critical component of demonstrating sustainable groundwater conditions.

2.2.3.1 Description of Surface Water Budget

Surface water primarily flows into the Basin through the mainstem Santa Clara River and its major tributary, Sespe Creek, along with other less significant tributaries (Figure 2.2-10). Of the tributaries, only Sespe Creek and Pole Creek are actively gauged for daily flows. Flows within the Santa Clara River are highly variable, which makes maintenance of accurate recording stream gauge stations difficult. Several stream gauges (e.g., VCWPD gauges 720 and 724) are inactive. Historical and projected surface water flows entering and leaving the Basin are quantified using the corresponding groundwater models by United (2021a, 2021b, and 2021e). The Basin surface water budget is useful for comparison with its groundwater budget.

2.2.3.1.1 *Inflows*

Surface water inflows into the Basin are accounted for by quantifying stream flows associated with the following (Figure 2.2-11):

- Sespe Creek (USGS stream gauging station 11113000 [SESPE C NR FILLMORE])
- Santa Clara River at the Basin boundary with the Piru Basin (estimated per the United [2021a, 2021b, and 2021e] groundwater model)
- Pole Creek (VCWPD stream gauging station 713 [Pole Creek at Sespe Avenue])

Inflows along the ungauged tributaries are not included for in this surface water budget because these streams are not gauged and analysis of typical Pole Creek flows indicates that these flows are minor.

2.2.3.1.2 *Outflows*

Surface water is considered to outflow from the Basin entirely through the Santa Clara River to downstream Santa Paula Basin. Flows at this outflow location are not measured due to the difficulty of maintaining accurate flow gauges on the Santa Clara Rivers, and are instead estimated based on relationships between observed flows and percolation rates modeled by United (2021b and 2021e). Smaller outflows, namely surface water diversions, are not accounted for in the surface water budget, because these diversions occur on ungauged tributaries (which are also not accounted for as inflows). The application of water from these diversions is accounted for in the United (2021a, 2021b, and 2021e) surface water and groundwater models.

2.2.3.1.3 *Differences in Inflows and Outflows*

The differences in the surface water budget inflows and outflows estimated for the Basin represent the outflows from surface water that include the stream percolation to the groundwater aquifer within the Basin and surface water diversions that divert within the Basin. These outflows are accounted for within the numerical model, and are grouped together as "other outflows" for presentation in these surface water budgets.

2.2.3.2 *Description of Groundwater Budget*

The components of Basin inflows and outflows that result in changes in groundwater in storage (Figure 2.2-32) are described by typical terminology. Recharge refers to water that infiltrates the land surface, percolates through the subsurface, and replenishes aquifers. Underflow consists of subsurface groundwater flows into and out of the Basin boundaries. Wells extract (pump) groundwater from the subsurface for various beneficial uses. ET is a process related to vegetation (i.e., GDE) use of shallow groundwater, primarily via roots. Stream exchange represents flows between streams and shallow groundwater, where flow from surface water is described as losing stream (e.g., streambed or groundwater recharge) conditions and groundwater flow to the surface is referred to as gaining stream (e.g., rising groundwater or groundwater discharge) conditions.

The Basin water budget is estimated based on flows calculated from the calibrated Regional Model (United, 2021a, 2021b, and 2021e). An advantage of using this groundwater model for water budgeting is that it simulates conditions in this Basin and adjacent basins (Figure 2.1-1) in the same model run, which provides inherent consistencies with adjacent water budgets (e.g., Piru Basin).

2.2.3.2.1 *Inflows*

Sources of inflow to groundwater in the Basin include the following:

- Underflow from the upgradient Piru Basin
- Recharge in the basin floor area
- Recharge in the mountain front area within the Basin
- Underflow from the mountain areas outside the Basin
- Stream percolation (losing stream flows) of surface water sourced from:
    - Runoff from storm events (e.g., Sespe Creek and Santa Clara River)
    - Rising groundwater (i.e., from Piru Basin via the Santa Clara River)
    - Conservation releases from Lake Piru or Castaic Lake via the Santa Clara River

Underflow from the Piru Basin occurs via the interconnected aquifers (Figure 2.2-4). Underflow from outside the Basin boundaries is significantly less than underflow from the Piru Basin because the outside hydrogeology is significantly less permeable. Recharge in the basin floor area consists of several components (Figure 2.2-10)—percolation of precipitation, agricultural return flows (irrigation), treated wastewater, and municipal and industrial (M&I) returns flows—as detailed in United (2018, 2021a, 2021b, and 2021e). Recharge within the mountain front and ungauged watershed areas represent surface water that percolates in the hillsides and smaller tributaries (United, 2018, 2021a, 2021b, and 2021e). Losing stream flows (groundwater recharge) are quantified in the Regional Model based on streambed conductance values and relationships with streamflow rates (United, 2021a) that are calibrated to match estimates of groundwater recharge calculated from observed flow rates along the Santa Clara River.

2.2.3.2.2 Outflows

Outflows from groundwater (in order of typical largest to smallest annual flow volumes) consist of the following:

- Pumping from wells for agricultural, domestic, industrial and municipal beneficial uses
- Underflow to the downgradient Santa Paula basin
- ET due to consumptive use of groundwater by vegetation (i.e., GDEs)
- Net gaining stream flows (when, overall, more groundwater discharges [rises] to the surface than surface water recharges the groundwater system), which occurs at areas of rising groundwater (i.e., along the Santa Clara River near the Basin boundary with Santa Paula)

Groundwater pumping data are collected on a semiannual (calendar year) basis, and are converted into water year equivalents for water budget (groundwater model) purposes using an inverse relationship between monthly precipitation and annual pumping (United, 2021a, 2021b, and 2021e).

Underflow to the Santa Paula Basin occurs via the interconnected aquifers (Figure 2.2-4). The Santa Paula Basin hydrogeology is the basis for categorizing the Santa Clara River Valley aquifers and aquitards into Aquifer Systems A, B, and C (i.e., where more significant aquitards exist [United, 2021a]); therefore, it is useful to categorize underflow by the A, B, and C zones (to match Santa Paula hydrogeology) and by the main and principal aquifers (to match Fillmore Basin hydrogeology) per Figure 2.2-4.

The ET rates are conceptualized to be at their maximum when groundwater levels are within 3 feet bgs, and decrease as groundwater lowers toward a depth of 5 feet bgs, at which point groundwater levels are no longer considered to be used by vegetation (i.e., GDEs). In the Piru, Fillmore, and Santa Paula Basins, the maximum ET flux was increased to 0.014 ft/d (5.2 ft/yr) in order to account for higher estimated water use associated with the presence of *Arundo donax* within the Santa Clara River channel corridor along with other vegetation species. To account for seasonal variation in ET, the maximum ET rates were adjusted according to percentages for each month that were calculated based on monthly average reference ET data obtained from DWR California Irrigation Management Information System (CIMIS) Santa Paula station (ID 198) for April 2005 to December 2019.

Gaining stream flows (stream exchanges) are simulated using similar hydraulic properties (i.e., streambed conductance) as losing stream flows, but differ from losing stream flows because gaining stream flows occur when hydraulic gradients cause groundwater to flow toward the land surface.

2.2.3.2.3 *Change in Storage*

The annual change in volume of groundwater stored in the Basin is a result of the difference between total annual inflows and outflows. Positive change in groundwater in storage values means an increase in the volume of groundwater in storage (higher overall groundwater levels), while negative values signify a decrease in the volume of groundwater in storage (lower overall groundwater levels). Each year, changes in groundwater in storage are positive or negative largely depending on the water year type (e.g., dry or wet). Gaining and losing stream flows are represented for the entire Basin by a stream exchange term that accounts for net (overall) groundwater discharge (outflow) conditions (typically during wet periods of high groundwater levels) or net groundwater recharge (inflow) conditions (typically during and immediately following dry periods of low groundwater levels).

2.2.3.3 *Quantification of Historical Water Budget Conditions (Reg § 354.18[c][2])*

Historical water budget conditions are quantified for a 28-year period (water years 1988 through 2015), based on the surface water and groundwater budgets calculated using the Regional Model (United, 2021a,e), to evaluate aquifer responses to water supply and demand trends relative to water year type. This historical period is chosen because it represents as far back as the United model simulates (minus the first couple of years due to groundwater level equilibration), which represents groundwater conditions during two droughts (i.e., early 1990s and the most recent, 2012–2016 drought). The annual temperature and precipitation and land use information used in the historical groundwater budget are described in United (2021a and 2021e). The past availability and reliability of surface water supply deliveries (e.g., SWP imports to Lake Piru and Castaic Lake) are evaluated in the context of water year types.

2.2.3.3.1 *Availability of Surface Water Supply Deliveries (Reg § 354.18[c][2][A])*

Imported water supplies consist of United's SWP Table A allocations during most years, but occasionally also Article 21 water, water transfers, and exchanges obtained by United. United has an SWP allocation of 5,000 AFY (United, 2020a)—1,850 AFY of which is allocated to Port Hueneme Water Agency to offset groundwater pumping on the Oxnard Plain, with the remaining 3,150 AFY available to be imported from Pyramid Lake into Lake Piru, or from Castaic Lake, for the benefit of the Santa Clara River Valley Basin (Figure 2.1-1). Water released from

Lake Piru or Castaic Lake reaches the Santa Clara River, where it contributes to stream flow and groundwater recharge. The full 3,150 AFY allocation is not received most years. DWR determines what percentage of the allocation is available for purchase each year, depending on the actual and forecast water supply and demand, which relates in part to recent water year types. United does not purchase its full allocation of SWP water on very wet years due to the lack of available storage. United has increased imports of supplemental SWP water (Article 21, exchanges and transfers) since 2017.

Historical imported surface water supply deliveries and releases to each basin are shown in Table 2.2-8.

Table 2.2-8. Recent Historical and Current Surface Water Deliveries

Calendar Year	Imported State Water Project Water (acre-feet)						
	Water Deliveries		Releases from		Recharge into		
	Table A	Article 21	Lake Piru	Castaic Lake	Piru Basin	Fillmore Basin	Lower Basins
2010	3,150	0	3,150	0	606	311	2,233
2011	2,520	0	0	0	0	0	0
2012	3,150	0	5,670	0	1,392	378	3,900
2013	2,242	0	0	0	0	0	0
2014	0	0	0	0	0	0	0
2015	630	0	0	0	0	0	0
2016	1,890	0	970	0	970	0	0
2017	2,678	10,000	6,470	10,000	5,094	795	581
2018	1,103	0	1,103	0	1,103	0	0
2019	8,988 [a]	15,000	15,000	0	0	0	15,000

Information is from United (2021c).
Information is available prior to 2010, but information presented here is limited to the most recent 10 years of data.
Releases can be greater than or less than imports due to carry-over (i.e., leftover) storage from previous deliveries or local water storage.
[a] This amount includes exchanges and transfers.

Most of the releases directly benefit (recharge) groundwater in the Piru Basin, which contributes to underflow into the Fillmore Basin and sometimes as surface water. United optimizes releases from Lake Piru to benefit certain subbasins of the Santa Clara River Valley (including Fillmore Basin) within its boundary. For instance, when groundwater levels are low in the coastal Oxnard

Basin, United will optimize their releases to convey water in the Santa Clara River to be diverted at the Freeman Diversion to provide recharge to groundwater through artificial recharge in their spreading grounds in the Oxnard Forebay (of the Oxnard Basin). United typically releases surface water during late summer or early fall, providing significant groundwater recharge in Piru and Fillmore Basins through the permeable Santa Clara River stream channel.

Historical SWP Table A allocations have varied—from zero to 60 percent (of the 3,150 AFY allocation for United) during dry years, to more than 60 percent and even more than 100 percent during above average and wet years.

2.2.3.3.2 Quantitative Assessment of the Historical Water Budget (Reg § 354.18[c][2][B])

The annual surface water budget for the Basin is shown with water year types on Figure 2.2-33, summarized with average, minimum, and maximum flows in Table 2.2-9, and tabulated in Appendix H-1. The water budget reveals a wide range of surface water conditions that depend on the water year type (Figure 2.2-34). During critical, dry, and below average years, surface water flows within the Basin average about 50,000, 62,000, and 86,000 AFY, respectively, while average flows increase drastically during above average (137,000 AFY) and wet (465,000 AFY) years.

Table 2.2-9. Historical Surface Water Budget Summary

Flow	Component	Annual Flow (AFY)		
		Average	Minimum	Maximum
Inflow	Sespe Creek	105,600	4,300	541,700
	Santa Clara River (from Piru Basin)	53,700	700	400,600
	Pole Creek	2,100	800	12,900
	Subtotal	161,400		
Inflow/Outflow	Other flows	14,500	–15,800	45,300
Outflow	Santa Clara River (to Santa Paula Basin)	–175,900	–9,600	–998,000
	Subtotal	–175,900		

The historical water budget is based on information from water years 1988 through 2015 from the United (2021a and 2021e) Regional Model.
Inflows are represented by positive values; outflows are represented by negative values.
Minimum and maximum values represent the smallest and largest magnitudes of annual flows, respectively.
Annual flow values (in AFY) are rounded to the nearest 100 AFY; therefore, a discrepancy of 100 AFY may occur.
Inflow/Outflow represents the sum of stream exchanges, which can result in overall groundwater inflow (recharge) or outflow (discharge) conditions.
Other flows = Difference in Inflows and outflows (i.e., typically inflows from ungauged tributaries, or sometimes stream losses).

For this historical period between water years 1988 and 2015, estimated total annual groundwater inflows and outflows within the Basin (Figure 2.2-35 and Appendix H-2) have averaged around 77,000 AFY and 79,000 AFY, respectively, resulting in an average deficit of about 2,000 AFY of groundwater in storage (Table 2.2-10). Annual changes in groundwater in storage vary with climatic conditions (i.e., water year types) as shown on Figure 2.2-36.

Table 2.2-10. Historical Groundwater Budget Summary

Flow	Component	Annual Flow (AFY)		
		Average	Minimum	Maximum
Inflow	Underflow from Piru Basin	47,600	34,100	53,900
	Recharge (basin floor)	20,900	13,800	30,600
	Recharge (mountain front)	7,200	4,400	14,200
	Underflow from outside subbasins	1,500	1,000	2,300
	Subtotal	77,200		
Inflow/Outflow	Stream exchange	–1,700	–8,500	15,000
Outflow	Wells	–46,800	–35,900	-58,700
	Underflow to Santa Paula Basin	–17,600	–16,600	-19,000
	Evapotranspiration	–13,100	–5,700	-17,500
	Subtotal	–77,500		
Change in Groundwater in Storage		–2,000		

The historical water budget is based on information from water years 1988 through 2015 from the United (2021a and 2021e) Regional Model.
Inflows are represented by positive values; outflows are represented by negative values.
Minimum and maximum values represent the smallest and largest magnitudes of annual flows, respectively.
Annual flow values (in AFY) are rounded to the nearest 100 AFY; therefore, a discrepancy of 100 AFY may occur.
Inflow/outflow represents the sum of stream exchanges, which can result in overall groundwater inflow (recharge) or outflow (discharge) conditions.
Change in Groundwater in Storage = Inflow + Outflow + Inflow/Outflow (stream exchange).

Underflow from Piru Basin, the largest source of inflow to groundwater in the Basin, is highest (about 49,500 AFY on average) during above normal and wet years, less (about 46,000 AFY) during below normal years, and lowest (about 42,000 AFY) during dry and critically dry years. The lower underflows from Piru Basin during drier periods are the result of lower groundwater levels within Piru Basin that flatten the hydraulic gradient from Piru Basin to Fillmore Basin. Similar trends of higher surface water recharge through the basin floor and mountain front areas occurs, ranging from about a total of 22,000 AFY during critical years, to about 26,000 AFY during dry and below normal years, and to about 29,700 AFY and 36,000 AFY during above normal and wet years, respectively. Modest inflows as underflow from outside the Basin boundaries are estimated to be relatively constant (about 1,400 AFY) throughout climatic conditions.

Pumping, the largest outflow component, generally decreases as water year types become wetter (from about 50,000 AFY during critical and dry years to about 45,000 AFY during below normal, above normal and wet years) due to increased availability of recharge from precipitation. Higher average pumping rates during dry periods (Figure 2.2-37) is biased—largely due to wells that pumped during the early 1990s drought, but have since become inactive or destroyed, and less so due to decreases in municipal (i.e., City of Fillmore) groundwater demand (i.e., due to use of recycled water). On the other hand, ET rates increase during wetter periods (from about 10,000 AFY during critical and dry years to about 12,500 AFY during below normal years and about 15,000 AFY during above normal and wet years) due to the increased extent of shallow groundwater conditions (i.e., higher groundwater levels) in the Basin for uptake by vegetation roots. Average outflow of groundwater as underflow to Santa Paula basin is relatively constant (about 17,500 AFY) throughout climatic conditions, due to the relatively stable (shallow) groundwater levels at the western Basin boundary. Historical trends in annual pumping for the Basin indicate about 13% less average demand during the recent (2012 to 2016) drought (46,700 AFY) compared to the previous (1986 to 1991) drought (53,700 AFY), even though the recent drought was more severe.

Flows between surface water (i.e., streams) and groundwater vary between net inflow (i.e., losing stream [Figure 2.2-28b]) conditions and net outflow (i.e., gaining stream [Figure 2.2-28a]) conditions (Figure 2.2-35) depending on how much groundwater is in storage (i.e., how high groundwater levels are). At the Basin scale (Figure 2.2-10), more groundwater tends to discharge to surface water during wet periods (e.g., 1994 to 2013), while more surface water tends to recharge the basin during and immediately following dry periods (i.e., 2015 to 2019). An exception to this pattern is during the initial wet years (e.g., 1992 and 1993) following a multi-year (e.g., 1987 to 1991) drought, when low groundwater levels as result of the drought provide more capacity for surface water to infiltrate and percolate into groundwater in storage.

Overall, these water budget components add up to and result in annual increases or decreases of groundwater in storage (Figure 2.2-36), with an average change of nearly zero over the 1988 to 2015 historical period. Typical annual changes in groundwater in storage range between increases and decreases of about 10,000 AFY, but increases as great as 30,000 AFY can occur during the wettest (e.g., 1993 and 2005) years, and decreases as low as about 20,000 AFY can occur during drought (e.g., 1990) years.

2.2.3.3.3 Ability of the Agency to Operate the Basin Within Sustainable Yield (Reg § 354.18[c][2][C])

In the context of observed long-term groundwater levels (Figure 2.2-18) and the historical water budget, the Basin has historically operated sustainably. Temporary groundwater budget deficits occur during drought periods (i.e., dry and critical water years), but recover during subsequent wet periods when groundwater budget surpluses occur (Figure 2.2-36). After even just one wet year (e.g., 1993 and 2005), groundwater level (storage) conditions reach Basin "full" conditions. At this point, the Basin (overall) ceases to incorporate additional groundwater in storage and instead discharges surplus water as surface water flow (i.e., via the Santa Clara River) into the next subbasin (i.e., Santa Paula Basin). The historical (1988 through 2015) water budget indicates an overall decrease in groundwater in storage; however, in the context of long-term groundwater levels (Figure 2.2-18), the Basin will likely continue to recover (as described further based on current and projected water budgets).

2.2.3.4 Quantification of Current Water Budget Conditions (Reg § 354.18[c][1])

Current water budget conditions are represented in this Plan by the four most recent water years, 2016 through 2019, which also coincide with the United (2021a and 2021e) model update period. This period represents a transition in observed climate conditions from the peak of the drought (during 2016) and toward less dry conditions (during 2017 through 2019), corresponding to a partial recovery of groundwater levels in the Basin. The current surface water budget is shown on Figure 2.2-33 (in addition to the historical water budget) and summarized in Table 2.2-11. The current groundwater budget is shown on Figure 2.2-37 (with the historical water budget) and summarized in Table 2.2-12.

Currently, there has not been significant enough above normal or wet year(s) to offset the historical deficit in groundwater in storage and "fill" the Basin. Although the historical average 2,000 AFY deficit rate is similar to the current average 1,900 AFY surplus, these changes in groundwater in storage do not completely offset one another, because the historical average represents a significantly longer duration than the current average change in storage (i.e., 28 years vs. 4 years). This is why tracking changes in groundwater in storage as the cumulative (total) of annual changes is useful for comparing different time periods. The current estimated rate of recovery of groundwater in storage is similar to rates of recovery that occurred in the past, prior to full recovery of groundwater levels. In 2018 and 2019, a notable decrease in annual pumping is attributed to reduced pumping at the Fillmore Fish Hatchery, which typically pumped between 4,300 and 10,000 AFY historically (i.e., 10 to 25 percent of Basin average annual pumping). This reduction of Fish Hatchery pumping is a material reduction in current water demands for the Basin.

Table 2.2-11. Current Surface Water Budget Summary

Flow	Component	Annual Flow (AFY)		
		Average	Minimum	Maximum
Inflow	Sespe Creek	65,600	6,600	143,400
	Santa Clara River (from Piru Basin)	21,700	1,000	47,800
	Pole Creek	1,200	0	2,700
	Subtotal	88,500		
Inflow/Outflow	Other flows	–5,900	–15,800	900
Outflow	Santa Clara River (to Santa Paula Basin)	–82,600	–9,600	–177,200
	Subtotal	–82,600		

The current water budget is based on information from water years 2016 through 2019 from the United (2021a and 2021e) Regional Model.
Inflows are represented by positive values; outflows are represented by negative values.
Minimum and maximum values represent the smallest and largest magnitudes of annual flows, respectively.
Annual flow values (in AFY) are rounded to the nearest 100 AFY; therefore, a discrepancy of 100 AFY may occur.
Inflow/Outflow represents the sum of stream exchanges, which can result in overall groundwater inflow (recharge) or outflow (discharge) conditions.
Other flows = Difference in Inflows and outflows (i.e., typically inflows from ungauged tributaries, or sometimes stream losses).

Table 2.2-12. Current Groundwater Budget Summary

Flow	Component	Annual Flow (AFY)		
		Average	Minimum	Maximum
Inflow	Underflow from Piru Basin	33,700	31,300	36,000
	Recharge (basin floor)	18,300	15,800	22,700
	Recharge (mountain front)	7,100	5,300	8,800
	Underflow from outside subbasins	1,000	900	1,100
	Subtotal	60,100		
Inflow/Outflow	Stream exchange	8,200	1,900	16,300
Outflow	Wells	–44,300	–34,600	-49,500
	Underflow to Santa Paula Basin	–17,000	–16,300	-17,600
	Evapotranspiration	–5,100	–4,300	-6,000
	Subtotal	–66,400		
Change in Groundwater in Storage		1,900		

The current water budget is based on information from water years 2016 through 2019 from the United (2021a and 2021e) Regional Model.
Inflows are represented by positive values; outflows are represented by negative values.
Minimum and maximum values represent the smallest and largest magnitudes of annual flows, respectively.
Annual flow values (in acre-feet per year [AFY]) are rounded to the nearest 100 AFY; therefore, a discrepancy of 100 AFY may occur.
Inflow/Outflow represents the sum of stream exchanges, which can result in overall groundwater inflow (recharge) or outflow (discharge) conditions.
Change in Groundwater in Storage = Inflow + Outflow + Inflow/Outflow (stream exchange)

This current water budget information was developed with consideration of available evapotranspiration and sea level rise information (Reg. § 354.18[d][2]) included in United (2018, 2021a, and 2021e) groundwater model documentation, water year type information provided by DWR (2021), and precipitation and temperature data from Parameter-elevation Relationships on Independent Slopes Model (PRISM) Climate Group. The land use information used in the historical water budget is consistent with that shown on Figure 2.2-10.

2.2.3.5 Quantification of Projected Water Budget Conditions (Reg § 354.18[c][3])

It is important to note that the projected water budget is based on assumptions of events that may occur in the future, and is not intended to represent a prediction of future conditions. Instead, the projected water budget is constructed to simulate a "what-if" scenario and evaluate the FPBGSA's ability to operate the Basin sustainably (discussed in Section 3). The projected water budget represents a scenario analogous to the water year 1944 to 2019 (76-year long) historical record, modified with changes in projected climate change and water demand and supply. This 76-year long historical period was simulated to evaluate projected Basin conditions during the initial 50-year SGMA implementation period (initial 20 years) and planning (remaining 30 years) period (i.e., the 1944 through 1992 historical time period representing the 2022 through 2071 projected time period), followed by 26 more water years (i.e., the 1993 through 2019 historical time period representing the 2072 through 2097 projected time period). The extra years projected beyond the 50 years required by SGMA is useful for comparing the projected water budget with the historical and current water budgets because they represent similar hydrologic patterns.

2.2.3.5.1 Projected Hydrology (Reg § 354.18[c][3][A])

The baseline hydrology used as the basis for the projected water budget is based on applying precipitation and ET change factors derived from the Variable Infiltration Capacity (VIC) 2070 central tendency (CT) climate scenario, provided by DWR (2018b and 2018c), to historical hydrology of years 1943 through 2019 (United, 2021b). DWR climate change factors were provided for the historical period, 1915 through 2011, so hydrology for projected water years (i.e., 2090 through 2097) that are equivalent to the historical 2012 through 2019 period were developed by United (2021b) by using analogous water years from the 2011 and earlier historical record that had similar precipitation and ET values. This historical period experienced long-term (i.e., 23-year) drier climate during the initial years followed by a transition to wetter climate (Figure 2.2-15). This assumption is useful for evaluating Basin sustainability in the context of a "mega-drought," considering the long-term dry climate period (analogous to the 1945 to 1967 period [Figure 2.2-15]) is being simulated soon after the most recent (i.e., 2012 through 2016) severe drought. This assumption is considered appropriate given current concerns that the American southwest is in the midst of a long-term drought cycle that started around 2000 (Figure 2.2-15). These long-term climate cycles are likely attributed to PDO climate cycles that tend to last decades.

Daily flows from tributaries and drainage areas were adjusted using the VIC 2070 CT projected streamflow change factors provided by DWR (see detailed description in Section 4.8 of United, 2021b [Appendix E-2]). Because DWR change factors are only available for 1916 through 2011, 2070 CT change factors for the years 2012 through 2019 were determined by identifying analogous water years in the historical record and using their associated DWR change factors. Analogous water years were identified by United (2021b) by calculating RMSE between monthly precipitation of each year from 2012 to 2019 with each year prior to 2012. Analogous years were generally those with the lowest RMSE based on the similarity of monthly rainfall patterns and quantities. The United groundwater model uses a 45-centimeter (cm) (approximately 1.5-foot) increase in sea level to represent 2070 CT climate change conditions, consistent with guidance from DWR (2018b and 2018c).

The 2070 CT climate change factors were determined to exhibit more variability (i.e., more severe droughts and intense wet years) than the 2030 CT climate change factors, indicating that the 2070 CT climate change assumptions are more conservative from a water supply and demand planning perspective.

2.2.3.5.2 Projected Water Demand (Reg § 354.18[c][3][B])

Projected water demands consist of similar outflow components as the historical model, with adjustments to account for potential increases in agricultural demands associated with a prolonged drought period and modest land use changes (i.e., urbanization). Projected water demands were generated using an approach similar to the localized constructed analog (LOCA) method (DWR, 2018b) by using pumping rates associated with historical years that had similar precipitation and temperature as the projected years with climate change factors applied. Projected agricultural water demand (36,000 AFY) during the 50-year SGMA implementation and planning period could be about 13 percent higher than the historical average (31,800 AFY) due to the assumption of more droughts. Urban water demand is expected to increase modestly by about 800 AFY due to limited urbanization (i.e., the expansion area on the eastern edge of City of Fillmore, near the Fish Hatchery) (AECOM, 2016). Urban growth is anticipated to be limited due to the 2040 Ventura County General Plan CURB and Greenbelt zoning designations (Figure 2.1-13).

2.2.3.5.3 Projected Surface Water Supply (Reg § 354.18[c][3][C])

United (2021b) used hydrological models to simulate reservoir operations and stream flow routing using historical datasets and DWR adjustment factors. United (2021b) used historical surface water delivery schedules and amounts, adjusted with DWR provided factors, to develop projected surface water deliveries and releases. Wastewater discharge from Santa Clarita is assumed to remain constant, consistent with assumptions used in the Upper Santa Clara River Valley water budget (United, 2021b). The wastewater discharge from Santa Clarita is an important component that directly benefits (recharges) Piru basin and the significant underflows from Piru Basin into Fillmore Basin. These projected surface water supplies are incorporated into the Regional Model (United, 2021b) to calculate the projected groundwater budget.

The projected annual surface water budget is shown on Figure 2.2-37, and summarized in Table 2.2-13. The projected surface water budget is tabulated in Appendix I-1.

Table 2.2-13. Projected Surface Water Budget Summary

Flow	Component	Annual Flow (AFY)		
		Average	Minimum	Maximum
Inflow	Sespe Creek	81,300	1,200	483,100
	Santa Clara River (from Piru Basin)	44,500	0	394,100
	Pole Creek	1,300	200	7,300
	Subtotal	127,100		
Inflow/Outflow	Other flows	200	–29,800	19,600
Outflow	Santa Clara River (to Santa Paula Basin)	–127,300	–400	–893,900
	Subtotal	–127,300		

The projected water budget is based on information from water years 1943 through 2019, adjusted for climate change using DWR (2019) 2070 CT change factors, as implemented by United (2021b).
Inflows are represented by positive values; outflows are represented by negative values.
Minimum and maximum values represent the smallest and largest magnitudes of annual flows, respectively.
Annual flow values (in AFY) are rounded to the nearest 100 AFY; therefore, a discrepancy of 100 AFY may occur.
Inflow/Outflow represents the sum of stream exchanges, which can result in overall groundwater inflow (recharge) or outflow (discharge) conditions.
Other flows = Difference in Inflows and outflows (i.e., typically inflows from ungauged tributaries, or sometimes stream losses).

The projected annual groundwater budget is shown on Figure 2.2-38, and summarized in Table 2.2-14. The projected groundwater budget is tabulated in Appendix I-2.

Table 2.2-14. Projected Groundwater Budget Summary

Flow	Component	Annual Flow (AFY)		
		Average	Minimum	Maximum
Inflow	Underflow from Piru Basin	47,000	33,800	55,400
	Recharge (basin floor)	17,900	13,300	29,800
	Recharge (mountain front)	7,300	2,900	10,700
	Underflow from outside subbasins	1,200	800	1,900
	Subtotal	73,400		
Inflow/Outflow	Stream exchange	2,800	–8,700	18,300
Outflow	Wells	–50,400	–37,800	-62,600
	Underflow to Santa Paula Basin	–16,900	–15,000	-17,500
	Evapotranspiration	–8,600	–2,900	-15,100
	Subtotal	–75,900		
Change in Groundwater in Storage		400		

The projected water budget is based on information from water years 1943 through 2019, adjusted for climate change using DWR (2019) 2070 CT change factors, as implemented by United (2021b).
Inflows are represented by positive values; outflows are represented by negative values.
Minimum and maximum values represent the smallest and largest magnitudes of annual flows, respectively.
Annual flow values (in AFY) are rounded to the nearest 100 AFY; therefore, a discrepancy of 100 AFY may occur.
Inflow/Outflow represents the sum of stream exchanges, which can result in overall groundwater inflow (recharge) or outflow (discharge) conditions.
Change in Groundwater in Storage = Inflow + Outflow + Inflow/Outflow (stream exchange)

2.2.3.6 Quantification of Overdraft (if applicable) (Reg. § 354.18[b][5])

The Basin is considered by DWR to not exhibit critical long-term overdraft. DWR's analysis of long-term groundwater hydrographs used a base period of water years 1989 to 2009 for this determination, which includes wet and dry periods and has the same mean precipitation as the long-term mean per California's Groundwater - Update 2020 (Bulletin 118). This finding is supported by the observed recovery of groundwater levels following each drought, as shown on Figure 2.2-18, and the insignificant cumulative change in storage estimated with the historical and projected water budgets.

Temporary overdraft occurs during periods of multiple years of below average or dry precipitation trends; however, following an above average or (especially) wet year, the Basin "resets" (refills) quickly. While beneficial uses (i.e., pumping) of groundwater contribute to steeper groundwater level (storage) declines during drier periods, the climate variability that is responsible for less precipitation is another significant factor that reduces groundwater levels during these periods, even in the absence of groundwater pumping.

2.2.3.7 Estimate of Sustainable Yield (Reg. § 354.18[b][7])

Estimating sustainable yield for the Basin is based on evaluation of current and historical groundwater conditions and the projected water budget. Sustainable yield is defined in SGMA legislation and refers to the maximum quantity of water, calculated over a base period representative of long-term conditions in the basin (including any temporary surplus), that can be withdrawn annually from a groundwater supply without causing an undesirable result. Historical trends in groundwater levels have shown declines during decades-long drought (i.e., 1943-1967) periods that repeatedly recover within shorter periods of time when conditions become wetter (i.e., 1967-2000). The sustainable yield can be calculated by adjusting the average pumping rate by the average change in groundwater in storage:

$$Sustainable\ Yield = Pumping + Change\ in\ Groundwater\ in\ Storage$$

The estimated minimum sustainable yield for the Basin is calculated to be 50,800 AFY, based on the first 50 years of the projected groundwater budget (Table 2.2-14), which shows an average annual surplus of 400 AFY in the change in groundwater in storage when the average pumping rate is 50,400 AFY. This sustainable yield estimate is considered a minimum, because additional groundwater model simulations with higher pumping volumes were not conducted and are not currently available as a basis for estimating the actual sustainable yield of the Basin. This current lower end sustainable yield estimate represents the average pumping rate for the 50-year SGMA planning horizon that corresponds with an estimate of no net change in groundwater in storage. Year-to-year rates of pumping are expected to vary less than or greater than the long-term sustainable yield value. For example, the projected groundwater budget (Appendix I-2) incorporated annual pumping rates as high as 62,600 AFY (during hypothetical water year 2050) and as low as 37,800 AFY (during hypothetical water year 2045). Based on this projected water budget, the Basin can pump (on average) 3,200 AFY more than historical (which was about 46,800 AFY) and not experience chronic declines in groundwater elevations or changes in groundwater in storage. Consideration of this low-end sustainable yield estimate in the context of other undesirable results is discussed in Section 3.

2.2.4 Management Areas (as Applicable) (Reg. § 354.20)

(a) Each Agency may define one or more management areas within a basin if the Agency has determined that creation of management areas will facilitate implementation of the Plan. Management areas may define different minimum thresholds and be operated to different measurable objectives than the basin at large, provided that undesirable results are defined consistently throughout the basin.
(b) A basin that includes one or more management areas shall describe the following in the Plan:
(1) The reason for the creation of each management area.
(2) The minimum thresholds and measurable objectives established for each management area, and an explanation of the rationale for selecting those values, if different from the basin at large.
(3) The level of monitoring and analysis appropriate for each management area.
(4) An explanation of how the management area can operate under different minimum thresholds and measurable objectives without causing undesirable results outside the management area, if applicable.
(c) If a Plan includes one or more management areas, the Plan shall include descriptions, maps, and other information required by this Subarticle sufficient to describe conditions in those areas.

A management area is designated for the GDE unit, the Cienega Riparian Complex (Stillwater, 2021a), located along the Santa Clara River at the rising groundwater area at the Basin's boundary with Piru Basin (Figure 2.2-30), which has historically shown the greatest degradation due to groundwater conditions (i.e., levels). This management area extends equally into the Fillmore Basin and Piru Basin; both basins are managed by the FPBGSA. The Agency considered a management area necessary here to mitigate the declines in groundwater levels that occur during drought periods and drop below the "critical water level" and contribute to vegetation die-off (Kibler, 2021; Kibler et al., 2021), as described in Section 2.2.2.7 of this GSP. A site-specific water budget is in development for the Cienega Springs Restoration Project (Stillwater, 2021b).

3. Sustainable Management Criteria (Subarticle 3)

> This Subarticle describes criteria by which an Agency defines conditions in its Plan that constitute sustainable groundwater management for the basin, including the process by which the Agency shall characterize undesirable results, and establish minimum thresholds and measurable objectives for each applicable sustainability indicator.

SMCs define conditions that constitute sustainable groundwater management for the Basin, including the process by which the FPBGSA shall characterize undesirable results and establish minimum thresholds (MTs) and measurable objectives (MOs) for each applicable sustainability indicator. Undesirable results and the associated sustainability indicators are evaluated based on metrics (e.g., groundwater elevations).

"Sustainable groundwater management" (Water Code Section 10721[v]) means the management and use of groundwater in a manner that can be maintained during the planning and implementation horizon without causing undesirable results. The SGMA planning horizon for high priority basins (i.e., Fillmore Basin) is 50 years into the future (i.e., 2022 through 2071), of which the first 20 years is considered the GSP implementation period. Six undesirable results are defined in Water Code Section 10721(x)(1-6), each of which is determined based on one or more sustainability indicators and may or may not be applicable to a basin (based on the basin setting).

A "sustainability indicator" (Reg. § 351[ah]) refers to any of the effects caused by groundwater conditions occurring throughout the basin that, when and where significant and unreasonable, cause undesirable results (e.g., loss of the ability to pump groundwater or die-off of GDEs due to declines in groundwater elevations). The development of SMC relies upon Basin setting information related to the HCM (Section 2.2.1), description of current and historical groundwater conditions (Section 2.2.2), and water budget (Section 2.2.3).

The FPBGSA developed SMCs (Figure 3.0-1) for the Fillmore Basin and Piru Basin over several months, beginning with an ad hoc committee of the Board of Directors that served to develop an initial framework for evaluating undesirable results, followed by months of open discussion with stakeholders and the entire board of directors during several board meetings (Appendix C) to finalize the SMC. A detailed description of the SMC development process is provided in Appendix J.

3.1 Sustainability Goal (Reg. § 354.24)

> Each Agency shall establish in its Plan a sustainability goal for the basin that culminates in the absence of undesirable results within 20 years of the applicable statutory deadline. The Plan shall include a description of the sustainability goal, including information from the basin setting used to establish the sustainability goal, a discussion of the measures that will be implemented to ensure that the basin will be operated within its sustainable yield, and an explanation of how the sustainability goal is likely to be achieved within 20 years of Plan implementation and is likely to be maintained through the planning and implementation horizon.

"Sustainability goal" means the existence and implementation of one or more GSPs that achieve sustainable groundwater management by identifying and causing the implementation of measures targeted to ensure that the Basin is operated within its sustainable yield (California Water Code Section 10721[u]). Based on the evaluation of historical, current, and projected water budgets (Section 2.2.3), the sustainable yield for the Basin is estimated to be 50,000 AFY.

The sustainability goal for the Basin is memorialized in the guiding principles (https://bit.ly/3sQp8LR) that were adopted by the FPBGSA Board of Directors in November 2019. The guiding principles include principles of understanding covering the governance, communication and education, funding and finances, and SGMA implementation and sustainability. These guiding principles are intended to be consistent with the JPA (Appendix A), which is the legal foundational document for the GSA. In the event of any conflict between the guiding principles and the JPA, the JPA takes precedence. Two of the general principles ("Gen") from the guiding principles that are most pertinent to the sustainability goal are:

- *Gen 6:* Sustainable groundwater conditions in the Basins are critical to support, preserve, and enhance the economic viability, social well-being, environmental health, and cultural norms of all beneficial users and uses including Tribal, domestic, municipal, agricultural, environmental and industrial users
- *Gen 7:* FPBGSA is committed to conduct sustainable groundwater practices that balance the needs of and protect the groundwater resources for all Beneficial Users in the Basins

The beneficial uses of water pertaining to water rights (CCR §659-672) include domestic, irrigation, power, municipal, mining, industrial, fish and wildlife preservation, and heat control. Additional beneficial uses are specified for surface water and groundwater in the LARWQCB [1994] Basin Plan for Coastal Watersheds in Los Angeles and Ventura Counties. Based on FPBGSA stakeholder engagement over the past couple of years, the beneficial uses of surface water and groundwater include domestic, agricultural (i.e., irrigation), municipal, industrial, and fish and wildlife preservation and enhancement.

The sustainability indicators that were identified by the Agency for each (applicable) undesirable result (Section 3.2) are shown in Figure 3.0-1, along with the corresponding minimum thresholds (Section 3.3) and measurable objectives (Section 3.4).

3.2 Undesirable Results (Reg. § 354.26)

An "undesirable result" means one or more of the following effects caused by groundwater conditions occurring throughout the basin (Water Code Section 10721[x]):

1. Chronic lowering of groundwater levels indicating a significant and unreasonable depletion of supply if continued over the planning and implementation horizon. Overdraft during a period of drought is not sufficient to establish a chronic lowering of groundwater levels if extractions and groundwater recharge are managed as necessary to ensure that reductions in groundwater levels or storage during a period of drought are offset by increases in groundwater levels or storage during other periods.
2. Significant and unreasonable reduction of groundwater storage (i.e., supply).
3. Significant and unreasonable seawater intrusion.
4. Significant and unreasonable degraded water quality, including the migration of contaminant plumes that impair water supplies.
5. Significant and unreasonable land subsidence that substantially interferes with surface land uses.
6. Depletions of interconnected surface water that have significant and unreasonable adverse impacts on beneficial uses of the surface water.

The criteria (i.e., SMCs) for determining when and where (and if at all) any of these undesirable results occur are specified based on FPBGSA's definitions of "significant and unreasonable." The following sections describe the processes and criteria used to develop SMCs and evaluate undesirable results.

3.2.1 Processes and Criteria to Define Undesirable Results (Reg. § 354.26[a])

Undesirable results occur when significant and unreasonable effects in relation to the sustainability indicators are caused by groundwater conditions (e.g., groundwater levels).

Applicable undesirable results were identified by the FPBGSA based on the Basin setting (Section 2.2) and feedback from stakeholders during public meetings (Appendix C) that were held at least monthly. DACs were considered equally as other areas in the Basin during the definition of undesirable results for each sustainability indicator (e.g., all production wells were evaluated for the potential to go dry in the future).

The Agency deliberated extensively (refer to Section 2.1.5.3.2) to determine if undesirable results related to the depletion of interconnected surface water, namely loss of *O. mykiss* rearing and spawning habitat along the Santa Clara River, is a significant and unreasonable effect of groundwater conditions resulting from groundwater extraction. In the context of the SGMA, ultimately, the Agency does not consider depletions of interconnected surface water a significant and unreasonable effect for the following reasons:

- The large variability of the ephemeral flows associated with streams in the Basin (observed prior to and up to year 2015) ranging from no flow conditions during extended dry periods to hundreds of cfs during occasional wet periods make surface water depletions irrelevant (when no surface water exists) and insignificant (when surface water flows are orders of magnitude greater than depletions due to groundwater pumping).
- There are no in-stream flow requirements for streams in the Basin.
- The Public Trust Doctrine does not apply to streams in the Basin because they are not navigable waterways and do not contribute to downstream navigable waterways (USDOT, 1987).
- There is no designated existing or potential beneficial use for spawning and rearing along the streams in the Basin per the LARWQCB Basin Plan and the habitat is considered poor for spawning and rearing (Stoecker and Kelley, 2005).
- There is no evidence of *O. mykiss* using the surface water (except during wet periods when the Santa Clara River is fully connected with surface water flow to support migration).
- Elimination of groundwater extractions within about 1 mile of the Santa Clara River (the equivalent of a severe 50 percent pumping reduction) would not prevent the surface water at Cienega Riparian Complex from going dry during severe droughts (Appendix J).
- Consultation with DWR staff, DBS&A and United (personal communication with DWR, 2021) ended with agreement from DWR staff that the following lines of evidence make it difficult to enforce MTs and MOs in regards to surface water depletions.

3.2.2 Description of Undesirable Results (Reg. § 354.26[b])

The following undesirable results have been identified by the Agency:

- Groundwater level declines that result in either of the following:
  - Loss of ability to pump groundwater from water wells (i.e., consideration of the Human Right to Water [AB 685])
  - Die-off of riparian vegetation (e.g., cottonwood or willow species in the Cienega Riparian Complex GDE unit [Stillwater, 2021a]), due to groundwater levels declines below the critical water level (Kibler, 2021; Kibler et al., 2021) that are attributable to groundwater pumping
    - Significant reductions in groundwater in storage are related to the loss of ability to pump groundwater (sustainability indicator)
    - Inelastic land subsidence that damages critical infrastructure (e.g., water distribution systems and roads)
    - Water quality degradation beyond historical conditions

Undesirable results related to surface water depletions were considered significant, yet not unreasonable, because natural climate variability (i.e., prolong droughts) is a significant cause of depleted surface waters (i.e., dry streams), that are not eliminated with pumping reductions (Appendix J). Climate conditions are considered to have a more significant impact on surface water flows than groundwater pumping.

Undesirable results related to seawater intrusion are not applicable to this Basin due to the large horizontal and vertical distances separating groundwater levels from seawater.

3.2.3 Cause of Groundwater Conditions that Would Lead to Undesirable Results (Reg. § 354.26[b][1])

Two primary causes of groundwater conditions that would lead to undesirable results are considered (1) climate variability and (2) groundwater pumping. Less precipitation (inflow) and more pumping (outflow) generally result in lower groundwater levels. A third and likely less significant cause of groundwater conditions that would lead to undesirable results is the presence of invasive species (e.g., *Arundo donax*), which are thought to use a higher amount of groundwater (via ET) than other native vegetation (e.g., GDEs), and also preclude the presence of native GDEs (i.e., beneficial uses).

3.2.3.1 Criteria to Define When and Where Undesirable Results Occur (Reg. § 354.26[b][2])

An undesirable result regarding chronic groundwater level declines occurs when groundwater elevations drop below the bottom of well perforations (i.e., screen) in 25 percent of the representative monitoring sites (see Section 3.5.3), or when groundwater elevations drop below MT equivalent to the critical water level of 10 feet below fall 2011 conditions in the area near the Cienega Springs Restoration Project.

The FPBGSA board of directors sought input from stakeholders during multiple board meetings and workshops, as well as separate meetings with stakeholder groups (e.g., Fillmore Basin Pumpers Association, Piru Basin Pumpers Association) on what proportion of the representative wells would need to have their water levels decline below the base of the well screen to be considered significant and unreasonable. Relatively small percentages of wells were considered to be only reflective of a localized condition and not the basin as a whole. Larger percentages were deemed to be more of a trailing indicator of a potential problem (i.e., the problem had already manifested itself into a nearly basin-wide condition) before the MT was exceeded. Ultimately, the Directors and stakeholders settled on a modest value of 25 percent of the representative wells as an appropriate balance between local and basin-wide conditions.

3.2.3.2 Potential Effects of Undesirable Results (Reg. § 354.26[b][3])

The potential effects on beneficial uses and users and/or land uses and property interests associated with each applicable undesirable result include the following:

- Chronic lowering of groundwater levels:
    - When groundwater levels drop below the base of well perforations (or screen intervals) prevents beneficial uses due to dry well conditions. Evaluation of the projected model (i.e., water budget per Section 2.2.3.5) indicates that the low-end sustainable yield estimated for the Basin (Section 2.2.3.7) is appropriate because water wells were evaluated and determined to not go dry under this scenario (Appendix J). An inability to pump groundwater would negatively impact DACs and the local economy. There are no particular threats to DACs in regards to water supply availability, because projected model scenarios show that dry production wells (including any wells within DACs) are unlikely to go dry.
    - Groundwater levels below the critical water level (Kibler, 2021; Kibler et al., 2021) in the GDE (rising groundwater) Basin boundary areas along the Santa Clara River have the potential effect of vegetation die-off. Die-off is considered significant and unreasonable

because the GDE units do not fully recover following recovery of groundwater levels, except until after the next major storm occurs to scour away debris and provide new habitat for recolonization (i.e., germination of seeds).

- Significant reduction in groundwater in storage has similar potential effects as chronic lowering of groundwater levels do on the ability to pump groundwater.
- Inelastic subsidence can cause the following issues:
  - Damage to infrastructure
  - Loss of aquifer storage (i.e., compaction of pore spaces)
- Significant and unreasonable water quality degradation would result if water quality exceeds MCLs (e.g., nitrate above the MCL can result in Blue Baby Syndrome) or water quality significantly exceeds historical concentrations.

3.2.4 Multiple Minimum Thresholds Used to Determine Undesirable Results (Reg. § 354.26[c])

Groundwater elevations are monitored and evaluated at several well sites throughout the Basin to evaluate groundwater conditions in relation to undesirable results, comprising namely the ability to pump groundwater (i.e., the Human Right to Water) and GDE die-off. MTs at several (25 percent of) representative monitoring sites (i.e., wells listed in Section 3.5.3) need to be exceeded for the sustainability indicator of water levels below the base of well screen to be considered significant and unreasonable (Figure 3.0-1). The representative monitoring sites to correspond with the critical water level MT (Figure 3.0-1) in the Cienega GDE unit area are pending with the additional shallow monitor wells that are planned to be installed there (see Section 4). Currently one representative monitoring site is designated for the GDE (see Section 3.5.3).

The FPBGSA evaluates multiple water quality parameters (e.g., Section 3.5.1.2) against the MTs associated with the WQOs and MCLs, but does not assume responsibility or the authority to enforce water quality standards. The FPBGSA acknowledges that it will cooperate with existing regulatory authorities (e.g., the RWQCB and DDW) and will not implement projects or management actions that further degrade water quality beyond historical conditions (i.e., Section 2.2.2.5).

3.2.5 Undesirable Results Related to Sustainability Indicators that Are Not Likely to Occur (Reg. § 354.26[d])

Undesirable results related to the potential for GDE die-off outside of the Cienega GDE unit area (Figure 2.2-30) are considered not likely to occur because Stillwater (2021a) NDVI and NDMI analysis indicate that the other GDEs recovered following the recent (2012 to 2016) severe drought and projected groundwater levels are not expected to be materially deeper than historical. Undesirable results related to chronic groundwater level declines that would result in dry domestic wells are not likely to occur because projected groundwater modeling indicates groundwater levels will be similar in the future as they have historically (DBS&A, 2021c) and no domestic wells are known to have gone dry historically.

Undesirable results in relation to degraded water quality are not likely to occur because GSP implementation is not expected to result in groundwater levels deeper than historical lows and there is no historical evidence of significant and unreasonable (i.e., undesirable) results to beneficial uses.

Undesirable results related to subsidence are not likely to occur because future groundwater levels are not expected to be deeper than historical.

