Salinas Valley Groundwater Basin
180/400-Foot Aquifer Subbasin
2022 GSP Amendment 1

Salinas Valley Basin
Groundwater Sustainability Agency

(Approved by Salinas Valley Basin Groundwater Sustainability Agency Board of Directors on September 8, 2022)

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King City
Castroville Community Services District
Monterey One Water

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ACRONYMS AND ABBREVIATIONS

$/AF ....dollar per acre-foot
AF ....acre-foot or acre-feet
AF/yr ....acre-feet per year
ALCO ....Alisal Water Company
ASR ....aquifer storage and recovery
Basin ....Salinas Valley Groundwater Basin
Basin Plan ......Water Quality Control Plan for the Central Coastal Basin
BLM ...............U.S. Bureau of Land Management
BMPs.............Best Management Practices
Caltrans ....California Department of Transportation
CASGEM ....California Statewide Groundwater Elevation Monitoring
CCC................California Coastal Commission
CCGC ....Central Coast Groundwater Coalition
CCRWQCB....Central Coast Regional Water Quality Control Board
CCWG............Central Coast Wetlands Group
CDFW ....California Department of Fish and Wildlife
CEQA ....California Environmental Quality Act
cfs ....cubic feet per second
COC ....constituents of concern
CPE Actions ...Communication and Public Engagement Actions
CSD ....Community Services District
CSIP ....Castroville Seawater Intrusion Project
DACs.............Disadvantage Communities
DDW ....Division of Drinking Water
DEM ....Digital Elevation Model
DMS ....Data Management System
D-TAC ....Drought Technical Advisory Committee
DTSC ....California Department of Toxic Substances Control
DWR ....California Department of Water Resources
EDF ....Environmental Defense Fund
EIR ....Environmental Impact Report
EPA ....Environmental Protection Agency
ET ....evapotranspiration
eWRIMS ....Electronic Water Rights Information Management System
GAMA ....Groundwater Ambient Monitoring and Assessment Program
GDE ....groundwater-dependent ecosystem
GEMS ....Monterey County Groundwater Extraction Management System
GIS ....Geographic Information System
GMP ....Groundwater Management Plan

gpm ....gallons per minute
GSA................Groundwater Sustainability Agency/Agencies
GSP or Plan....Groundwater Sustainability Plan
HCM ....hydrogeologic conceptual model
HCP ....Habitat Conservation Plan
IIP ....Integrated Implementation Plan
ILRP ....Irrigated Lands Regulatory Program
IPR ....indirect potable reuse
InSAR ....Interferometric Synthetic Aperture Radar
IRWMP ....Integrated Regional Water Management Plan
ISW ....interconnected surface water
JPA ....Joint Powers Authority
M1W ....Monterey One Water
MCLs ....Maximum Contaminant Levels
MCWD ....Marina Coast Water District
MCWRA ....Monterey County Water Resources Agency
Monterey County GSA…County of Monterey Groundwater Sustainability Agency
MPWMD........Monterey Peninsula Water Management District
MTBE ....methyl-tertiary-butyl ether
NAVD88 ....North American Vertical Datum of 1988
NCCAG..........Natural Communities Commonly Associated with Groundwater
NEPA ....National Environmental Policy Act
NMFS ....National Marine Fisheries Service
NOAA ....National Oceanic & Atmospheric Administration
O&M ....operations and maintenance
OSWCR ....Online System for Well Completion Report
RCDMC ....Resource Conservation District of Monterey
Reclamation Plant…Salinas Valley Reclamation Plant
River Series ....Salinas River Discharge Measurement Series
RMA ....Routine Maintenance Agreement
RMS ....Representative Monitoring Sites
RWMG ....Greater Monterey County Regional Water Management Group
SAGBI............Soil Agricultural Groundwater Banking Index
SDACs ....Severely Disadvantaged Communities
SGMA ....Sustainable Groundwater Management Act
SMC ....Sustainable Management Criteria
SMCLs ....Secondary Maximum Contaminant Levels
SMP................Salinas River Stream Maintenance Program
SRDF..............Salinas River Diversion Facility
Subbasin ....180/400-Foot Aquifer Subbasin

SVBGSA ....Salinas Valley Basin Groundwater Sustainability Agency
SVIHM ....Salinas Valley Integrated Hydrologic Model
SVOM ....Salinas Valley Operational Model
SVRP..............Salinas Valley Reclamation Project
SWIG ....Seawater Intrusion Working Group
SWRCB..........State Water Resources Control Board
URCs ....Underrepresented Communities
TAC................Technical Advisory Committee
TDS ....total dissolved solids
USACE ..........U.S. Army Corps of Engineers
USFWS ..........U.S. Fish and Wildlife Service
USGS .............U.S. Geological Survey
UWMP ....Urban Water Management Plan

EXECUTIVE SUMMARY

ES-1 INTRODUCTION (GSP UPDATE CHAPTER 1)

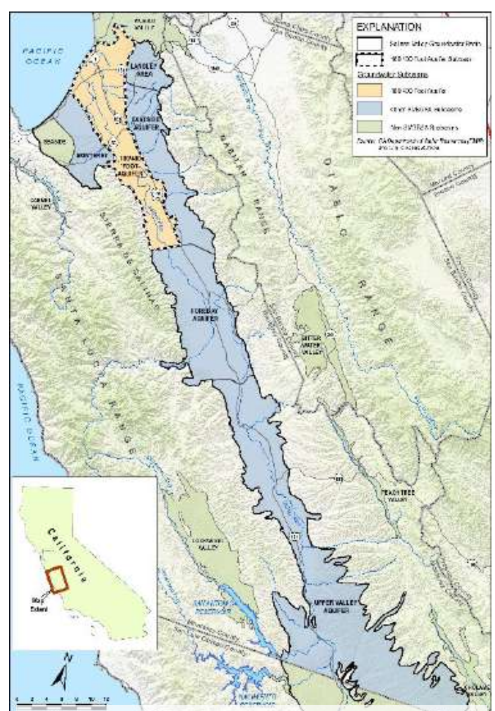
The 2014 California Sustainable Groundwater Management Act (SGMA) requires that medium- and high-priority groundwater basins and subbasins develop Groundwater Sustainability Plans (GSPs) that outline how groundwater sustainably will be achieved in 20 years, and then maintained for an additional 30 years. The 180/400-Foot Aquifer Subbasin (Subbasin) GSP was submitted in 2020. This 2022 GSP Update replaces the original GSP and fulfills this requirement for the Salinas Valley—180/400-Foot Aquifer Subbasin, which is designated by the DWR as a high priority and critically overdrafted groundwater subbasin.

In 2017