3.3 Minimum Thresholds (Reg. § 354.28)

(a) Each Agency in its Plan shall establish minimum thresholds that quantify groundwater conditions for each applicable sustainability indicator at each monitoring site or representative monitoring site established pursuant to Section 354.36. The numeric value used to define minimum thresholds shall represent a point in the basin that, if exceeded, may cause undesirable results as described in Section 354.26.
(b) The description of minimum thresholds shall include the following:
(1) The information and criteria relied upon to establish and justify the minimum thresholds for each sustainability indicator. The justification for the minimum threshold shall be supported by information provided in the basin setting, and other data or models as appropriate, and qualified by uncertainty in the understanding of the basin setting.
(2) The relationship between the minimum thresholds for each sustainability indicator, including an explanation of how the Agency has determined that basin conditions at each minimum threshold will avoid undesirable results for each of the sustainability indicators.
(3) How minimum thresholds have been selected to avoid causing undesirable results in adjacent basins or affecting the ability of adjacent basins to achieve sustainability goals.
(4) How minimum thresholds may affect the interests of beneficial uses and users of groundwater or land uses and property interests.
(5) How state, federal, or local standards relate to the relevant sustainability indicator. If the minimum threshold differs from other regulatory standards, the Agency shall explain the nature of and basis for the difference.
(6) How each minimum threshold will be quantitatively measured, consistent with the monitoring network requirements described in Subarticle 4.

3.3.1 Chronic Lowering of Groundwater Levels

The minimum threshold for chronic lowering of groundwater levels shall be the groundwater elevation indicating a depletion of supply at a given location that may lead to undesirable results. Minimum thresholds for chronic lowering of groundwater levels shall be supported by the following:
(A) The rate of groundwater elevation decline based on historical trends, water year type, and projected water use in the basin.
(B) Potential effects on other sustainability indicators.

MTs related to chronic lowering of groundwater levels are proposed for two sustainability indicators: (1) ability to pump and (2) protection of GDEs during droughts. The metric for measuring ability to pump is groundwater elevation (relative to bottom of screen) in representative monitor wells. The Agency acknowledges wells going dry is an undesirable result, yet, a certain number of shallow water wells (i.e., less than 100 feet deep) going dry is acceptable (see Appendix J). Model scenarios with varying annual pumping rates in the Basin were evaluated to determine the sustainable yield based on the number of representative monitor sites (wells actively monitored for groundwater levels) and number of wells with screen interval information (wells monitored based on groundwater model) that would be projected to go dry (i.e., during droughts). The evaluation is considered robust because the groundwater model represents a greater area and number of wells than can be monitored directly with measurements, and with consideration of model biases (i.e., slight overprediction of groundwater levels) (see mean residuals summary from United, 2021a), the groundwater elevations in representative monitoring sites can be associated with those that correspond to unmonitored wells.

The MT for groundwater levels in the Cienega Restoration/Fish Hatchery area is set at the critical water level (Kibler, 2021; Kibler et al., 2021), 10 ftee below 2011 low groundwater levels (i.e., the MO). If/when this MT is exceeded, mitigation (Section 4) will be implemented to offset the undesirable result that would occur without adequate soil moisture. It is important to note that the concept of this mitigation program is not expected to restore groundwater levels above the MT (because it is believed this would require an unreasonable amount of supplemental water), but more importantly, provide assurance that adequate soil moisture is sustained in the vadose/root zone of the GDEs to prevent die-off (i.e., prevent an undesirable result) related to groundwater level declines.

Undesirable results related to inability to pump groundwater due to dry well conditions can also be monitored based on information collected through the DWR Household Water Supply Shortage Reporting System (Household Water Supply Shortage Reporting System Data - Datasets - California Natural Resources Agency Open Data). This database indicates that no dry wells have occurred in Ventura County. Undesirable results have been evaluated with consideration of the recommendations made by Summary Analysis of 31 Groundwater Sustainability Plans in Critically Overdrafted Basins February 19, 2021 Consideration of Selected Beneficial Users – Key Findings and Examples.

3.3.2 Reduction of Groundwater Storage

> The minimum threshold for reduction of groundwater storage shall be a total volume of groundwater that can be withdrawn from the basin without causing conditions that may lead to undesirable results. Minimum thresholds for reduction of groundwater storage shall be supported by the sustainable yield of the basin, calculated based on historical trends, water year type, and projected water use in the basin.

The minimum threshold for the reduction of groundwater storage is the same as that for chronic lowering of groundwater levels (Figure 3.0-1).

3.3.3 Seawater Intrusion

> The minimum threshold for seawater intrusion shall be defined by a chloride concentration isocontour for each principal aquifer where seawater intrusion may lead to undesirable results. Minimum thresholds for seawater intrusion shall be supported by the following:
> (A) Maps and cross-sections of the chloride concentration isocontour that defines the minimum threshold and measurable objective for each principal aquifer.
> (B) A description of how the seawater intrusion minimum threshold considers the effects of current and projected sea levels.

A minimum threshold for seawater intrusion is not applicable for this Basin.

3.3.4 Degraded Water Quality

> The minimum threshold for degraded water quality shall be the degradation of water quality, including the migration of contaminant plumes that impair water supplies or other indicator of water quality as determined by the Agency that may lead to undesirable results. The minimum threshold shall be based on the number of supply wells, a volume of water, or a location of an isocontour that exceeds concentrations of constituents determined by the Agency to be of concern for the basin. In setting minimum thresholds for degraded water quality, the Agency shall consider local, state, and federal water quality standards applicable to the basin.

The MTs for degraded water quality correspond to WQOs and MCLs established by the LARWQCB Basin Plan and California DDW, respectively. The FPBGSA does not assume responsibility for enforcing these water quality objectives/regulations, but will continue to monitor water quality (i.e., to make sure water quality is not degrading further due to GSP projects and/or management actions) and will coordinate with the applicable authorities to prevent water quality degradation.

3.3.5 Land Subsidence

> The minimum threshold for land subsidence shall be the rate and extent of subsidence that substantially interferes with surface land uses and may lead to undesirable results. Minimum thresholds for land subsidence shall be supported by the following:
> (A) Identification of land uses and property interests that have been affected or are likely to be affected by land subsidence in the basin, including an explanation of how the Agency has determined and considered those uses and interests, and the Agency's rationale for establishing minimum thresholds in light of those effects.
> (B) Maps and graphs showing the extent and rate of land subsidence in the basin that defines the minimum threshold and measurable objectives.

An MT of 1 foot per year or 1 foot cumulative change over 5 years was approved by the FPBGSA board of directors with the condition that the agency would consider performing a subsidence vulnerability evaluation for critical infrastructure in the basin. The FPBGSA board of directors extensively discussed the distinction between differential subsidence and basin-size ground surface movement and recognized that differential subsidence is a more problematic phenomenon to critical infrastructure (e.g., pipelines, roadways, bridges).

3.3.6 Depletions of Interconnected Surface Waters

> The minimum threshold for depletions of interconnected surface water shall be the rate or volume of surface water depletions caused by groundwater use that has adverse impacts on beneficial uses of the surface water and may lead to undesirable results. The minimum threshold established for depletions of interconnected surface water shall be supported by the following:
> (A) The location, quantity, and timing of depletions of interconnected surface water.
> (B) A description of the groundwater and surface water model used to quantify surface water depletion. If a numerical groundwater and surface water model is not used to quantify surface water depletion, the Plan shall identify and describe an equally effective method, tool, or analytical model to accomplish the requirements of this Paragraph.

An MT is not warranted for this undesirable result as discussed in Section 3.2.1 and in greater detail in Appendix J.

3.4 Measurable Objectives (Reg. § 354.30)

(a) Each Agency shall establish measurable objectives, including interim milestones in increments of five years, to achieve the sustainability goal for the basin within 20 years of Plan implementation and to continue to sustainably manage the groundwater basin over the planning and implementation horizon.
(b) Measurable objectives shall be established for each sustainability indicator, based on quantitative values using the same metrics and monitoring sites as are used to define the minimum thresholds.
(c) Measurable objectives shall provide a reasonable margin of operational flexibility under adverse conditions which shall take into consideration components such as historical water budgets, seasonal and long-term trends, and periods of drought, and be commensurate with levels of uncertainty.
(d) An Agency may establish a representative measurable objective for groundwater elevation to serve as the value for multiple sustainability indicators where the Agency can demonstrate that the representative value is a reasonable proxy for multiple individual measurable objectives as supported by adequate evidence.
(e) Each Plan shall describe a reasonable path to achieve the sustainability goal for the basin within 20 years of Plan implementation, including a description of interim milestones for each relevant sustainability indicator, using the same metric as the measurable objective, in increments of five years. The description shall explain how the Plan is likely to maintain sustainable groundwater management over the planning and implementation horizon.
(f) Each Plan may include measurable objectives and interim milestones for additional Plan elements described in Water Code Section 10727.4 where the Agency determines such measures are appropriate for sustainable groundwater management in the basin.
(g) An Agency may establish measurable objectives that exceed the reasonable margin of operational flexibility for the purpose of improving overall conditions in the basin, but failure to achieve those objectives shall not be grounds for a finding of inadequacy of the Plan.

The MOs and accompanying rational (comments) for each sustainability indicator are listed in Figure 3.0-1. The MO for groundwater levels and groundwater in storage is recovery to fall 2011 (Basin "full") conditions following drought conditions. This MO is expected to be achieved after a period of above normal to wet years occurs. The MO for degraded water quality is the same as the MTs (i.e., MCLs and WQOs) for each constituent. The MO for subsidence is equivalent to inelastic subsidence that is within 0.1 ft/yr (i.e., the error of the InSAR method).

3.5 Monitoring Network (Subarticle 4)

The monitoring network is described in detail in the FPBGSA Monitoring Program and Data Gap technical memorandum (Appendix K) and summarized in this subsection. This subsection includes descriptions of existing monitoring networks that will continue to be relied on during GSP implementation, monitoring protocols and representative monitoring points (RMPs) for SMC evaluation. An assessment of FPBGSA's monitoring network and planned improvements is also described in this subsection.

The monitoring network is used to measure metrics against monitoring objectives (e.g., measurable objectives, minimum thresholds, and interim milestones) associated with sustainability indicators (Reg. § 354.34 c), as described in the Fillmore and Piru Basins SMC technical memorandum (Appendix J), per the monitoring protocols and data reporting requirements described in the sampling and analysis plan (SAP) (Appendix L). The monitoring network promotes the collection of data of sufficient quality, frequency, and distribution to characterize groundwater and related surface water conditions in the Basin and evaluate changing conditions that occur through implementation of this Plan in accordance with Reg. § 354.34. Data gaps and plans to address them are also described in this subsection.

3.5.1 Description of Monitoring Network (Reg. § 354.34)

This GSP adopts existing water resources monitoring and management programs (Reg. § 354.34 e) implemented by public agencies (see GSP Section 2.1.2 for general descriptions) active in Ventura County and include data collection in Fillmore Basin. United and VCWPD have existing long-standing monitoring networks, and FPBGSA's monitoring network relies heavily upon these agencies' existing monitoring activities. Where available, additional data from other sources, including the SWRCB's GAMA and GeoTracker groundwater monitoring programs, are used as a component of the FPBGSA's monitoring network. The USGS has historically conducted studies in the Basin, but does not routinely monitor for water quality or groundwater level in wells in the Basin.

The purpose of the monitoring network is to gather representative data of sufficient quantity (e.g., spatial and temporal coverage) and accuracy (see FPBGSA SAP) to demonstrate sustainable management with respect to the SMCs developed for the Fillmore Basin. Basin-specific data quality objectives (DQOs) are described in the FPBGSA Monitoring Program and Data Gap technical memorandum and summarized in GSP Section 3.5.2. Collecting data that meet the DQOs ensures that the analysis level of confidences is known and documented. Implementation of the monitoring network objectives will demonstrate progress toward achieving the measurable objectives, monitors impacts to beneficial uses or users of groundwater, monitors changes in groundwater conditions, and gathers the necessary data for quantifying annual changes in water budget components (Reg. § 354.20 b).

Spatial groundwater quality and level monitor well (monitoring points) density included in existing monitoring networks is evaluated in Sections 5.3 and 5.4, respectively, in Appendix K and summarized here. The evaluation includes consideration of the frequency of monitoring, number, and distribution of monitor wells screened discretely in a single aquifer zone in the Fillmore Basin.

3.5.1.1 Groundwater Level Monitoring Network

The complete groundwater level monitoring network for the Basin is shown on Figure 3.5-1. The United and VCWPD monitoring program lists include substantial monitoring and reporting of groundwater level measurements in wells in the Fillmore Basin. The California Statewide Groundwater Elevation Monitoring (CASGEM) Program is a collaboration between local monitoring parties and the DWR to collect statewide groundwater elevation measurements from wells in each basin throughout the state. Much of the water level data directly collected or gathered from other sources by United and VCWPD is reported to the state and made publicly available as part of the program. VCWPD acts as the CASGEM submitting agency for water level data collected in Ventura County (VCWPD, 2016).

3.5.1.1.1 United and VCWPD Networks

The United and VCWPD active monitoring networks in the Fillmore and Piru Basins are shown in Figure 2.1-8. VCWPD monitors groundwater levels in wells on a quarterly basis, and United conducts its monitoring on monthly, bimonthly, semiannual or event-based schedules. There are 4 wells in the Fillmore Basin (and 1 in the Piru Basin) shown on Figure 2.1-8 (red circles) that are monitored by both United and VCWPD staff. The overlap between the United and VCWPD monitoring networks is useful as a quality assurance/quality control (QA/QC) measure to ensure consistency between data collected by the different entities (United, 2016a).

From the United and VCWPD monitoring program 2019 respective lists (shown graphically in Figure 2.1-8), 41 unique wells are monitored for water level in Fillmore Basin. VCWPD monitors 14 wells, and there are 4 overlap wells included in the 31 wells United monitors. Groundwater level monitoring protocols for data collection are summarized in Section 3.5.2.1.

3.5.1.1.2 Recording Groundwater Level Devices

Pressure transducers and data loggers can be used for recording water level measurements in wells on user defined or event-based schedules. Field procedures and the DWR's recommendations are described in the FPBGSA's SAP (Appendix L) and summarized in Section 3.5.2.1.2. Frequency of pressure transducer data collection and data uses (e.g., trend evaluation) are described in Section 3.5.4.1.2.

United has 13 pressure transducers and data loggers deployed in wells (locations are shown in the Figure 2.1-8). The most recent of these deployments was in well (04N19W32B03S) near the

Fillmore Fish Hatchery in winter 2020 to fill an identified groundwater level monitoring data gap. Data obtained from the United deployment of pressure transducers and data loggers is an important component of the groundwater level monitoring network in the Fillmore Basin.

United also requests pressure transducer data recorded by Farmers Irrigation Company (FICO) in their wells roughly three times per year. FICO operates primarily in Santa Paula Basin, but has 1 well (03N21W12F07S) in west Fillmore Basin just across the Santa Paula-Fillmore Basin boundary. The sensor in this well is the only known pressure transducer employed for groundwater level monitoring in the Fillmore Basin that is connected to a telemetry system.

3.5.1.1.3 Well Spatial Density

Table 3.5-1 summarizes the number of wells in the Fillmore Basin included in the United and VCWPD groundwater level monitoring networks as of summer 2020, as well as the theoretical number of wells per 100 square miles (the combined surface area of the Basins is less than 100 square miles). Note that well density is reported here as number of wells per 100 square miles for consistency for comparison with BMP #2 recommended standards for groundwater level monitoring programs (DWR, 2016). Additional information on monitoring network well spatial density and DWR recommendations are included in Appendix K.

Table 3.5-1. Number of Wells in the Fillmore Basin Included in the United and VCWPD Groundwater Level Monitoring Networks

	Number of Wells	Theoretical Number of Wells per 100 square miles
Zone A and/or B (principal aquifer)	28	80
Zone C	1	2.9
Screened across multiple zones	5	14.3
Unknown construction	7	20
Total	41	117.1

The number of wells in the basin divided by the ground surface area in square miles yields the monitoring site density. Fillmore Basin surface area is approximately 35 square miles. The horizontal distribution of wells sampled for groundwater quality in the Fillmore Basin is extensive when considering its size. There are 117.1 wells per 100 square miles (1.2 wells per square mile) in Fillmore Basin.

A data gap assessment of well density with respect to the number of monitored wells in the Fillmore Basin completed discretely in a single aquifer is summarized in Section 3.5.4.1 (see Appendix K Section 5.4 for the detailed discussion). Monitoring network measurement frequency and planned improvements to the FPBGSA monitoring network are also included in Section 3.5.4.1.

3.5.1.2 Groundwater Quality Monitoring Network

The complete groundwater quality monitoring network for the Basin is shown on Figure 3.5-2. Groundwater quality monitoring in Fillmore Basin is conducted by several organizations in addition to the monitoring programs administered by United and VCWPD. For water purveyors' wells that produce groundwater for human use and consumption, monitoring of a variety of regulated constituents, including biological constituents, is required by law and ensures that groundwater is safe for potable uses. These data are available from the DDW (United, 2016a) for water systems with 15 or more connections. Other sources of groundwater quality monitoring include the following:

- California Department of Water Resources
- City of Fillmore potable water supply wells
- WWTPs (i.e., City of Fillmore)
- Landfill (i.e., Toland Road) operators
- Consultant reports and technical studies
- Individual well owners

3.5.1.2.1 United and VCWPD Networks

The United and VCWPD active groundwater quality monitoring networks in the Fillmore and Piru Basins are shown on Figure 2.1-9. United samples monitoring and production wells in the Basins semiannually (in the spring and fall), and VCWPD annually samples production wells within the Basins in the fall. VCWPD's list of groundwater sampling wells is somewhat dependent on availability of staff time and the Agency's annual budget. There are a core group of wells VCWPD prioritizes to be sampled almost every year, and if one of these wells is unavailable for some reason, they will often sample a nearby well that is pumping.

A total of 21 unique wells are sampled for groundwater quality within the Fillmore Basin as part of the United and VCWPD 2019 monitoring program lists (Figure 2.1-9). VCWPD samples

14 wells (and has 1 alternate well shown as an orange square on Figure 2.1-9) and United samples 6 production wells and 1 monitor well for a total of 21 unique wells.

3.5.1.2.2 Well Spatial Density

Note that Figure 3.5-2 shows an alternate VCWPD sampling well in Fillmore Basin (orange square in the figure). This alternate well is not included in the tabulated number of wells per basin in Table 3.5-2 because it is only sampled as an alternate well if a VCWPD core group well is unavailable.

Table 3.5-2. Number of Wells in the Fillmore Basin included in the United and VCWPD Groundwater Quality Monitoring Networks

	Number of Wells
Zone A and/or B (principal aquifer)	17
Zone C	0
Screened across multiple zones	3
Unknown construction	1
Total	21

The number of wells in the Basin divided by the ground surface area in square miles yields the monitoring site density. Fillmore Basin surface area is approximately 35 square miles. The horizontal distribution of wells sampled for groundwater quality in the Fillmore Basin is extensive when considering the size of the Basin. There is 0.6 well per square mile in the Fillmore Basin. Note that well density here is reported as wells per square mile and well density is reported in Section 3.5.1.1.3 as wells per 100 square miles for consistency with BMP #2 recommended standards for groundwater level monitoring programs (DWR BMP 2, 2016).

A data gap assessment of well density with respect to the number of monitored wells in the Fillmore Basin completed discretely in a single aquifer is summarized in Section 3.5.4.2 (see technical memorandum Section 5.3 for the detailed discussion). Monitoring network measurement frequency and planned improvements to the FPBGSA monitoring network are also described in Section 3.5.4.2.

3.5.1.3 Trend Analysis: Short-Term, Seasonal and Long-Term

FPBGSA's monitoring network gathers data for use in demonstrating short-term, seasonal, and long-term trends in groundwater conditions (Reg. § 354.20 a). A trend analysis was performed and detailed in Appendix K. Appendix K includes evaluation of water level observations and groundwater quality analytes (chemicals) from select wells in Fillmore Basin.

Evaluation of trend types (i.e., short-term, seasonal and long-term) requires data collected at varying frequencies, although high-frequency data can be pared down for analyses that require less frequent data. Short-term and seasonal trend evaluations may require higher-frequency data than long-term trends, and therefore require a greater level of effort and cost to gather the necessary data. Wells equipped with data loggers (e.g., pressure transducers and water quality sensors) can be useful tools for assessing short-term and seasonal trends. Collection of higher-frequency data from newly established monitoring sites is often necessary to assess site-specific short-term and seasonal trends. Over time, once these trends are understood, it may be determined from the data that less frequent monitoring is adequate for collecting representative data for describing local groundwater conditions. "An understanding of the full range of monitor well conditions should be reached prior to establishing a long-term monitoring frequency" (DWR BMP 2, 2016).

Seasonal trends (e.g., minimum and maximum annual fluctuation or separating spring and fall collected data for independent evaluation) can be assessed using semiannual, quarterly, or higher-frequency data. Less frequent (e.g., annual or biennial) data collection can be leveraged for assessing long-term trends. Trend analysis results may be somewhat dependent on the time period selected for data evaluation. Commonly, data availability influences the time period selected for analysis in historical evaluations. The trend analysis in Appendix K used existing datasets, and will inform potential revisions to FPBGSA's monitoring program.

The technical memorandum trend analysis used the following trend type general criteria for analysis of select groundwater data:

- Short-term: Available data since the year 2000
- Seasonal (short-term): Available semiannual or higher frequency data
- Long-term: Last 36 years (1983–2018)

The long-term time period of water years 1983 through 2018 employed for the purpose of data trend analysis in the technical memorandum was selected with consideration of available annual precipitation data. The time period includes both wet and dry cycles including recent drought years. Water year 1983 is among the wettest on record, and the ensuing period through 2018 includes several above average years, some of which are over twice the long-term average (i.e., 1998 and 2005). A standardized period of analysis is used in the technical memorandum for assessing trends to facilitate better comparison of trend spatial distribution from well to well. Complete record sets (i.e., including data prior to 1983) for the groundwater data analyzed in the trend analysis are included in the appendix of the technical memorandum.

Additional time periods could be used in future analysis of data trends. At the time of writing of the technical memorandum, complete datasets were available through calendar year 2018, and more recent data were presented in the technical memorandum where available. Trends were assessed through 2018 to provide context of groundwater conditions leading into the potential adoption and initiation of the GSP implementation period. Future analysis may include the identification of base periods that differ from the time periods used in the technical memorandum, and may include stakeholder input and additional current data, if available.

However, the evaluation summarized here from the technical memorandum is useful for demonstrating that FPBGSA's monitoring program is capable of collecting sufficient data to demonstrate short-term, seasonal, and long-term trends in groundwater and related surface conditions, and to yield representative information about groundwater conditions as necessary to evaluate GSP implementation.

3.5.1.4 Groundwater Extraction Monitoring

Locations of active water wells for which groundwater extraction volumes are monitored (currently on a semiannual calendar year basis) are shown on Figure 3.5-3. Fillmore Basin-wide groundwater production record keeping began with the advent of a United funding mechanism tied to groundwater produced within their boundary. Detailed pumping records by well are available for nearly a 40-year period in Fillmore Basin and the other basins within United's boundary. Groundwater extractions were first reported to United in 1979, with 1980 constituting the first relatively complete calendar year of record.

Following the formation of the FPBGSA in 2017, pumpers in the Fillmore and Piru Basins have been required to report their groundwater extractions to the Agency. As an administration cost saving measure, the Agency has used United's reported pumping records from wells in the Fillmore and Piru Basins and an accounting system to invoice well operators on a semiannual calendar year basis for the Agency's levied groundwater extraction fee. Groundwater extraction measuring protocols are summarized in Section 3.5.2.3.

3.5.1.5 Surface Water Monitoring

Stream flow and surface water quality monitoring in the Fillmore Basin is summarized in the following subsections. Detailed descriptions are included in Sections 2.2 and 3.2 of Appendix K.

3.5.1.5.1 Stream Flow Monitoring

The FPBGSA's stream flow monitoring network includes manual in-stream measurements at established locations and permanent fixed recording gauges. Available stream flow discharge data for the Fillmore Basin includes measurements from the Santa Clara River and tributaries. Figure 2.1-10 shows the locations of stream flow gauging sites in the Basin and nearby areas. Stream flow measurements have been used by United to estimate percolation rates within various reaches of the stream channels of the Fillmore and Piru Basins (Appendix K).

The Santa Clara River reaches of perennial rising groundwater that exist near the Basin boundaries (i.e., Santa Paula/Fillmore Basins and Fillmore/Piru Basins) are intermittently monitored by United. They measure streamflow discharges and collect global positioning system (GPS) point data of the distal upstream extent where water is flowing in the river channel. United has established monitoring points where they have determined the approximate location of peak flow at the Santa Paula/Fillmore Basins and Fillmore/Piru Basins boundaries.

Figure 2.1-10 shows the active and historical recording stream flow gauges in Fillmore and Piru Basins operated by the USGS or VCWPD. Stream flow datasets are available for download through the USGS NWI Web Interface (https://waterdata.usgs.gov/ca/nwis/). These datasets include, but are not necessarily limited to, the following:

- Daily stream flow data and statistics
- Average monthly (statistics)
- Average annual (statistics)
- Annual stream flow peak

Stream flow datasets are also available for download through the VCWPD's Hydrologic Data Server (Hydrodata). These datasets include, but are not necessarily limited to, the following:

- Average daily streamflow
- Annual and event streamflow peaks

A summary of stream flow monitoring protocols is included in Section 3.5.2.4.

3.5.1.5.2 Surface Water Quality Monitoring

United's existing surface water monitoring network has been adopted by the FPBGSA. The historical surface water monitoring point inventory includes 16 sites located within the Fillmore Basin. As shown on Figure 2.1-11, 4 of these sites are included in United's current surface water quality monitoring. There are over 3,100 surface water quality records in FPBGSA's database with a date range of 1951 through 2018. Additional sources of surface water quality data contained in FPBGSA's database (transferred from United) generally originated from the following entities:

- City of Fillmore
- DWR
- SWRCB DDW (formally under California Department of Public Health [CDPH])
- USGS

United conducts monthly surface water sampling for TDS, chloride, and nitrate in the Santa Clara River downstream of the Ventura/Los Angeles County Line (see Figure 2.1-11). On a quarterly basis, surface water samples are collected for general mineral analysis from the Santa Clara River and tributaries at approximately 8 locations in the Fillmore and Piru Basins and nearby areas. On alternate quarters, United has a reduced suite of analytes run for some sample locations (United, 2016a).

The Ventura County Stormwater Resources Group coordinates surface water sampling for all MS4 permittees (cities and county), and they collect wet and dry weather runoff samples in storm drains and rivers. For the Santa Clara River watershed, they sample at United's Freeman Diversion Facility in Saticoy and one storm drain each in the Cities of Santa Paula and Fillmore. Annual reports are published, and can be downloaded from their website (www.vcstormwater.org).

3.5.1.6 Meteorological Monitoring

Fillmore Basin has historically experienced a Mediterranean type climate (mild wet winter and dry summer). The timing and intensity of precipitation throughout the wet season impacts both surface water runoff (to rivers and streams) and groundwater recharge. Meteorological (climate) conditions data (i.e., measured precipitation gauge and evaporation data) are available for download through VCWPD's Hydrodata online portal. Available datasets and active Fillmore Basin monitoring points are described in Section 2.3 of Appendix K. These atmospheric datasets are important inputs in United's Regional Model, which served as a vital groundwater conditions assessment tool in preparing this GSP.

Precipitation datasets accessed through VCWPD's Hydrodata portal include hourly totals for recording gauges and daily rainfall totals for standard (i.e., manually measured) gauges. Data can also be downloaded by summed monthly or water year totals. There are four active sites (stations) within the Fillmore Basin.

ET is a water budget component that combines the processes of plant transpiration, surface water and soil moisture evaporation. ET can be estimated from weather station measured parameters that include, but are not necessarily limited to, the following components:

- Wind speed
- Air temperature
- Humidity
- Solar radiation

Site-specific ET is dependent on the parameters listed above, but also includes factors such as vegetation ground cover and soil moisture. Fillmore Fish Hatchery Site (171) is the only monitoring point within the Fillmore Basin that records monthly evaporation data. One of the four active precipitation gauges in the Basin shares this site location.

3.5.1.7 Land Elevation Monitoring

Land elevation monitoring related to the undesirable result of land subsidence is conducted using InSAR datasets provided by TRE Altimira and DWR. Figure 2.2-26 shows the extent of land subsidence monitoring (i.e., the entire Basin). Annual changes in land surface elevation are measurable with InSAR within 0.07 feet (Towill, 2021; DBS&A, 2021a). Cumulative changes in land subsidence have larger errors that increase over time (to at least 0.1 foot for cumulative changes that are estimated between 2015 and 2019).

3.5.2 Monitoring Protocols for Data Collection and Monitoring (Reg. § 352.2)

Robust and reliable data collection protocols are used to gather monitoring network data for assessing groundwater and related surface water conditions in the Filmore Basin. The SAP (Appendix L) details groundwater level and water quality (groundwater and surface water) data collection standardized field and reporting methods. Monitoring protocols described in detail in the SAP are summarized in this section along with groundwater production measuring and stream flow monitoring protocols.

The SAP includes:

- Water sample collection procedures

- Analytical methods to be used
- Groundwater level measurement protocol in water wells
- Data QA and QC procedures

3.5.2.1.1 Groundwater Elevation Monitoring Protocols

The FPBGSA SAP (Appendix L) describes groundwater data collection procedures that will produce reliable basin-specific water level data that can be used to evaluate sustainability in the Fillmore and Piru Basins with respect to the SGMA legislation sustainability indicators.

This subsection summarizes protocols for measuring water levels in wells and steps that are undertaken to ensure the adequacy of the data collection activities. Refer to Section 3 of Appendix L for detailed descriptions of the FPBGSA groundwater level monitoring program protocols that include, but are not necessarily limited to, the following SAP components:

- Field documentation and record keeping
- Scheduling of groundwater level monitoring events
- Equipment testing, inspection, and maintenance requirements
- Measurements and related field activities
- QA/QC

3.5.2.1.2 Manual Groundwater Level Measurements

Manual groundwater level measurements collected in Fillmore Basin wells by United and VCWPD are with either a steel survey tape, acoustic sounder (VCWPD only), or dual-wire or single-wire electric sounder. Permanently installed airlines are also used by United to gather water level measurements in a few production wells that are difficult to measure with an electric sounder or steal tape. Depth to groundwater is measured to a minimum accuracy of 0.1 foot (Reg. § 352.4) relative to the reference point (RP).

Wells exhibiting naturally flowing (artesian) conditions are able to be monitored where this occurs (i.e., at the fish hatchery) because the top of casing is completed several feet above ground surface, allowing for a groundwater elevation at or above ground surface to be measured.

3.5.2.1.3 Recording Groundwater Level Device Measurements

As mentioned in Section 3.5.1.1.2, United has an established pressure transducer and data logger monitoring network in Fillmore Basin. These devices can be used for recording water level measurements in wells on user defined or event-based schedules. When installing pressure transducers, care must be exercised to ensure that the data recorded by the transducers is confirmed with hand measurements.

The electronic components of the device are sealed in a housing that is installed below the water level surface in the well. They measure pressure (commonly in psi) above the sensor and a simple linear correction (coefficient) can be applied to adjust output readings to depth-to-water in the well or water level elevation referenced to mean sea level (given an RP elevation has been surveyed for the site). The devices can be downloaded during site visits or can be connected to telemetry systems to transmit data remotely.

Office-based data processing includes tying the pressure transducers to manual water level measurements and periodically checking (i.e., QA/QC) the reliability of the high-frequency pressure transducer measurements against periodic manual measurements to ensure a high level of confidence in these data. A detailed description of how raw data are collected, processed, and stored is included in Appendix K.

3.5.2.2 Water Quality Monitoring Protocols

Groundwater and surface water sample collection protocols are described in Section 2 of Appendix L that yield reliable basin-specific water quality data. These data are used to evaluate sustainability in the Fillmore Basin with respect to the water quality sustainability indicator set forth in the SGMA legislation.

This subsection summarizes activities associated with data collection, including field sampling methods, documentation, analytical requirements of the SAP, and steps to ensure the adequacy of the data collection activities. All samples collected are analyzed by a laboratory certified under the Environmental Laboratory Accreditation Program (ELAP). The specific sample collection procedure will reflect the type of analysis to be performed and DQOs.

3.5.2.2.1 Groundwater Quality

Before purging and collecting a sample for laboratory analysis, groundwater level elevation should be measured in the well (see Section 3.5.2.1.1). Each well not equipped with low-flow or passive sampling equipment will be purged of a minimum of three casing volumes, if practicable, prior to sampling to ensure that a representative groundwater sample is obtained. Professional judgment will be used to determine the proper configuration of the sampling equipment with respect to well construction such that a representative ambient groundwater sample is collected.

Field parameters should be collected before, during, and immediately after purging, and should stabilize prior to sampling. Minimum field parameters collected at the time of sampling include specific conductivity or electrical conductivity (EC), pH, and temperature. Additional field parameters may also be useful for meeting DQOs and assessing purge conditions (e.g., dissolved oxygen, oxidation/reduction potential, and turbidity).

Laboratory analytical methods are described in Section 2.5 of Appendix L. Samples will be accompanied by full chain of custody documentation (see Section 2.3.4 of Appendix L). Samples requiring preservation will be preserved as soon as practically possible, ideally at the time of sample collection. Samples requiring filtration, such as those to be analyzed for metals, will be filtered in the filed prior to preservation.

3.5.2.2.2 Surface Water Quality

Similar methodologies including field parameter collection will be used in sampling surface water as have been summarized above for sampling groundwater and are described in detail in Appendix L. Samples should be collected from flowing streams (not stagnate ponded water). Samples can be collected directly from the water source, so pumps and the purging process described above are not necessary for collecting surface water samples. Section 2.7.2 of Appendix L describes field equipment and instrument considerations.

Laboratory analytical methods are described in Section 2.5. Samples will be accompanied by full chain of custody documentation (see SAP subsection 2.3.4). If field conditions require filtering (e.g., such as with turbid surface water), the water samples will be mechanically filtered to remove suspended particulates prior to the samples being placed in the appropriate containers for laboratory analyses. Samples requiring filtration such as those to be analyzed for metals will be filtered in the filed prior to preservation.

3.5.2.3 Groundwater Extraction Measuring Protocols

Groundwater pumpers that produce groundwater from the Fillmore Basin pay United an extraction fee based on the number of AF they pump during a 6-month period (reporting to United twice per calendar year). Period 1 covers January through June and period 2 covers July through December of each year. A description of the historical groundwater extraction monitoring in Fillmore Basin is provided in Section 3.5.1.4.

Groundwater pumpers are required to self-report groundwater extractions by well to United by one of three methods: domestic multiplier, electrical meter (based on SCE efficiency testing), or water flow meter. For non-reporters, an estimate from historical usage is entered in the groundwater production database for accounting and basin volume calculation purposes.

For wells with water meters, reporting typically involves filing out a form and submitting an accompanying photograph of the digital totalizer reading. The extent to which "smart meters" or automated (advanced) metering infrastructure (AMI) technology is used by individual well owners to quantify their groundwater production is unknown in the Fillmore Basin. There is not currently a mechanism by which well owners can automatically report groundwater production from their water meters to United or the FPBGSA.

De minimis domestic (M&I) pumping can be reported to United using a multiplier of 0.2 AF per person per 6-month period with a minimum of 0.5 AF (e.g., if there are 1 or 2 people reporting domestic usage on a well, then 0.5 AF minimum is assessed). De minimis pumpers (extractors) that have a meter on their well discharge have the option of calculating their usage based on the meter reading which may show less than 0.5 AF usage, and are billed based on actual usage.

3.5.2.4 Stream Flow Monitoring Protocols

Manual (hand) stream flow calculations are based on velocity measurements from a current meter at several intervals along a wetted cross-sectional profile of a stream channel. Established manual stream flow discharge measurement techniques include, but are not limited to, the following methods:

- In-stream wading measurements (e.g., using a top-set wading rod)
- Bridge suspended current meter
- Acoustic doppler current profiler (ADCP)

United has historically collected in-stream discharge measurements using a top-set wading rod equipped with a velocity meter. Velocity measurements were historically performed using USGS Type AA or Pygmy current meters. More recently acoustic doppler velocimeters (SonTek FlowTracker or FlowTracker2) or electromagnetic velocity meters (Hach FH950) are being used. United generally uses established USGS protocols (USGS, 2004; Turnipseed and Sauer, 2010) for wading stream flow measurements. Manual stream flow monitoring in the Fillmore Basin is summarized in Section 3.5.1.5.1, and additional information can be found in Appendix K. United and VCWPD maintain recording gauges (Figure 2.2-11).

Recording stream flow gauges typically measure surface water stage height (i.e., water surface level). Site-specific rating curves are established by correlating stage height with manual stream flow discharge measurements, which are periodically collected for this purpose. The rating curve is generally revised over time (e.g., as additional velocity data are collected or if the channel is significantly modified), typically using linear regression methods.

Recording gauges can be affixed to a bridge or other stationary structure that transverses a water course. These stations are equipped with a device (e.g., affixed float or sensor) that can measure stage. Stilling wells installed in stream banks are also commonly employed, and are frequently constructed adjacent to weirs that afford ideal laminar flow conditions.

Recording gauges can be equipped with telemetry systems that transmit data in near real-time. Data that are publicly accessible in real-time (e.g., via the USGS National Water Information System [NWIS]) are generally initially reported as "Provisional" and are later evaluated with a QA/QC process and revised by the monitoring entity, if necessary, before being published as "Approved."

3.5.3 Representative Monitoring (Reg. § 354.36)

Representative monitoring sites are designated for groundwater level monitoring to make tracking and communicating SMCs efficient and effective. Representative sites (Figure 3.5-4) are selected from the actively monitored wells (Figure 3.5-1) to target locations with relatively long water level records and provide relatively even spatial coverage of the Basin. The corresponding MT and MO are shown (in elevation relative to approximate mean sea level) at each well location on Figure 3.5-4 and listed in Table 3.5-3.

Table 3.5-3. Representative Monitoring Sites for Groundwater Levels in Fillmore Basin

State Well Number	Elevation (feet msl) [a]	
	Minimum Threshold (MT)	Measureable Objective (MO)
03N20W01C04S	188	375
03N20W03D03S	–52	327
03N20W03J02S	146	338
03N20W05D01S	125	310
03N20W09D01S	17	320
03N21W01P02S	201	270
04N19W30D01S	60	395
04N19W32M02S	150	435
04N19W33D04S [b]	465	475
04N20W22N01S	453	675
04N20W26L01S	31	380
04N20W36MW104	376	401

[a] Groundwater elevation relative to approximate mean sea level (NGVD29).
[b] Well where the MT is based on the critical water level for GDEs (10 feet below the MO).

3.5.4 Assessment and Improvement of Monitoring Network (Reg. § 354.38)

From the available data in the Fillmore Basin reviewed in preparing this GSP, data are generally of high quality and are of sufficient or nearly sufficient quantity and quality for use in assessing the SGMA sustainability indicators. The existing United and VCWPD monitoring programs include substantial annual data collection activities in the Fillmore Basin, and are an important component of the FPBGSA monitoring network. Potential data gaps ranging in sustainability evaluation significance are summarized in this subsection and are described in detail in Appendix K.

Potential data gaps are present in the historical groundwater datasets presented in Section 2 of Appendix K and in existing United and VCWPD monitoring programs described in Section 3 of Appendix K. Existing monitoring networks are the focus here, as they facilitate the gathering of new data and by their enhancement, where practicable, afford important documentation of the progression toward sustainable management in the Fillmore Basin. Filling data gaps will inform GSP five-year update assessments and annual reporting.

The lack of streamflow gauging locations within the Basin is not considered a data gap for the purposes of this GSP. Additional locations are considered infeasible (United, 2011 and 2016b), and there are no SMCs established for interconnected surface water.

3.5.4.1 Groundwater Level Monitoring

Groundwater level data collected from existing monitoring networks are described in the FPBGSA Monitoring Program and Data Gap technical memorandum. This GSP subsection addresses potential spatial and temporal (and or frequency) data gaps that may exist in the FPBGSA groundwater level monitoring network. In 2020, United expanded its water level monitoring program list to include three additional wells in the Fillmore and Piru Basins to fill monitoring network data gaps by using existing privately owned wells, where possible. One of these wells, 4N20W25D02S, is in Fillmore Basin near Sespe Creek and west of the Pole Creek Fan.

3.5.4.1.1 Well Spatial Density by Aquifer Zone

Monitoring network well spatial density in Fillmore Basin was described previously in Section 3.5.1.1.3. Potential spatial data gaps are summarized in this subsection, and Section 3.5.4.4.2 identifies potential new monitor well locations that will serve to fill groundwater level monitoring data gaps. From Table 3.5-1, approximately 70 percent (i.e., 29 of 41) of the monitored wells in the Fillmore Basin are screened discretely in the main or deep principal aquifers.

The majority of wells currently monitored by United and VCWPD screened in a single principal aquifer are completed in Zone A and/or B (main). There are 80 wells per 100 square miles in the Fillmore Basin. Overall, this represents a good distribution of principal aquifer wells. There is a potential monitoring point data gap in Fillmore Basin north of the Santa Clara River and between Timber Creek and Boulder Creek. To minimize this potential data gap, the FPBGSA attempted to obtain easements to an existing well in this area, but was unsuccessful. The FPBGSA is not currently pursuing another well location, but can reinitiate this effort at a future date if deemed critical to a future management strategy.

There is only one monitoring point (well) screened discretely in aquifer Zone C in the Fillmore Basin. There are not many wells that access groundwater from Zone C, but this is not considered a significant lack of data because little groundwater is extracted from this deep zone.

3.5.4.1.2 Temporal and Frequency Assessment

Groundwater levels in California basins are often at their highest annual levels during the spring of each year following winter precipitation and groundwater recharge. They are often at their lowest in the fall preceding the start of the winter rainy season (much of the annual precipitation falls from November through February in Ventura County). Temporal coordination of groundwater level collection activities across the state is important for comparison of water level measurements collected by different monitoring entities. The DWR's BMP #2 specifies that "Groundwater levels will be collected during the middle of October and March for comparative reporting purposes" (DWR BMP 2, 2016).

With respect to the length of the monitoring event time windows DWR offers (DWR BMP 1, 2016):

> Groundwater elevation data will form the basis of basin-wide water-table and piezometric maps, and should approximate conditions at a discrete period in time. Therefore, all groundwater levels in a basin should be collected within as short a time as possible, preferably within a 1 to 2 week period.

As subsequently mentioned, an SGMA requirement is the development of a monitoring network capable of collecting sufficient data to demonstrate short-term, seasonal, and long-term trends in the Basin. At a minimum, biannual data is needed to assess seasonal groundwater level trends for evaluation of GSP implementation. Water levels are collected by both United and VCWPD as part of their established monitoring networks in the Basin during other times of the year for various purposes, but as tight (short) a monitoring event time window as reasonably possible will be scheduled around the middle of October and March of each year. United and VCWPD coordinate their groundwater monitoring event campaigns to the extent practicable. Their respective monitoring program schedules are described in Section 3.5.1.1.1 and shown graphically in Figure 2.1-8.

Most of the pressure transducers in the Fillmore Basin operated by United are programed to a recording frequency of every four hours (six water level measurement per day). These high-frequency data provide a level of detail that is useful in assessing short-term trends that may be masked by biannual or monthly water level measurement programs. Potential groundwater level short-term trends that can be assessed from these data may include, but are not necessarily limited to, the following:

- Daily diurnal fluctuations
- Groundwater recharge events (e.g., in shallow wells near the Santa Clara River)

- Pumping from nearby wells
- Drawdown and recovery when installed in pumping wells

Pressure transducers and data loggers are also valuable for collecting highly reliable data for assessing seasonal high and low trends. United produces groundwater level hydrographs from the high-frequency pressure transducer data that they use to pick spring high (maximum) and fall low (minimum) water levels that are processed for import into their database and are included in Appendix K. These data are especially useful for the spring high and fall low groundwater level elevation contouring. United uses these data and manual water level measurements for groundwater level contouring for inclusion on maps in their hydrogeological conditions report series. United does not store the voluminous recording pressure transducer data directly in their database, but maintains these records in Excel files for individual wells and archives raw data logger downloaded files on their servers.

Equipping additional wells in the Fillmore Basin with pressure transducers and data loggers is planned (e.g., equipping the potential new monitor wells described in Section 3.5.4.4.2) for collecting highly reliable data for assessing short-term and seasonal high and low trends. A description of pressure transducers and data loggers currently deployed as a component of the FPBGSA monitoring network in the Fillmore Basin is included in Section 3.5.1.1.2.

3.5.4.2 Groundwater Quality Monitoring

Groundwater quality data collected from existing monitoring networks are described in Section 3.1 of Appendix K. The following subsections address potential spatial and temporal (and or frequency) data gaps that may exist in the FPBGSA's groundwater quality monitoring network.

3.5.4.2.1 Well Spatial Density by Aquifer Zone

Groundwater monitoring network wells spatial density in Fillmore Basin is described previously in Section 3.5.1.2.2. Spatial data gaps are summarized in this subsection, and Section 3.5.4.4.2 identifies potential new monitor well locations that will serve to fill groundwater quality monitoring data gaps.

From Table 3.5-2, approximately 80 percent (i.e., 17 of 21) monitored wells in the Fillmore Basin are screened discretely in the principal aquifer (Zone A and/or B). There is 0.5 well per square mile in Fillmore Basin. Overall, this represents a good distribution of principal aquifer wells. There is a potential monitoring point data gap in Fillmore Basin north of the Santa Clara River between Timber Creek and Boulder Creek.

There are no wells in the Basin screened discretely in aquifer Zone C. This is not considered a significant lack of data because little groundwater is extracted from this deep zone.

3.5.4.2.2 Temporal and Frequency Assessment

As previously mentioned, an SGMA requirement is the development of a monitoring network capable of collecting sufficient data to demonstrate short-term, seasonal, and long-term trends in the Basin. At a minimum, semiannual data are needed to assess seasonal groundwater quality trends for evaluation of GSP implementation.

Groundwater quality samples are currently collected on varying schedules in the in the Fillmore Basin. United samples monitoring and production wells in the Fillmore Basin biannually in the spring and fall to evaluate the quality of groundwater within their boundary (United, 2016a). These scheduled sampling runs are occasionally supplemented by targeted event-based sampling. VCWPD annually samples production wells within the Basin in the fall. VCWPD's list of groundwater sampling wells is a bit more fluid than United's, and is somewhat dependent on availability of staff's time and the Agency's annual budget. There is a core group of wells that VCWPD prioritizes to be sampled almost every year (green squares on Figure 2.1-9), and if one of these wells is unavailable for some reason, they will often sample a nearby well that is pumping (VCWPD, 2020).

Wells sampled in the Fillmore Basin as part of VCWPD county-wide groundwater quality monitoring program may not be sufficient for SGMA purposes. It is important to sample the same wells from year to year and to collect at least a spring and fall sample each year. Over a period of years that include both dry and wet precipitation years, if groundwater quality seasonal variability is demonstrated to be minimal in a particular well, annual sampling may be sufficient for GSP purposes.

3.5.4.3 Groundwater Extraction Monitoring

Groundwater extraction monitoring and measuring protocols are summarized in Sections 3.5.1.4 and 3.5.2.3, respectively. This subsection addresses potential temporal (and or frequency) data gaps that may exist in FPBGSA's groundwater extraction monitoring network.

An SGMA requirement is the annual reporting of groundwater extractions on a water year basis [23 CCR § 356.2(b)(2)]. Water years begin October 1 and end September 30 of the following year, and are intended to capture a complete annual wet period as opposed to splitting it across two years as is commonly an artifact of calendar year reporting. This is not easily accomplished under FPBGSA's current reporting mechanism, which is tied to United's accounting system (as a

FPBGSA cost saving measure), and if modified would impact several additional basins within United's boundary.

Different schemes have been unofficially proposed for meeting SGMA water year groundwater production reporting requirement for Fillmore and Piru Basins. Large capacity groundwater pumpers could be requested to report quarterly (or monthly) to develop a dataset for estimating seasonal variability in water demand supplied by groundwater pumping. Another potential solution is to require all pumpers in the Basins to report groundwater production on a quarterly basis but to-date the Agency has not proposed a formal resolution. FPBGSA is working closely with United to resolve this issue in a timely and cost-effective manner that does not impose additional undue burden on Fillmore and Piru Basins pumpers or United staff.

3.5.4.4 Description of Steps to Fill Data Gaps

The data gap component of Appendix K includes prioritized recommendations (Section 6 of Appendix K) on how refinement and or expansion of the existing monitoring networks in the Fillmore Basin might minimize or eliminate data gaps, especially in critical areas. A plan to install new monitor wells to fill data gaps in the Fillmore Basin is also summarized in this subsection.

3.5.4.4.1 Data Gaps Priority Ranking

Prioritization levels were used to rank FPBGSA monitoring program potential data gaps identified in this GSP. Table 3.5-4 was modified from the table in Section 6.1 of Appendix K to include only those recommendations that pertain to filling data gaps in the existing FPBGSA monitoring network, and does not include the recommendations for filling data gaps pertaining to historical data sets. A simple "Very High-High-Medium-Low-Very Low" priority classification ranking system is employed.

GSP preparation and implementation "value added" evaluated against cost is considered in this recommendation prioritization. For example, it would be advantageous in GSP implementation sustainability evaluation to only use groundwater data collected from properly constructed multiple-well monitoring facilities with completions in each of the aquifer zones in the Basin. Construction of 20 of these facilities equally spaced across the Basins would greatly decrease GSP analysis uncertainty and would be consistent with the DWR's data quality recommendations, but would likely be cost prohibitive for FPBGSA rate payers in the Fillmore and Piru Basins.

Table 3.5-4 summarizes the Appendix K (Section 5) monitoring network data gap analysis recommendations and ranks them by priority. They are ordered by section number in the technical memorandum.

Table 3.5-4. Summary of Monitoring Network Data Gaps

Appendix K Section	Priority Level	Description of Potential Monitoring Network Data Gap
5.1.1, 5.1.4, 5.3.1.1, 5.4.1.1	High	Investigate wells included in United and VCWPD's existing monitoring networks of unknown well construction (e.g., contact owner for records or perform a well video survey). If screened interval cannot be determined, they should be replaced in the monitoring networks with wells of known construction if potential substitute monitor points exist nearby.
5.1.3	High	Evaluate existing monitoring network water level data RP elevation accuracy, consistency of vertical datum reference and recording of measurement offset height above/below RP for depth to water below ground surface calculations.
5.1.4, 5.3.1.1, 5.3.1.2, 5.4.1.2	Medium	Identify additional monitoring points (for collecting groundwater quality and level) using existing wells screened discretely in each of the principal aquifers, where possible. For water quality, these might include additional groundwater sampling from existing wells surrounding known radiochemistry and selenium "hot spots".
1.2.6, 5.3.1.2, 5.4.1.2, 6.2	Medium	Construct a new multiple-well groundwater monitoring site near the Santa Paula/Fillmore Basin boundary for assessing vertical groundwater gradients and collecting aquifer zone specific water quality samples.
5.1.4, 5.4.1.2	High	Identify additional monitoring points for measuring groundwater levels using existing shallow wells screened discretely in the principal aquifer and/or construct new shallow monitor wells near the Santa Clara River and its tributaries.
5.1.4, 5.4.2	Medium	Equip additional wells in the Basin with pressure transducers and data loggers (AMI equipment can include pressure transducers for measuring water level). Wells identified in the GSPs as sustainable management criteria RMPs should be prioritized for pressure transducer and data logger deployment.
5.5.1	Medium	Consider a policy that establishes groundwater extraction reporting method requirements for all pumping wells in the Fillmore and Piru Basins. Additionally, consider commissioning a feasibility study that includes cost estimates to equip large capacity production wells in the Basins with AMI technology.
5.5.1	Very High	Gather groundwater production data sufficient for reporting to DWR by water year and for use in preparing water budgets.
5.5.1	Low	Quantification of potential unreported pumping in the Basin.

3.5.4.4.2 Potential New Monitor Wells

A portion of FPBGSA's Proposition 1 Grant includes funds earmarked for constructing new monitor wells to fill monitoring network data gaps in the Fillmore and Piru Basins (see Section 6.2 of Appendix K). Appendix K identifies several potential locations for installation of new shallow Zone A monitor wells and a nested (multi-depth monitoring facility) site. United staff have reviewed the potential locations for new wells suggested in Appendix K, and have identified existing wells that could be substituted for some of the shallow wells. It is proposed that these existing wells be added to the monitoring network to reduce the need for construction of new wells to address data gaps in these areas.

Existing wells were not located that would address some of the other data gaps. Four new monitor well sites are proposed (Figure 3.5-1) to be constructed:

- Three shallow single-completion wells at the Cienega site
- One deep triple-completion well near the Fillmore and Santa Paula basins boundary

It is unlikely that new monitor wells will be installed elsewhere, and existing wells will provide the data for four of the locations (this includes the currently monitored well in the Bardsdale area).

4. Projects and Management Actions to Achieve Sustainability Goal (Reg. § 354.44)

The FPBGSA has developed a list of potential projects and/or management actions that will be further considered for implementation in the post-GSP adoption time frame. The FPBGSA has not identified unmitigated significant and unreasonable impacts that would result from the implementation of the GSP. However, the FPBGSA also recognizes that there are project or management actions that could enhance the water resources of the Fillmore Basin and aid in keeping the Basin closer to the desired future conditions as represented by the measurable objectives.

The potential projects or management actions being considered by the FPBGSA include, but are not necessarily limited to, the following:

- Supporting Cienega Springs Restoration project as drought refuge
- Monitor wells at Cienega Springs Restoration project site
- Installation of shallow monitor wells across basin
- Buying supplemental water when available
- Additional water quality sampling
- Arundo removal
- Subsidence studies: critical infrastructure, City of Fillmore and Town of Piru gravity systems (water, sewer), install continuous GPS (CGPS) stations

4.1 Project #1: Supporting the Cienega Springs Restoration Project as a Drought Refuge

Technical analyses show that groundwater extractions in the Basin can exacerbate the effects of major, multi-year droughts on the rising groundwater that supports the GDE areas in the vicinity of the fish hatchery and the adjacent Cienega Restoration Project. These effects include vegetative stress when, for example, the decline of water levels below the critical water levels sooner and keeping the water levels depressed below the critical water level longer when normal or wet conditions return.

The FPBGSA desires to dampen the impacts of groundwater extraction by supporting the restoration efforts at the Cienega Restoration Project. The primary action being considered by the FPBGSA is to provide supplemental groundwater to the restoration program during multi-year droughts when the shallow groundwater levels decline to below the critical water level. The groundwater would be supplied from an existing production well (if a suitable well can be found or alternatively a newly constructed well) that is extracting water from the deeper hydrostratigraphic units (i.e., not the shallow aquifers). CDFW and the restoration management team would use the water in the manner they deem most beneficial to their restoration program.

The mitigative effects of this action include:

- Providing a refuge for vegetation and wildlife during a period of prolonged drought
- Supplying water that can be used to irrigate additional land parcels that are not served by the effluent from the fish hatchery operations
- Providing a natural seed supply that will be important for revegetation efforts in post-drought time frame
- Possible use as a seed source area for a "seed bank" that can function as a repository for native vegetation seeds for use in future restoration programs

Monitoring the depth of the shallow groundwater near this GDE area is an important component of this project. The FPBGSA recognized the lack of shallow aquifer groundwater level data in this area as a data gap and has proposed the installation of three monitor wells to serve as the reference wells for this project. The monitor wells are further described in another project.

Details of how this project would be implemented have not yet been developed. FPBGSA staff have engaged with CDFW representatives about this project, and the conversations are continuing. A detailed mitigation plan will be developed after the GSP has been adopted by the FPBGSA and the GSP has been submitted to DWR for their review (January 2022). The mitigation plan will specify critical project elements, such as source of the groundwater (i.e., which well will be used), timing (including when supplemental groundwater deliveries would start and stop), amount of water to be supplied, and the installation (capital) costs with the associated ongoing operation and maintenance costs. An implementation timeline will consider when the restoration project will be sufficiently far enough along in its development to receive the supplemental groundwater. The mitigation plan will be developed in a transparent manner with input from stakeholders, directors, and Cienega Springs Restoration Project management team considered during the development process. The FPBGSA would consider developing, adopting, and implementing the mitigation plan, likely in 2022 or 2023.

4.2 Project #2: Construction of Shallow Monitor Wells at Cienega Springs Restoration Project Site

The FPBGSA included the construction of new monitor wells (up to three) in the current grant scope of work and budget for GSP development. Data gap analyses have identified a need for additional water level information for the shallow aquifer system near this project site where rising groundwater supports the GDE complex in the area. The grant funds will be used to install three new shallow monitor wells at locations that will be identified in consultation with CDFW and the restoration team.

The FPBGSA will need to develop a funding mechanism to support the continued monitoring of the water levels in these wells, in addition to periodic (e.g., semiannual) water quality analyses. It is likely that the wells will be equipped with pressure transducers to minimize the number of field visits.

4.3 Project #3: Construction of Shallow Monitor Wells

The FPBGSA included the construction of new monitor wells in the current grant scope of work and budget for GSP development. Data gap analyses have identified a need for additional water level information for the shallow aquifer system across the Basin, and the grant funds will be used to install up to two new shallow monitor wells at yet to be determined locations in the Fillmore Basin. The locations will be defined once land access agreements and easements are procured.

The FPBGSA will need to develop a funding mechanism to support the continued monitoring of the water levels in these wells, in addition to periodic (e.g., semiannual) water quality analyses. It is likely that the wells will be equipped with pressure transducers to minimize the number of field visits.

4.4 Project #4: Purchase Supplemental Waters

The FPBGSA will consider establishing a discretionary fund that will be used to purchase supplemental waters when they are available. The amount of these waters that become available will vary from year to year, with little or no water available most years. A likely source of supplemental water could come from United's Table A allocation and the opportunity that allocation affords United to purchase Article 21 waters. In the past, United has used their funds to purchase Article 21 waters and deliver them via the Santa Clara River to downstream users. A significant portion of the waters infiltrate in the Fillmore and Piru Basins, thus increasing the water levels and groundwater storage.

It has been suggested by stakeholders that the FPBGSA should consider establishing a discretionary fund that would be used solely for the purchase of supplemental water. Conceptually, when United is informed that Article 21 waters are available, the FPBGSA could elect to supplement the United funds for the purchase of a larger quantity of water. The FPBGSA would work with United on the delivery of those waters so that the appropriate portion of the Article 21 waters would percolate in the Fillmore Basin.

The FPBGSA will also consider exploring relationships with other entities that may, on occasion, have supplemental water that could be purchased or are in a position to sell some of their water entitlements to raise capital. There are several existing water banks in California that could be explored to identify which member entities might be amenable to selling water when the conditions and pricing are appropriate. This a long-lead-time effort that will require outreach to water bank operators and their member entities to craft buy-sell agreements in advance of a possible transaction. The purchase of water currently stored in an existing water bank affords the FPBGSA flexibility in how and when the water is delivered. If it is not needed immediately, the water can remain in the water bank. If those waters cannot be physically delivered to the Fillmore and Piru Basins due the lack of suitable conveyance infrastructure, the water entitlement can be traded to others with access to water conveyance infrastructures (e.g., Santa Clarita Valley Water Agency) that enable delivery of the water to the basin via Castaic Lake or Lake Piru.

It is anticipated that the FPBGSA will evaluate the pros and cons of implementing a program to purchase supplemental waters and, if deemed appropriate, will develop and implement such a program prior to the submittal of the five-year update to the GSP.

4.5 Project #5: Additional Water Quality Sampling

The FPBGSA will consider augmenting the water quality network in the vicinity of Pole Creek Fan. This area was identified (Appendix K) as having limited water quality information on analytes that are near a regulatory threshold. If additional water quality sampling is deemed appropriate by the FPBGSA, a detailed monitoring program outlining which wells would be sampled, the sampling frequency, and the suite of analytes will be prepared and implemented by the FPBGSA prior to the five year update to the GSP.

The FPBGSA would need to identify who is going to collect these additional samples (e.g., FPBGSA staff, consultant) and develop a funding source for these activities. Water quality regulatory authorities do not fall into the purview of FPBGSA, but the Agency is committed to monitoring the water quality and working with the appropriate entity that does have regulatory authority to address any concerns identified in the future.

4.6 Project #6: Non-Native Vegetation Removal

The FPBGSA will consider developing a program to assist other entities in the removal of non-native vegetation (e.g., arundo, tamarisk). The program would likely focus on providing financial or in-kind services to assist other entities engaged in the removal of non-native vegetation species that are intensive water users. Periods of vegetation die-off in the GDE areas associated with a prolonged series of drought years creates opportunities for plants such as arundo and tamarisk to aggressively colonize areas impacted by the die-off. The FPBGSA will evaluate the cost-benefit relationship of a non-native vegetation removal program as integrated into other entities vegetation removal activities. Prior high-level cost estimates of arundo removal (Bell et al., 2016) vary depending on the density of arundo per acre (e.g., from as low as $5,500 per acre for high density areas that can be efficiently removed with heavy machinery up to the range of $24,500 to $44,250 per acre for moderate and low density areas, respectively, which require more manual labor to treat localized occurrences). Effective (i.e., long-lasting) removal of arundo for the Basin would likely require coordination with upper Watershed (i.e., Santa Clarita) to remove all sources of the arundo that would otherwise likely transport and recolonize downriver in the Basin. The non-native vegetation removal program, if deemed appropriate by the FPBGSA, will be include the preparation of an implementation and funding plan by the FPBGSA prior to the five-year update to the GSP.

4.7 Project #7: Subsidence Infrastructure Vulnerability Evaluation

The FPBGSA will consider developing an infrastructure vulnerability evaluation of civil infrastructure that may be susceptible to differential, inelastic ground subsidence. The Fillmore Basin Pumpers Association (FBPA) (letter dated March 9, 2021) expressed a desire for the FPBGSA to study the major infrastructure in the basin (e.g., bridges, pipelines, gravity sewage, gravity water lines, roads). The focus of the study would be to identify the sensitivity of these structures to differential subsidence and to establish thresholds (e.g., how much inelastic subsidence is too much) that could be used to refine the definition of significant and unreasonable and the related minimum threshold. Additionally, the FBPA recommended installing permanent CGPS stations (at least one in the Fillmore Basin) to help distinguish between subsidence and tectonic movement.

If deemed appropriate by the FPBGSA, a subsidence infrastructure vulnerability evaluation plan will be prepared and implemented (with a funding plan) by the FPBGSA prior to the five-year update to the GSP. The Fillmore Basin is classified as having a low potential for subsidence by DWR (2014), and DBS&A (2021) reaffirms this low potential.

5. Plan Implementation

Implementation of the GSP requires the identification of funding sources and development of an implementation schedule, including how and when annual reports and periodic GSP reevaluations will be performed.

5.1 Estimate of GSP Implementation Costs (Reg. § 354.6)

The ongoing FPBGSA administrative costs are covered by a current groundwater extraction fee of $12.00 per acre-foot that generates an estimated income of about $540,000.00. This fee is sufficient to cover routine legal counsel support of agency operations, as well as reimbursement of expenses from United for the executive director and accounting services.

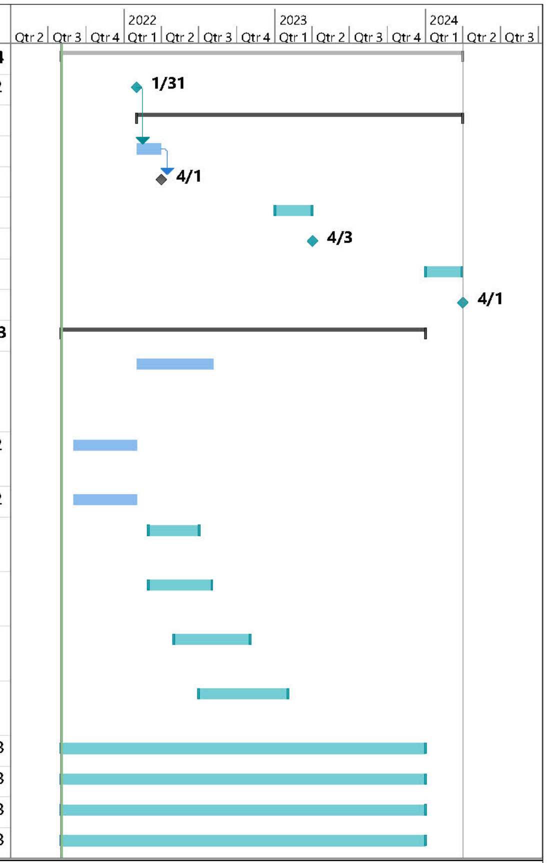
The GSP development grant awarded to FPBGSA from DWR includes funds to cover the installation of monitor wells to reduce data gaps identified during GSP creation (Projects 2 and 3 in Section 4). As identified in Section 4, there are other projects that the FPBGSA will consider implementing in the near-term future (Section 5.2). The project consideration process includes the identification of likely funding sources (e.g., supplemental groundwater extraction fees, ad valorem taxes, grants). The FPBGSA will consider the technical viability and water resource management impact of a project, the cost-benefit relationship, as well as the availability of funding.

5.2 Schedule for Implementation

The schedule for implementation of the GSP has the following major milestones through the first quarter of 2024:

GSP Preliminary Implementation Schedule

Task Name	Duration	Start	Finish
GSP Implementation Schedule2	**695 days**	**Sun 8/1/21**	**Mon 4/1/24**
GSP submitted to DWR	0 days	Mon 1/31/22	Mon 1/31/22
Annual Reports	**564 days**	**Tue 2/1/22**	**Mon 4/1/24**
Prepare 2021 Anual Report	43 days	Tue 2/1/22	Thu 3/31/22
Submit 2021 Annual Report to DWR	0 days	Fri 4/1/22	Fri 4/1/22
Prepare 2022 Anual Report	66 days	Sun 1/1/23	Fri 3/31/23
Submit 2022 Annual Report to DWR	0 days	Mon 4/3/23	Mon 4/3/23
Prepare 2023 Anual Report	65 days	Mon 1/1/24	Fri 3/29/24
Submit 2023 Annual Report to DWR	0 days	Mon 4/1/24	Mon 4/1/24
Project and Management Actions	**630 days**	**Sun 8/1/21**	**Sun 12/31/23**
1- Develop Mitigation Plan for vegetative GDEs - Supplemental groundwaer to Cienga Springs restoration program	133 days	Tue 2/1/22	Thu 8/4/22
2 - Construct Shallow Monitoring Wells at Cienega Springs restoration project site	109 days	Wed 9/1/21	Mon 1/31/22
3 - Construction of Shallow Montioring Wells	109 days	Wed 9/1/21	Mon 1/31/22
4 - Consider creating discretionary fund to Purchase Supplemental Waters	89 days	Tue 3/1/22	Fri 7/1/22
5 - Consider augmenting Water Quality Monitoring Network	110 days	Tue 3/1/22	Mon 8/1/22
6 - Consider creating Non-Native Vegetation Removal Program	132 days	Mon 5/2/22	Tue 11/1/22
7 - Consider performing Subsidence Infrastructure Vulnerability Evaluation	154 days	Fri 7/1/22	Wed 2/1/23
FPBGSA Administration	632 days	Sun 8/1/21	Sun 12/31/23
Groundwater Monitoring - WLs & WQ	632 days	Sun 8/1/21	Sun 12/31/23
Surface Water Monitoring - Flow & WQ	632 days	Sun 8/1/21	Sun 12/31/23
Data Management & Online DMS Updates	632 days	Sun 8/1/21	Sun 12/31/23



The project and management actions consist of activities that have been funded by the Proposition 1 GSP Development Grant, and will be completed prior to the submittal of the GSP to DWR (Projects 2 and 3), as well as projects the FPBGSA board of directors will consider for implementation after GSP submittal. The vegetative GDE mitigation plan would be developed in the first half of 2023 after consultation with the Cienega Springs restoration project management team and basin stakeholders. Projects 4 through 7 will be considered for potential implementation by the board of directors once further details are developed (e.g., project scope, costs, implementation timeline, cost-benefit ratio for water resources). These projects are not specifically required for the basin to remain in a sustainable condition, but could provide water resource benefits if the cost-benefit relationship is acceptable to the stakeholders.

5.3 Annual Reporting

The FPBGSA will prepare the required annual report for submittal to DWR by the April 1 deadline. Groundwater extractions in the Fillmore basin are required to be reported to United every six months on a calendar year basis. The extraction reports for the second half of the year include information from July 1 through December 31, and are due to United shortly after the first of the subsequent year. Data tabulation for the annual report can proceed for several of the report items; however, the pumping totals will be dependent on the timing of those submittals to United.

5.4 Periodic Evaluations

The FPBGSA has an extensive groundwater level and water quality monitoring program for the Fillmore Basin. United monitors key wells on a monthly basis, with others on a quarterly or semiannual basis. If anomalous conditions are observed, United personnel will report those conditions to the FPBGSA board of directors. It is expected that, unless otherwise directed by the FPBGSA board of directors, a quarterly groundwater conditions summary will be delivered to the directors.

SGMA regulations require that the FPBGSA evaluate, and update as needed, this GSP at least every five years (or whenever the GSP is updated). The types of information to be considered in the five-year update include, but are not necessarily limited to, the following:

- Current groundwater conditions for each applicable sustainability indicator relative to measurable objectives, interim milestones, and minimum thresholds.
- A description of the implementation of any projects or management actions, and their effects or expected effects on groundwater conditions.
- Foundational components such as Basin setting based on new information or changes in water use, or the identification of undesirable results and the setting of minimum thresholds and measurable objectives, shall be reconsidered and revisions proposed, if necessary.
- A reevaluation of the monitoring network within the Basin, including whether data gaps persist, or if new data gaps have been identified. The evaluation shall include the following:
  - An assessment of monitoring network function with an analysis of data collected to date, identification of data gaps, and the actions necessary to improve the monitoring network, consistent with the requirements of Section 354.38.

  - If the FPBGSA identifies data gaps, the GSP shall describe a program for the acquisition of additional data sources, including an estimate of the timing of that acquisition, and for incorporation of newly obtained information into the GSP.

- A description of material new information that has been made available since GSP adoption or amendment, or the last five-year assessment.
- A description of actions taken by the FPBGSA, including a summary of regulations or ordinances related to the Plan.
- Information describing any enforcement or legal actions taken by the FPBGSA to achieve the sustainability goal for the Basin.
- A description of completed or proposed Plan amendments.
- Other information the FPBGSA deems appropriate, along with any information required by the DWR to conduct a periodic review as required by Water Code Section 10733.

6. References and Technical Studies (Reg. § 354.4)

AECOM. 2016. *City of Fillmore 2015 urban water management plan, Final draft*. https://www.fillmoreca.com/home/showdocument?id=1914

Bell, I., E. Berry, B. Prentice-Dekker, Z. Mckelvey, M. Steele, and D. Booth. 2016. *Economic analysis of invasive giant reed (Arundo donax) control for the lower Santa Clara River*. Submitted in partial satisfaction of the requirements for the degree of Master of Environmental Science and Management. Bren School of Environmental Science & Management, University of California, Santa Barbara. https://s29420.pcdn.co/wp-content/uploads/2021/04/arundofinalreport_bren-2016-1.pdf

Beller, E.E., P.W. Downs, R.M. Grossinger, B.K. Orr, and M.N. Soloman. 2016. From past patterns to future potential: using historical ecology to inform river restoration on an intermittent California river. *Landscape Ecology*. https://link.springer.com/article/10.1007/s10980-015-0264-7

California Code of Regulations (CCR), Title 23 – Waters, Division 2 – Department of Water Resources, Chapter 1.5 – Groundwater Management, Subchapter 2 – Groundwater Sustainability Plans and Alternatives. Current as of January 1, 2021. https://www.waterboards.ca.gov/laws_regulations/docs/wrregs.pdf

California Department of Public Works (CDPW). 1933. *Ventura County investigation*. Bulletin 46.

California State Water Resources Board (CSWRB). 1956. *Ventura County investigation*. Bulletin 12.

California Geological Survey (CGS). 2002. *California geomorphic provinces*. Note 36. Revised December 2002. https://www.conservation.ca.gov/cgs/Documents/Publications/CGS-Notes/CGS-Note-36.pdf

CGS. 2012. Geologic compilation of Quaternary surficial deposits in southern California. Special Report 217. Revised December 2012. https://www.conservation.ca.gov/cgs/publications/sr217

CH2M Hill. 2006. *Literature review and data acquisition, Task 1A - Evaluate existing models, literature, and data, Upper Santa Clara River chloride TMDL collaborative process*. Prepared for Sanitation District of Los Angeles County and Los Angeles Regional Water Quality Control Board. March 2006.

Daniel B. Stephens & Associates, Inc. (DBS&A). 2017. *Santa Paula Basin hydrogeologic characterization and safe yield study, Ventura County, California*.

DBS&A. 2020. *Sampling and analysis plan*. Prepared for Fillmore and Piru Basins Groundwater Sustainability Agency. May 2020. https://s29420.pcdn.co/wp-content/uploads/2020/10/2020-FPBGSA-SAP_Final-Draft_May-2020-reduced.pdf

DBS&A. 2021a. *Monitoring network and data gap analysis*. Prepared for Fillmore and Piru Basins Groundwater Sustainability Agency.

DBS&A. 2021b. *Subsidence technical memorandum*. Prepared for Fillmore and Piru Basins Groundwater Sustainability Agency.

DBS&A. 2021c. *Sustainable management criteria technical memorandum*. Prepared for Fillmore and Piru Basins Groundwater Sustainability Agency.

Department of Water Resources [California] (DWR). 1959. *Water quality and water quality problems, Ventura Count*y. Bulletin 75.

DWR. 1974a. *Mathematical modeling of water quality for water resources management, Volume 1: Development of the ground water quality model*.

DWR. 1974b. *Mathematical modeling of water quality for water resources management, development of the ground water quality model, Volume 2: Development of historic data for the verification of the ground water quality model of the Santa Clara–Calleguas area, Ventura County*.

DWR. 2006. *Hydrologic Region South Coast, Santa Clara River Valley Groundwater Basin, Fillmore Subbasin*. California's Groundwater Bulletin 118. Last updated January 20, 2006. https://water.ca.gov/-/media/DWR-Website/Web-Pages/Programs/Groundwater-Management/Bulletin-118/Files/2003-Basin-Descriptions/4_004_05_FillmoreSubbasin.pdf

DWR. 2016. *Groundwater sustainability plan (GSP) emergency regulations guide*. July 2016. http://cosumnes.waterforum.org/wp-content/uploads/2020/07/DWR_GSP_Emegency_Regulations_Guide-07-2016.pdf

DWR. 2016a. *Best management practices for the sustainable management of groundwater, Monitoring protocols standards and sites BMP 1*. December 2016. https://water.ca.gov/-/media/DWR-Website/Web-Pages/Programs/Groundwater-Management/Sustainable-Groundwater-Management/Best-Management-Practices-and-Guidance-Documents/Files/BMP-1-Monitoring-Protocols-Standards-and-Sites_ay_19.pdf

DWR. 2016b. *Best management practices for the sustainable management of groundwater, Monitoring networks and identification of data gaps BMP 2*. December 2016. https://water.ca.gov/-/media/DWR-Website/Web-Pages/Programs/Groundwater-Management/Sustainable-Groundwater-Management/Best-Management-Practices-and-Guidance-Documents/Files/BMP-2-Monitoring-Networks-and-Identification-of-Data-Gaps_ay_19.pdf

DWR. 2016c. Best management practices for the sustainable management of groundwater, Hydrogeologic conceptual model BMP 3. December 2016. https://water.ca.gov/-/media/DWR-Website/Web-Pages/Programs/Groundwater-Management/Sustainable-Groundwater-Management/Best-Management-Practices-and-Guidance-Documents/Files/BMP-3-Hydrogeologic-Conceptual-Model_ay_19.pdf

DWR. 2016d. *Best management practices for the sustainable management of groundwater, Water budget BMP 4*. December 2016. https://water.ca.gov/-/media/DWR-Website/Web-Pages/Programs/Groundwater-Management/Sustainable-Groundwater-Management/Best-Management-Practices-and-Guidance-Documents/Files/BMP-4-Water-Budget_ay_19.pdf

DWR. 2016e. *Best management practices for the sustainable management of groundwater, Modeling BMP 5*. December 2016. https://water.ca.gov/-/media/DWR-Website/Web-Pages/Programs/Groundwater-Management/Sustainable-Groundwater-Management/Best-Management-Practices-and-Guidance-Documents/Files/BMP-5-Modeling_ay_19.pdf

DWR. 2017. *DRAFT Best management practices for the sustainable management of groundwater, Sustainable management criteria BMP 6*. November 2017. https://water.ca.gov/-/media/DWR-Website/Web-Pages/Programs/Groundwater-Management/Sustainable-Groundwater-Management/Best-Management-Practices-and-Guidance-Documents/Files/BMP-6-Sustainable-Management-Criteria-DRAFT_ay_19.pdf

DWR. 2018a. *Bulletin 118 boundary modifications for Santa Paula, Fillmore and Piru Basins*. November 19, 2018. https://sgma.water.ca.gov/basinmod/modrequest/preview/191

DWR. 2018b. DWR-provided climate change data and guidance for use during groundwater sustainability plan development. July 2018. https://data.cnra.ca.gov/dataset/sgma-climate-change-resources/resource/833a3998-809d-4585-b9e1-462704631934

DWR. 2018c. Guidance for climate change data use during groundwater sustainability plan development. July 2018. https://data.cnra.ca.gov/dataset/sgma-climate-change-resources/resource/f824eb68-1751-4f37-9a15-d9edbc854e1f

DWR. 2021a. *Sustainable Groundwater Management Act water year type dataset development report*. Sustainable Groundwater Management Office. January 2021. https://data.cnra.ca.gov/dataset/sgma-water-year-type-dataset/resource/79c7b9c1-1203-4203-b956-844554fcec79

DWR. 2021b. Sustainable Groundwater Management Office projected water year types. May 2021. https://data.cnra.ca.gov/dataset/sgma-climate-change-resources/resource/77ccda55-7a3c-4b1e-931d-f950782aeb29

Dibblee, T.W. and H.E. Ehrenspeck (Eds.). 1990. *Geologic map of the Santa Paula Peak quadrangle, Ventura County, California*. Dibblee Foundation Map DF-26. Scale 1:24,000. https://ngmdb.usgs.gov/Prodesc/proddesc_213.htm

Dibblee, T.W. and H.E. Ehrenspeck (Eds.). 1990. *Geologic map of the Fillmore quadrangle, Ventura County, California*. Dibblee Foundation Map DF-27. Scale 1:24,000. https://ngmdb.usgs.gov/Prodesc/proddesc_212.htm

Dibblee, T.W. and H.E. Ehrenspeck (Eds.). 1990. *Geologic map of the Piru quadrangle, Ventura County, California*. Dibblee Foundation Map DF-34. Scale 1:24,000. https://ngmdb.usgs.gov/Prodesc/proddesc_216.htm

Dibblee, T.W. and H.E. Ehrenspeck (Eds.). 1992. *Geologic map of the Simi quadrangle, Ventura County, California*. Dibblee Foundation Map DF-39. Scale 1:24,000. https://ngmdb.usgs.gov/Prodesc/proddesc_225.htm

Dibblee, T.W. and H.E. Ehrenspeck (Eds.). 1992. *Geologic map of the Moorpark quadrangle, Ventura County, California*. Dibblee Foundation Map DF-40. Scale 1:24,000. https://ngmdb.usgs.gov/Prodesc/proddesc_220.htm

Dibblee, T.W. and H.E. Ehrenspeck (Eds.). 1992. *Geologic map of the Santa Paula quadrangle, Ventura County, California*. Dibblee Foundation Map DF-41. Scale 1:24,000. https://ngmdb.usgs.gov/Prodesc/proddesc_222.htm

Dibblee, T.W. and H.E. Ehrenspeck (Eds.). 1993. *Geologic map of the Val Verde quadrangle, Ventura County, California*. Dibblee Foundation Map DF-50. Scale 1:24,000. https://ngmdb.usgs.gov/Prodesc/proddesc_187.htm

Greene, H.G. and M.P. Kennedy. 1987. *Geology of the California Continental Margin: Explanation of the California Continental Margin Geologic Map Series, Interpretive methods, symbology, stratigraphic units and bibliography: Area 2*. U.S. Geological Survey (USGS) Bulletin 207, pl. 2A. https://ngmdb.usgs.gov/Prodesc/proddesc_43663.htm

Hanson, R.T., P. Martin, and K.M. Kozcot, 2003. *Simulation of ground-water/surface-water flow in the Santa Clara-Calleguas Ground-Water Basin, Ventura County, California*. A contribution of the Southern California Regional Aquifer-System Analysis Program. USGS Water-Resources Investigations Report 02-4136. https://pubs.usgs.gov/wri/wri024136/wrir024136.pdf

Kibler, C.L., 2021. *Sensitivity of groundwater-dependent riparian woodlands to water table declines*. A presentation of preliminary research made to the FPBGSA at the January 21 public meeting. University of California, Santa Barbara, PhD candidate. Slides: https://s29420.pcdn.co/wp-content/uploads/2021/01/Item-5A-Kibler_GSA_Draft_Slides-2021-01-21.pdf. Presentation: https://youtu.be/72clL-bsOOc.

Kibler, C.L., C.E. Schmidt, D.A. Roberts, J.C. Stella, L. Kui, A.M. Lambert, and M.B. Singer. 2021. A brown wave of riparian woodland mortality following groundwater declines during the 2012-2019 California drought. *Environmental Research Letters* 16 (July 28). https://s29420.pcdn.co/wp-content/uploads/2021/07/Kibler_2021_Environ._Res._Lett._16_084030_California-drought.pdf

Land IQ. 2021. 2018 statewide crop mapping. https://data.cnra.ca.gov/dataset/statewide-crop-mapping

Larry Walker Associates (LWA). 2015. *Lower Santa Clara River salt and nutrient management plan*. Prepared for City of Ventura, City of Fillmore, City of Santa Paula, Ventura County Water Works District 17, United Water Conservation District, Farm Bureau of Ventura County, Ventura County Public Works Agency/Watershed Protection District. April 2015.

https://www.waterboards.ca.gov/losangeles/water_issues/programs/salt_and_nutrient_management/docs/2015/May/DraftSaltandNutrientManagementPlan/Section1IntroductionandGoals.pdf

Los Angeles County Sanitation District (LACSD). 2008. *2008 Chloride source identification/ reduction, pollution prevention, and public outreach plan*.

Los Angeles Regional Water Quality Control Board (LARWQCB). 1994. *Basin plan for the coastal watersheds of Los Angeles and Ventura Counties*. Beneficial Uses (Chapter 2) and Water Quality Objectives (Chapter 3). Updated May 6, 2019. https://www.waterboards.ca.gov/losangeles/water_issues/programs/basin_plan/basin_plan_documentation.html

Mann, John F. Jr. & Associates (Mann). 1959. *A plan for groundwater management*. Prepared for United Water Conservation District. September 1, 1959. https://s29420.pcdn.co/wp-content/uploads/2020/10/1959-Mann-A-Plan-for-Ground-Water-Management.pdf

Mukae, M. and J.M. Turner. 1975. *Ventura County water resources management study, Geologic formations, structures and history in the Santa Clara Calleguas area*. Ventura County Department of Public Works Flood Control District, Technical Information Record. January 1975.

National Marine Fisheries Service (NMFS). 2012. *Southern California steelhead recovery plan*. Prepared by Southwest Region, Protected Resources Division, Long Beach, California. https://repository.library.noaa.gov/view/noaa/15988

Natural Resources Conservation Service (NRCS). 2009. *National Engineering Handbook Part 630, Hydrology*. Chapter 7 Hydrologic Soil Groups. January 2009. https://directives.sc.egov.usda.gov/OpenNonWebContent.aspx?content=22526.wba

Nichols, D.R. and J.M. Buchanan-Banks. 1974. Seismic hazards and land use planning. USGS Circular 690. https://pubs.er.usgs.gov/publication/cir690

Oakley, N.S., B.J. Hatchett, D. McEvoy, and L. Rodriguez. 2019. *Projected changes in Ventura County climate*. Western Regional Climate Center, Desert Research Institute, Reno, Nevada. Available at <wrcc.dri.edu/Climate/reports.php>.

Parameter-elevation Relationships on Independent Slopes Model (PRISM) Climate Group. 2004. http://prism.oregonstate.edu. Created February 4, 2004.

Porcello, J., J. Rumbaugh, and S. Panday. 2021. Memorandum to United Water Conservation District regarding Expert panel review of the expansion and update to the Ventura Regional Groundwater Flow Model (Ventura County, California). August 19, 2021. https://www.unitedwater.org/wp-content/uploads/2021/10/Expert-Panel-Review-Memo-UWCD-Model-2021-08-19.pdf

Predmore, S.K., K.M. Koczot, and K.S. Paybins. 1996. *Documentation and description of the digital spatial data base for the Southern California Regional Aquifer-System Analysis Program, Santa Clara-Calleguas Basin, Ventura County, California*. U.S. Geological Survey Open-File Report 96-629. https://ca.water.usgs.gov/archive/reports/ofr96_629/index.html

San Francisco Estuary Institute (SFEI). 2011. *Historical ecology of the Lower Santa Clara River, Ventura River, and Oxnard Plain: An analysis of terrestrial, riverine, and coastal habitats.* Contribution Number 641. August 2011. https://www.sfei.org/documents/historical-ecology-lower-santa-clara-river-ventura-river-and-oxnard-plain-analysis-terrest

Southern California Gas Company (SoCal Gas). 2020. *Coastal Region Conservation Program multi-species habitat conservation plan*. https://www.fws.gov/ventura/docs/SoCalGasMSHCP/SoCalGasMSHCP2.pdf

Stillwater Sciences (Stillwater). 2018. *City of Ventura special studies—Phase 3: Assessment of the physical and biological conditions of the Santa Clara River estuary, Ventura County, California*. February 2018. https://www.waterboards.ca.gov/losangeles/board_decisions/tentative_orders/other_resolutions/City_of_Ventura/Ventura_Final_PhaseIIIStudies_Report_20180220.pdf

Stillwater. 2021a. *Assessment of groundwater dependent ecosystems for the Fillmore and Piru Basins groundwater sustainability plan*. Prepared for Fillmore and Piru Basins Groundwater Sustainability Agency. December 2021.

Stillwater. 2021b. *Restoration planning at the Cienega Springs Ecological Reserve: Basis of design technical report*. Prepared for California Department of Fish & Wildlife. April 2021. https://santaclarariver.org/sespe-cienega-planning-project/

Stoecker, M. and E. Kelley. 2005. *Santa Clara River steelhead trout: Assessment and recovery opportunities*. Prepared for the Santa Clara River Trustee Council and The Nature Conservancy. December 2005. http://friendsofventurariver.org/wp-content/themes/client-sites/venturariver/docs/santa-clara-river-steelhead-recovery-opp-summary.pdf

The Nature Conservancy (TNC). 2006. *Santa Clara River Upper Watershed conservation plan*. https://www.cerc.usgs.gov/orda_docs/DocHandler.ashx?task=get&ID=1315

TNC. 2008. *Conservation plan for the Lower Santa Clara River Watersheds and surrounding areas.* https://nrm.dfg.ca.gov/FileHandler.ashx?DocumentID=60245

Towill, Inc.. 2021. *InSAR Data Accuracy for California Groundwater Basins CGPS Data Comparative Analysis January 2015 to October 2020*. Final report. Prepared for California Department of Water Resources. April 7, 2021. https://data.cnra.ca.gov/dataset/tre-altamira-insar-subsidence/resource/a1949b59-2435-4e5d-bb29-7a8d432454f5

Trihydro Corporation (Trihydro). 2021. *Monitored natural attenuation assessment report, Former Pacific Coast Pipeline Superfund Site, Fillmore, California*. Prepared for Chevron Environmental Management Company. Revised January 25, 2021. https://www.envirostor.dtsc.ca.gov/public/view_document?docurl=/esi/uploads/geo_report/8759336173/202101%5FFillmore%2DMNA%2DEval%2DRevised%5FRPT%2Epdf

Turnipseed, D.P. and V.B. Sauer. 2010. *Discharge measurements at gaging stations*. USGS Techniques and Methods (Book 3). Chapter A8. https://pubs.usgs.gov/tm/tm3-a8/tm3a8.pdf

U.S. Department of Transportation (USDOT), United States Coast Guard, 1987. Memorandum regarding Navigability of Santa Clara River at Mile 8.42 June 3, 1987. https://www.spl.usace.army.mil/Portals/17/docs/regulatory/JD/NavigableWater/CA_Sec10_Nav_Det/1987-06-03_D11_Memo.pdf?ver=0Vi6oDs6vTor9MU_W7EiSw%3d%3d

U.S. Geological Survey (USGS). 2004. Office of surface water technical memorandum 2004.04 regarding Policy on the use of the FlowTracker for discharge measurements. June 2, 2004. https://hydroacoustics.usgs.gov/memos/OSW2004-04.pdf

United Water Conservation District (United). 2011. Personal communication with Matthew Scrudato of the USGS. March 17, 2011.

United. 2013. *Draft 2013 Piru/Fillmore Basins AB3030 groundwater management plan*. October 2013. https://s29420.pcdn.co/wp-content/uploads/2020/10/2013-DRAFT_Piru-Fillmore_AB3030_GW_Man_Plan_10-23-2013-all.pdf

United. 2015. *DRAFT 2012 and 2013 Piru and Fillmore Basins AB 3030 Biennial groundwater conditions report*. Prepared by Groundwater Resources Department. February 2015. https://www.unitedwater.org/wp-content/uploads/2020/10/2012-2013-Piru-Fillmore-basins-AB3030-Biennial-GW-Cond-Rpt-FINAL.pdf

United. 2016a. *2014 and 2015 Piru and Fillmore Basins biennial groundwater conditions report*. Prepared by Groundwater Resources Department. June 2016. https://www.unitedwater.org/wp-content/uploads/2020/10/2014-2015-Piru-Fillmore-basins-Biennial-GW-Cond-Rpt-FINAL.pdf

United. 2016b. Personal communication with Stuart Hill of the USGS. August 16, 2016.

United. 2017. *Groundwater and surface water conditions report - 2015*. Prepared by Groundwater Resources Department. Open-File Report 2017-01. March 2017. https://www.unitedwater.org/wp-content/uploads/2020/10/UWCD_OFR-2017-01-2015-GW-and-SW-Conds-Report-reduced.pdf

United. 2018. *Ventura regional groundwater flow model and updated hydrogeologic conceptual model: Oxnard Plain, Oxnard Forebay, Pleasant Valley, West Las Posas, and Mound Groundwater Basins*. Open-File Report 2018-02. July 2018. https://www.unitedwater.org/wp-content/uploads/2020/10/VRGWFM_Ver1-0_Documentation_UWCD-OFR2018-02_Complete-Reduced.pdf

United. 2020a. *Annual investigation and report of groundwater conditions within United Water Conservation District: A summary of findings for the previous water year (2018-2019) current water year (2019-2020), and ensuing water year (2020-2021)*. Prepared by Groundwater Department. March 2020. https://www.unitedwater.org/wp-content/uploads/2020/10/2020-Annual-Engineering-Investigation-and-GW-Conditions-Report-1.pdf

United. 2020b. *2019 Santa Paula Basin annual report*. Prepared for Santa Paula Basin Technical Advisory Committee. United Water Conservation District Professional Paper 2020-02 September 2020. https://sgma.water.ca.gov/adjudbasins/documentservice/download/511

United. 2020c. *Summary of past groundwater models and water budgets for the Piru, Fillmore, and Santa Paula Groundwater Basins*. Open-File Report 2020-02. November 2020. https://www.unitedwater.org/wp-content/uploads/2021/08/UWCD_OFR_2020_02_Summary_of_Past_Groundwater_Models_and_Water_Budgets_for_Piru_Fillmore_Santa_Paula_Basins.pdf

United. 2021a. *Ventura regional groundwater flow model expansion and updated hydrogeologic conceptual model for the Piru, Fillmore and Santa Paula Groundwater Basin*s. Open-File Report 2021-01. June 2021. https://www.unitedwater.org/wp-content/uploads/2021/06/UWCD_OFR_2021_01_Ventura_Regional_Groundwater_Flow_Model_Expansion.pdf

United. 2021b. *Implementation of groundwater and surface water model inputs for simulations in support of groundwater sustainability plan development by the Mound, Fillmore and Piru Groundwater Sustainability Agencies*. Open-File Report 2021-02. June 2021. https://www.unitedwater.org/wp-content/uploads/2021/06/UWCD_2021_June_Technical_Memorandum_Future_Modeling_Documentation_GSP_Support.pdf

United. 2021c. E-mail communication between Dr. Bram Sercu and DBS&A. July 23, 2021.

United. 2021d. E-mail communication between Dr. Jason Sun and DBS&A. July 29, 2021.

United. 2021e. *Ventura regional groundwater flow model 2016-2019 update for the Piru, Fillmore, Santa Paula, Mound, Oxnard, Pleasant Valley, and West Las Posas Groundwater Basins*. Open-File Report 2021-02. September 2021. UWCD_OFR_2021_02_Ventura_Regional_Groundwater_Flow_Model_Update.pdf (unitedwater.org)

Ventura County Watershed Protection District (VCWPD) and Los Angeles County Department of Public Works (LADPW). 2005. Santa Clara River enhancement and management plan. Prepared by AMEC Earth and Environmental. https://dpw.lacounty.gov/wmd/watershed/sc/docs/SCREMP_Full_Report.pdf

Ventura County Waterworks District No. 16, 2016. *Piru Wastewater Treatment Plant (Cl-5714), 2015 annual WDR summary report and 2015 Annual groundwater monitoring and summary report*. January 28, 2016.

Ventura Regional Sanitation District. 2010. *Toland Landfill (M&RP No. CI-5644), Spring/summer semi-annual monitoring report*. April 29, 2010.

Watersheds Coalition of Ventura County. 2019. *2019 Integrated regional water management plan*. http://wcvc.ventura.org/IRWMP/2019IRWMP.htm

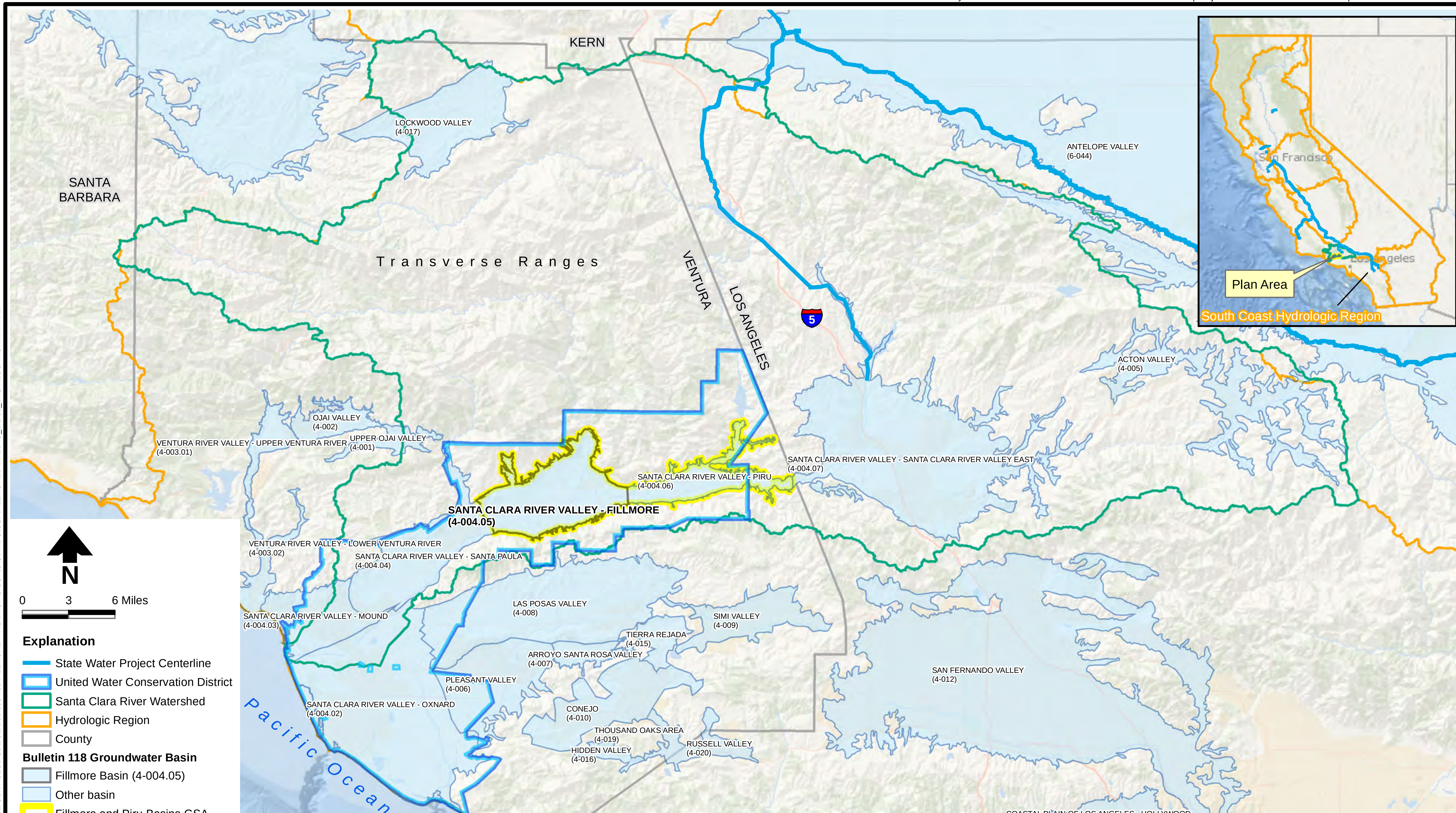
Weber, F.H., E.W. Kiessling, E.C. Sprotte, J.A. Johnson, R.W. Sherburne, and G.B. Cleveland. 1976. *Seismic hazards study of Ventura County, California*. California Department of Conservation, California Division of Mines and Geology Open-File Report 76-5.

Yeats, R.S., M.N. Clark, E.A. Keller, and T.K. Rockwell. 1981. Active fault hazard in southern California: Ground rupture versus seismic shaking. *Geol. Soc. America Bull*. 92(1): 189-196. https://pubs.geoscienceworld.org/gsa/gsabulletin/article-abstract/92/4/189/202660/Active-fault-hazard-in-southern-California-Ground?redirectedFrom=PDF

Yerkes, R.F., A.M. Sarna-Wojcicki, and K.R. Lajoie. 1987. *Geology and Quaternary deformation of the Ventura area, in Recent reverse faulting in the Transverse Ranges, California*. USGS Professional Paper 1339. https://pubs.usgs.gov/pp/1339/report.pdf

Figures

Coordinate System: NAD 1983 StatePlane California V FIPS 0405 Feet | Projection: Lambert Conformal Conic | Datum: North American 1983



Sources: Esri, GEBCO, NOAA, National Geographic, Garmin, HERE, Geonames.org, and other contributors | Esri, Garmin, GEBCO, NOAA NGDC, and other contributors

Notes:
1. The term "basin" refers to a groundwater basin or sub-basin of a basin (e.g., Fillmore sub-basin of the Santa Clara River Valley basin), as defined by California Department of Water Resources (DWR) Bulletin 118.
2. The version of Bulletin 118 basins depicted on this figure is recent as of the 2019 basin boundary modifications.
3. Hydrologic region boundaries are from DWR Detailed Analysis Unit (DAU) dataset.
4. Watershed boundary is from the United States Geological Survey (USGS) Watershed Boundary Dataset (WBD).

Fillmore and Piru Basins Groundwater Sustainability Agency

FILLMORE BASIN GROUNDWATER SUSTAINABILITY PLAN

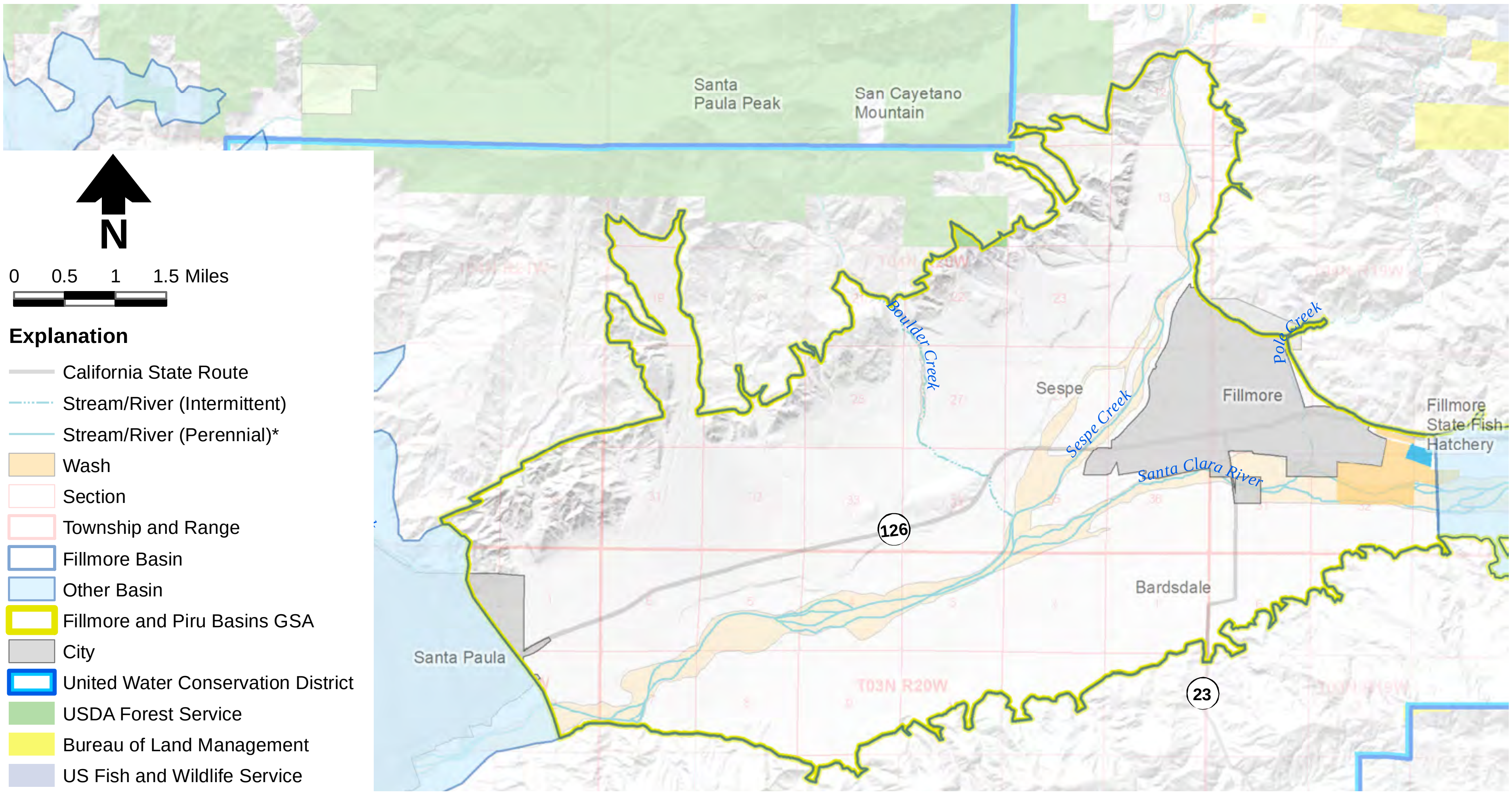
Basin Location Map

DBS&A Daniel B. Stephens & Associates, Inc.
12/16/2021 DB19.1084

Figure 2.1-1

K:\PROJECTS\WATER RESOURCE SERVICES\PUBLIC\DB19.1084.00 FILLMORE PIRU BASINS GSP\GIS\MXDS\GSP\FILLMORE\FINAL\FIG_2.1-01_BASINLOCATIONMAP.MXD

K:\PROJECTS\WATER RESOURCE SERVICES\PUBLIC\DB19.1084.00 FILLMORE PIRU BASINS GSP\GIS\MXDS\GSP\FILLMORE\FINAL\FIG_2.1-02_JURISDICTIONSMAP.MXD



Explanation

- California State Route
- Stream/River (Intermittent)
- Stream/River (Perennial)*
- Wash
- Section
- Township and Range
- Fillmore Basin
- Other Basin
- Fillmore and Piru Basins GSA
- City
- United Water Conservation District
- USDA Forest Service
- Bureau of Land Management
- US Fish and Wildlife Service

CDFW Lands and Easements

- Ecological Reserve
- Fish Hatchery
- Undesignated

Basemap: USGS The National Map: 3D Elevation Program. USGS Earth Resources Observation & Science (EROS) Center: GMTED2010. Data refreshed March, 2021.

Notes:
* Perennial streams (designated by the U.S. Geological Survey [USGS] National Hydrography Dataset [NHD]) exhibit interrupted perennial (i.e., intermittent to ephemeral) conditions in the Santa Clara River Valley (Hanson et al., 2003; SFEI, 2011; Beller et al., 2016; United, 2017).
1. CDFW: California Department of Fish and Wildlife
2. USDA: United States Department of Agriculture

Coordinate System: NAD 1983 StatePlane California V FIPS 0405 Feet | Projection: Lambert Conformal Conic | Datum: North American 1983

Fillmore and Piru Basins Groundwater Sustainability Agency

FILLMORE BASIN GROUNDWATER SUSTAINABILITY PLAN

Jurisdictions Map

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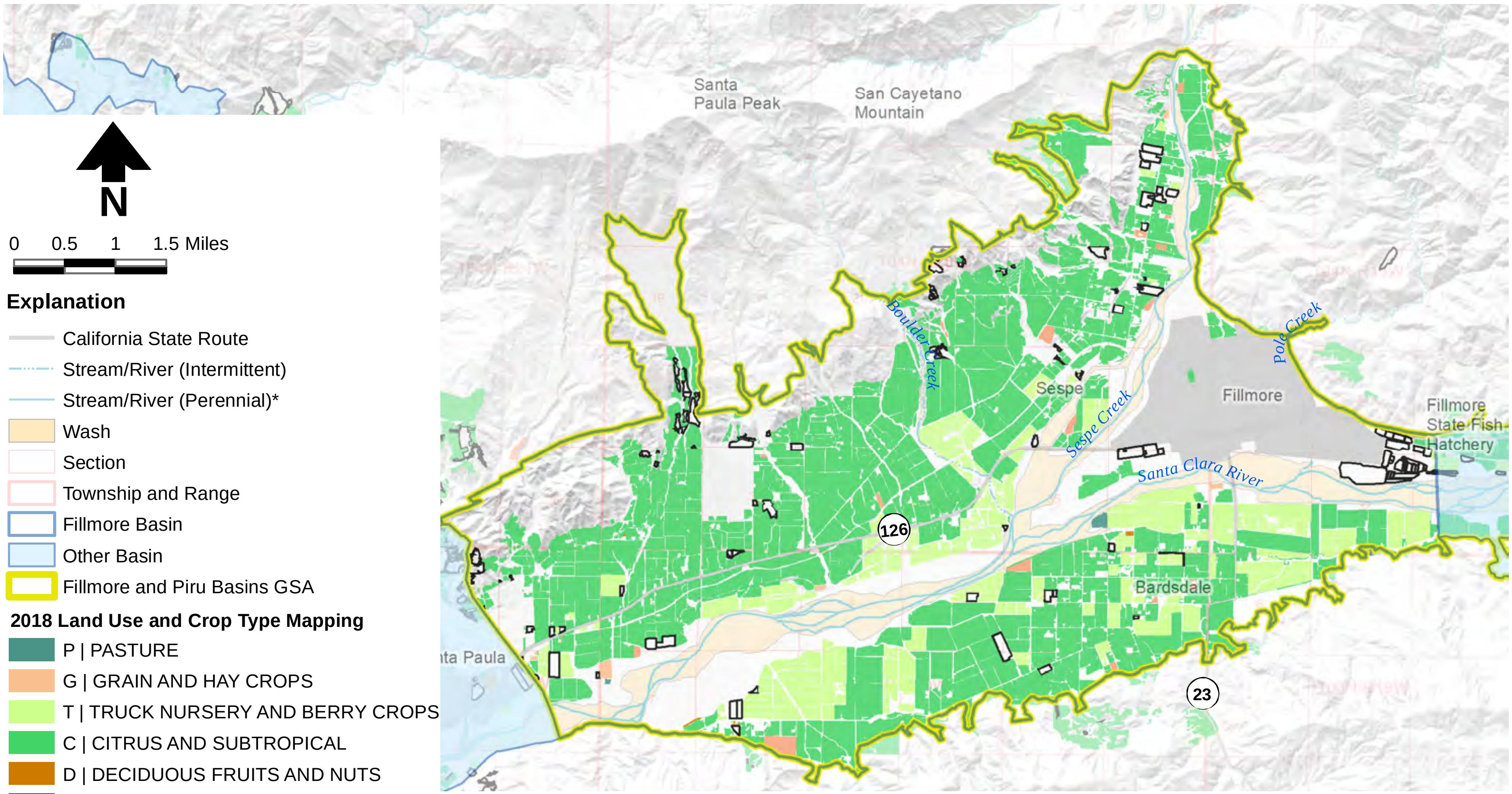
Figure 2.1-2

K:\PROJECTS\WATER RESOURCE SERVICES\PUBLIC\DB19.1084.00 FILLMORE PIRU BASINS GSP\GIS\MXDS\GSP\FILLMORE\FINAL\FIG_2.1-03_LANDUSEMAP.MXD



Explanation

- California State Route
- Stream/River (Intermittent)
- Stream/River (Perennial)*
- Wash
- Section
- Township and Range
- Fillmore Basin
- Other Basin
- Fillmore and Piru Basins GSA

2018 Land Use and Crop Type Mapping

- P | PASTURE
- G | GRAIN AND HAY CROPS
- T | TRUCK NURSERY AND BERRY CROPS
- C | CITRUS AND SUBTROPICAL
- D | DECIDUOUS FRUITS AND NUTS
- V | VINEYARD
- YP | YOUNG PERENNIAL
- U | URBAN
- X | UNCLASSIFIED

Basemap: USGS The National Map: 3D Elevation Program. USGS Earth Resources Observation & Science (EROS) Center: GMTED2010. Data refreshed March, 2021.

Notes:
* Perennial streams (designated by the U.S. Geological Survey [USGS] National Hydrography Dataset [NHD]) exhibit interrupted perennial (i.e., intermittent to ephemeral) conditions in the Santa Clara River Valley (Hanson et al., 2003; SFEI, 2011; Beller et al., 2016; United, 2017).
1. Land use information is from the 2018 Crop Mapping dataset provided by Land IQ (2021) and DWR.

Coordinate System: NAD 1983 StatePlane California V FIPS 0405 Feet | Projection: Lambert Conformal Conic | Datum: North American 1983

Fillmore and Piru Basins Groundwater Sustainability Agency

FILLMORE BASIN GROUNDWATER SUSTAINABILITY PLAN

Land Use Map

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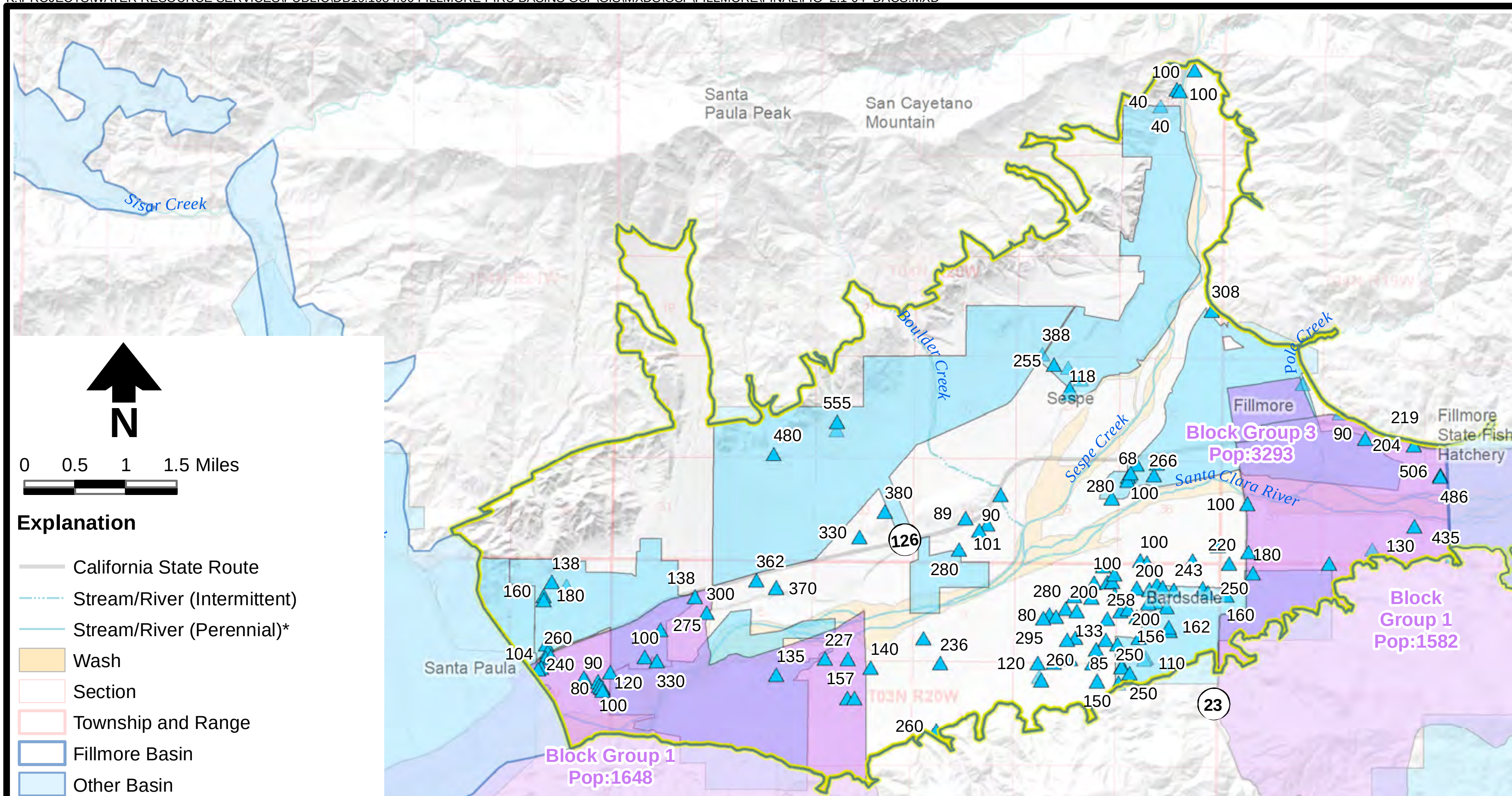
Figure 2.1-3

K:\PROJECTS\WATER RESOURCE SERVICES\PUBLIC\DB19.1084.00 FILLMORE PIRU BASINS GSP\GIS\MXDS\GSP\FILLMORE\FINAL\FIG_2.1-04_DACS.MXD



Explanation

- California State Route
- Stream/River (Intermittent)
- Stream/River (Perennial)*
- Wash
- Section
- Township and Range
- Fillmore Basin
- Other Basin
- Fillmore and Piru Basins GSA
- Domestic Well (perforation depth, ft)
- DAC (Census Block Group)
- Drinking water system

Coordinate System: NAD 1983 StatePlane California V FIPS 0405 Feet | Projection: Lambert Conformal Conic | Datum: North American 1983

Basemap: USGS The National Map: 3D Elevation Program. USGS Earth Resources Observation & Science (EROS) Center: GMTED2010. Data refreshed March, 2021.

Notes:
* Perennial streams (designated by the U.S. Geological Survey [USGS] National Hydrography Dataset [NHD]) exhibit interrupted perennial (i.e., intermittent to ephemeral) conditions in the Santa Clara River Valley (Hanson et al., 2003; SFEI, 2011; Beller et al., 2016; United, 2017).
1. Disadvantaged Community (DAC) information is from DWR DAC Mapping Tool (https://gis.water.ca.gov/app/dacs/).
2. Drinking water system boundaries are from SWRCB's System Area Boundary Layer dataset (as of Oct. 25, 2021).
3. Existing domestic wells are shown:
   a. active wells have solid symbology
   b. inactive or unknown status wells have transparent symbology
   c. perforation depth corresponds to the bottom of well screen/perforation

Fillmore and Piru Basins Groundwater Sustainability Agency

FILLMORE BASIN GROUNDWATER SUSTAINABILITY PLAN

Disadvantaged Communities (DAC)s Map

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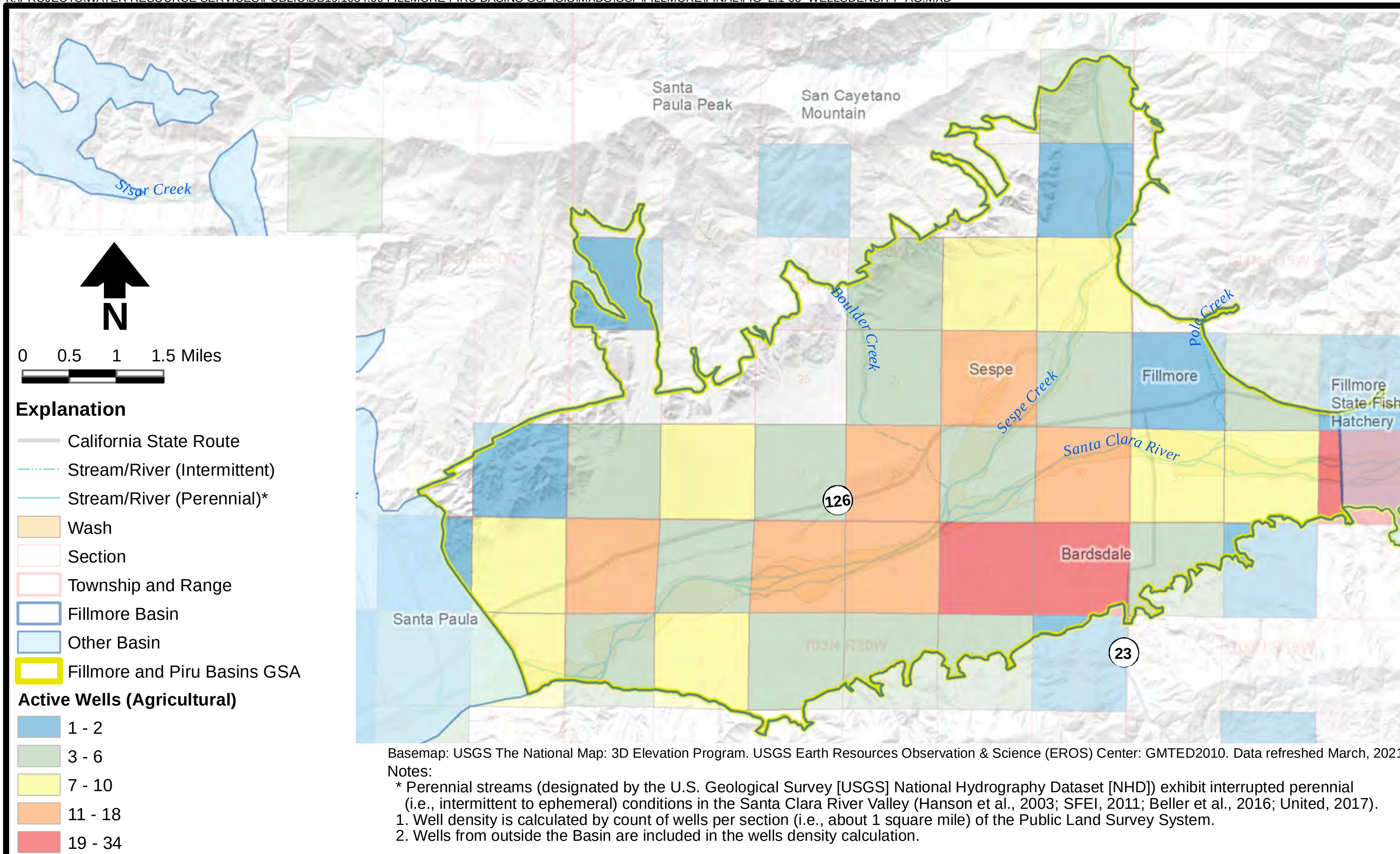
Figure 2.1-4

K:\PROJECTS\WATER RESOURCE SERVICES\PUBLIC\DB19.1084.00 FILLMORE PIRU BASINS GSP\GIS\MXDS\GSP\FILLMORE\FINAL\FIG_2.1-05_WELLSDENSITY_AG.MXD



Coordinate System: NAD 1983 StatePlane California V FIPS 0405 Feet | Projection: Lambert Conformal Conic | Datum: North American 1983

Basemap: USGS The National Map: 3D Elevation Program. USGS Earth Resources Observation & Science (EROS) Center: GMTED2010. Data refreshed March, 2021.

Notes:

* Perennial streams (designated by the U.S. Geological Survey [USGS] National Hydrography Dataset [NHD]) exhibit interrupted perennial (i.e., intermittent to ephemeral) conditions in the Santa Clara River Valley (Hanson et al., 2003; SFEI, 2011; Beller et al., 2016; United, 2017).

1. Well density is calculated by count of wells per section (i.e., about 1 square mile) of the Public Land Survey System.
2. Wells from outside the Basin are included in the wells density calculation.

Fillmore and Piru Basins Groundwater Sustainability Agency

FILLMORE BASIN GROUNDWATER SUSTAINABILITY PLAN

Density of Agricultural Wells Map

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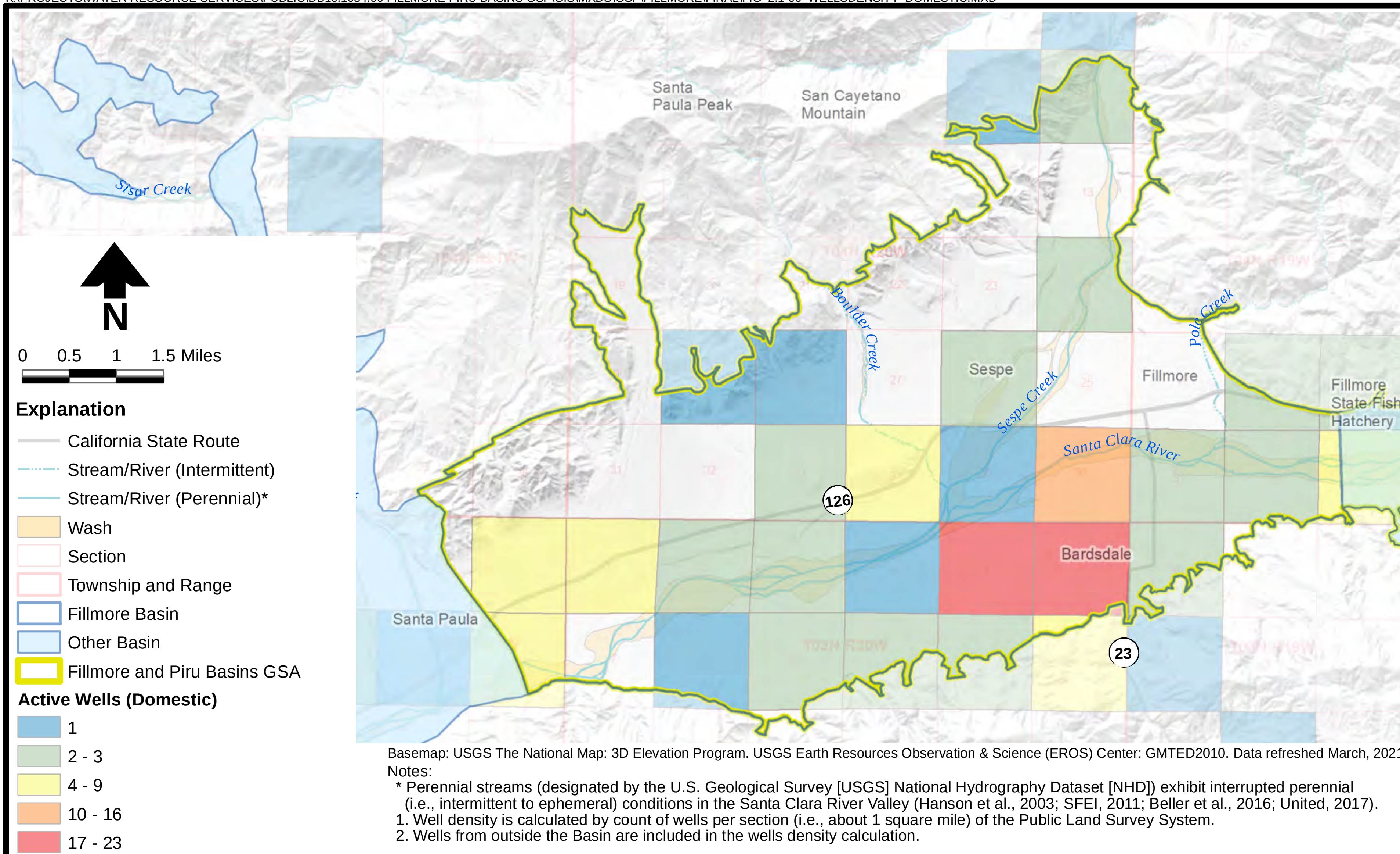
Figure 2.1-5

K:\PROJECTS\WATER RESOURCE SERVICES\PUBLIC\DB19.1084.00 FILLMORE PIRU BASINS GSP\GIS\MXDS\GSP\FILLMORE\FINAL\FIG_2.1-06_WELLSDENSITY_DOMESTIC.MXD



Basemap: USGS The National Map: 3D Elevation Program. USGS Earth Resources Observation & Science (EROS) Center: GMTED2010. Data refreshed March, 2021.

Notes:

* Perennial streams (designated by the U.S. Geological Survey [USGS] National Hydrography Dataset [NHD]) exhibit interrupted perennial (i.e., intermittent to ephemeral) conditions in the Santa Clara River Valley (Hanson et al., 2003; SFEI, 2011; Beller et al., 2016; United, 2017).

1. Well density is calculated by count of wells per section (i.e., about 1 square mile) of the Public Land Survey System.
2. Wells from outside the Basin are included in the wells density calculation.

Coordinate System: NAD 1983 StatePlane California V FIPS 0405 Feet | Projection: Lambert Conformal Conic | Datum: North American 1983

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FILLMORE BASIN GROUNDWATER SUSTAINABILITY PLAN

Density of Domestic Wells Map

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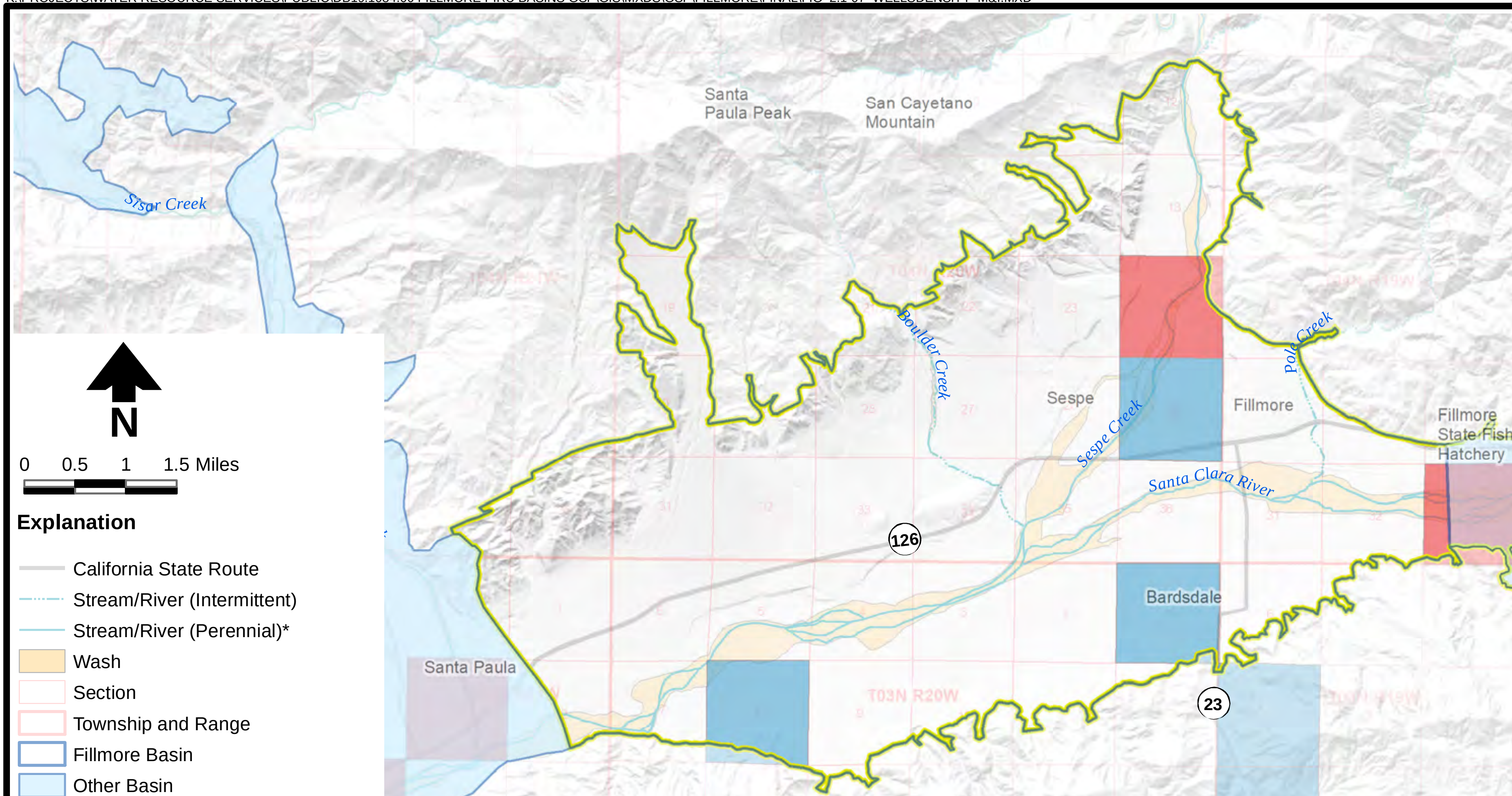
Figure 2.1-6

K:\PROJECTS\WATER RESOURCE SERVICES\PUBLIC\DB19.1084.00 FILLMORE PIRU BASINS GSP\GIS\MXDS\GSP\FILLMORE\FINAL\FIG_2.1-07_WELLSDENSITY_M&I.MXD



Basemap: USGS The National Map: 3D Elevation Program. USGS Earth Resources Observation & Science (EROS) Center: GMTED2010. Data refreshed March, 2021.

Notes:

* Perennial streams (designated by the U.S. Geological Survey [USGS] National Hydrography Dataset [NHD]) exhibit interrupted perennial (i.e., intermittent to ephemeral) conditions in the Santa Clara River Valley (Hanson et al., 2003; SFEI, 2011; Beller et al., 2016; United, 2017).

1. Well density is calculated by count of wells per section (i.e., about 1 square mile) of the Public Land Survey System.
2. Wells from outside the Basin are included in the wells density calculation.

Coordinate System: NAD 1983 StatePlane California V FIPS 0405 Feet | Projection: Lambert Conformal Conic | Datum: North American 1983

Fillmore and Piru Basins Groundwater Sustainability Agency

FILLMORE BASIN GROUNDWATER SUSTAINABILITY PLAN

Density of Municipal and Industrial (M&I) Wells Map

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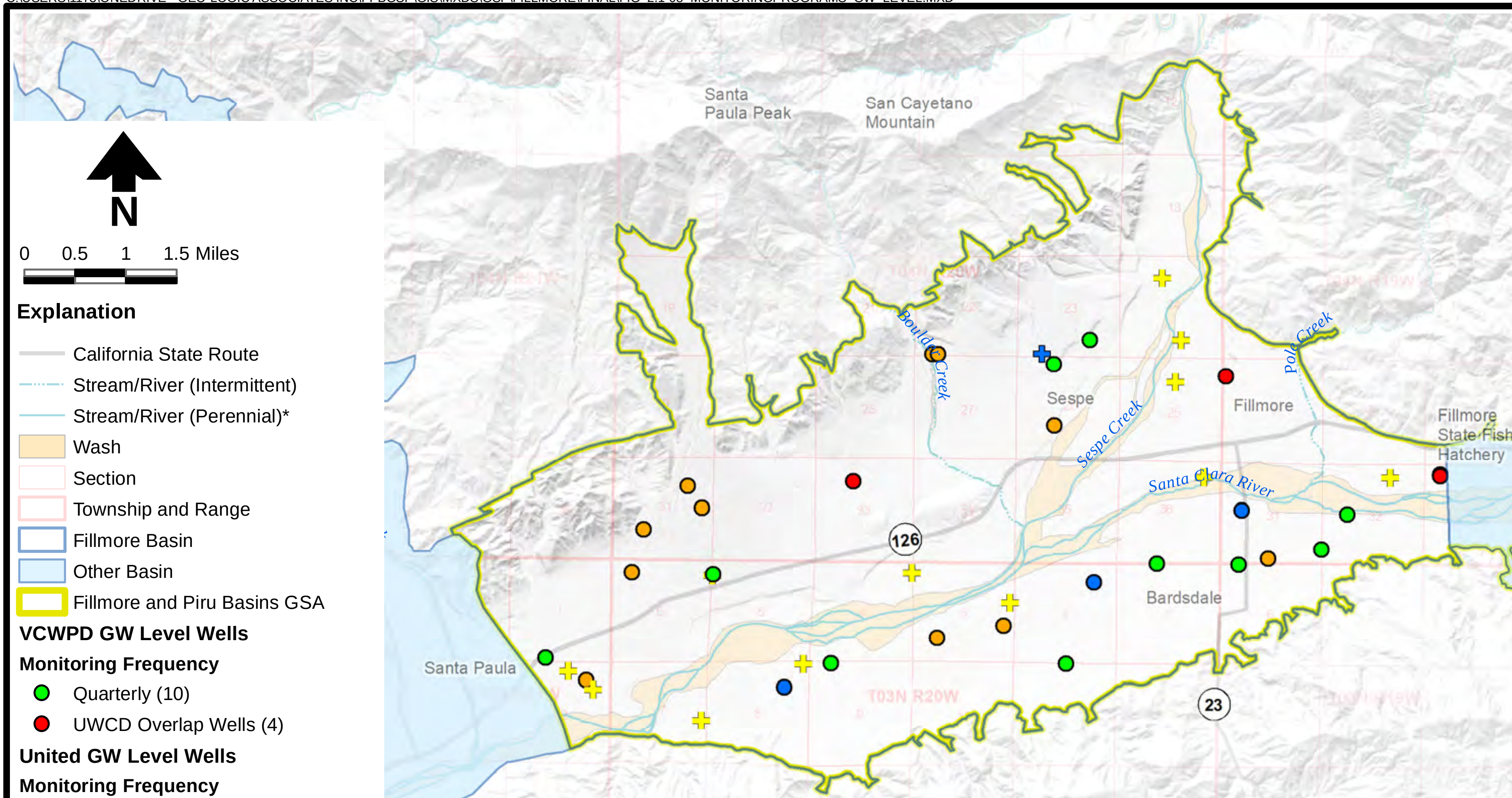
Figure 2.1-7

C:\USERS\1173\ONEDRIVE - GEO-LOGIC ASSOCIATES INC\FPBGSP\GIS\MXDS\GSP\FILLMORE\FINAL\FIG_2.1-08_MONITORINGPROGRAMS_GW_LEVEL.MXD



Basemap: USGS The National Map: 3D Elevation Program. USGS Earth Resources Observation & Science (EROS) Center: GMTED2010. Data refreshed March, 2021.

Notes:
* Perennial streams (designated by the U.S. Geological Survey [USGS] National Hydrography Dataset [NHD]) exhibit interrupted perennial (i.e., intermittent to ephemeral) conditions in the Santa Clara River Valley (Hanson et al., 2003; SFEI, 2011; Beller et al., 2016; United, 2017).
1. GW: groundwater
2. VCWPD: Ventura County Watershed Protection District
3. United: United Water Conservation District

Coordinate System: NAD 1983 StatePlane California V FIPS 0405 Feet | Projection: Lambert Conformal Conic | Datum: North American 1983

Fillmore and Piru Basins Groundwater Sustainability Agency

FILLMORE BASIN GROUNDWATER SUSTAINABILITY PLAN

Existing Groundwater Level Monitoring Programs Map

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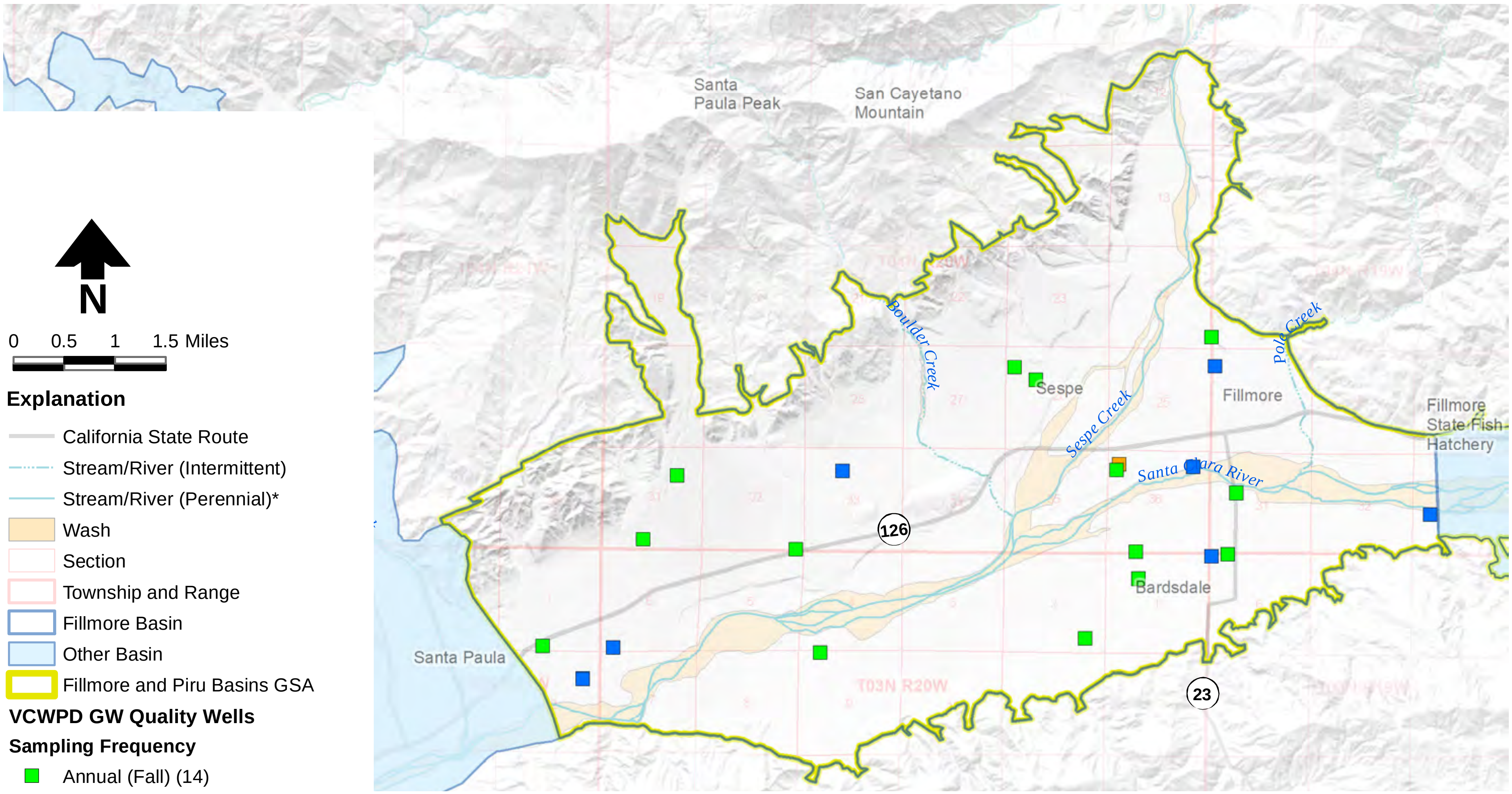
Figure 2.1-8

K:\PROJECTS\WATER RESOURCE SERVICES\PUBLIC\DB19.1084.00 FILLMORE PIRU BASINS GSP\GIS\MXDS\GSP\FILLMORE\FINAL\FIG_2.1-09_MONITORINGPROGRAMS_GW_QUALITY.MXD



Basemap: USGS The National Map: 3D Elevation Program. USGS Earth Resources Observation & Science (EROS) Center: GMTED2010. Data refreshed March, 2021.

Notes:
* Perennial streams (designated by the U.S. Geological Survey [USGS] National Hydrography Dataset [NHD]) exhibit interrupted perennial (i.e., intermittent to ephemeral) conditions in the Santa Clara River Valley (Hanson et al., 2003; SFEI, 2011; Beller et al., 2016; United, 2017).
1. GW: groundwater
2. Alternate sampling frequency means this well is sampled if the other nearby well is not accessible.
3. VCWPD: Ventura County Watershed Protection District
4. United: United Water Conservation District

Coordinate System: NAD 1983 StatePlane California V FIPS 0405 Feet | Projection: Lambert Conformal Conic | Datum: North American 1983

Fillmore and Piru Basins Groundwater Sustainability Agency

FILLMORE BASIN GROUNDWATER SUSTAINABILITY PLAN

Existing Groundwater Quality Monitoring Programs Map

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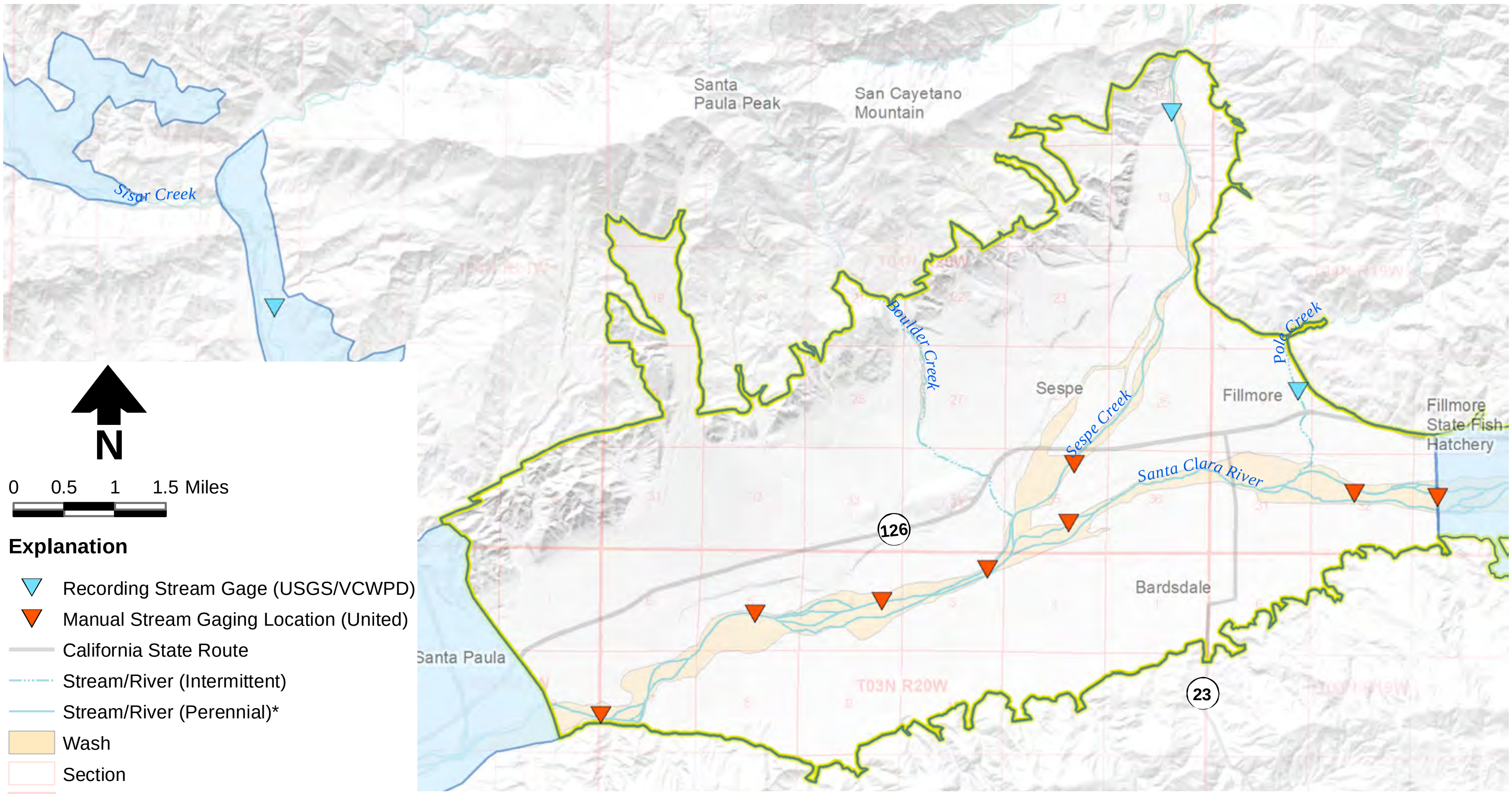
Figure 2.1-9

K:\PROJECTS\WATER RESOURCE SERVICES\PUBLIC\DB19.1084.00 FILLMORE PIRU BASINS GSP\GIS\MXDS\GSP\FILLMORE\FINAL\FIG_2.1-10_MONITORINGPROGRAMS_SW_FLOW.MXD



Coordinate System: NAD 1983 StatePlane California V FIPS 0405 Feet | Projection: Lambert Conformal Conic | Datum: North American 1983

Basemap: USGS The National Map: 3D Elevation Program. USGS Earth Resources Observation & Science (EROS) Center: GMTED2010. Data refreshed March, 2021.

Notes:
* Perennial streams (designated by the U.S. Geological Survey [USGS] National Hydrography Dataset [NHD]) exhibit interrupted perennial (i.e., intermittent to ephemeral) conditions in the Santa Clara River Valley (Hanson et al., 2003; SFEI, 2011; Beller et al., 2016; United, 2017).
1. VCWPD: Ventura County Watershed Protection District
2. United: United Water Conservation District

Fillmore and Piru Basins Groundwater Sustainability Agency

FILLMORE BASIN GROUNDWATER SUSTAINABILITY PLAN

Existing Surface Water Flow Monitoring Programs Map

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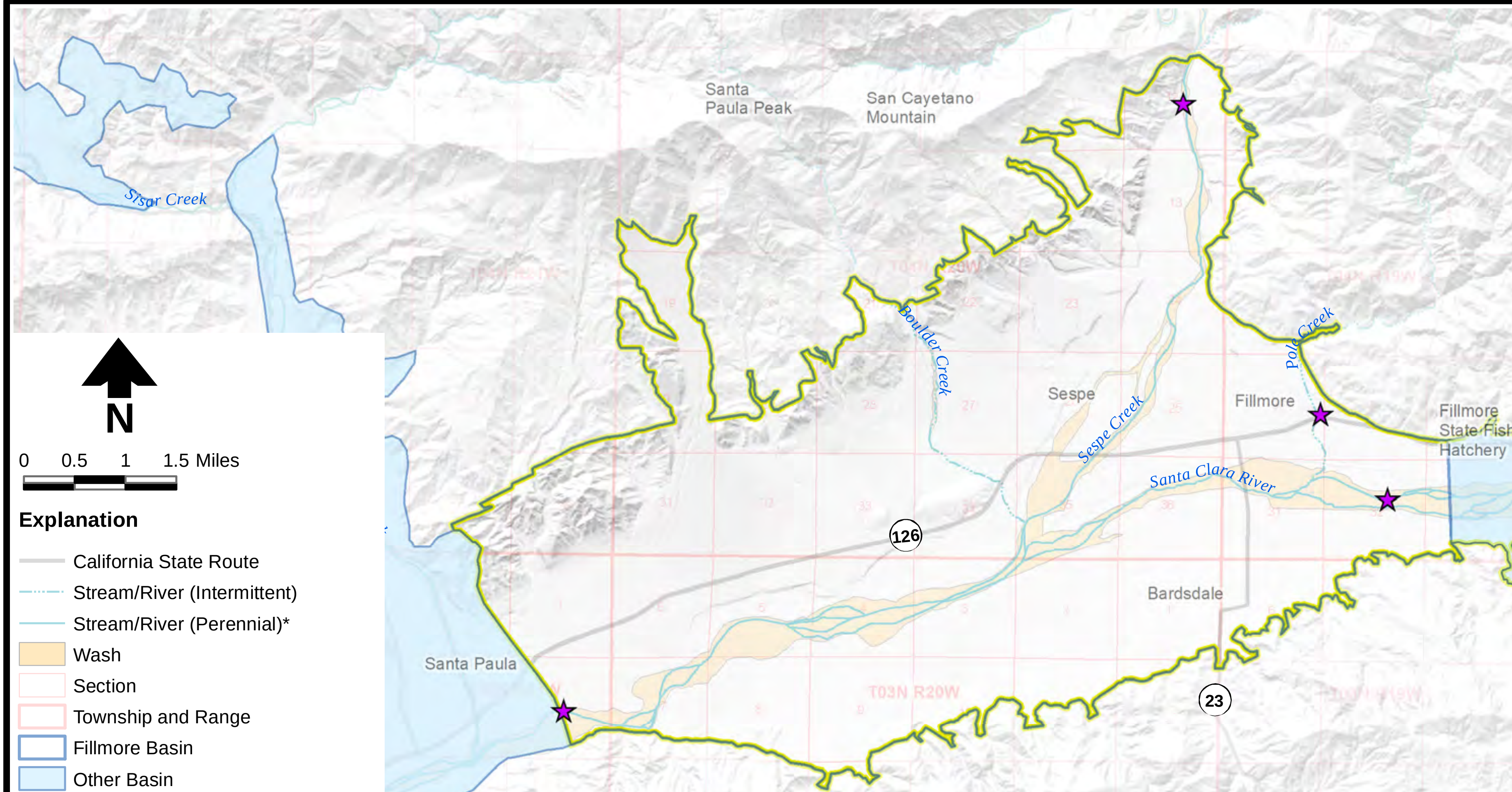
Figure 2.1-10

K:\PROJECTS\WATER RESOURCE SERVICES\PUBLIC\DB19.1084.00 FILLMORE PIRU BASINS GSP\GIS\MXDS\GSP\FILLMORE\FINAL\FIG_2.1-11_MONITORINGPROGRAMS_SW_QUALITY.MXD



Explanation

- California State Route
- Stream/River (Intermittent)
- Stream/River (Perennial)*
- Wash
- Section
- Township and Range
- Fillmore Basin
- Other Basin
- Fillmore and Piru Basins GSA

United SW Quality Sampling Site Status

- Active (4)

Basemap: USGS The National Map: 3D Elevation Program. USGS Earth Resources Observation & Science (EROS) Center: GMTED2010. Data refreshed March, 2021.

Notes:
* Perennial streams (designated by the U.S. Geological Survey [USGS] National Hydrography Dataset [NHD]) exhibit interrupted perennial (i.e., intermittent to ephemeral) conditions in the Santa Clara River Valley (Hanson et al., 2003; SFEI, 2011; Beller et al., 2016; United, 2017).
1. SW: surface water
2. United: United Water Conservation District

Coordinate System: NAD 1983 StatePlane California V FIPS 0405 Feet | Projection: Lambert Conformal Conic | Datum: North American 1983

Fillmore and Piru Basins Groundwater Sustainability Agency

FILLMORE BASIN GROUNDWATER SUSTAINABILITY PLAN

Existing Surface Water Quality Monitoring Programs Map

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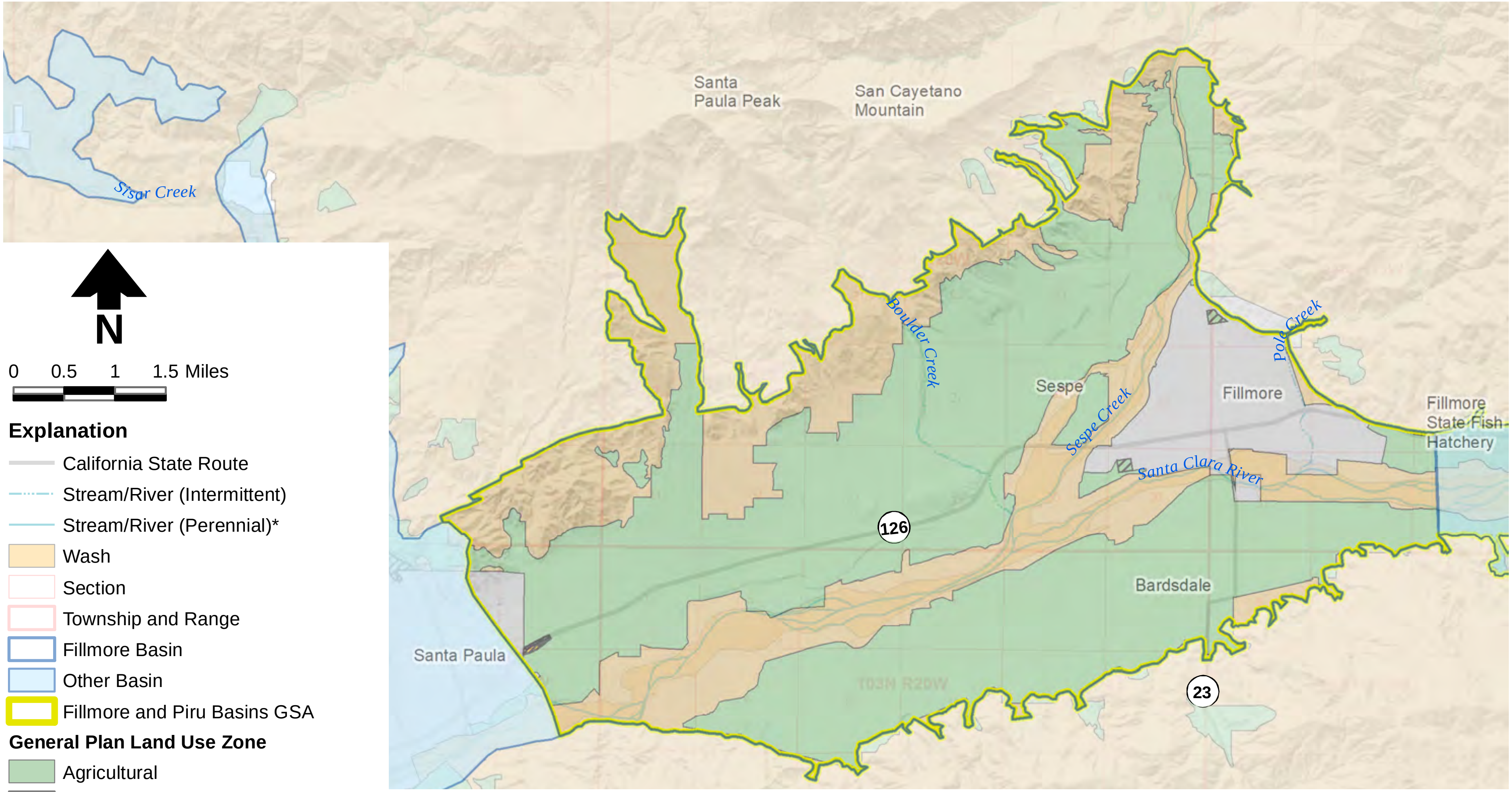
Figure 2.1-11

K:\PROJECTS\WATER RESOURCE SERVICES\PUBLIC\DB19.1084.00 FILLMORE PIRU BASINS GSP\GIS\MXDS\GSP\FILLMORE\FINAL\FIG_2.1-12_LANDZONINGMAP.MXD



N

0 0.5 1 1.5 Miles

Explanation

- California State Route
- Stream/River (Intermittent)
- Stream/River (Perennial)*
- Wash
- Section
- Township and Range
- Fillmore Basin
- Other Basin
- Fillmore and Piru Basins GSA

General Plan Land Use Zone

- Agricultural
- Agricultural - Urban Reserve
- Existing Community - Urban Reserve
- Open Space
- Urban

Basemap: USGS The National Map: 3D Elevation Program. USGS Earth Resources Observation & Science (EROS) Center: GMTED2010. Data refreshed March, 2021.

Notes:
* Perennial streams (designated by the U.S. Geological Survey [USGS] National Hydrography Dataset [NHD]) exhibit interrupted perennial (i.e., intermittent to ephemeral) conditions in the Santa Clara River Valley (Hanson et al., 2003; SFEI, 2011; Beller et al., 2016; United, 2017).
1. Land use zoning information is from the 2040 Ventura County General Plan.

Coordinate System: NAD 1983 StatePlane California V FIPS 0405 Feet | Projection: Lambert Conformal Conic | Datum: North American 1983

Fillmore and Piru Basins Groundwater Sustainability Agency

FILLMORE BASIN GROUNDWATER SUSTAINABILITY PLAN

Land Zoning Map

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Figure 2.1-12

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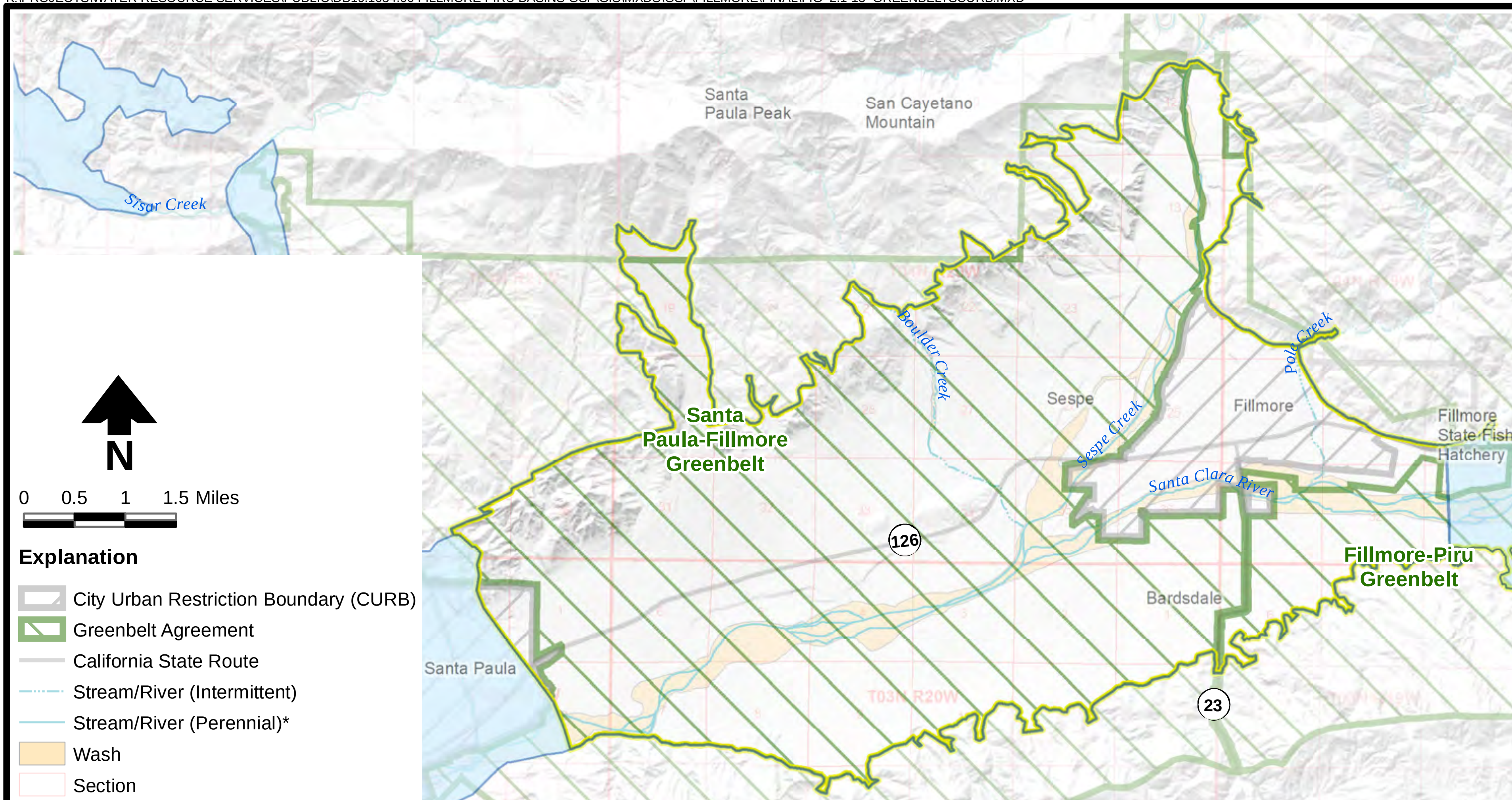

Basemap: USGS The National Map: 3D Elevation Program. USGS Earth Resources Observation & Science (EROS) Center: GMTED2010. Data refreshed March, 2021.

Coordinate System: NAD 1983 StatePlane California V FIPS 0405 Feet | Projection: Lambert Conformal Conic | Datum: North American 1983

Notes:
* Perennial streams (designated by the U.S. Geological Survey [USGS] National Hydrography Dataset [NHD]) exhibit interrupted perennial (i.e., intermittent to ephemeral) conditions in the Santa Clara River Valley (Hanson et al., 2003; SFEI, 2011; Beller et al., 2016; United, 2017).
1. Land use zoning information is from the 2040 Ventura County General Plan.

Fillmore and Piru Basins Groundwater Sustainability Agency

FILLMORE BASIN GROUNDWATER SUSTAINABILITY PLAN

Ventura County Greenbelts and City Urban Restriction Boundary (CURB) Map

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Figure 2.1-13

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Geologic era	Geologic system	Geologic series (epoch)	Weber and others (1976)	Dibblee[1]	Turner (1975) Green and others (1978)[2]	RASA[3]	Hanson et al. (2003) Aquifer system, model layer	United (2021a) Aquifer zone, model layer(s)
			Lithologic units and Formations		Aquifers			
Cenozoic	Quaternary	Holocene	**Recent Alluvium** (Lagoonal, beach, river and flood plain deposits, artificial fill, and alluvial fan deposits)		Recent alluvial and semiperched	Shallow	Upper-aquifer system[4], layer 1	**Aquifer zone A, layer 1**
			Recent Alluvium (Lagoonal, beach, river and flood plain deposits and alluvial fan deposits)		Oxnard[5]			**layer 3**
		Late (Upper) Pleistocene[6]	***Older Alluvium*** (Lagoonal, beach, river and flood plain, alluvial fan, terrace, and marine terrace deposits)		Mugu[2]			**Aquifer zone B, layer 5**
			Saugus Formation[7] (Terrestrial fluvial sediments)	Saugus Formation	Hueneme	Upper Hueneme	Lower-aquifer system, layer 2	**layer 7**
			San Pedro Formation[8] (Marine clays and sands and terrestrial fluvial sediments)			Lower Hueneme		**Aquifer zone C**
				Las Posas Sand (Marine shallow regressive sands)	Fox Canyon	Fox Canyon		
		Early (Lower) Pleistocene[6]	***Santa Barbara Formation***[8] (Marine shallow regressive sands)		Grimes Canyon[9,10]	Grimes Canyon		
			Pico Formation [11] (Marine siltstones, sandstones, and conglomerates)		Formation not included in regional flow model		Formation not included in regional flow model	
	Tertiary	Pliocene[6]	***Repetto formation*** (Terrestrial conglomerates, sandstones, and shales)		Formation not included in regional flow model		Formation not included in regional flow model	
		Miocene	***Santa Margarita Formation, Monterey Shale, Rincon Mudstone, Towsley Formation*** (Terrestrial fluvial sandstones and fine-grained lake deposits)		Not Included	Santa Margarita sandstones included in northeastern Santa Rosa Valley	Lower-aquifer system, layer 2	
			Conejo Volcanics (Terrestrial and marine extrusive and intrusive, felsic-andesites to basalts)		Formation not included in regional flow model			
			Lower Topanga Formation, Topanga-Vaqueros Sandstones, Modelo Formation, Sisquoc Formation (Marine transgressive sands and siltstones)					
		Oligocene	***Sespe Formation*** (Terrestrial fluvial claystones and sandstones)					
		Eocene	***Llajas Formation, Coldwater Sandstone, Cozy Dell Shale, Matilija Sandstone, Juncal Formation, Santa Susana Formation*** (Marine sandstones, mudstones, and claystones)					
		Paleocene	***Martinez Formation*** (Terrestrial conglomerate, sandstones, and marine shales)					
Mesozoic	**Upper Cretaceous**		Chico Formation (Sandstones with shales)					

FIGURE MODIFIED FROM: Figure 7B from Hanson et al. (2003). Simulation of Ground-Water/Surface-Water Flow in the Santa Clara–Calleguas Ground-Water Basin, Ventura County, CA

1 Formations from Dibblee (1988; 1990a,b; 1991; 1992a,b,c,d) and Dibblee and Ehrenspeck (1990).
2 Perched aquifer designated in parts of the Oxnard Plain only.
3 From the Southern California Regional Aquifer-System Analysis Program of the U.S. Geological Survey.
4 Shallow aquifer included in the Oxnard Plain Forebay and inland subbasins. Semiperched part of Shallow aquifer not included in remainder of Oxnard Plain.
5 Restricted to the Oxnard Plain and Forebay by Turner (1975).
6 Modified on the basis of ash-deposit age dates (Yerkes and others, 1987, fig.11.2).
7 Mapped in eastern Ventura County subbasins of Santa Paula, Fillmore, Piru, and Las Posas Valley and may be time equivalent to parts of the San Pedro and Santa Barbara Formations (Weber and others, 1976, fig. 3).
8 Mapped in western Ventura County subbasins.
9 San Pedro Formation everywhere except in Pleasant Valley where the Santa Barbara Formation was assigned to the Grimes Aquifer.
10 Las Posas and Pleasant Valley subbasins only.
11 Includes Mud Pit and Claystone Members.

☐ - Fillmore and Piru Basins

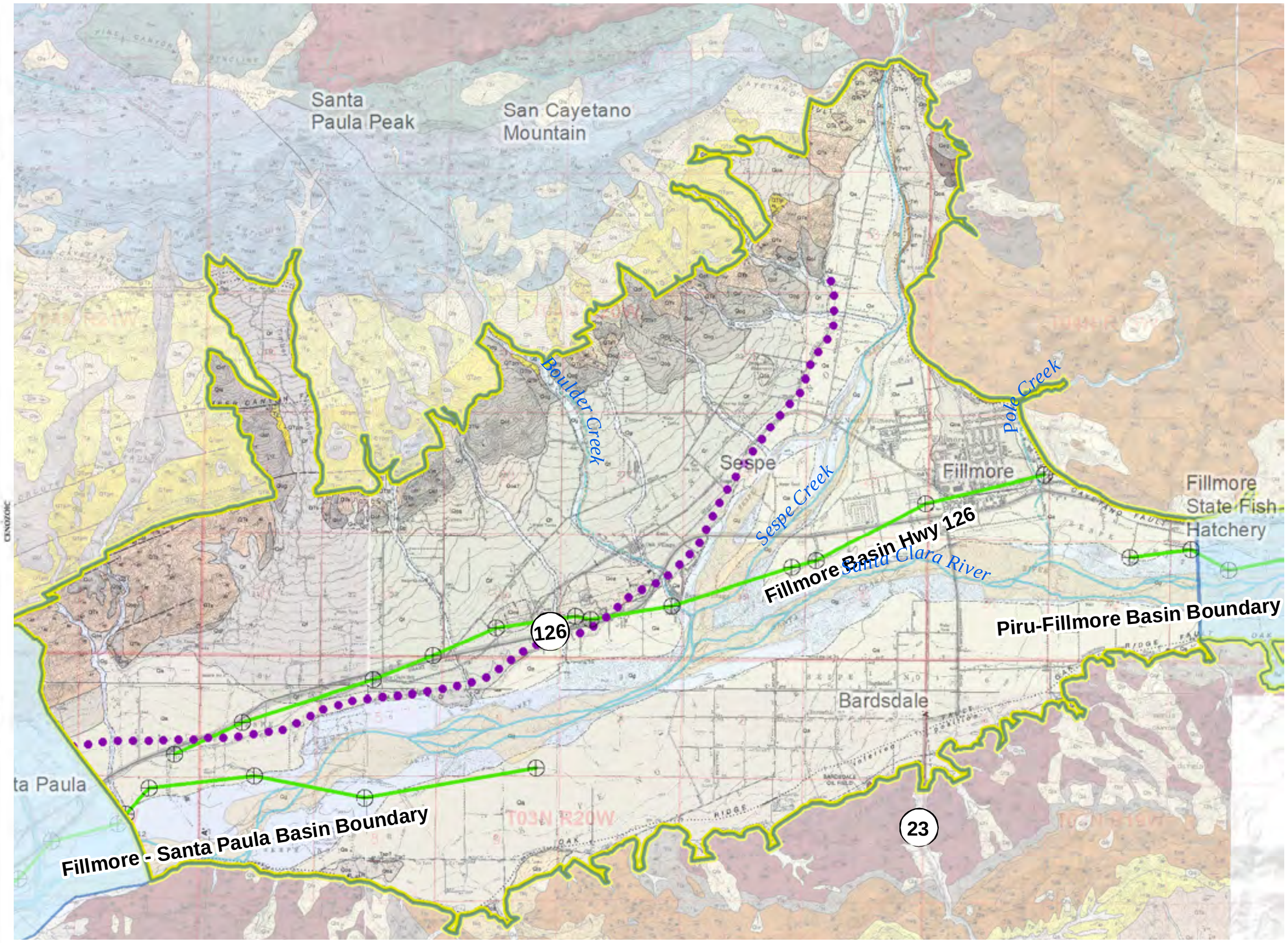
Fillmore and Piru Basins Groundwater Sustainability Agency

FILLMORE BASIN GROUNDWATER SUSTAINABILITY PLAN

Regional Stratigraphic Column with Aquifer Designations

Figure 2.2-1

K:\PROJECTS\WATER RESOURCE SERVICES\PUBLIC\DB19.1084.00 FILLMORE PIRU BASINS GSP\GIS\MXDS\GSP\FILLMORE\FINAL\FIG_2.2-02_GEOLOGICMAP_DIBBLEE.MXD



N

0 0.5 1 1.5 Mile

Explanation

- California Highway
- Stream (Intermittent)
- Stream (Perennial)*
- Wash
- Section
- Township and Range
- Fillmore Basin
- Other Basin
- FPBGSA
- ⊕ Cross Section Well
- Cross Section Path

Basemap: USGS The National Map: 3D Elevation Program. USGS Earth Resources Observation & Science (EROS) Center: GMTED2010. Data refreshed March, 2021.

Notes:
* Perennial streams (designated by the U.S. Geological Survey [USGS] National Hydrography Dataset [NHD]) exhibit interrupted perennial (i.e., intermittent to ephemeral) conditions in the Santa Clara River Valley (Hanson et al., 2003; SFEI, 2011; Beller et al., 2016; United, 2017).
1. Southern extent of Sespe Uplands from Mann (1959).
2. USGS: United States Geological Survey
3. Geologic map source: Dibblee, T.W., and Ehrenspeck, H.E., ed. Quadrangle Geologic Maps.
4. FPBGSA: Fillmore and Piru Basins Groundwater Sustainability Agency (FPBGSA)
5. Cross section paths are from United Water Conservation District (2021a).

Fillmore and Piru Basins Groundwater Sustainability Agency

FILLMORE BASIN GROUNDWATER SUSTAINABILITY PLAN

Detailed (Dibblee) Geologic Map

Coordinate System: NAD 1983 StatePlane California V FIPS 0405 Feet | Projection: Lambert Conformal Conic | Datum: North American 1983

Figure 2.2-2

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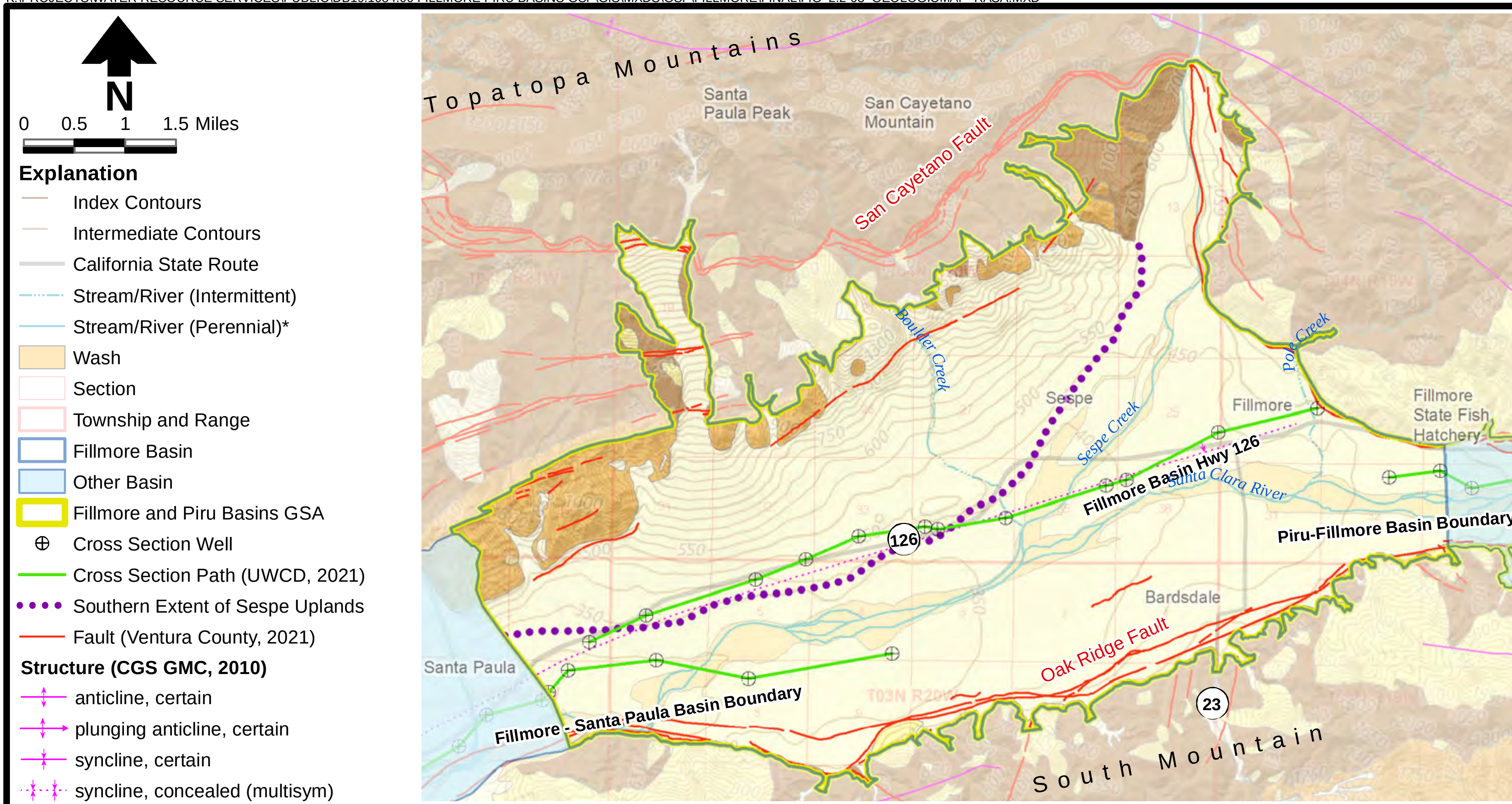

Basemap: USGS The National Map: 3D Elevation Program. USGS Earth Resources Observation & Science (EROS) Center: GMTED2010. Data refreshed March, 2021.

Coordinate System: NAD 1983 StatePlane California V FIPS 0405 Feet | Projection: Lambert Conformal Conic | Datum: North American 1983

Notes:
* Perennial streams (designated by the U.S. Geological Survey [USGS] National Hydrography Dataset [NHD]) exhibit interrupted perennial (i.e., intermittent to ephemeral) conditions in the Santa Clara River Valley (Hanson et al., 2003; SFEI, 2011; Beller et al., 2016; United, 2017).
1. Land (index/intermediate) contours are in feet relative to the North American Vertical Datum of 1988 (NAVD88).
2. Southern extent of Sespe Uplands approximated from Mann (1959).
3. Ventura County, 2021: a compilation of faults identified in:
   a. U.S. Geological Survey. Seismic Hazards and Land Use Planning. Geological Survey Circular 690, 1974, and
   b. Dibblee, T.W., and Ehrenspeck, H.E., ed. Quadrangle Geologic Maps,
4. USGS: United States Geological Survey
5. RASA: Regional Aquifer-System Analysis Program
6. CGS: California Geological Survey
7. GMC: Geologic Map of California

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FILLMORE BASIN GROUNDWATER SUSTAINABILITY PLAN

Generalized Geologic Map

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Figure 2.2-3

Aquifer System[1]	Hydrostratigraphic Unit[1]	Model Layer[1]	Basin Aquifer or Aquitard[2]
A	Surficial Deposits and Colluvium	1	Principal Aquifer
	Aquitard (discontinuous)	2	
	Recent (younger) Alluvium	3	
B	Aquitard (insignificant)	4	
	Older Alluvium	5	
	Aquitard (insignificant)	6	
	Upper Saugus/San Pedro	7	
C	Aquitard (continuous)	8	Aquitard
	Lower Saugus/San Pedro	9	Non-Principal Aquifer
	Undifferentiated Sedimentary Deposits	10	

Notes:
1. Figure is modified from United (2021a).
2. Principal aquifer and aquitard designations for Plan purposes.

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FILLMORE BASIN GROUNDWATER SUSTAINABILITY PLAN

Conceptual Basin Hydrostratigraphy with Principal Aquifer and Aquitards

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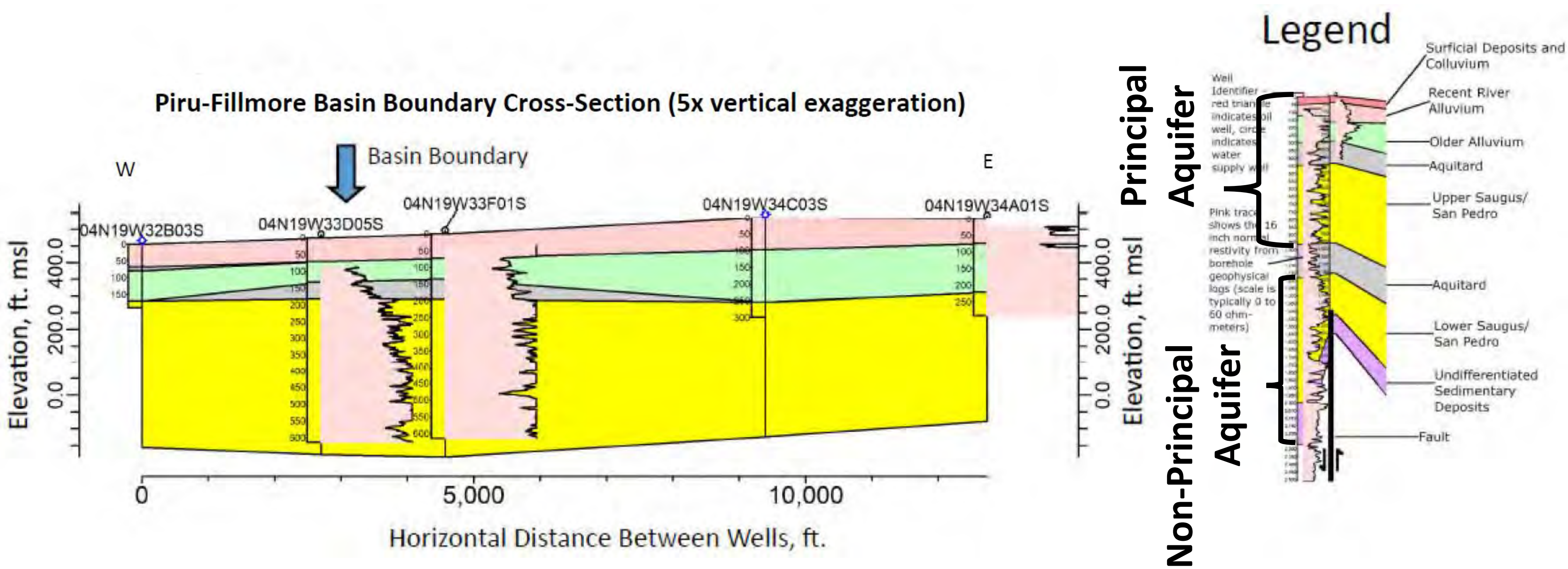
Figure 2.2-4



<u>Notes</u>:

Figure modified from Figure 2-21 from United (2021a).

United Water Conservation District, 2021a. Ventura Regional Groundwater Flow Model Expansion and Updated Hydrogeologic Conceptual Model for the Piru, Fillmore, and Santa Paula Groundwater Basins. Open-File Report 2021-01. June.

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FILLMORE BASIN GROUNDWATER SUSTAINABILITY PLAN

Piru-Fillmore Basin Boundary Cross-Section

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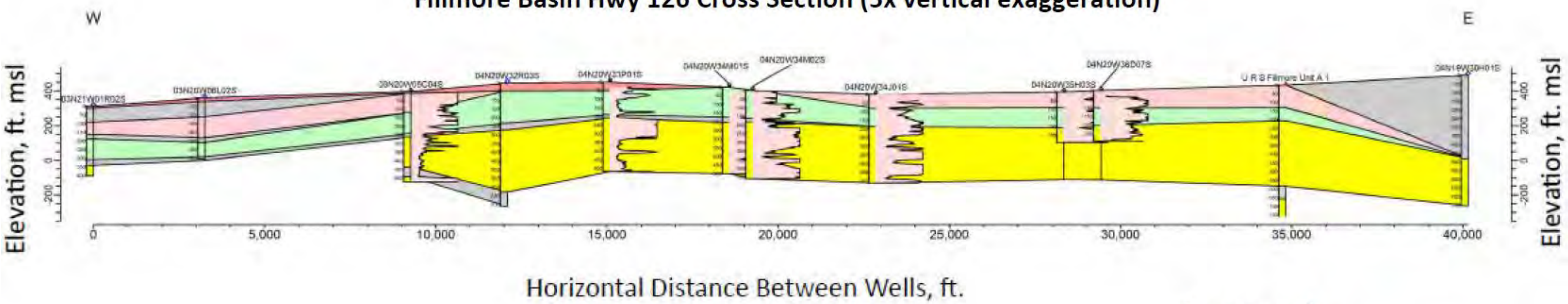
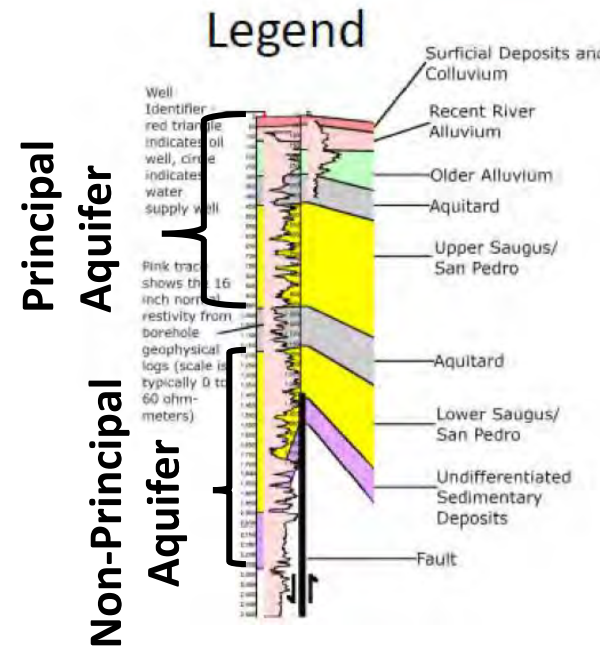
Figure 2.2-5

Fillmore Basin Hwy 126 Cross Section (5x vertical exaggeration)





Notes:

Figure modified from Figure 2-19 from United (2021a).

United Water Conservation District, 2021a. Ventura Regional Groundwater Flow Model Expansion and Updated Hydrogeologic Conceptual Model for the Piru, Fillmore, and Santa Paula Groundwater Basins. Open-File Report 2021-01. June.

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FILLMORE BASIN GROUNDWATER SUSTAINABILITY PLAN

Fillmore Basin Highway 126 Cross-Section

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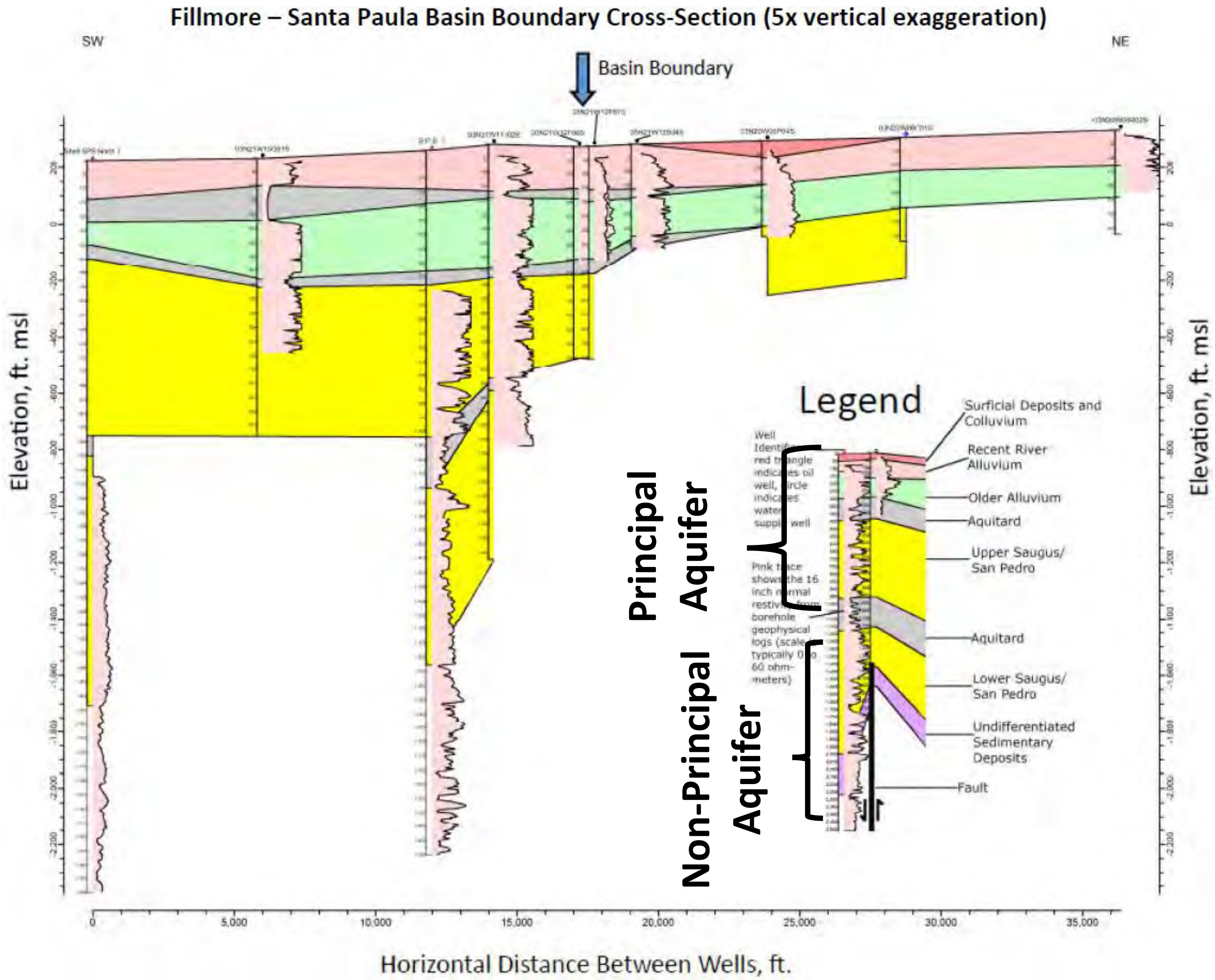
Figure 2.2-6



<u>Notes</u>:

Figure modified from Figure 2-22 from United (2021a).

United Water Conservation District, 2021a. Ventura Regional Groundwater Flow Model Expansion and Updated Hydrogeologic Conceptual Model for the Piru, Fillmore, and Santa Paula Groundwater Basins. Open-File Report 2021-01. June.

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FILLMORE BASIN GROUNDWATER SUSTAINABILITY PLAN

Fillmore - Santa Paula Basin Boundary Cross-Section

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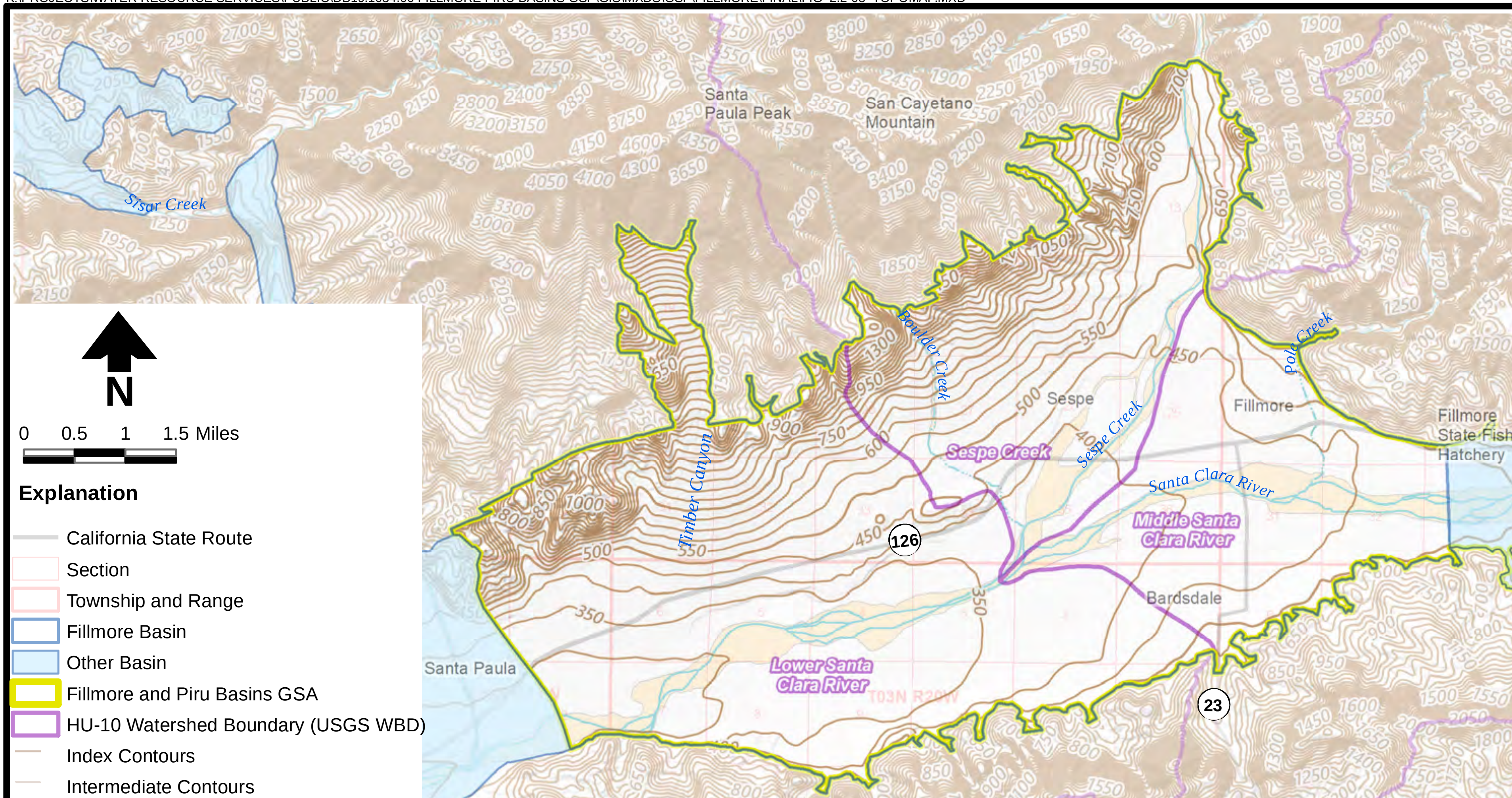
Figure 2.2-7

K:\PROJECTS\WATER RESOURCE SERVICES\PUBLIC\DB19.1084.00 FILLMORE PIRU BASINS GSP\GIS\MXDS\GSP\FILLMORE\FINAL\FIG_2.2-08_TOPOMAP.MXD



Basemap: USGS The National Map: 3D Elevation Program. USGS Earth Resources Observation & Science (EROS) Center: GMTED2010. Data refreshed March, 2021.

Coordinate System: NAD 1983 StatePlane California V FIPS 0405 Feet | Projection: Lambert Conformal Conic | Datum: North American 1983

Notes:
* Perennial streams (designated by the U.S. Geological Survey [USGS] National Hydrography Dataset [NHD]) exhibit interrupted perennial (i.e., intermittent to ephemeral) conditions in the Santa Clara River Valley (Hanson et al., 2003; SFEI, 2011; Beller et al., 2016; United, 2017).
1. Land (index/intermediate) elevation contours are in feet relative to the North American Vertical Datum of 1988 (NAVD88).
2. USGS: United State Geological Survey
3. WBD: Watershed Boundary Dataset
4. HU: Hydrologic Unit
5. NHD: National Hydrologic Dataset

Fillmore and Piru Basins Groundwater Sustainability Agency

FILLMORE BASIN GROUNDWATER SUSTAINABILITY PLAN

Topographic Map

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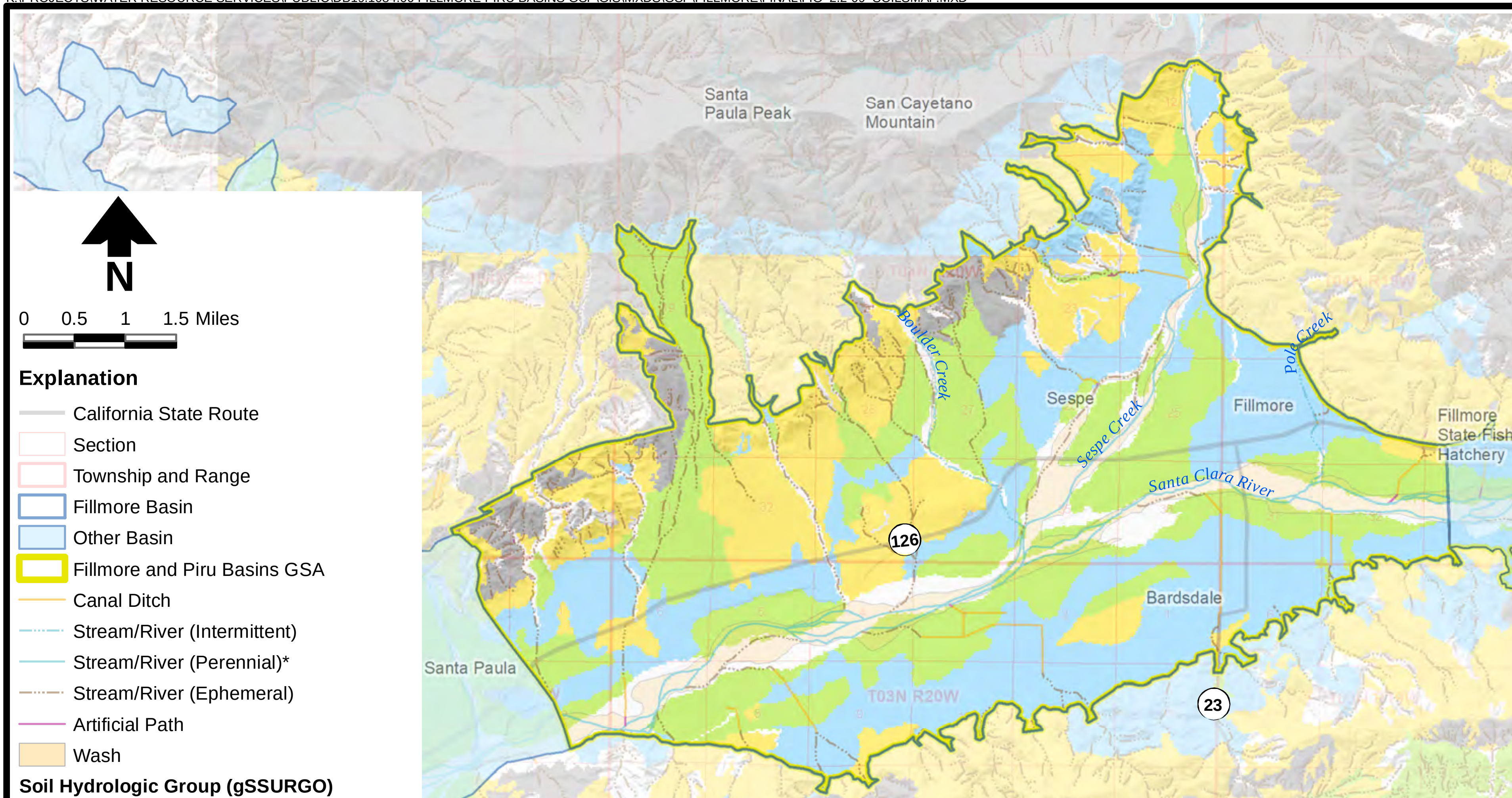
Figure 2.2-8

K:\PROJECTS\WATER RESOURCE SERVICES\PUBLIC\DB19.1084.00 FILLMORE PIRU BASINS GSP\GIS\MXDS\GSP\FILLMORE\FINAL\FIG_2.2-09_SOILSMAP.MXD



Explanation

- California State Route
- Section
- Township and Range
- Fillmore Basin
- Other Basin
- Fillmore and Piru Basins GSA
- Canal Ditch
- Stream/River (Intermittent)
- Stream/River (Perennial)*
- Stream/River (Ephemeral)
- Artificial Path
- Wash

Soil Hydrologic Group (gSSURGO)

- Group A
- Group B
- Group C
- Group D

Basemap: USGS The National Map: 3D Elevation Program. USGS Earth Resources Observation & Science (EROS) Center: GMTED2010. Data refreshed March, 2021.

Notes:
* Perennial streams (designated by the U.S. Geological Survey [USGS] National Hydrography Dataset [NHD]) exhibit interrupted perennial (i.e., intermittent to ephemeral) conditions in the Santa Clara River Valley (Hanson et al., 2003; SFEI, 2011; Beller et al., 2016; United, 2017).
1. USDA: United States Deparment of Agriculture
2. NRCS: National Resources Conservation Service
3. Soil hydrologic group data from USDA NRCS gSSURGO database (July 2020).

Group A soils consist of deep, well drained sands or gravelly sands with high infiltration and low runoff rates.
Group B soils consist of deep well drained soils with a moderately fine to moderately coarse texture and a moderate rate of infiltration and runoff.
Group C consists of soils with a layer that impedes the downward movement of water or fine textured soils and a slow rate of infiltration.
Group D consists of soils with a very slow infiltration rate and high runoff potential. This group is composed of clays that have a high shrink-swell potential, soils with a high water table, soils that have a clay pan or clay layer at or near the surface, and soils that are shallow over nearly impervious material.

Coordinate System: NAD 1983 StatePlane California V FIPS 0405 Feet | Projection: Lambert Conformal Conic | Datum: North American 1983

Fillmore and Piru Basins Groundwater Sustainability Agency

FILLMORE BASIN GROUNDWATER SUSTAINABILITY PLAN

Soil Hydrologic Characteristics Map

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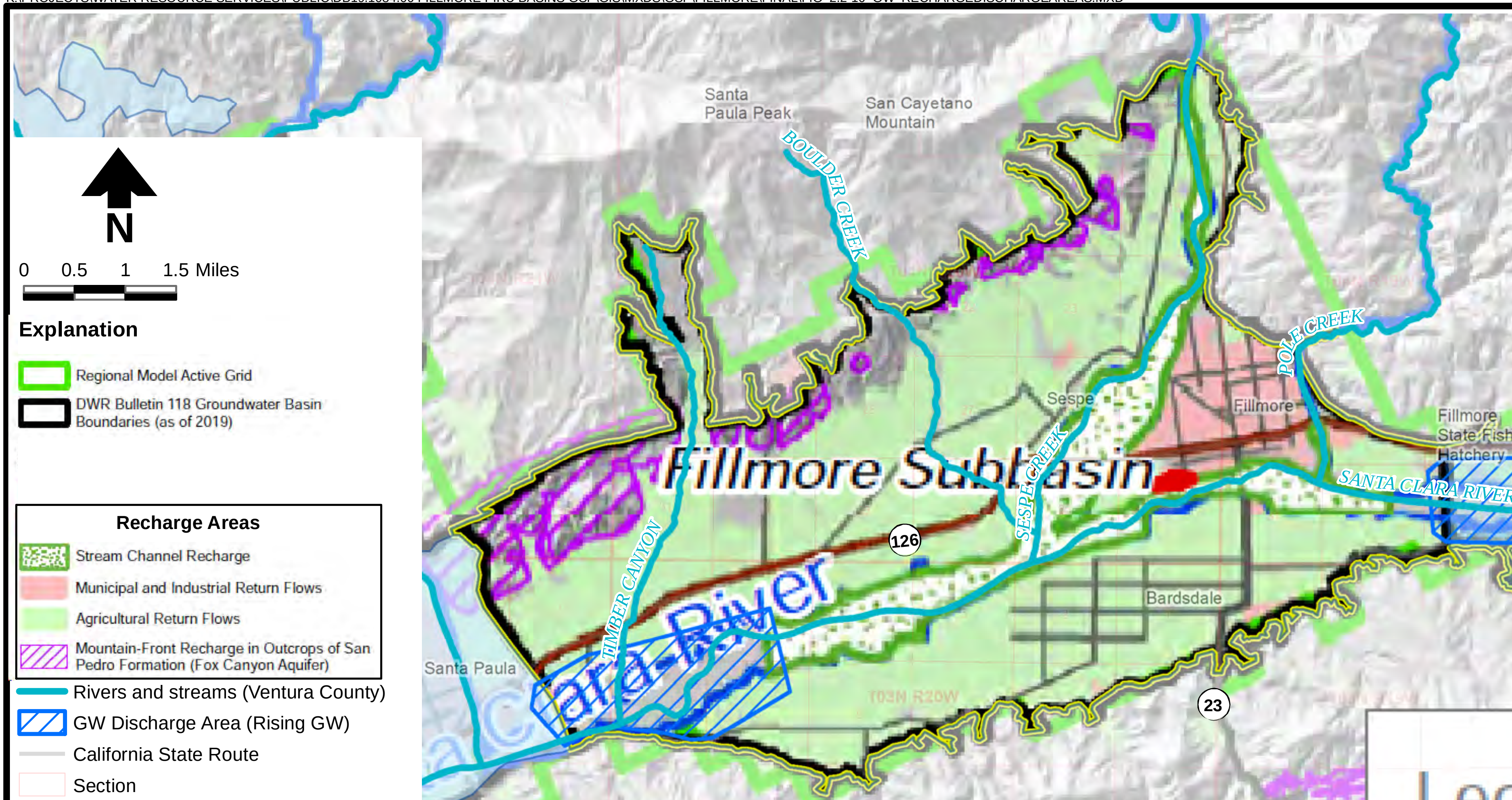
Figure 2.2-9

K:\PROJECTS\WATER RESOURCE SERVICES\PUBLIC\DB19.1084.00 FILLMORE PIRU BASINS GSP\GIS\MXDS\GSP\FILLMORE\FINAL\FIG_2.2-10_GW_RECHARGEDISCHARGEAREAS.MXD



Coordinate System: NAD 1983 StatePlane California V FIPS 0405 Feet | Projection: Lambert Conformal Conic | Datum: North American 1983

Basemap: USGS The National Map: 3D Elevation Program. USGS Earth Resources Observation & Science (EROS) Center: GMTED2010. Data refreshed March, 2021.

Notes:
* Perennial streams (designated by the U.S. Geological Survey [USGS] National Hydrography Dataset [NHD]) exhibit interrupted perennial (i.e., intermittent to ephemeral) conditions in the Santa Clara River Valley (Hanson et al., 2003; SFEI, 2011; Beller et al., 2016; United, 2017).
1. Map is modified from Figure 2-25 from United Water Conservation District (2021a).
2. GW: groundwater

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FILLMORE BASIN GROUNDWATER SUSTAINABILITY PLAN

Groundwater Recharge and Discharge Areas Map

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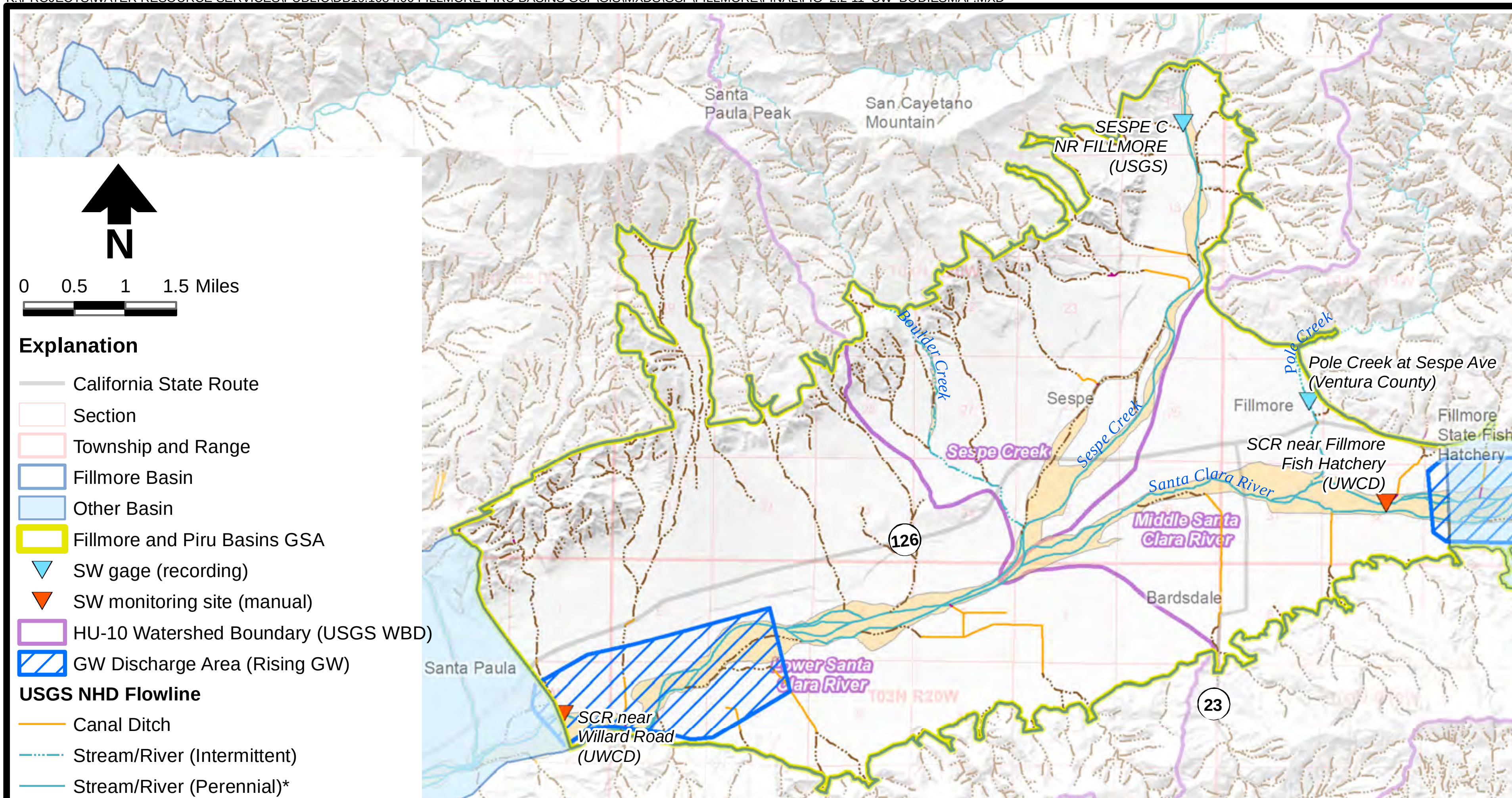
Figure 2.2-10

K:\PROJECTS\WATER RESOURCE SERVICES\PUBLIC\DB19.1084.00 FILLMORE PIRU BASINS GSP\GIS\MXDS\GSP\FILLMORE\FINAL\FIG_2.2-11_SW_BODIESMAP.MXD



Coordinate System: NAD 1983 StatePlane California V FIPS 0405 Feet | Projection: Lambert Conformal Conic | Datum: North American 1983

Basemap: USGS The National Map: 3D Elevation Program. USGS Earth Resources Observation & Science (EROS) Center: GMTED2010. Data refreshed March, 2021.

Notes:
* Perennial streams (designated by the U.S. Geological Survey [USGS] National Hydrography Dataset [NHD]) exhibit interrupted perennial (i.e., intermittent to ephemeral) conditions in the Santa Clara River Valley (Hanson et al., 2003; SFEI, 2011; Beller et al., 2016; United, 2017).
1. SW: surface water, monitoring sites labelled with site name and (corresponding agency).
2. GW: groundwater
3. SCR: Santa Clara River
4. USGS: United States Geological Survey
5. NHD: National Hydrography Dataset
6. HU: Hydrologic Unit (classification level)
7. UWCD: United Water Conservation District

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FILLMORE BASIN GROUNDWATER SUSTAINABILITY PLAN

Surface Water Bodies Map

Figure 2.2-11

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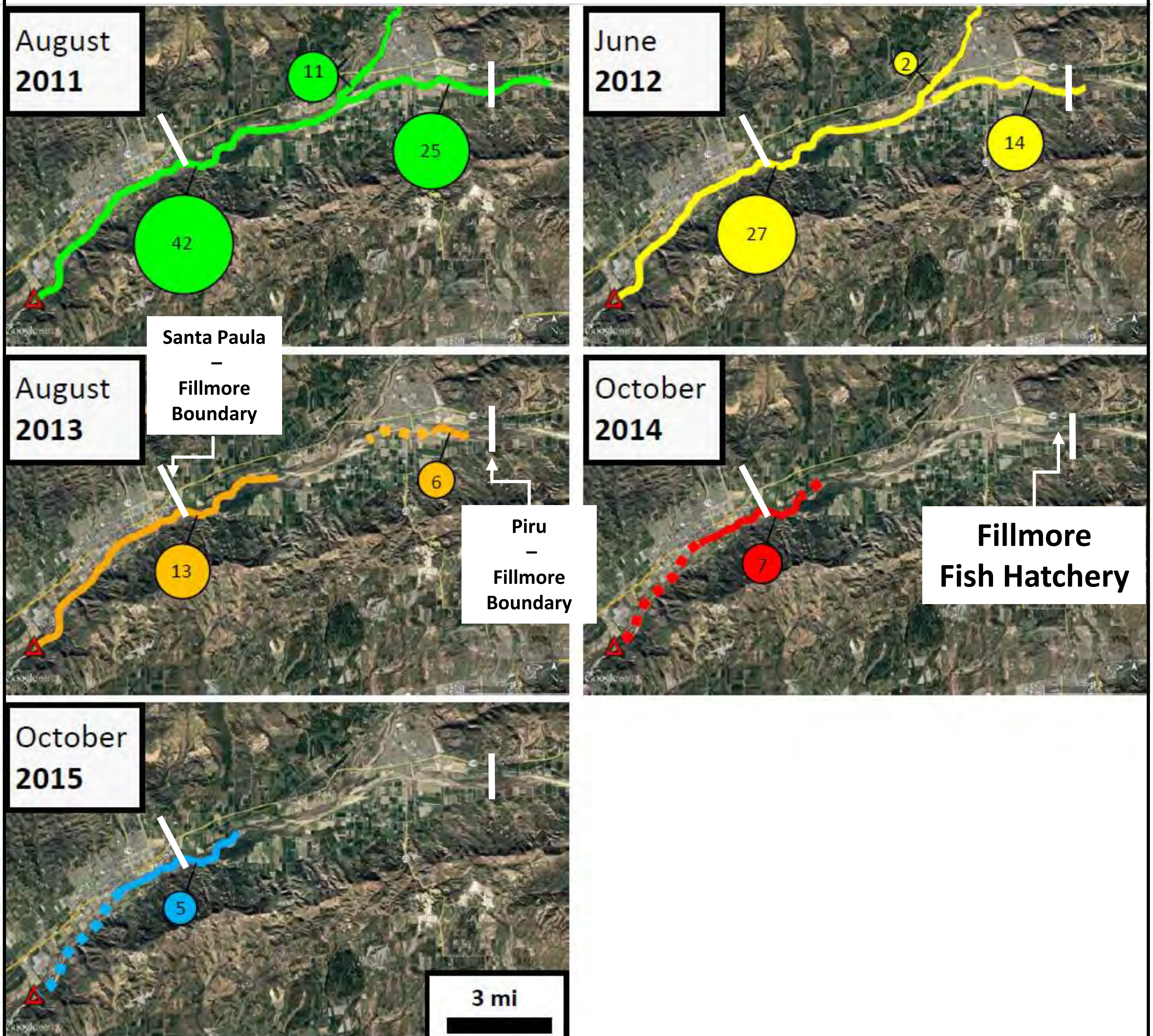

Notes:
- Figure is modified from United (2017).
- Solid lines are observed wetted stream reaches; dotted lines indicate uncertain wetted intervals.
- Circles and values represent surface water flow in cubic-feet per second (cfs) at manual streamflow monitoring sites conducted by United.
- Aerial imagery is static (does not represent the changes observed over time).

Fillmore and Piru Basins Groundwater Sustainability Agency

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FILLMORE BASIN GROUNDWATER SUSTAINABILITY PLAN
Change in Wetted Extent of Streams Between 2011 and 2015

Figure 2.2-12

K:\PROJECTS\WATER RESOURCE SERVICES\PUBLIC\DB19.1084.00 FILLMORE PIRU BASINS GSP\GIS\MXDS\GSP\FILLMORE\FINAL\FIG_2.2-13_SW_DIVERSIONSMAP.MXD

N

0 0.5 1 1.5 Miles

Explanation

1985-2015 Average Diversions (AFY)

- 0 - 25
- 25 - 500
- 500 - 1500
- 1500 - 3000
- 3000 - 63113.09
- Diversion Application Area
- DWR Bulletin 118 Groundwater Basin Boundaries (as of 2019):
- Active Model Grid, 2020 Regional Model
- California State Route
- Section
- Township and Range
- Fillmore Basin
- Other Basin
- Fillmore and Piru Basins GSA
- Rivers and streams (Ventura County)

Basemap: USGS The National Map: 3D Elevation Program. USGS Earth Resources Observation & Science (EROS) Center: GMTED2010. Data refreshed March, 2021.

Notes:
* Map is sourced from Figure 2-10 from United Water Conservation District (2021a).

Coordinate System: NAD 1983 StatePlane California V FIPS 0405 Feet | Projection: Lambert Conformal Conic | Datum: North American 1983

Fillmore and Piru Basins Groundwater Sustainability Agency

FILLMORE BASIN GROUNDWATER SUSTAINABILITY PLAN

Surface Water Diversions and Application Areas Map

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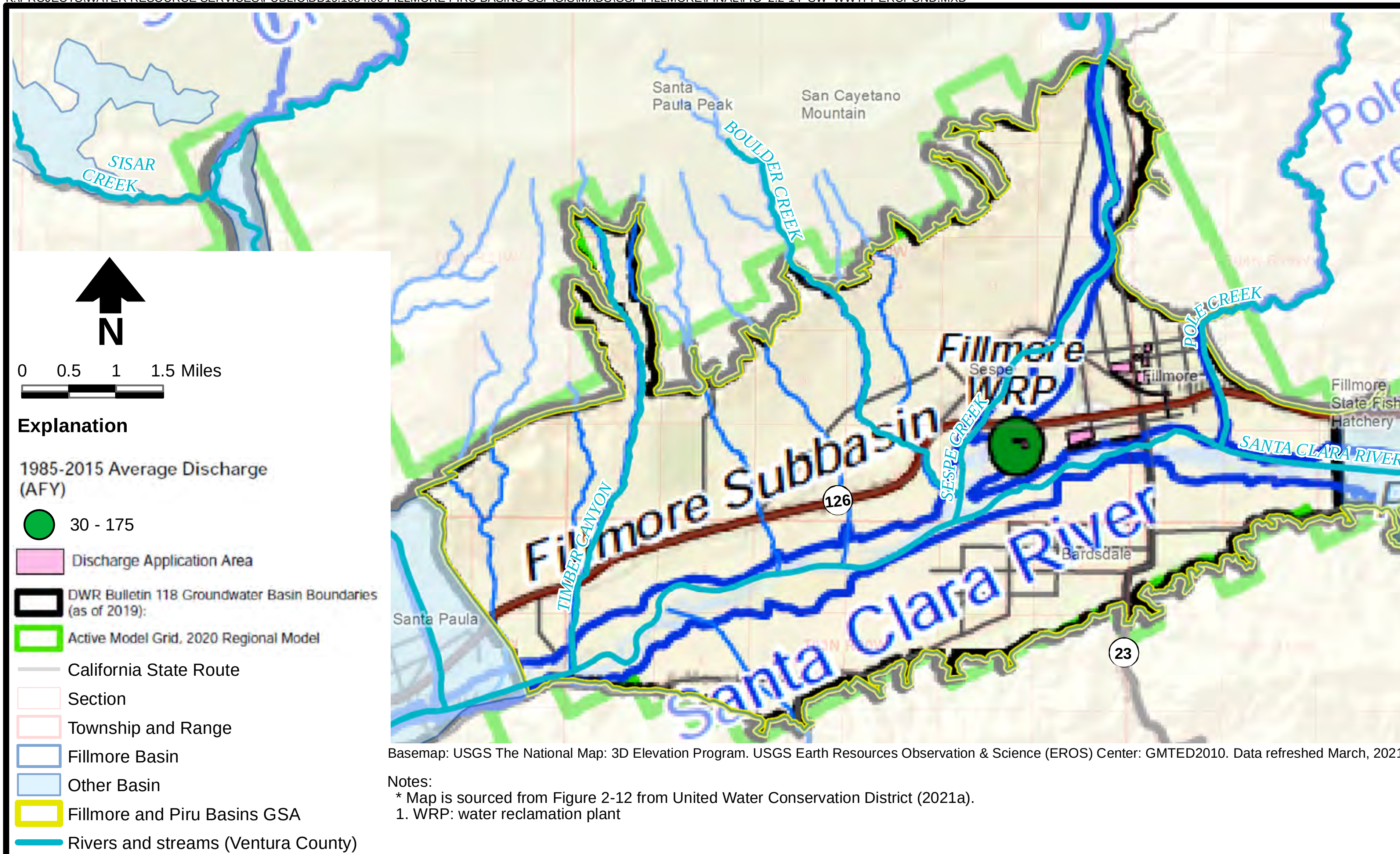
Figure 2.2-13

K:\PROJECTS\WATER RESOURCE SERVICES\PUBLIC\DB19.1084.00 FILLMORE PIRU BASINS GSP\GIS\MXDS\GSP\FILLMORE\FINAL\FIG_2.2-14_SW_WWTPPERCPOND.MXD



Coordinate System: NAD 1983 StatePlane California V FIPS 0405 Feet | Projection: Lambert Conformal Conic | Datum: North American 1983

Basemap: USGS The National Map: 3D Elevation Program. USGS Earth Resources Observation & Science (EROS) Center: GMTED2010. Data refreshed March, 2021.

Notes:
* Map is sourced from Figure 2-12 from United Water Conservation District (2021a).
1. WRP: water reclamation plant

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FILLMORE BASIN GROUNDWATER SUSTAINABILITY PLAN

Wastewater Treatment Plant (WWTP) and Percolation Pond Map

Figure 2.2-14

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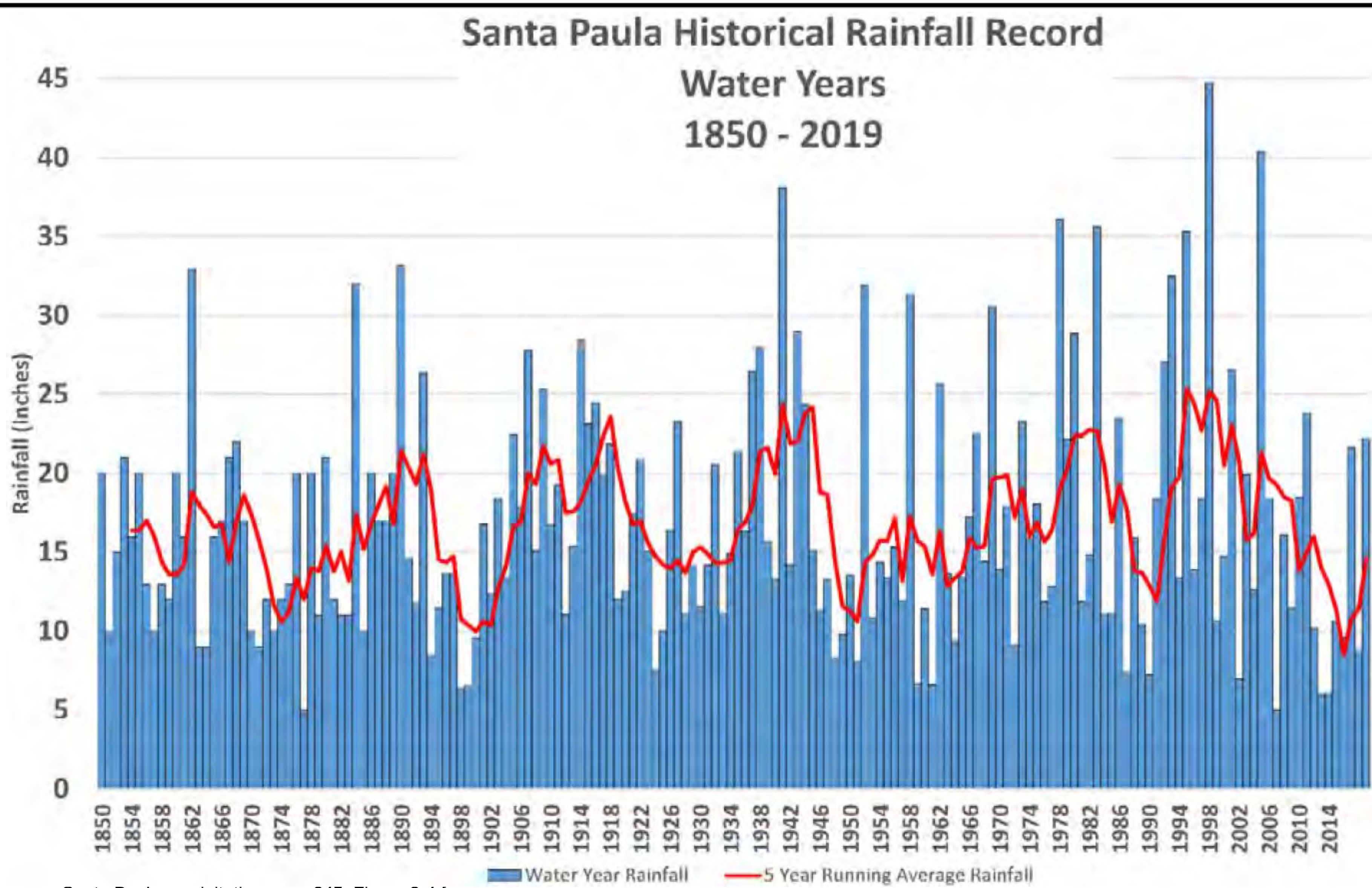

Source: Santa Paula precipitation gage 245, Figure 2-4 from:
United Water Conservation District, 2021a. Ventura Regional Groundwater Flow Model Expansion and Updated Hydrogeologic Conceptual Model for the Piru, Fillmore, and Santa Paula Groundwater Basins. Open-File Report 2021-01. June.

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FILLMORE BASIN GROUNDWATER SUSTAINABILITY PLAN

Long-Term Precipitation Record for Santa Clara River Valley

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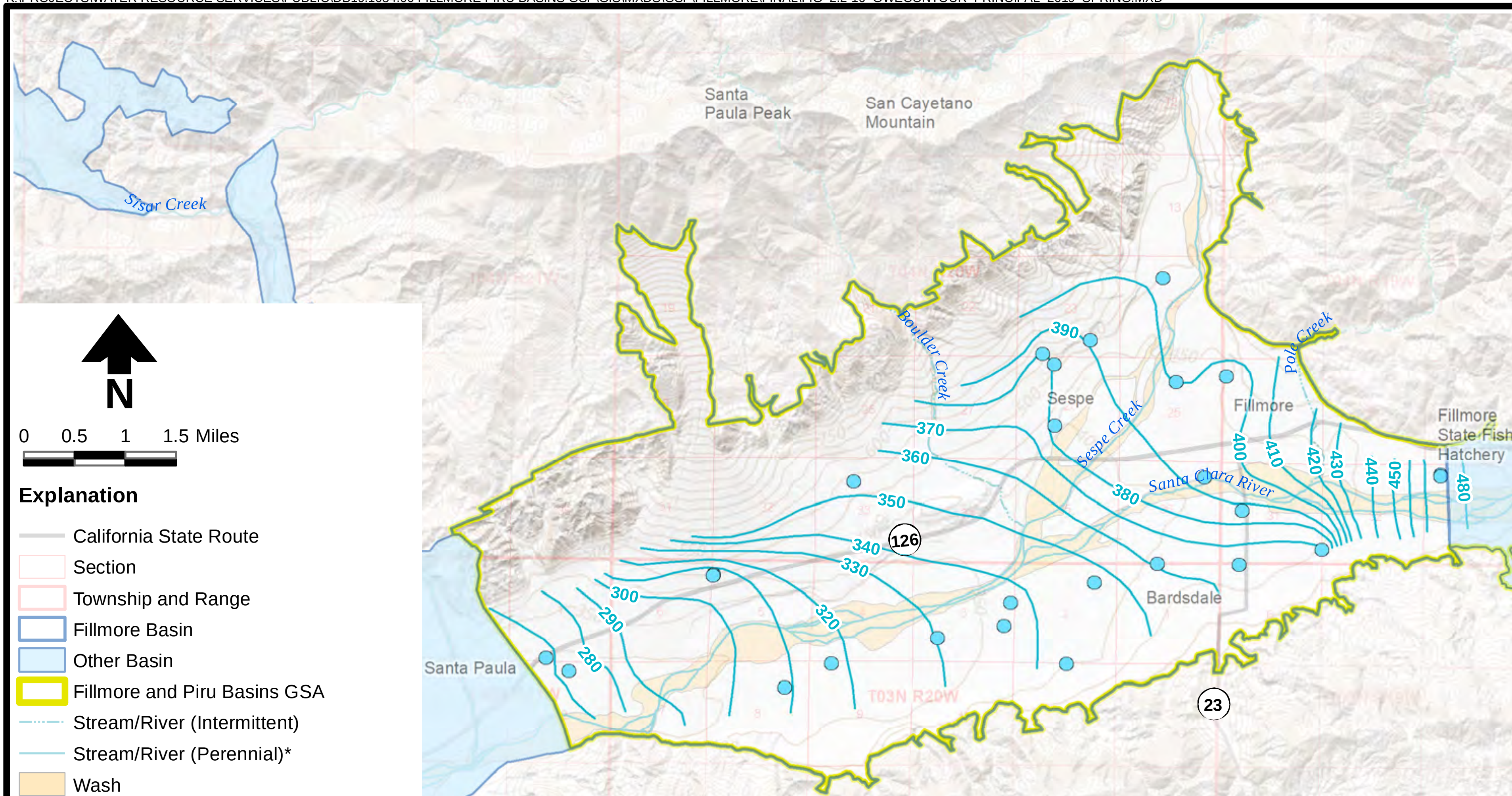
Figure 2.2-15

K:\PROJECTS\WATER RESOURCE SERVICES\PUBLIC\DB19.1084.00 FILLMORE PIRU BASINS GSP\GIS\MXDS\GSP\FILLMORE\FINAL\FIG_2.2-16_GWECONTOUR_PRINCIPAL_2019_SPRING.MXD



Coordinate System: NAD 1983 StatePlane California V FIPS 0405 Feet | Projection: Lambert Conformal Conic | Datum: North American 1983

Basemap: USGS The National Map: 3D Elevation Program. USGS Earth Resources Observation & Science (EROS) Center: GMTED2010. Data refreshed March, 2021.

Notes:

* Perennial streams (designated by the U.S. Geological Survey [USGS] National Hydrography Dataset [NHD]) exhibit interrupted perennial (i.e., intermittent to ephemeral) conditions in the Santa Clara River Valley (Hanson et al., 2003; SFEI, 2011; Beller et al., 2016; United, 2017).

1. Land (index/intermediate) elevation contours are in feet relative to the North American Vertical Datum of 1988 (NAVD88).
2. GW elevation contours are provided at 10-foot intervals by United Water Conservation District, based on GWL data measured 3/1-3/31/2019, in feet relative to approximate mean sea level (ft-msl), the National Geodetic Vertical Datum of 1929 (NGVD29).
3. GWL: groundwater level

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FILLMORE BASIN GROUNDWATER SUSTAINABILITY PLAN

Groundwater Elevation Contours in the Principal Aquifer, Spring 2019

Figure 2.2-16

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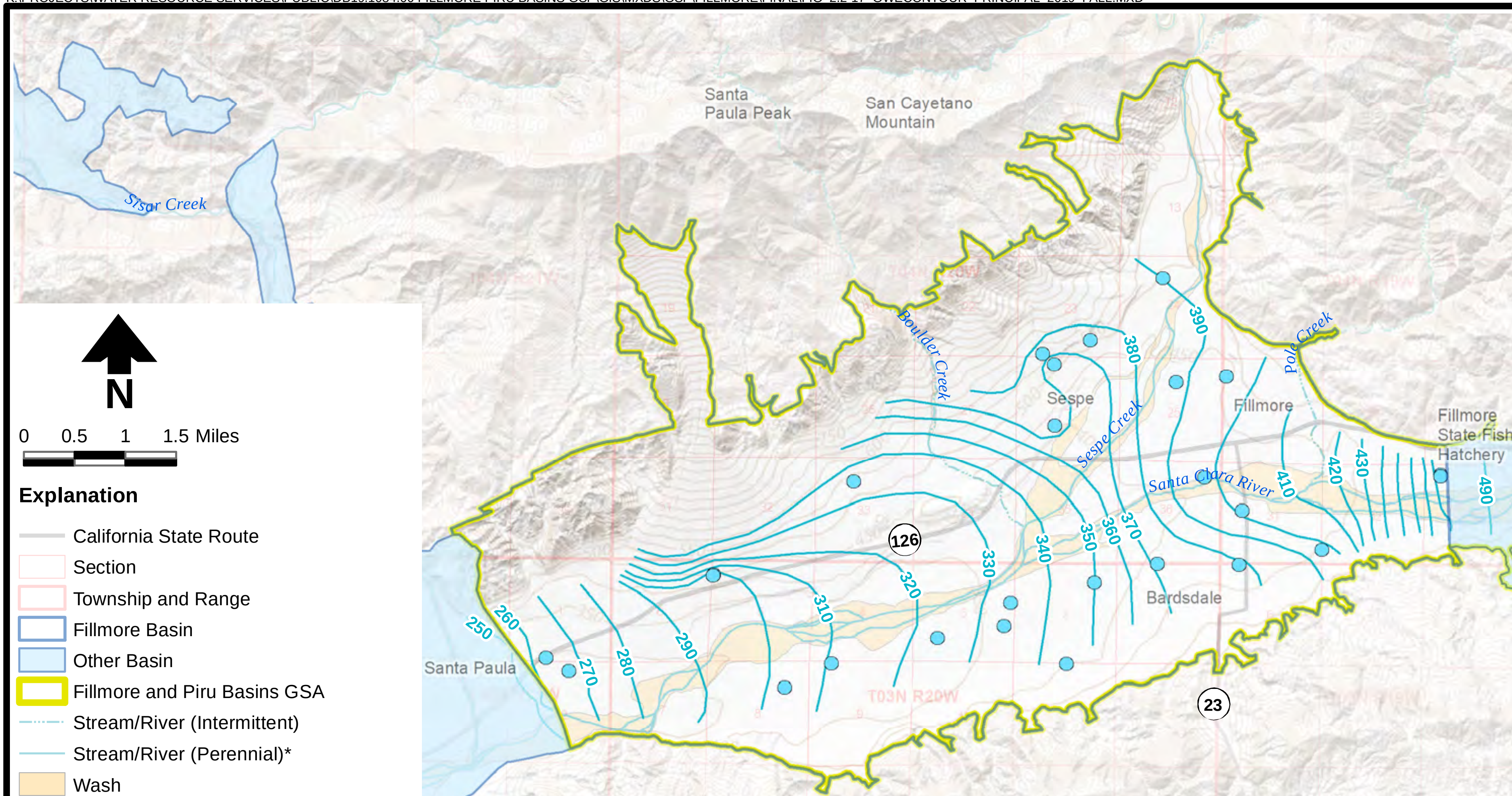
K:\PROJECTS\WATER RESOURCE SERVICES\PUBLIC\DB19.1084.00 FILLMORE PIRU BASINS GSP\GIS\MXDS\GSP\FILLMORE\FINAL\FIG_2.2-17_GWECONTOUR_PRINCIPAL_2019_FALL.MXD



Basemap: USGS The National Map: 3D Elevation Program. USGS Earth Resources Observation & Science (EROS) Center: GMTED2010. Data refreshed March, 2021.

Notes:

* Perennial streams (designated by the U.S. Geological Survey [USGS] National Hydrography Dataset [NHD]) exhibit interrupted perennial (i.e., intermittent to ephemeral) conditions in the Santa Clara River Valley (Hanson et al., 2003; SFEI, 2011; Beller et al., 2016; United, 2017).

1. Land (index/intermediate) elevation contours are in feet relative to the North American Vertical Datum of 1988 (NAVD88).
2. GW elevation contours are provided at 10-foot intervals by United Water Conservation District, based on GWL data measured 9/9-11/14/2019, in feet relative to approximate mean sea level (ft-msl), the National Geodetic Vertical Datum of 1929 (NGVD29).
3. GWL: groundwater level

Coordinate System: NAD 1983 StatePlane California V FIPS 0405 Feet | Projection: Lambert Conformal Conic | Datum: North American 1983

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FILLMORE BASIN GROUNDWATER SUSTAINABILITY PLAN

Groundwater Elevation Contours in the Principal Aquifer, Fall 2019

Figure 2.2-17

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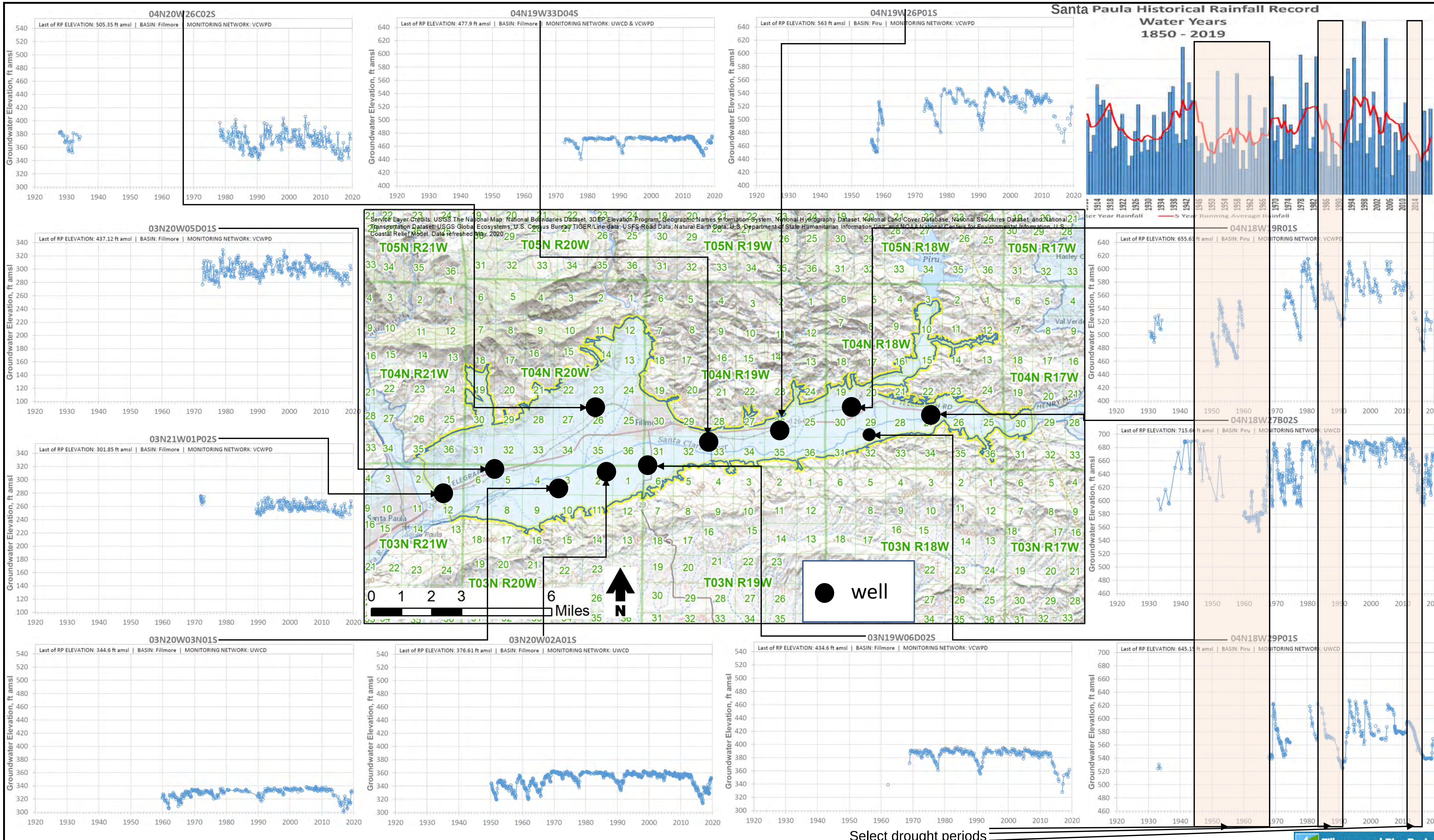

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FILLMORE BASIN GROUNDWATER SUSTAINABILITY PLAN

Long-Term Groundwater Level Hydrographs in Map View

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Figure 2.2-18

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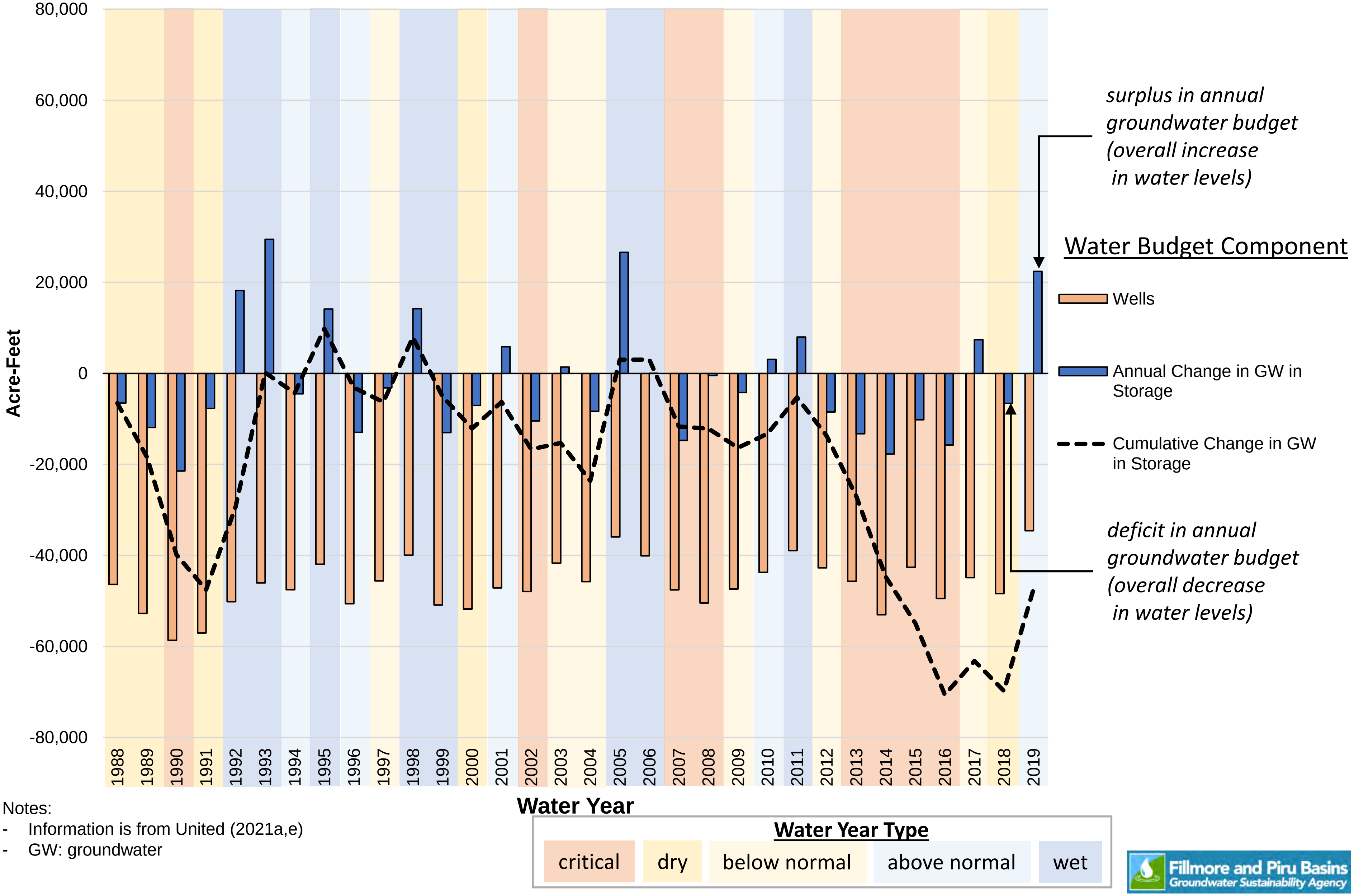

Notes:
- Information is from United (2021a,e)
- GW: groundwater

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FILLMORE BASIN GROUNDWATER SUSTAINABILITY PLAN

Estimates of the Change in Groundwater in Storage

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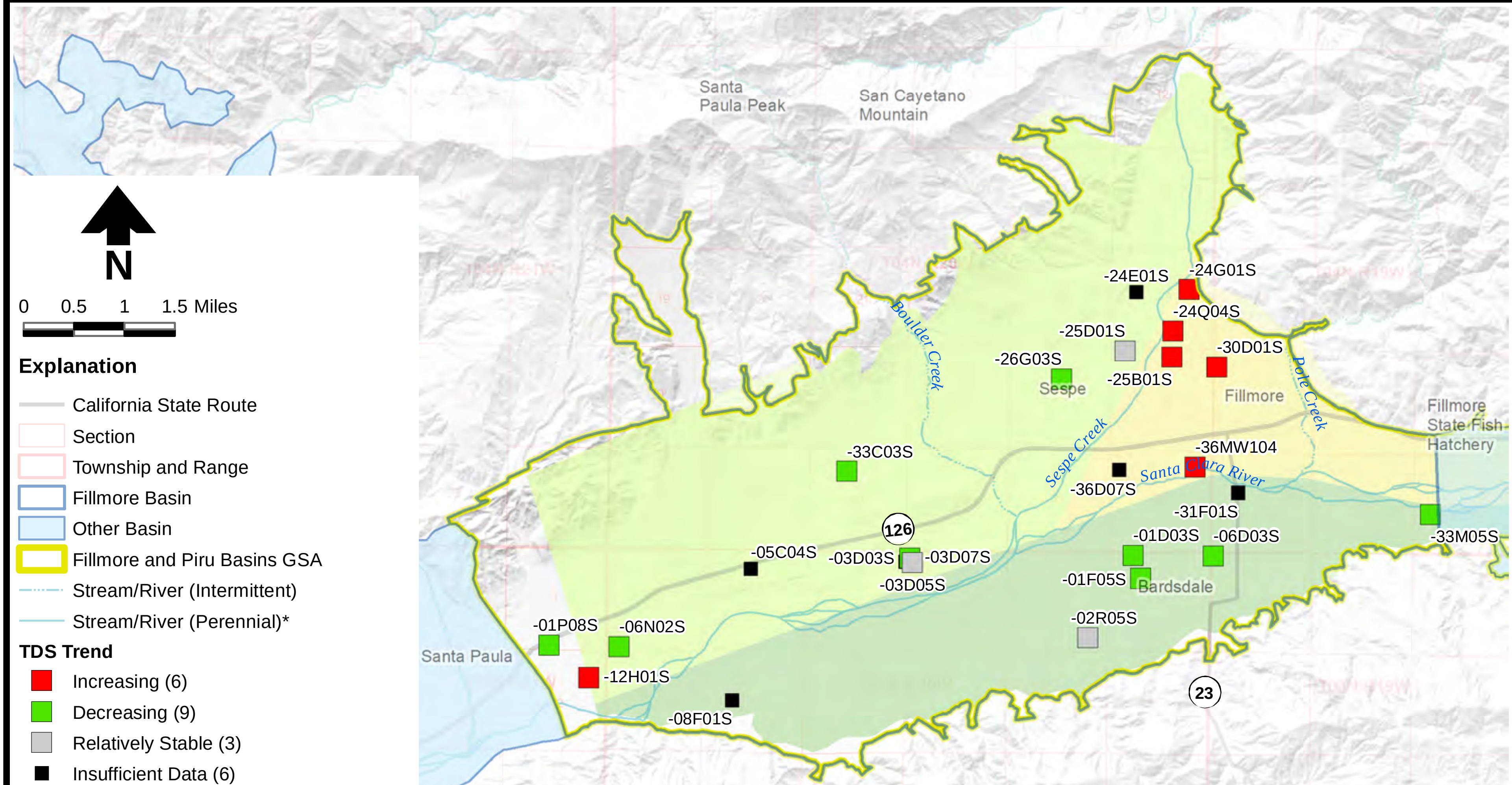
Figure 2.2-19

K:\PROJECTS\WATER RESOURCE SERVICES\PUBLIC\DB19.1084.00 FILLMORE PIRU BASINS GSP\GIS\MXDS\GSP\FILLMORE\FINAL\FIG_2.2-20_GWQ_TREND_TDS.MXD



Basemap: USGS The National Map: 3D Elevation Program. USGS Earth Resources Observation & Science (EROS) Center: GMTED2010. Data refreshed March, 2021.

Notes:

* Perennial streams (designated by the U.S. Geological Survey [USGS] National Hydrography Dataset [NHD]) exhibit interrupted perennial (i.e., intermittent to ephemeral) conditions in the Santa Clara River Valley (Hanson et al., 2003; SFEI, 2011; Beller et al., 2016; United, 2017).

1. Trends are quantified at wells with water quality (WQ) data available since 2000.
2. LARWQCB: Los Angeles Regional Water Quality Control Board
3. SNMP: Salt and Nutrient Management Plan, a component of the LARWQCB Basin Plan for Coastal Watersheds of Los Angeles and Ventura County
4. WQ Objective Area boundaries represent the original Department of Water Resources (DWR) Bulletin 118 basin boundaries.

Coordinate System: NAD 1983 StatePlane California V FIPS 0405 Feet | Projection: Lambert Conformal Conic | Datum: North American 1983

Fillmore and Piru Basins Groundwater Sustainability Agency

FILLMORE BASIN GROUNDWATER SUSTAINABILITY PLAN

Map of Groundwater Quality Trends, Total Dissolved Solids (TDS)

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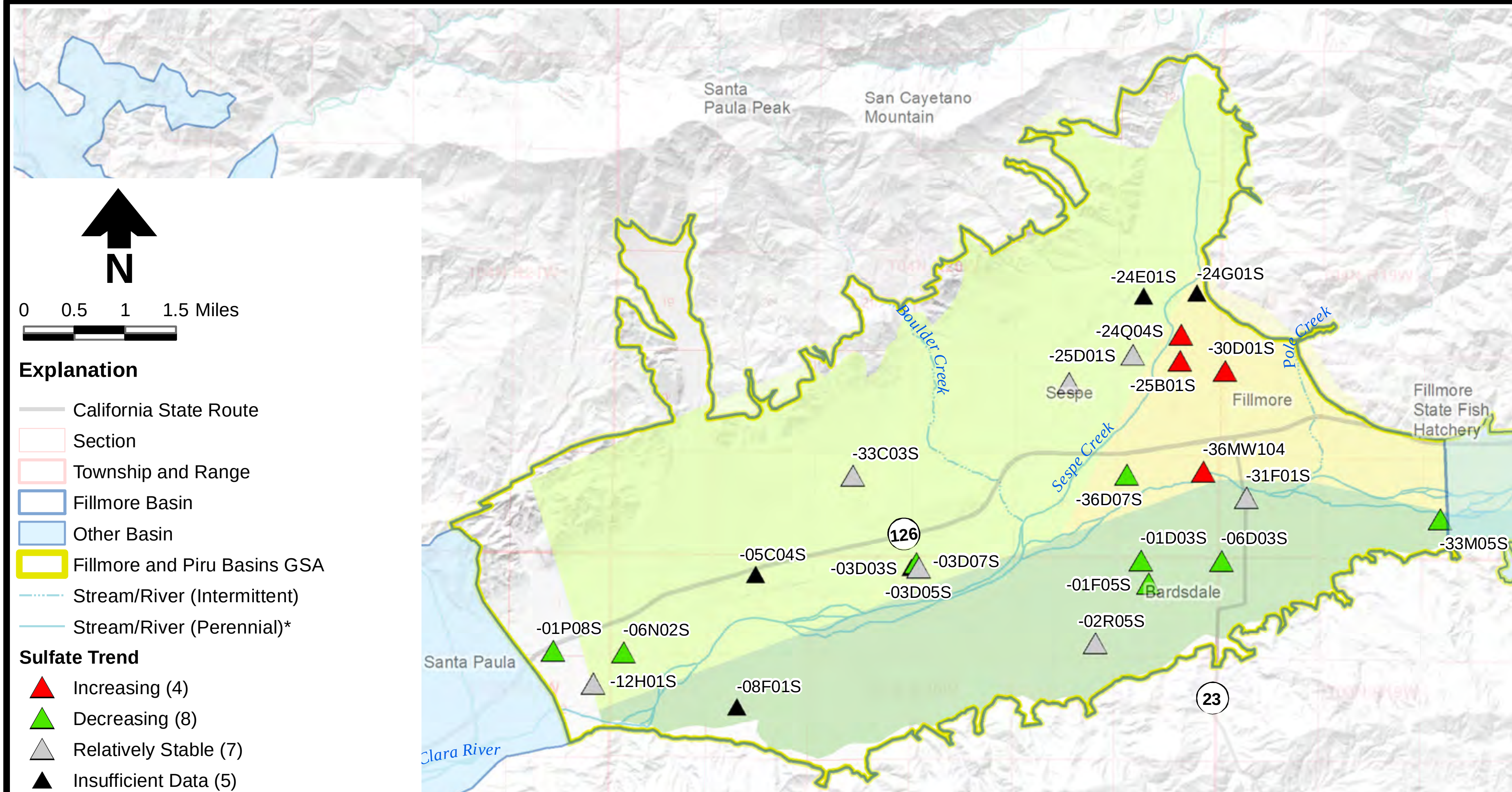
Figure 2.2-20

K:\PROJECTS\WATER RESOURCE SERVICES\PUBLIC\DB19.1084.00 FILLMORE PIRU BASINS GSP\GIS\MXDS\GSP\FILLMORE\FINAL\FIG_2.2-21_GWQ_TREND_SO4.MXD



Basemap: USGS The National Map: 3D Elevation Program. USGS Earth Resources Observation & Science (EROS) Center: GMTED2010. Data refreshed March, 2021.

Notes:
* Perennial streams (designated by the U.S. Geological Survey [USGS] National Hydrography Dataset [NHD]) exhibit interrupted perennial (i.e., intermittent to ephemeral) conditions in the Santa Clara River Valley (Hanson et al., 2003; SFEI, 2011; Beller et al., 2016; United, 2017).

1. Trends are quantified at wells with water quality (WQ) data available since 2000.
2. LARWQCB: Los Angeles Regional Water Quality Control Board
3. SNMP: Salt and Nutrient Management Plan, a component of the LARWQCB Basin Plan for Coastal Watersheds of Los Angeles and Ventura County
4. WQ Objective Area boundaries represent the original Department of Water Resources (DWR) Bulletin 118 basin boundaries.

Fillmore and Piru Basins Groundwater Sustainability Agency

FILLMORE BASIN GROUNDWATER SUSTAINABILITY PLAN

Map of Groundwater Quality Trends, Sulfate (SO4)

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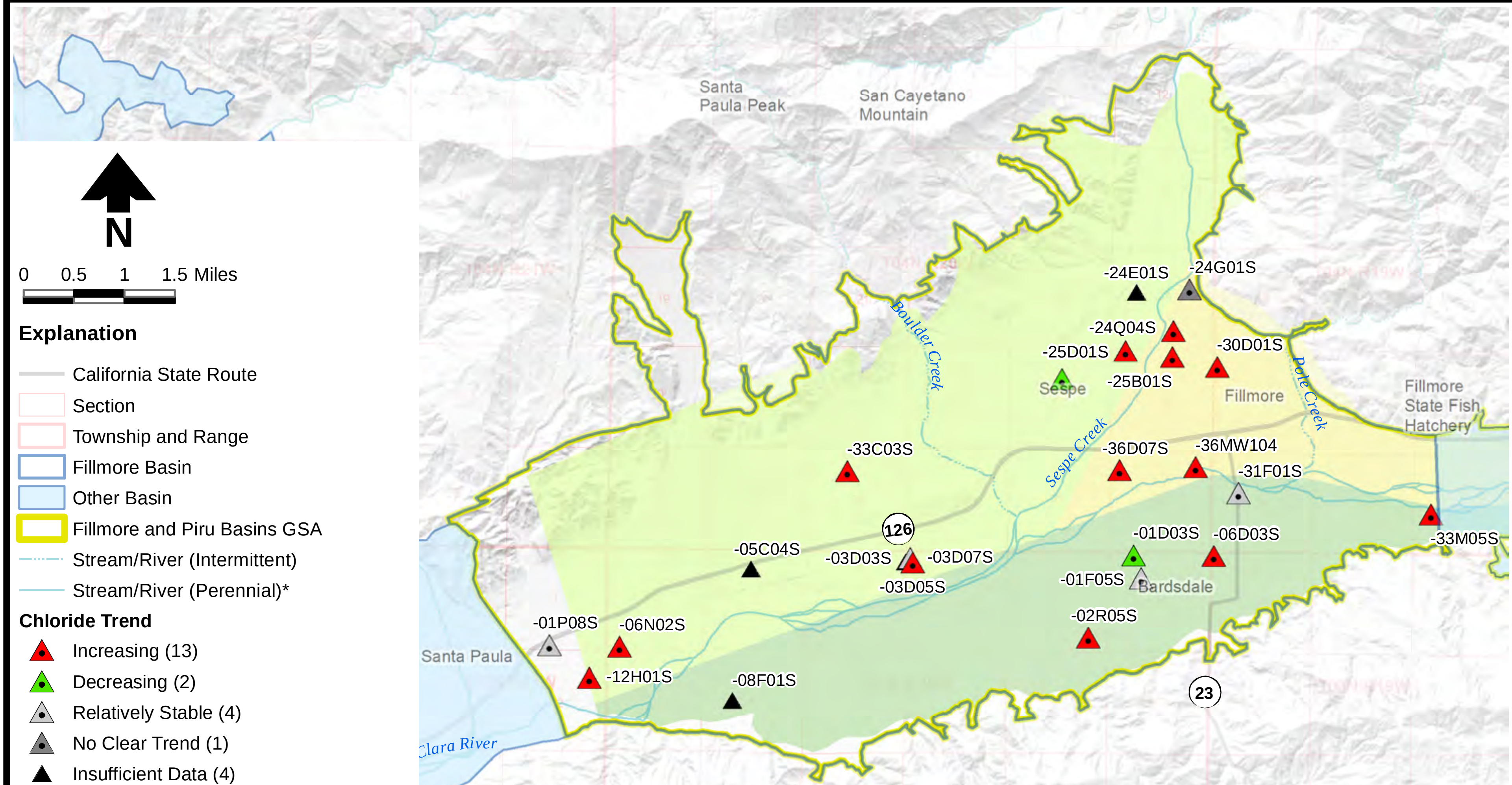
Figure 2.2-21

K:\PROJECTS\WATER RESOURCE SERVICES\PUBLIC\DB19.1084.00 FILLMORE PIRU BASINS GSP\GIS\MXDS\GSP\FILLMORE\FINAL\FIG_2.2-22_GWQ_TREND_CL.MXD



Basemap: USGS The National Map: 3D Elevation Program. USGS Earth Resources Observation & Science (EROS) Center: GMTED2010. Data refreshed March, 2021.

Notes:
* Perennial streams (designated by the U.S. Geological Survey [USGS] National Hydrography Dataset [NHD]) exhibit interrupted perennial (i.e., intermittent to ephemeral) conditions in the Santa Clara River Valley (Hanson et al., 2003; SFEI, 2011; Beller et al., 2016; United, 2017).

1. Trends are quantified at wells with water quality (WQ) data available since 2000.
2. LARWQCB: Los Angeles Regional Water Quality Control Board
3. SNMP: Salt and Nutrient Management Plan, a component of the LARWQCB Basin Plan for Coastal Watersheds of Los Angeles and Ventura County
4. WQ Objective Area boundaries represent the original Department of Water Resources (DWR) Bulletin 118 basin boundaries.

Fillmore and Piru Basins Groundwater Sustainability Agency

FILLMORE BASIN GROUNDWATER SUSTAINABILITY PLAN

Map of Groundwater Quality Trends, Chloride (Cl)

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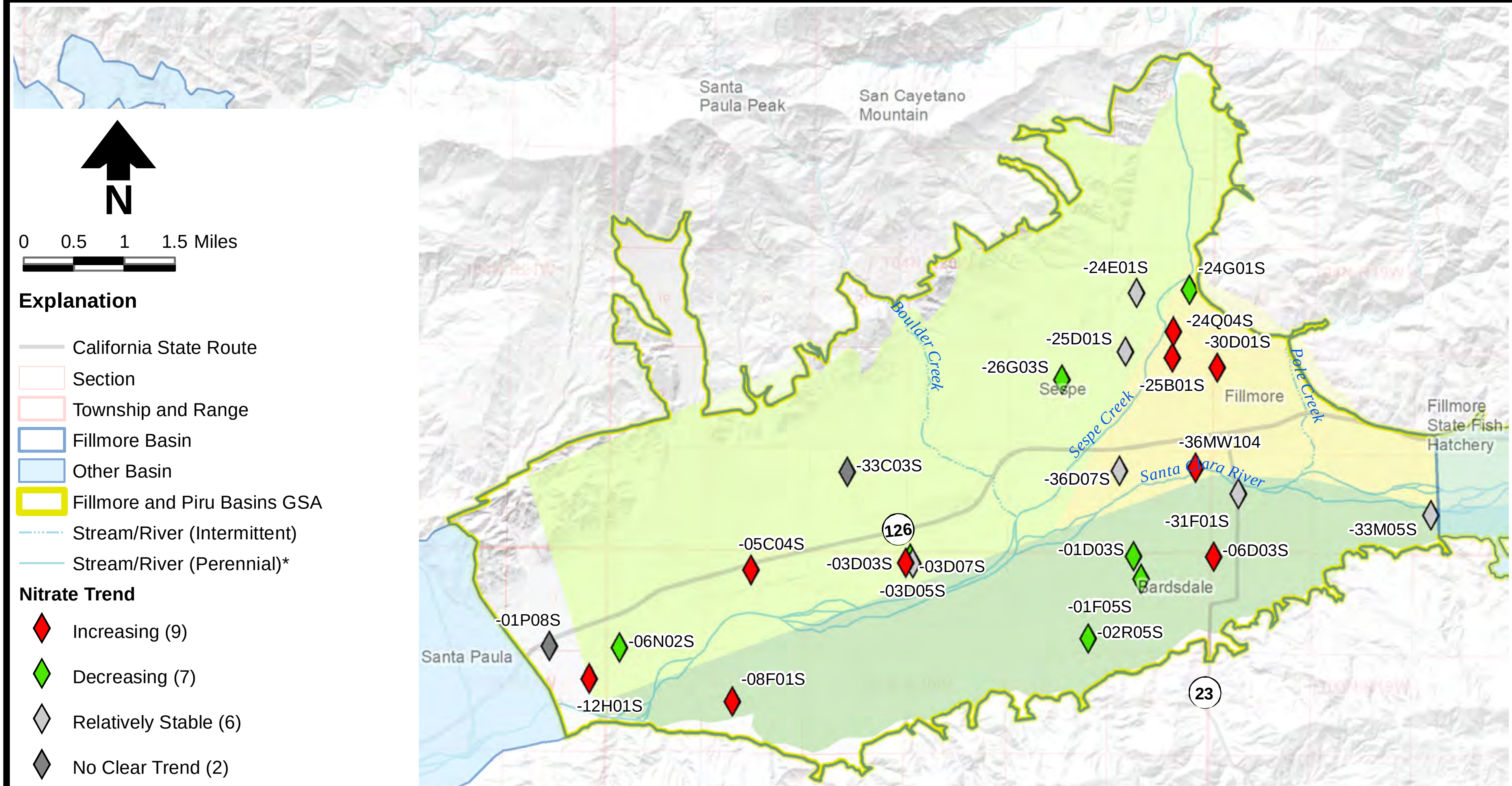
Figure 2.2-22

Coordinate System: NAD 1983 StatePlane California V FIPS 0405 Feet | Projection: Lambert Conformal Conic | Datum: North American 1983

K:\PROJECTS\WATER RESOURCE SERVICES\PUBLIC\DB19.1084.00 FILLMORE PIRU BASINS GSP\GIS\MXDS\GSP\FILLMORE\FINAL\FIG_2.2-23_GWQ_TREND_NO3.MXD



Coordinate System: NAD 1983 StatePlane California V FIPS 0405 Feet | Projection: Lambert Conformal Conic | Datum: North American 1983

Basemap: USGS The National Map: 3D Elevation Program. USGS Earth Resources Observation & Science (EROS) Center: GMTED2010. Data refreshed March, 2021.

Notes:
* Perennial streams (designated by the U.S. Geological Survey [USGS] National Hydrography Dataset [NHD]) exhibit interrupted perennial (i.e., intermittent to ephemeral) conditions in the Santa Clara River Valley (Hanson et al., 2003; SFEI, 2011; Beller et al., 2016; United, 2017).

1. Trends are quantified at wells with water quality (WQ) data available since 2000.
2. LARWQCB: Los Angeles Regional Water Quality Control Board
3. SNMP: Salt and Nutrient Management Plan, a component of the LARWQCB Basin Plan for Coastal Watersheds of Los Angeles and Ventura County
4. WQ Objective Area boundaries represent the original Department of Water Resources (DWR) Bulletin 118 basin boundaries.

Fillmore and Piru Basins Groundwater Sustainability Agency

FILLMORE BASIN GROUNDWATER SUSTAINABILITY PLAN

Map of Groundwater Quality Trends, Nitrate (NO3)

Figure 2.2-23

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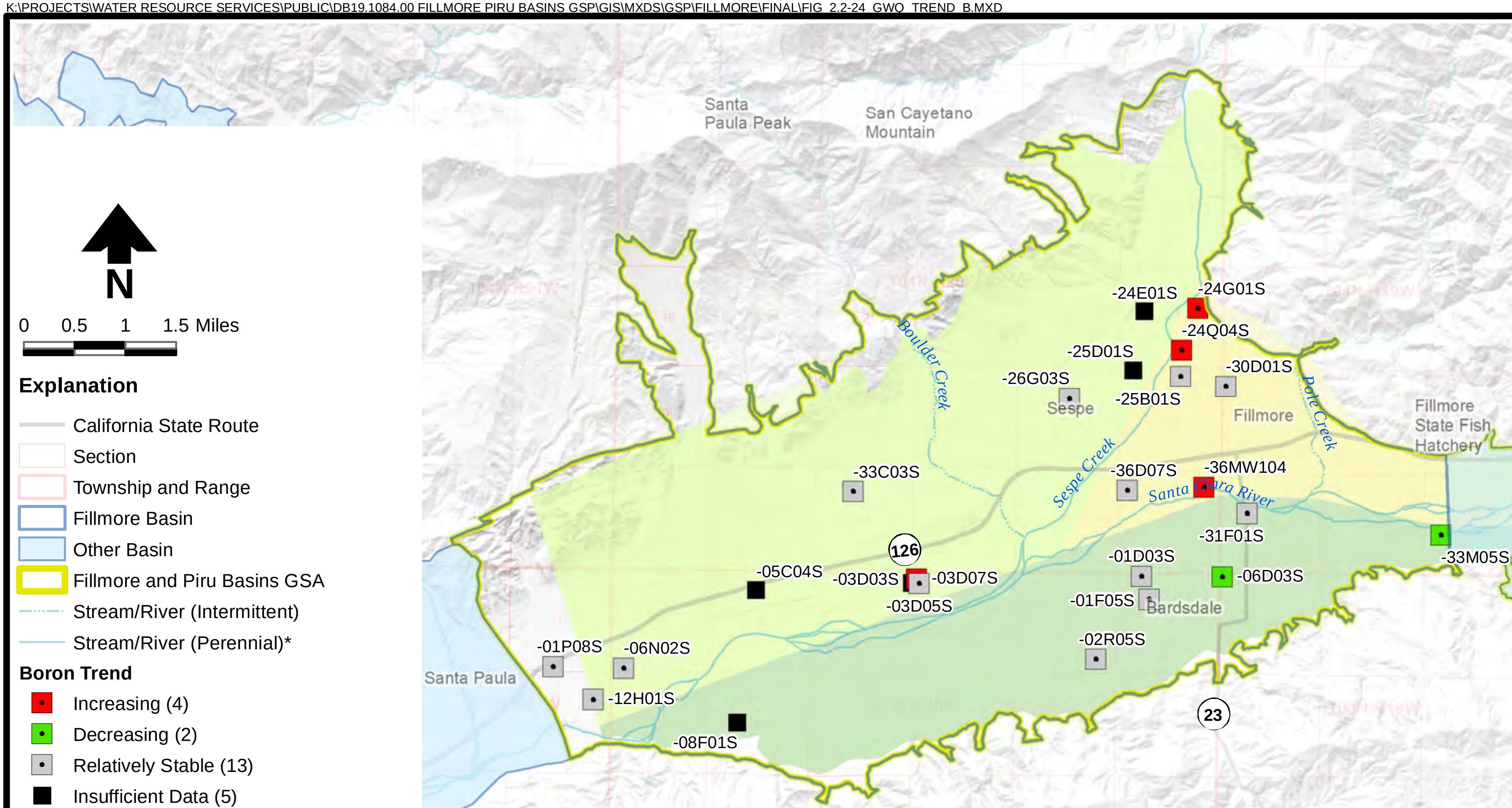
K:\PROJECTS\WATER RESOURCE SERVICES\PUBLIC\DB19.1084.00 FILLMORE PIRU BASINS GSP\GIS\MXDS\GSP\FILLMORE\FINAL\FIG_2.2-24_GWQ_TREND_B.MXD



Coordinate System: NAD 1983 StatePlane California V FIPS 0405 Feet | Projection: Lambert Conformal Conic | Datum: North American 1983

Basemap: USGS The National Map: 3D Elevation Program. USGS Earth Resources Observation & Science (EROS) Center: GMTED2010. Data refreshed March, 2021.

Notes:
* Perennial streams (designated by the U.S. Geological Survey [USGS] National Hydrography Dataset [NHD]) exhibit interrupted perennial (i.e., intermittent to ephemeral) conditions in the Santa Clara River Valley (Hanson et al., 2003; SFEI, 2011; Beller et al., 2016; United, 2017).
1. Trends are quantified at wells with water quality (WQ) data available since 2000.
2. LARWQCB: Los Angeles Regional Water Quality Control Board
3. SNMP: Salt and Nutrient Management Plan, a component of the LARWQCB Basin Plan for Coastal Watersheds of Los Angeles and Ventura County
4. WQ Objective Area boundaries represent the original Department of Water Resources (DWR) Bulletin 118 basin boundaries.

Fillmore and Piru Basins Groundwater Sustainability Agency

FILLMORE BASIN GROUNDWATER SUSTAINABILITY PLAN

Map of Groundwater Quality Trends, Boron (B)

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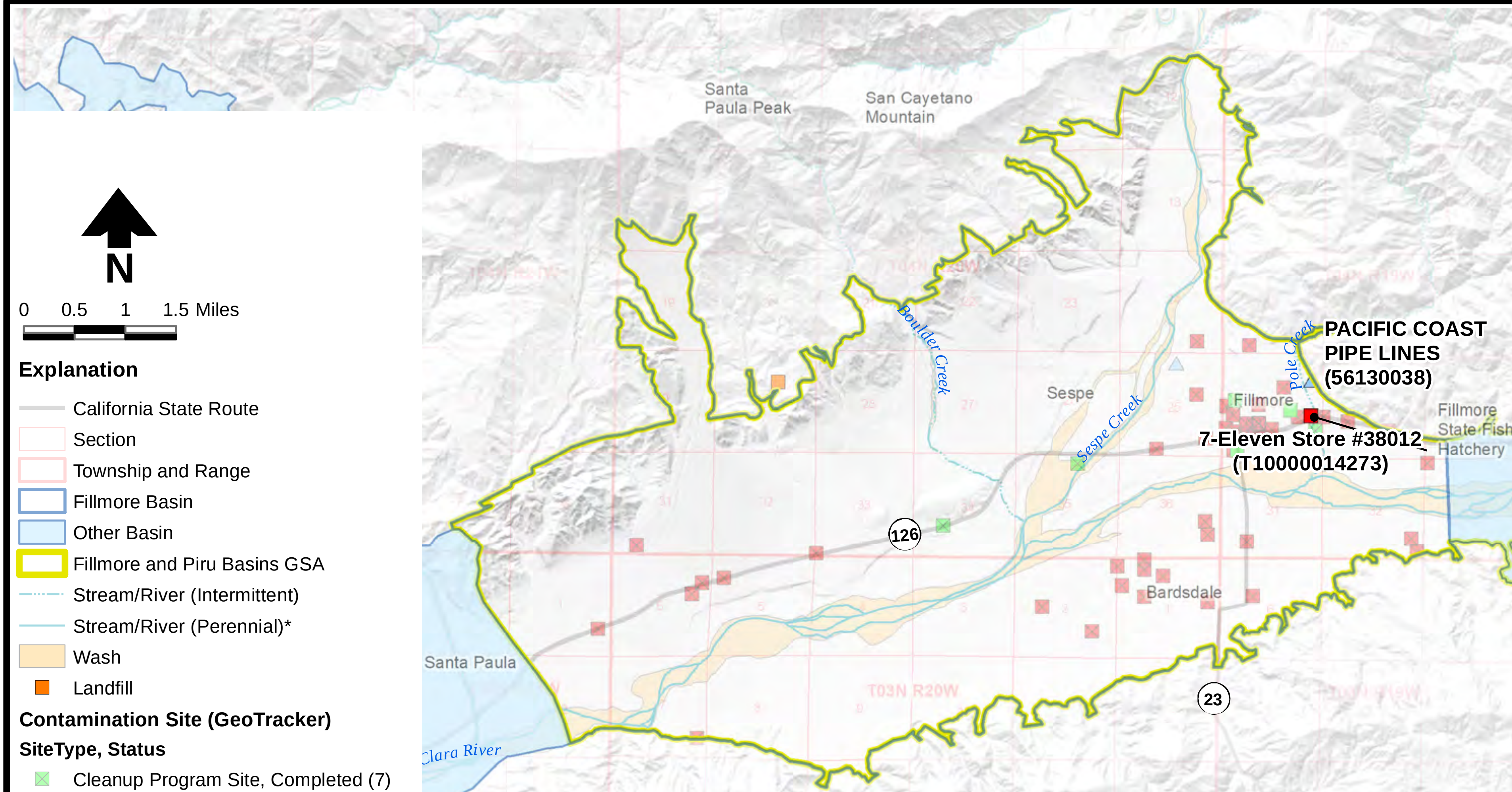
Figure 2.2-24

K:\PROJECTS\WATER RESOURCE SERVICES\PUBLIC\DB19.1084.00 FILLMORE PIRU BASINS GSP\GIS\MXDS\GSP\FILLMORE\FINAL\FIG_2.2-25_GWQ_CONTAMINATIONSITES.MXD



Coordinate System: NAD 1983 StatePlane California V FIPS 0405 Feet | Projection: Lambert Conformal Conic | Datum: North American 1983

Basemap: USGS The National Map: 3D Elevation Program. USGS Earth Resources Observation & Science (EROS) Center: GMTED2010. Data refreshed March, 2021.

Notes:

* Perennial streams (designated by the U.S. Geological Survey [USGS] National Hydrography Dataset [NHD]) exhibit interrupted perennial (i.e., intermittent to ephemeral) conditions in the Santa Clara River Valley (Hanson et al., 2003; SFEI, 2011; Beller et al., 2016; United, 2017).

1. SWRCB: State Water Resources Control Board
2. Known contamination sites from SWRCB GeoTracker database (as of July 21, 2021) that have affected groundawter are shown in solid color (e.g., the 2 sites in the City of Fillmore), while other sites with insignificant impacts on groundwater are transparent.
3. DTSC: Department of Toxic Substances Control
4. LUST: Leaky Underground Storage Tank

Fillmore and Piru Basins Groundwater Sustainability Agency

FILLMORE BASIN GROUNDWATER SUSTAINABILITY PLAN

Known Groundwater Contamination Sites Map

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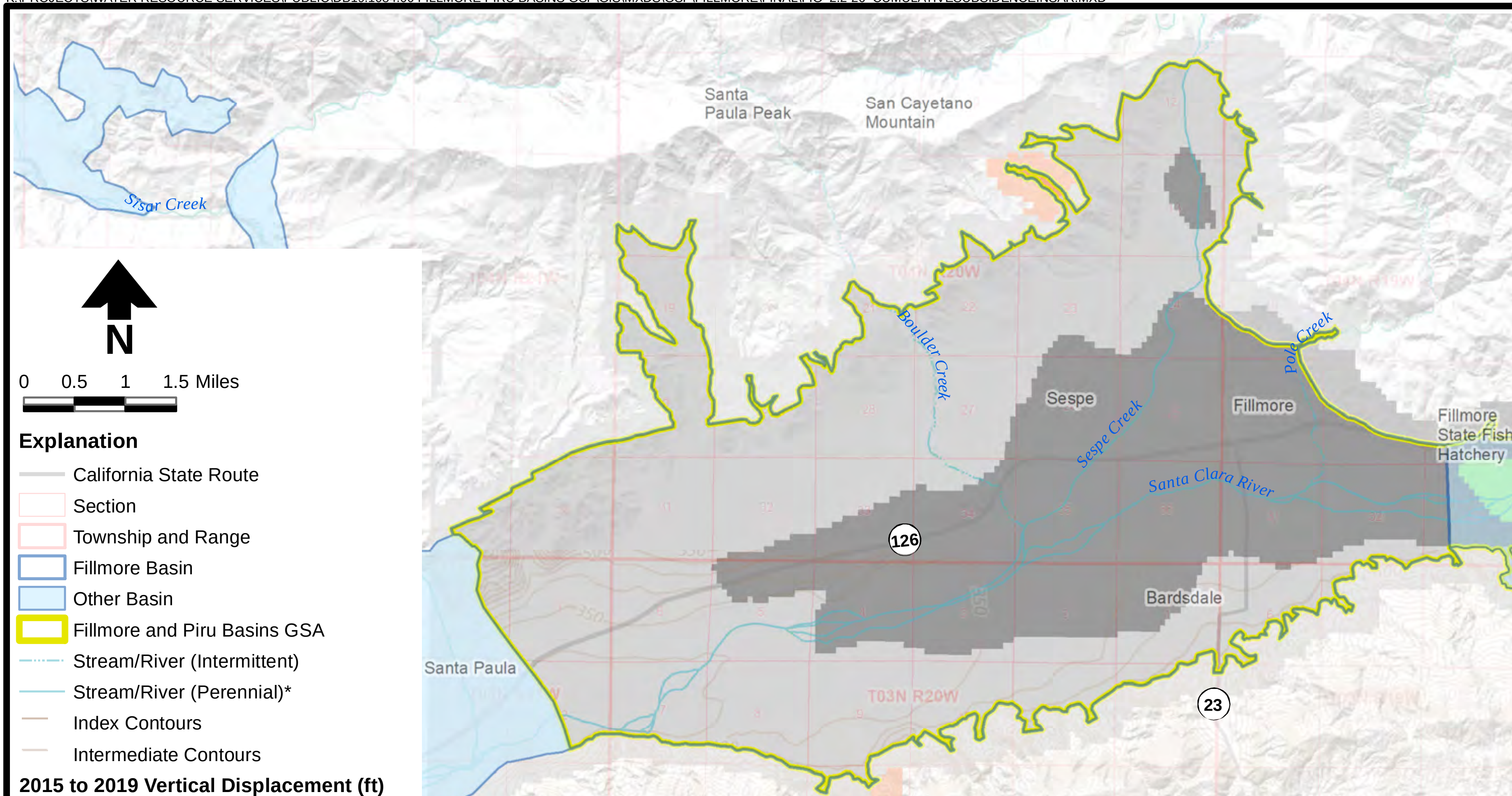
Figure 2.2-25

K:\PROJECTS\WATER RESOURCE SERVICES\PUBLIC\DB19.1084.00 FILLMORE PIRU BASINS GSP\GIS\MXDS\GSP\FILLMORE\FINAL\FIG_2.2-26_CUMULATIVESUBSIDENCEINSAR.MXD



Explanation

- California State Route
- Section
- Township and Range
- Fillmore Basin
- Other Basin
- Fillmore and Piru Basins GSA
- Stream/River (Intermittent)
- Stream/River (Perennial)*
- Index Contours
- Intermediate Contours

2015 to 2019 Vertical Displacement (ft)

- +0.05 to +0.1
- 0.00 to +0.05
- -0.05 to 0.00
- -0.1 to -0.05

Basemap: USGS The National Map: 3D Elevation Program. USGS Earth Resources Observation & Science (EROS) Center: GMTED2010. Data refreshed March, 2021.

Notes:

* Perennial streams (designated by the U.S. Geological Survey [USGS] National Hydrography Dataset [NHD]) exhibit interrupted perennial (i.e., intermittent to ephemeral) conditions in the Santa Clara River Valley (Hanson et al., 2003; SFEI, 2011; Beller et al., 2016; United, 2017).

1. Cumulative land subsidence measurements come from TRE Altimira Interferometric Synthetic Aperture Radar (InSAR), via DWR.
   a. Cumulative subsidence (vertical displacement) values are insignificant (i.e., within the range of error) +/-0.1 foot.
2. Land (index/intermediate) elevation contours are in feet relative to the North American Vertical Datum of 1988 (NAVD88).

Coordinate System: NAD 1983 StatePlane California V FIPS 0405 Feet | Projection: Lambert Conformal Conic | Datum: North American 1983

Fillmore and Piru Basins Groundwater Sustainability Agency

FILLMORE BASIN GROUNDWATER SUSTAINABILITY PLAN

Cumulative Land Subsidence Map

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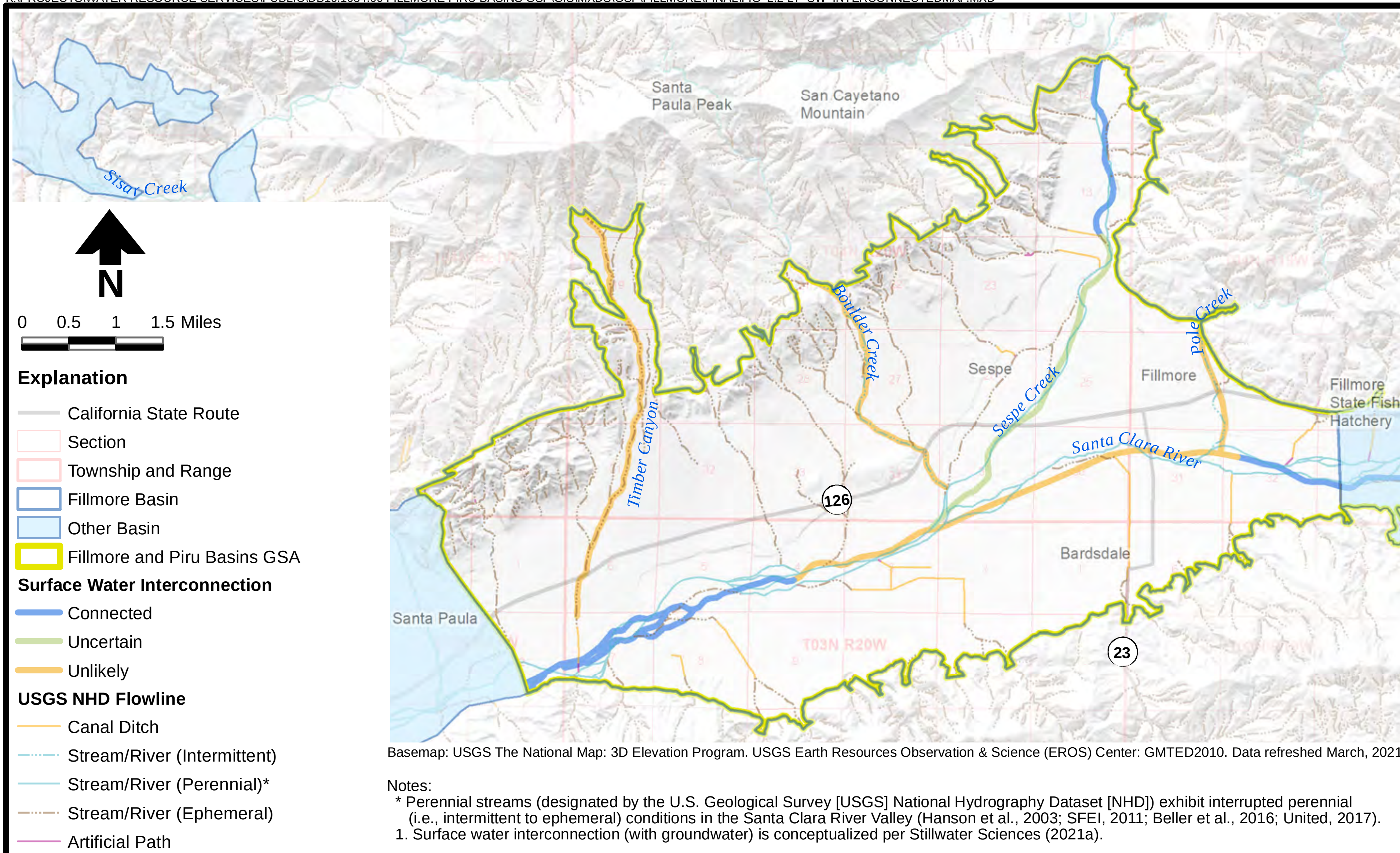
Figure 2.2-26

K:\PROJECTS\WATER RESOURCE SERVICES\PUBLIC\DB19.1084.00 FILLMORE PIRU BASINS GSP\GIS\MXDS\GSP\FILLMORE\FINAL\FIG_2.2-27_SW_INTERCONNECTEDMAP.MXD



Basemap: USGS The National Map: 3D Elevation Program. USGS Earth Resources Observation & Science (EROS) Center: GMTED2010. Data refreshed March, 2021.

Notes:
* Perennial streams (designated by the U.S. Geological Survey [USGS] National Hydrography Dataset [NHD]) exhibit interrupted perennial (i.e., intermittent to ephemeral) conditions in the Santa Clara River Valley (Hanson et al., 2003; SFEI, 2011; Beller et al., 2016; United, 2017).
1. Surface water interconnection (with groundwater) is conceptualized per Stillwater Sciences (2021a).

Coordinate System: NAD 1983 StatePlane California V FIPS 0405 Feet | Projection: Lambert Conformal Conic | Datum: North American 1983

Fillmore and Piru Basins Groundwater Sustainability Agency

FILLMORE BASIN GROUNDWATER SUSTAINABILITY PLAN

Interconnected Surface Water Reaches Map

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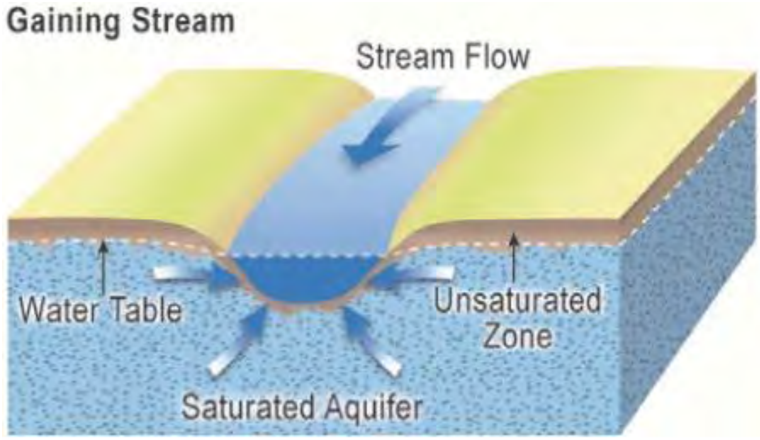
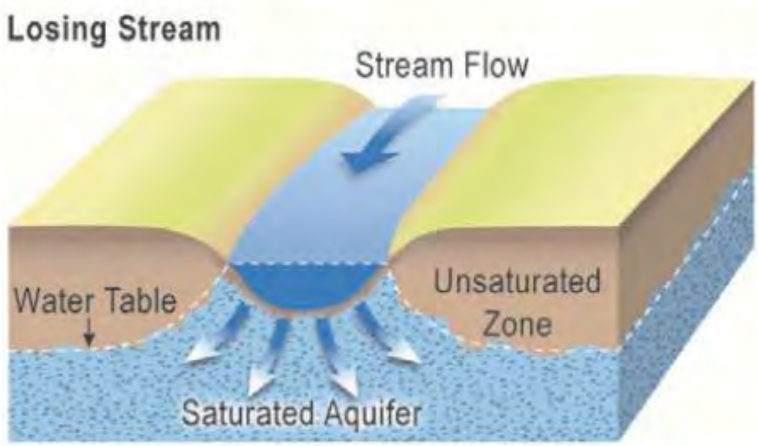
Figure 2.2-27

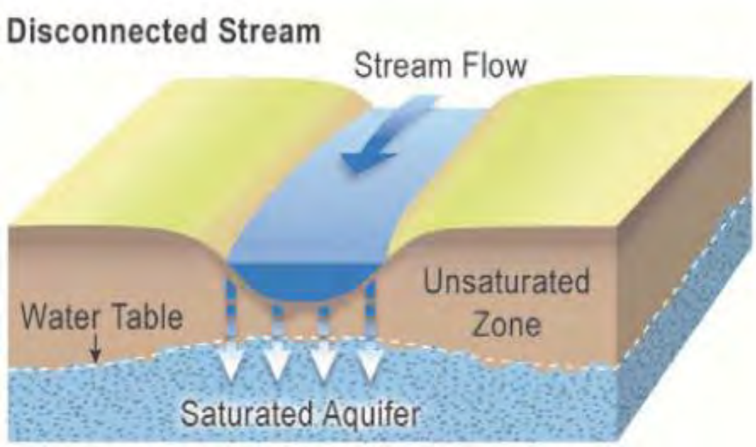
(a)



(b)



(c)



Notes:

- Figure is from DWR (2018d).
- Gaining stream conditions are similar to interconnected "rising" groundwater conditions.
- Losing stream conditions represent stream recharge (or induced recharge due to stream flow depletions) to interconnected groundwater.
- Disconnected stream conditions represent stream segments where groundwater levels are too deep to affect surface water depletion rates, yet streams continue to recharge groundwater at relatively high rates (i.e., due to large hydraulic gradients between surface water and groundwater).

Fillmore and Piru Basins Groundwater Sustainability Agency

FILLMORE BASIN GROUNDWATER SUSTAINABILITY PLAN

Conceptual Models of Interconnected and Disconnected Stream Conditions

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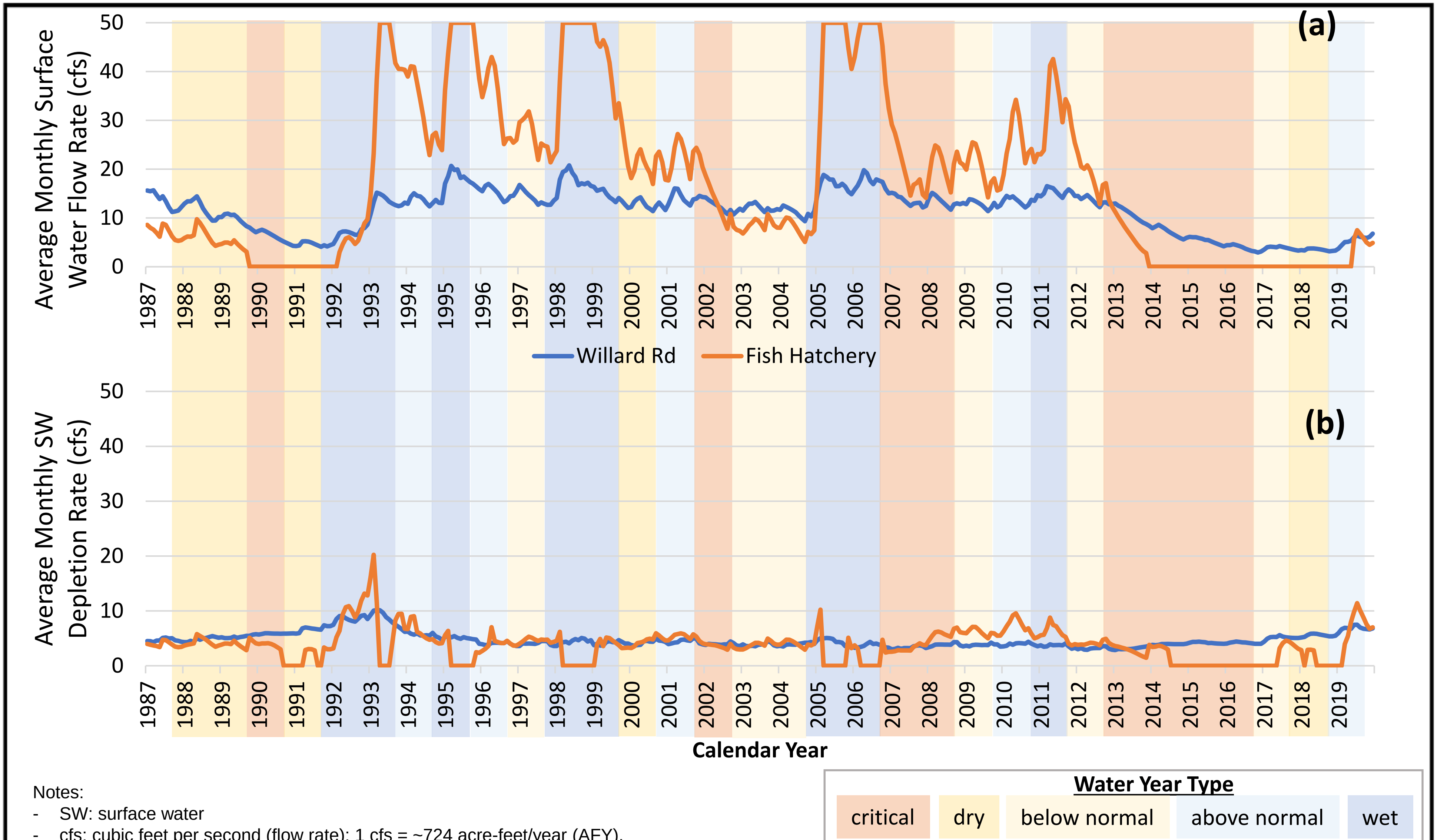
Figure 2.2-28



Notes:
- SW: surface water
- cfs: cubic feet per second (flow rate); 1 cfs = ~724 acre-feet/year (AFY).
- Surface water flow rates are estimated based on strong correlations between measured groundwater levels and surface water flows (United, 2017, 2021a,e).
- Surface water depletion rates are calculated based on the difference in surface water flows, estimated from correlations with groundwater levels simulated with United groundwater flow model (VRGWFM; United 2021a) scenarios that represent historical pumping rates and historical pumping rates reduced by 50% (no pumping within 1-mile band centered along the Santa Clara River).

Fillmore and Piru Basins Groundwater Sustainability Agency

FILLMORE BASIN GROUNDWATER SUSTAINABILITY PLAN

Surface Water Flow and Depletion Rate Estimates at the Areas of Rising Groundwater

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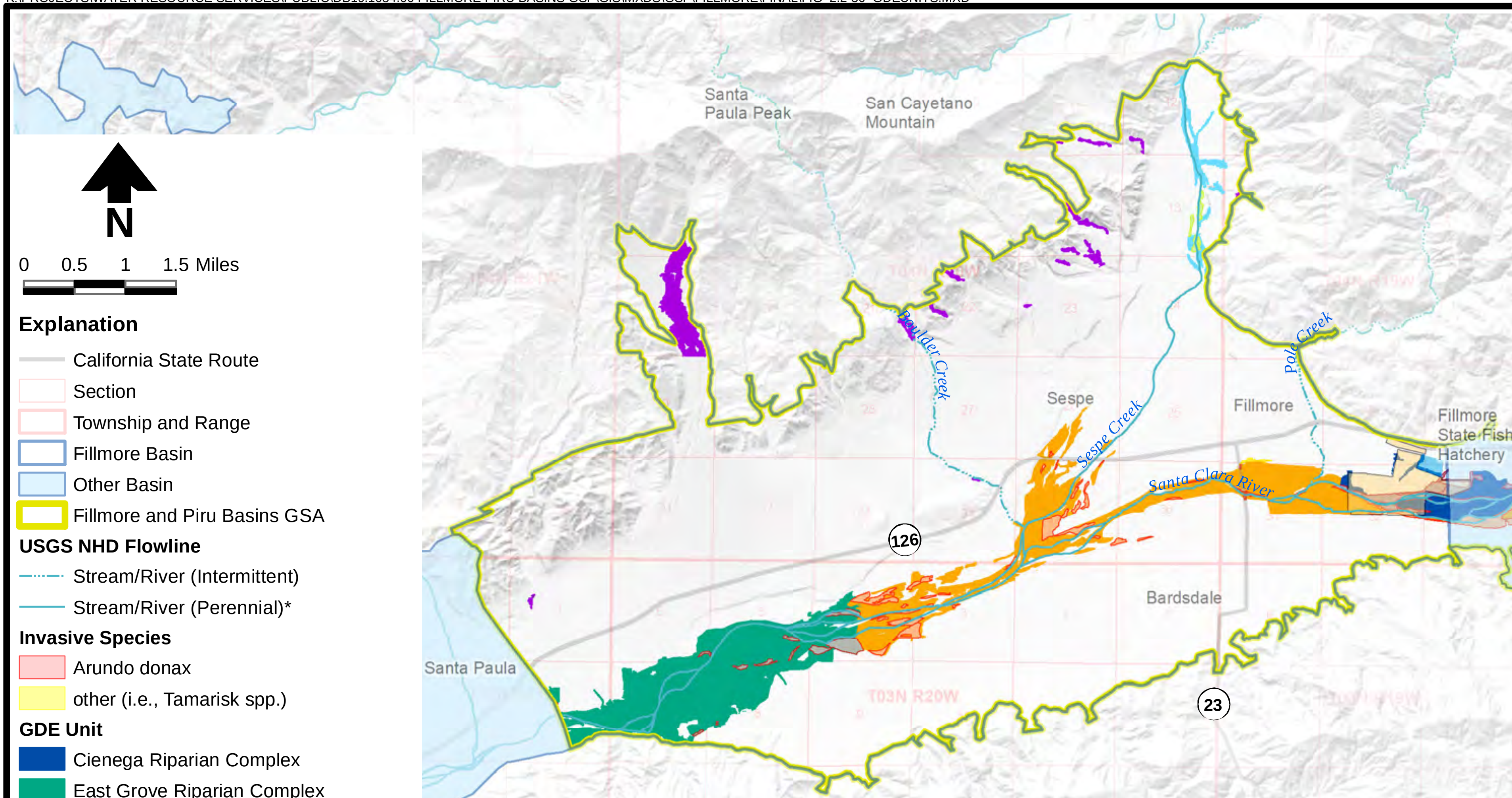
Figure 2.2-29

K:\PROJECTS\WATER RESOURCE SERVICES\PUBLIC\DB19.1084.00 FILLMORE PIRU BASINS GSP\GIS\MXDS\GSP\FILLMORE\FINAL\FIG_2.2-30_GDEUNITS.MXD



Coordinate System: NAD 1983 StatePlane California V FIPS 0405 Feet | Projection: Lambert Conformal Conic | Datum: North American 1983

Basemap: USGS The National Map: 3D Elevation Program. USGS Earth Resources Observation & Science (EROS) Center: GMTED2010. Data refreshed March, 2021.

Notes:

* Perennial streams (designated by the U.S. Geological Survey [USGS] National Hydrography Dataset [NHD]) exhibit interrupted perennial (i.e., intermittent to ephemeral) conditions in the Santa Clara River Valley (Hanson et al., 2003; SFEI, 2011; Beller et al., 2016; United, 2017).

1. GDE: groundwater-dependent ecosystem
2. GDE unit and invasive species' extents are from Stillwater Sciences (2021a).
3. CDFW: California Department of Fish and Wildlife

Fillmore and Piru Basins Groundwater Sustainability Agency

FILLMORE BASIN GROUNDWATER SUSTAINABILITY PLAN

Groundwater Dependent Ecosystem (GDE) Units Map

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Figure 2.2-30

K:\PROJECTS\WATER RESOURCE SERVICES\PUBLIC\DB19.1084.00 FILLMORE PIRU BASINS GSP\GIS\MXDS\GSP\FILLMORE\FINAL\FIG_2.2-31_CRITICALHABITAT.MXD

Basemap: USGS The National Map: 3D Elevation Program. USGS Earth Resources Observation & Science (EROS) Center: GMTED2010. Data refreshed March, 2021.

Notes:

* Perennial streams (designated by the U.S. Geological Survey [USGS] National Hydrography Dataset [NHD]) exhibit interrupted perennial (i.e., intermittent to ephemeral) conditions in the Santa Clara River Valley (Hanson et al., 2003; SFEI, 2011; Beller et al., 2016; United, 2017).

1. NMFS: National Marine Fisheries Service
2. USFWS: United States Fish and Wildlife Services

Coordinate System: NAD 1983 StatePlane California V FIPS 0405 Feet | Projection: Lambert Conformal Conic | Datum: North American 1983

Fillmore and Piru Basins Groundwater Sustainability Agency

FILLMORE BASIN GROUNDWATER SUSTAINABILITY PLAN

Critical Habitat Map

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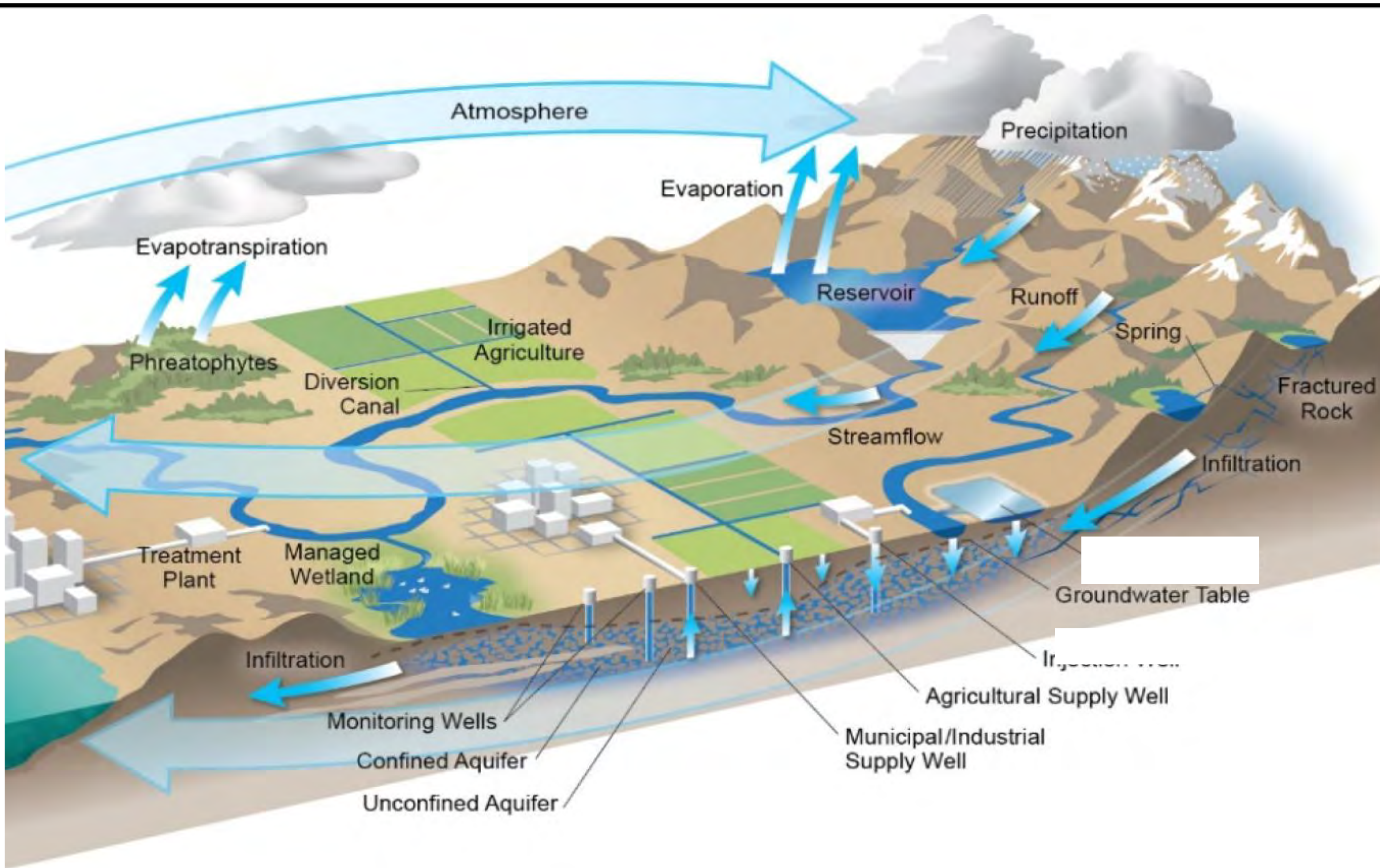
Figure 2.2-31



Notes:
- Figure is modified from DWR, 2016d.

FILLMORE BASIN GROUNDWATER SUSTAINABILITY PLAN
Water Budget Schematic

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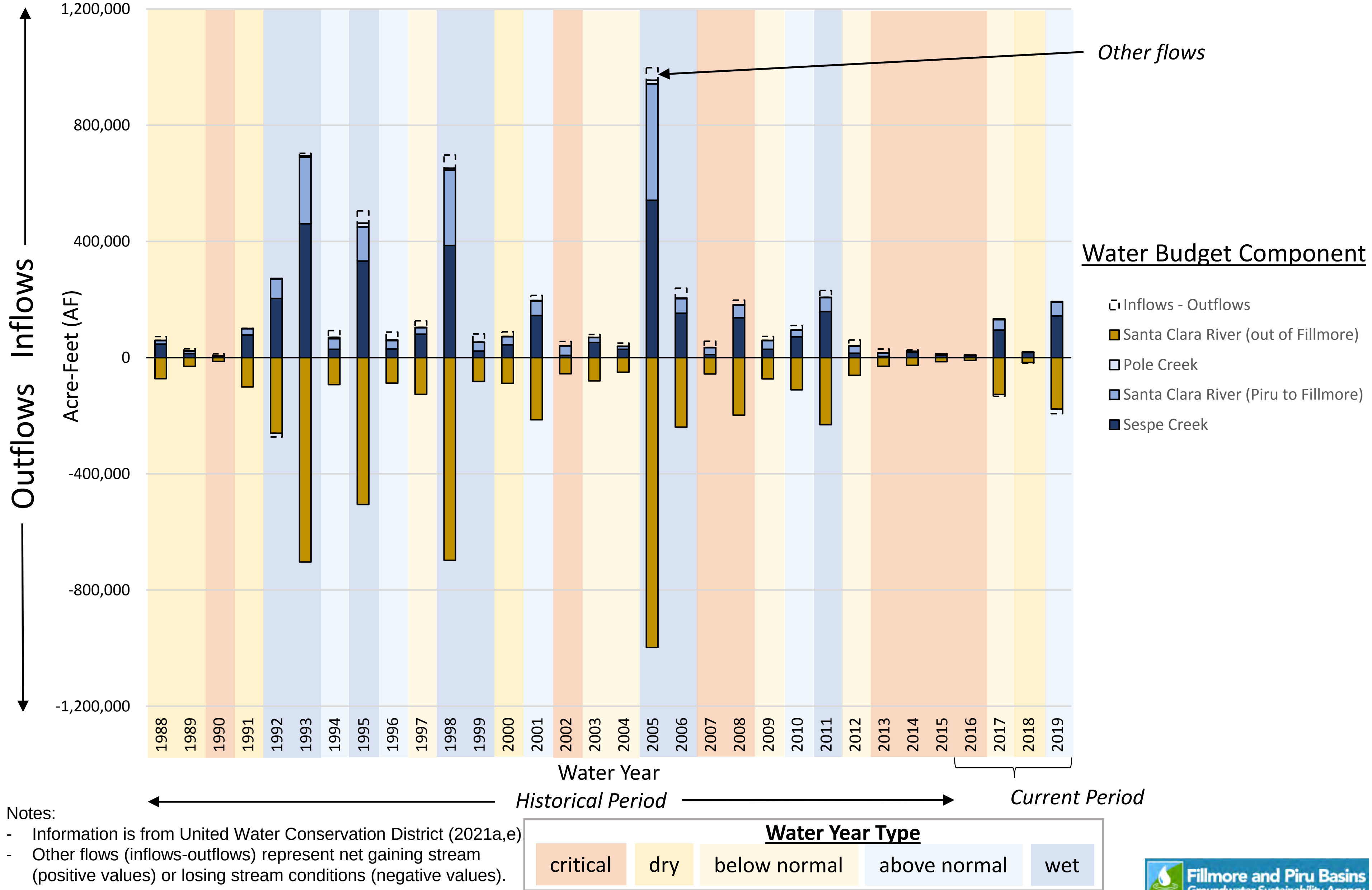
Fillmore and Piru Basins Groundwater Sustainability Agency



Notes:
- Information is from United Water Conservation District (2021a,e)
- Other flows (inflows-outflows) represent net gaining stream (positive values) or losing stream conditions (negative values).

Fillmore and Piru Basins Groundwater Sustainability Agency

FILLMORE BASIN GROUNDWATER SUSTAINABILITY PLAN

Historical and Current Annual Surface Water Budget

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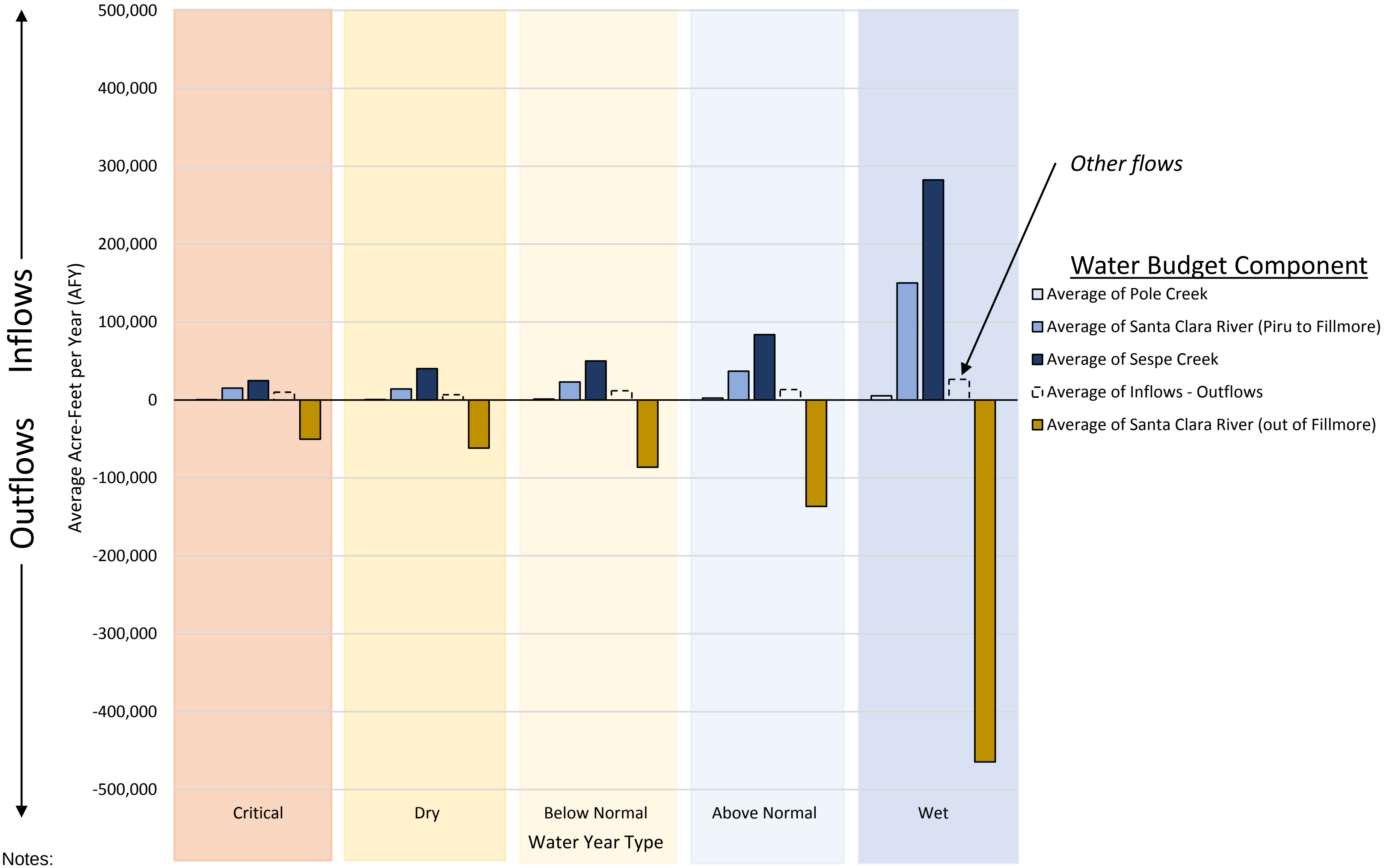

Notes:
- Information is from United Water Conservation District (2021a,e).
- Other flows (inflows-outflows) represent net gaining stream (positive values) or losing stream conditions (negative values).

Fillmore and Piru Basins Groundwater Sustainability Agency

FILLMORE BASIN GROUNDWATER SUSTAINABILITY PLAN

Historical and Current Average Annual Surface Water Flows by Water Year Type

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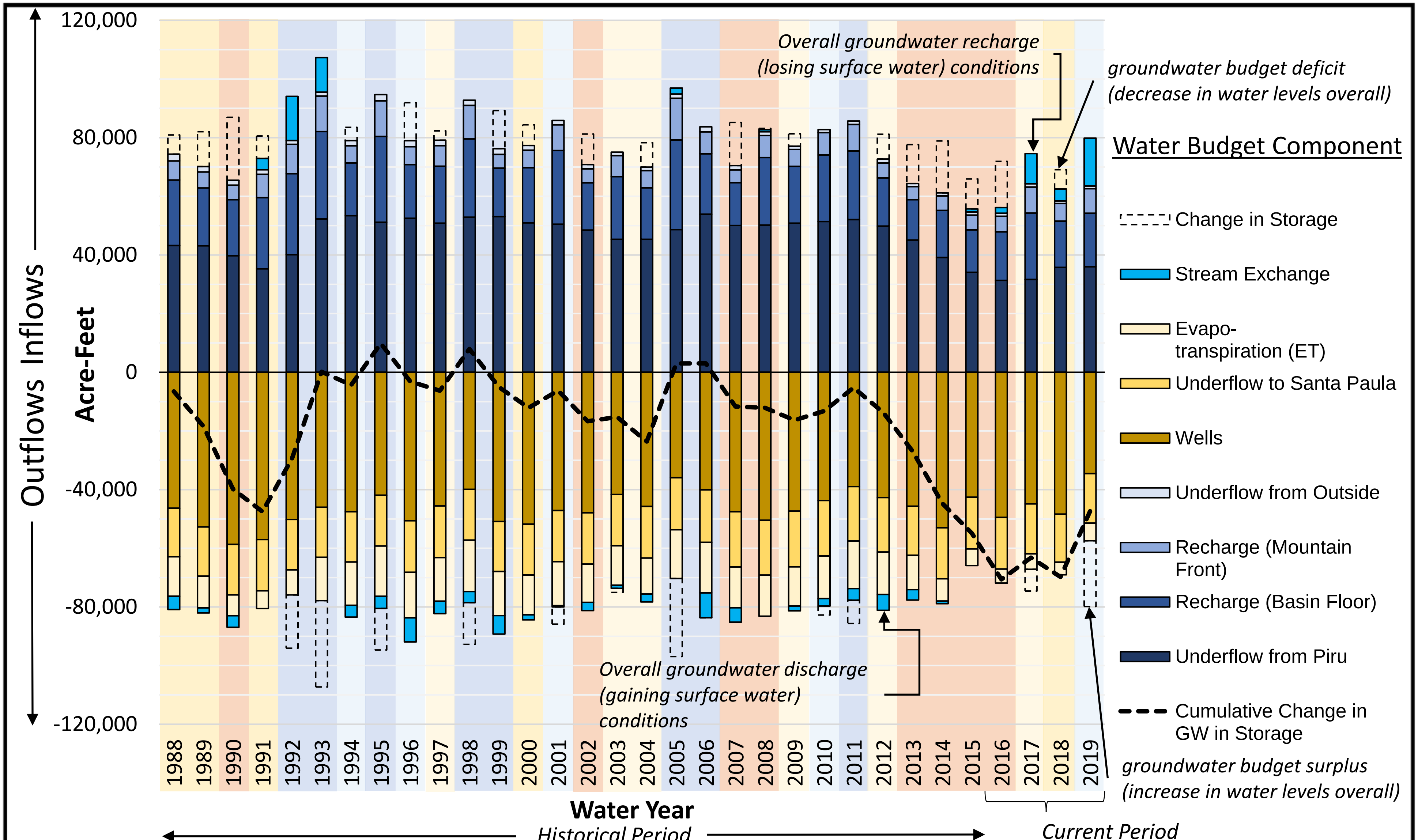
12/16/2021 DB19.1084

Figure 2.2-34



Notes:
- Information is from United Water Conservation District (2021a,e).
- Change in storage values are placed on opposite side of positive and negative y-axis directions, to demonstrate a balanced water budget (i.e., $inputs + outputs + change\ in\ storage = 0$).
- GW: groundwater

Water Year Type

critical	dry	below normal	above normal	wet

Fillmore and Piru Basins Groundwater Sustainability Agency

FILLMORE BASIN GROUNDWATER SUSTAINABILITY PLAN

Historical and Current Annual Groundwater Budget

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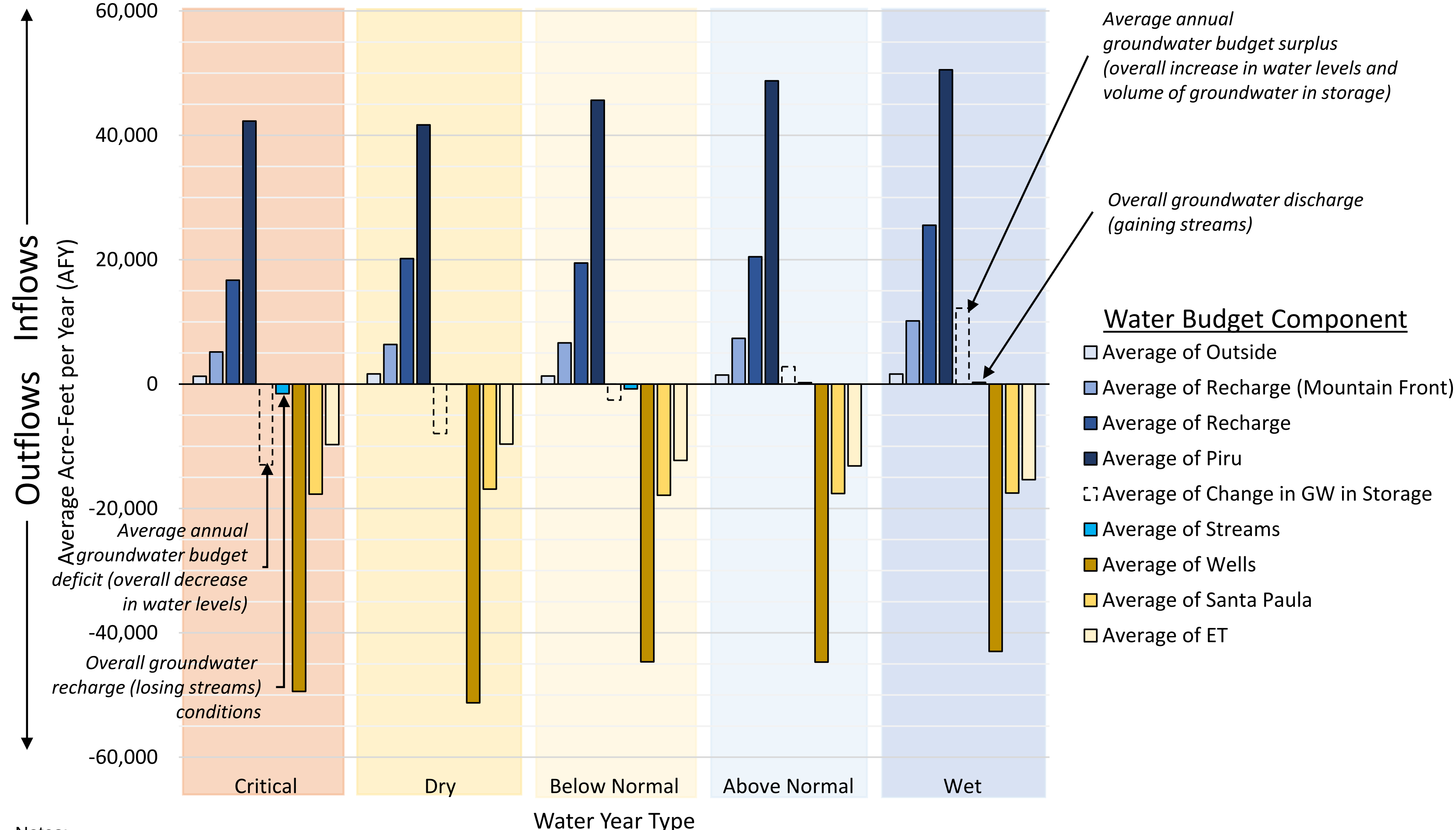
12/16/2021 DB19.1084

Figure 2.2-35



Notes:

- Information is from United Water Conservation District (2021a,e).
- Change in storage values represent the imbalance between inflows and outflows (i.e., $inputs + outputs = change\ in\ groundwater\ in\ storage$).
- Average pumping rates during dry water years are considered biased high, because the majority of these years occurred during the late 1980s and early 1990s drought, when more wells were pumping (and have since become inactive).
- GW: groundwater

Fillmore and Piru Basins Groundwater Sustainability Agency

FILLMORE BASIN GROUNDWATER SUSTAINABILITY PLAN

Historical and Current Average Annual Groundwater Flows by Water Year Type

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12/16/2021 DB19.1084

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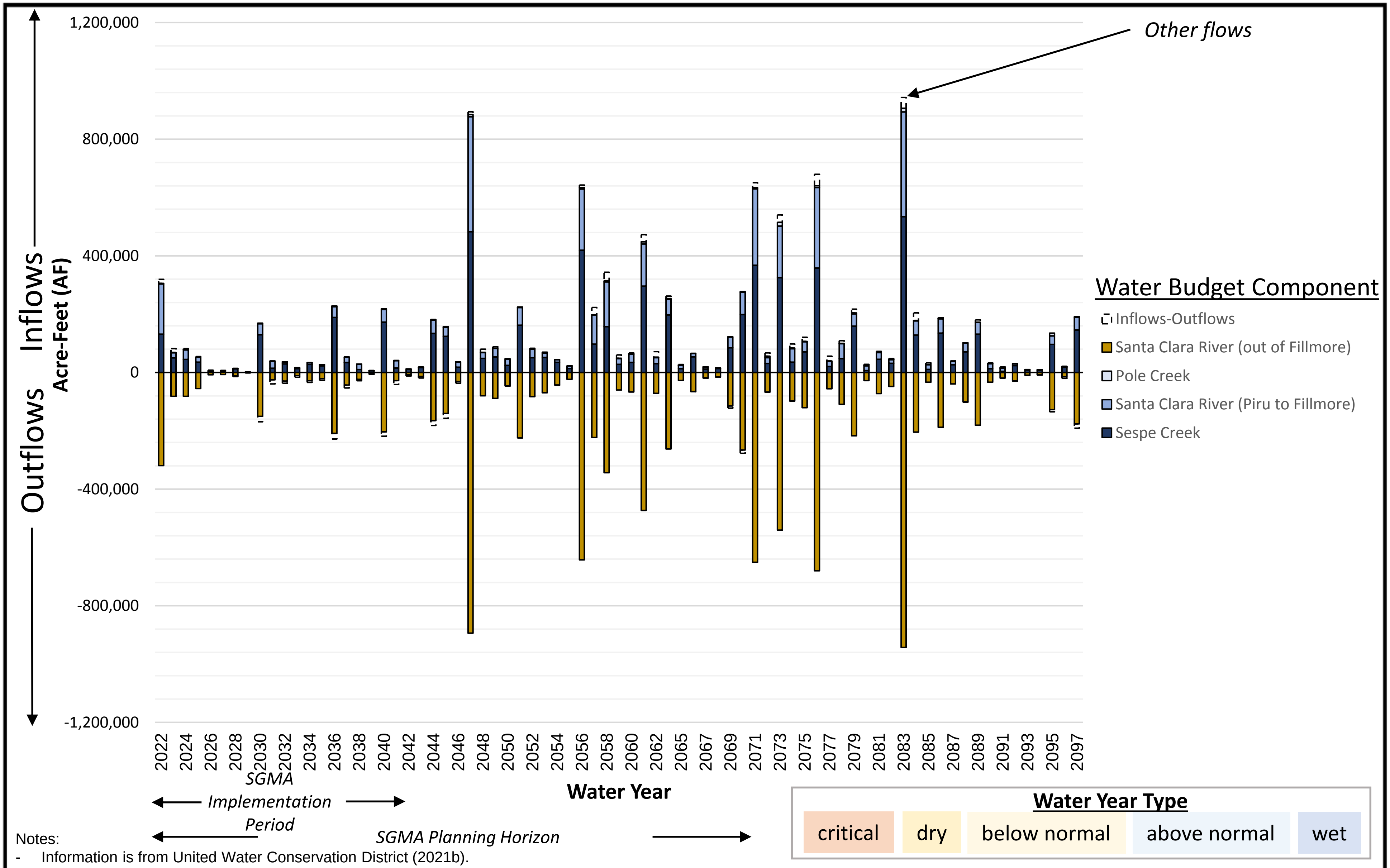

Notes:
- Information is from United Water Conservation District (2021b).
- Other flows (inflows-outflows) represent net gaining stream (positive values) or losing stream conditions (negative values).

Fillmore and Piru Basins Groundwater Sustainability Agency

FILLMORE BASIN GROUNDWATER SUSTAINABILITY PLAN

Projected Annual Surface Water Budget

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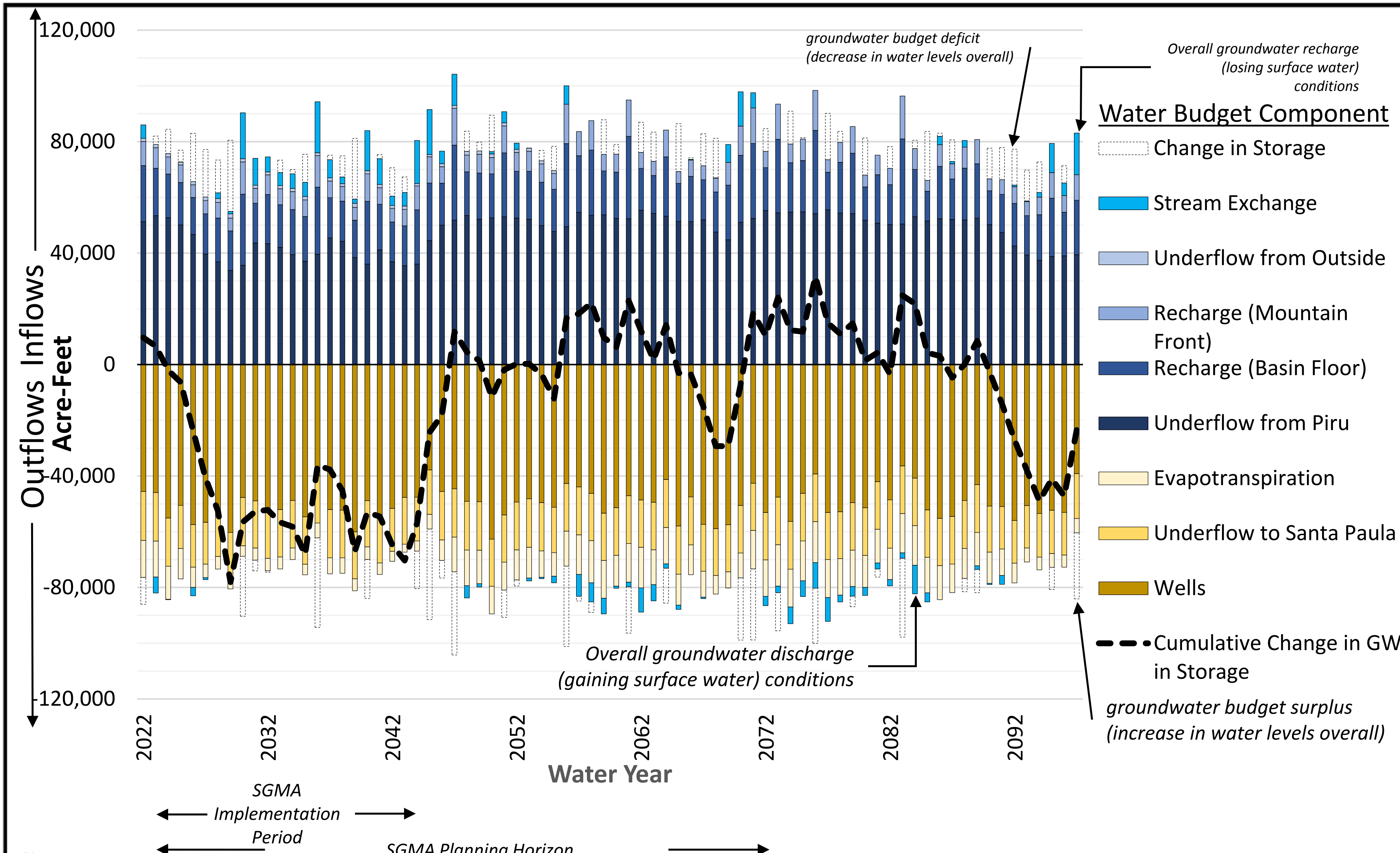
12/16/2021 DB19.1084

Figure 2.2-37



Notes:
- Information is from United Water Conservation District (2021b).
- Change in storage values are placed on opposite side of positive and negative y-axis directions, to demonstrate a balanced water budget (i.e., $inputs + outputs + change\ in\ storage = 0$).
- GW: groundwater

Water Year Type				
critical	dry	below normal	above normal	wet

Fillmore and Piru Basins Groundwater Sustainability Agency

FILLMORE BASIN GROUNDWATER SUSTAINABILITY PLAN

Projected Annual Groundwater Budget

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Figure 2.2-38

Figure 2.2-38

SMC	Undesirable Results	Metric	MT	MO	Comments
GW Elevation	Loss of ability to pump GW	GW elevation	WL declines below the base of well screens in more than 25% of representative wells	GW levels at 2011 high WL	maximizes range between MT and MO
	Significant and unreasonable GDE vegetation die-off due to GSP implementation	Depth to GW at the Fillmore - Piru basin boundary	WL declines below the Critical Water Level defined as 10 ft lower than 2011 low WL*	GW levels at 2011 high WL	*when the CWL is exceeded, mitigation water (e.g., pumped GW) will be provided to CDFW for use at the Cienega Springs restoration project site, if the WL has not recovered to CWL by the subsequent May 1st
GW Storage Reduction	inadequate GW storage to last through multi-year drought without GW extraction limitations	GW elevation	WL declines below the base of well screens in more than 25% of representative wells	GW levels at 2011 high WL	maximizes range between MT and MO
SW Depletion	Surface water flow declines due to GW extractions that interfere with the beneficial use and users	Rising GW rates at the Fillmore-Piru basin boundary (Fish Hatchery area)	A MT is not applicable for this sustainability indicator.	GW levels at 2011 high WL	**Future rising GW conditions are not expected to be materially different from historical conditions.** The GSP does not propose projects or management actions that would change the operational regime of the basins. Therefore, implementation of the GSP does not cause significant and unreasonable effects.
Land Subsidence	Land subsidence amounts that interfere with infrastructure operations	Subsidence rates	Total inelastic subsidence of 1ft/yr or 1ft over 5 yrs	Inelastic subsidence rates within +/- 0.1 ft/yr as determined by InSAR	Monitor subsidence amount - InSAR data from DWR; study to identify susceptible infrastructure (e.g., long-span bridges, gravity sewage systems) for 5 yr GSP update
Degraded WQ	Water quality degradation that impairs the beneficial use of the resource	WQ values	Water quality parameters established in existing or future regulations	FPBGSA is not a water purveyor and lacks regulatory authority for WQ compliance, but will cooperate with appropriately empowered entities	
Seawater Intrusion	NA	NA	NA	NA	

Notes:
- SMC: sustainable management criteria
- MT: minimum threshold
- MO: measurable objective
- GW: groundwater
- WL: water level
- WQ: water quality
- GDE: groundwater-dependent ecosystem

Fillmore and Piru Basins Groundwater Sustainability Agency

FILLMORE BASIN GROUNDWATER SUSTAINABILITY PLAN
Sustainable Management Criteria (SMC) Matrix

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Figure 3.0-1

N

0 0.5 1 1.5 Miles

Explanation

Index Contours
Intermediate Contours
California State Route
Section
Township and Range
Fillmore Basin
Other Basin
Fillmore and Piru Basins GSA
Limited shallow GW level data (1)
Pending new well installation (4)

Pending Existing Well to Include

Aquifer Zone

A+B (1)

GWL Monitoring Site (Well)

Aquifer Zone

A (5)
A+B (10)
B (14)
A+B+C (1)
B+C (4)
C (1)
unknown (6)

Principal Aquifer (A, A+B, B)

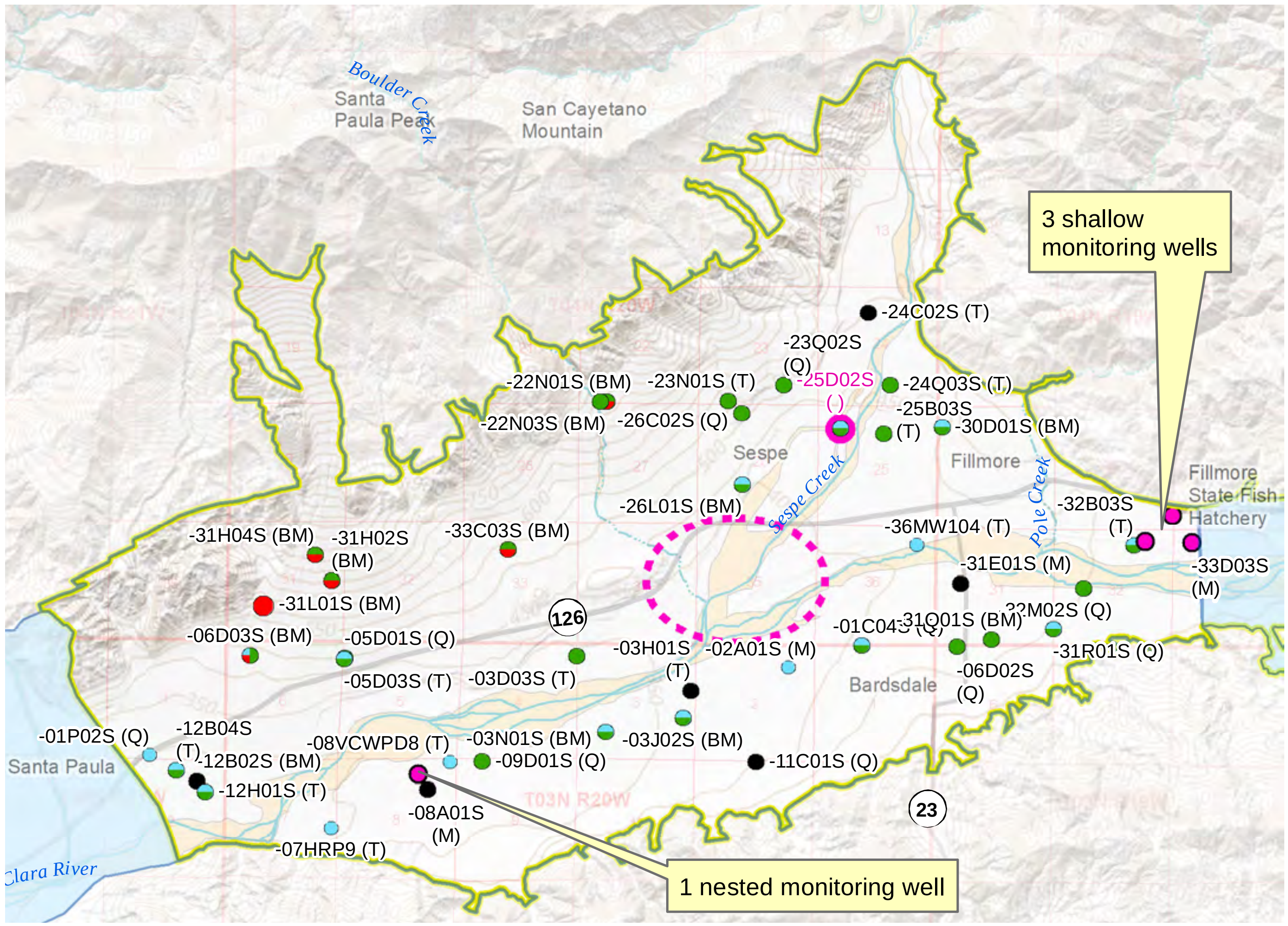
Non-Principal Aquifer (A+B+C, B+C, C)

USGS NHD Flowline

Stream/River (Intermittent)
Stream/River (Perennial)*

USGS NHD Area

Wash



Basemap: USGS The National Map: 3D Elevation Program. USGS Earth Resources Observation & Science (EROS) Center: GMTED2010. Data refreshed March, 2021.

Notes:
* Perennial streams (designated by the U.S. Geological Survey [USGS] National Hydrography Dataset [NHD]) exhibit interrupted perennial (i.e., intermittent to ephemeral) conditions in the Santa Clara River Valley (Hanson et al., 2003; SFEI, 2011; Beller et al., 2016; United, 2017).
1. Aquifer zones A and B are considered merged and constitute the Principal Aquifer; Aquifer zone C constitutes a non-principal aquifer.
2. GWL: groundwater level
3. Land (index/intermediate) contours are in feet relative to the North American Vertical Datum of 1988 (NAVD88).

Monitoring Frequency:
T: transducer (6x/day)
M: monthly
BM: bi-monthly
Q: quarterly

Coordinate System: NAD 1983 StatePlane California V FIPS 0405 Feet | Projection: Lambert Conformal Conic | Datum: North American 1983

Fillmore and Piru Basins Groundwater Sustainability Agency

FILLMORE BASIN GROUNDWATER SUSTAINABILITY PLAN

Groundwater Elevation Monitoring Network and Data Gaps Map

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Figure 3.5-1

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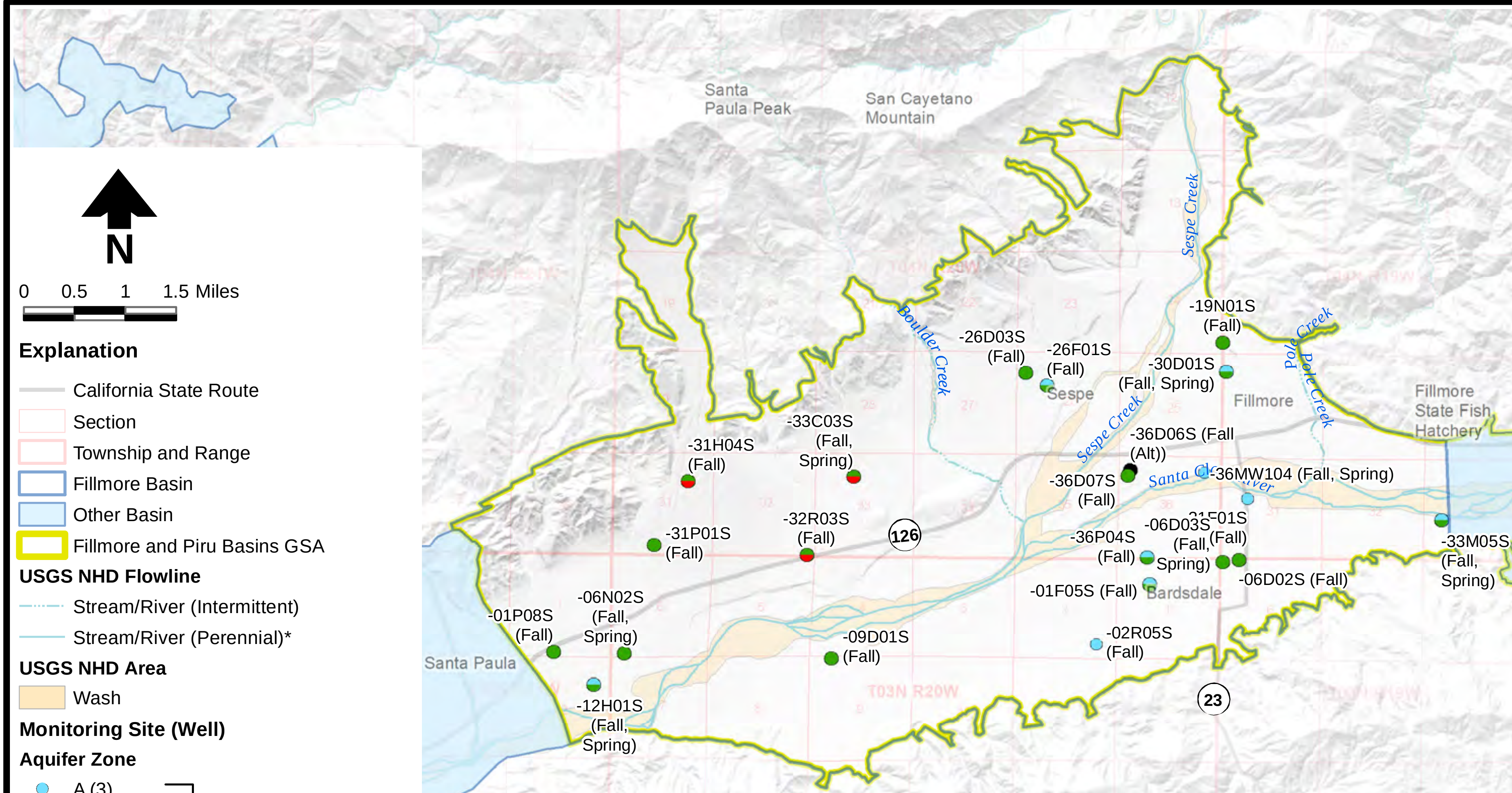

Basemap: USGS The National Map: 3D Elevation Program. USGS Earth Resources Observation & Science (EROS) Center: GMTED2010. Data refreshed March, 2021.

Notes:
* Perennial streams (designated by the U.S. Geological Survey [USGS] National Hydrography Dataset [NHD]) exhibit interrupted perennial (i.e., intermittent to ephemeral) conditions in the Santa Clara River Valley (Hanson et al., 2003; SFEI, 2011; Beller et al., 2016; United, 2017).
1. Aquifer zones A and B are considered merged and constitute the Principal Aquifer; Aquifer zone C constitutes a non-principal aquifer.

Coordinate System: NAD 1983 StatePlane California V FIPS 0405 Feet | Projection: Lambert Conformal Conic | Datum: North American 1983

Fillmore and Piru Basins Groundwater Sustainability Agency

FILLMORE BASIN GROUNDWATER SUSTAINABILITY PLAN

Groundwater Quality Monitoring Network Map

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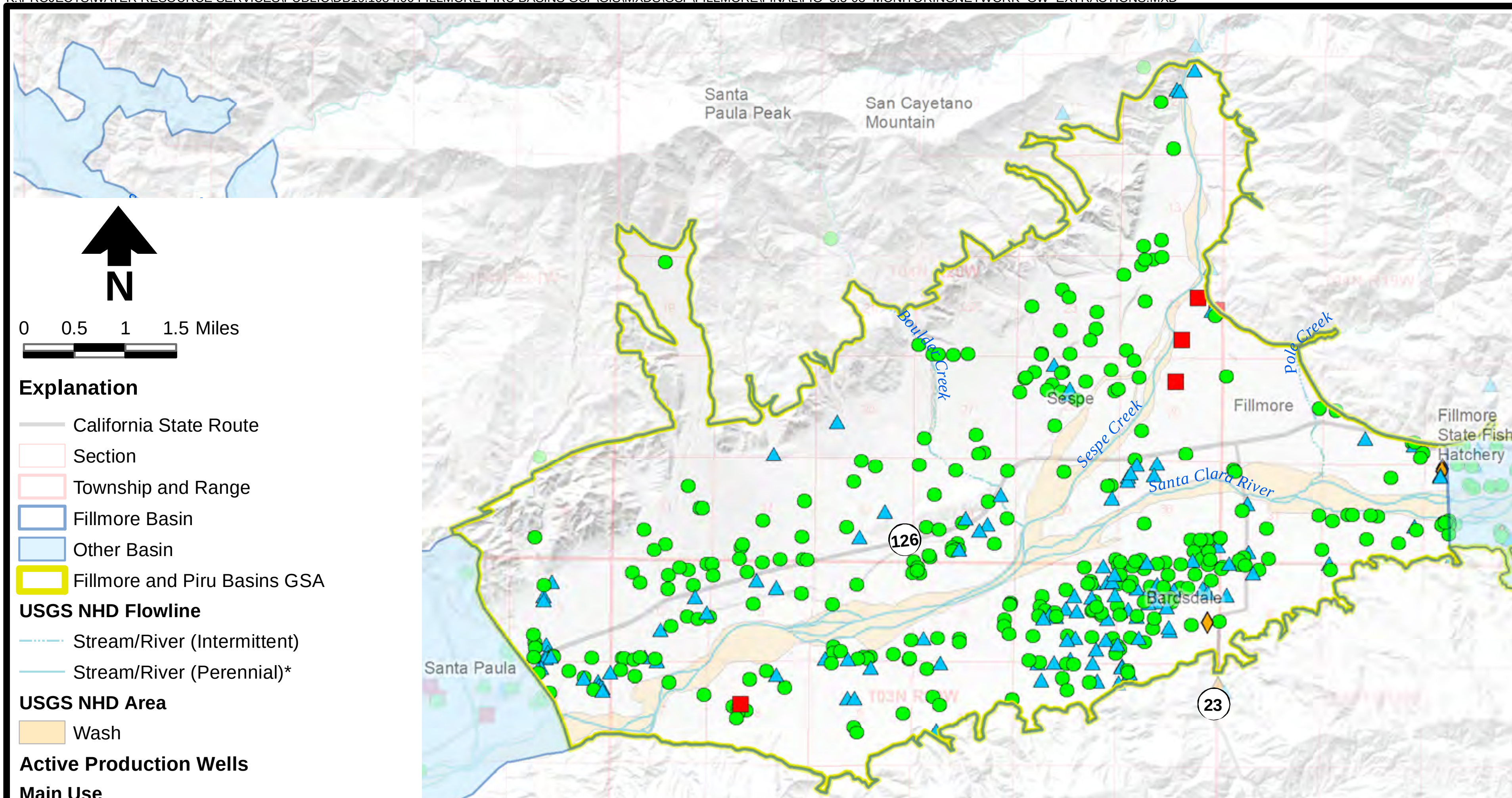
Figure 3.5-2

K:\PROJECTS\WATER RESOURCE SERVICES\PUBLIC\DB19.1084.00 FILLMORE PIRU BASINS GSP\GIS\MXDS\GSP\FILLMORE\FINAL\FIG_3.5-03_MONITORINGNETWORK_GW_EXTRACTIONS.MXD



Coordinate System: NAD 1983 StatePlane California V FIPS 0405 Feet | Projection: Lambert Conformal Conic | Datum: North American 1983

Basemap: USGS The National Map: 3D Elevation Program. USGS Earth Resources Observation & Science (EROS) Center: GMTED2010. Data refreshed March, 2021.

Notes:
* Perennial streams (designated by the U.S. Geological Survey [USGS] National Hydrography Dataset [NHD]) exhibit interrupted perennial (i.e., intermittent to ephemeral) conditions in the Santa Clara River Valley (Hanson et al., 2003; SFEI, 2011; Beller et al., 2016; United, 2017).
1. Transparent well symbology represents wells outside the Basin that are also monitored for production by United Water Conservation District.
2. Well counts represent well types within the Basin.

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FILLMORE BASIN GROUNDWATER SUSTAINABILITY PLAN

Groundwater Extractions Monitoring Network Map

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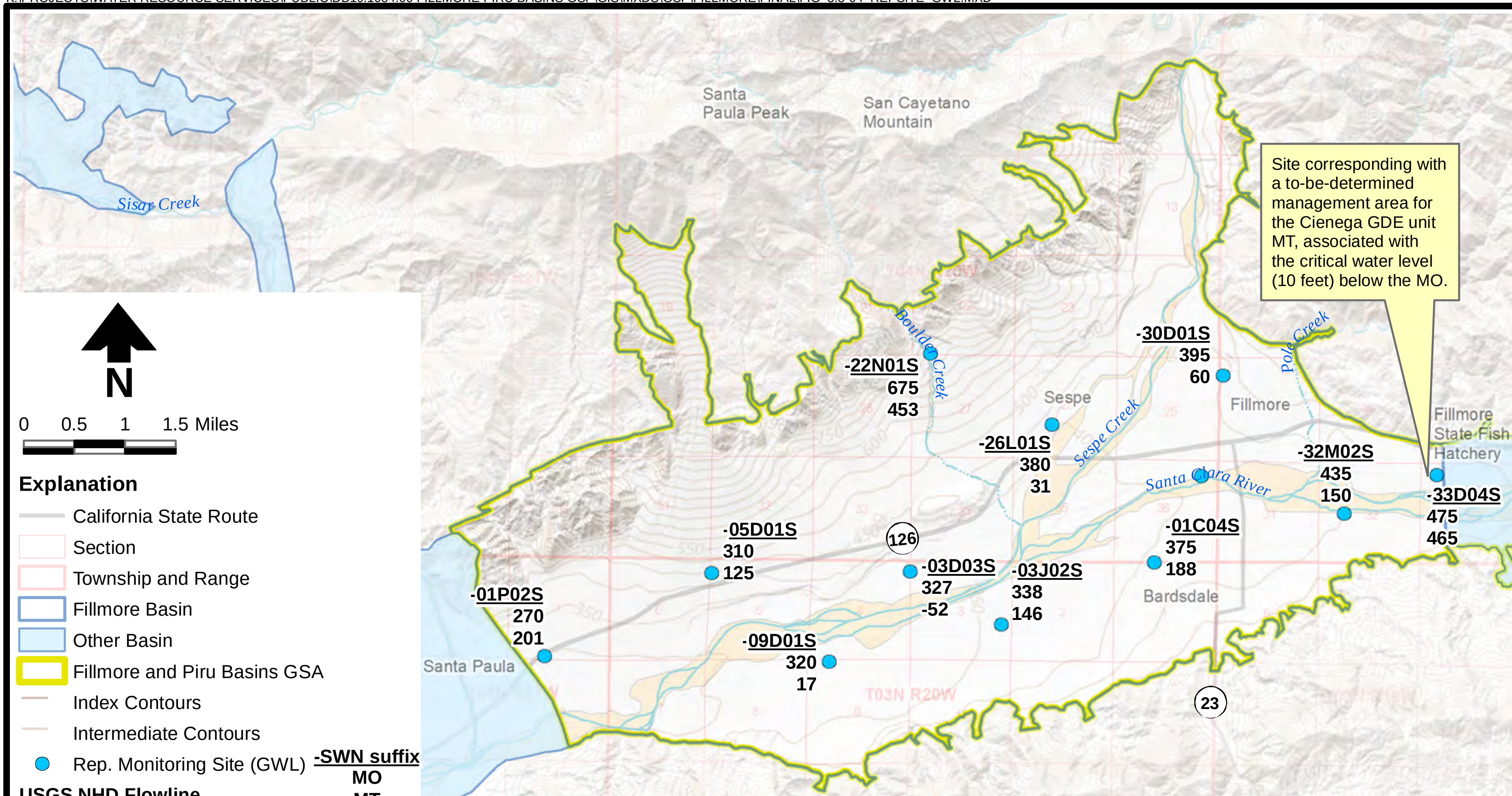
Figure 3.5-3

K:\PROJECTS\WATER RESOURCE SERVICES\PUBLIC\DB19.1084.00 FILLMORE PIRU BASINS GSP\GIS\MXDS\GSP\FILLMORE\FINAL\FIG_3.5-04_REPSITE_GWL.MXD



Basemap: USGS The National Map: 3D Elevation Program. USGS Earth Resources Observation & Science (EROS) Center: GMTED2010. Data refreshed March, 2021.

Notes:

* Perennial streams (designated by the U.S. Geological Survey [USGS] National Hydrography Dataset [NHD]) exhibit interrupted perennial (i.e., intermittent to ephemeral) conditions in the Santa Clara River Valley (Hanson et al., 2003; SFEI, 2011; Beller et al., 2016; United, 2017).

1. GWL is elevation is in feet relative to approximate mean sea level (ft-msl), the National Geodetic Vertical Datum of 1929 (NGVD29).
2. Land (index/intermediate) contours are in feet relative to the North American Vertical Datum of 1988 (NAVD88).
3. MT: minimum threshold (elevation corresponding with the bottom of well perforation/screen or critical water level [10 ft below MO])
4. MO: measurable objective (fall of 2011 groundwater elevation in ft-msl [NGVD29])
5. GWL: groundwater level (i.e., elevation or depth)
6. SWN: State well number (well idenitfier).
7. GDE: groundwater-dependent ecosystem

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FILLMORE BASIN GROUNDWATER SUSTAINABILITY PLAN

Map of Representative Monitoring Sites for Groundwater Elevations

Coordinate System: NAD 1983 StatePlane California V FIPS 0405 Feet | Projection: Lambert Conformal Conic | Datum: North American 1983

Figure 3.5-4

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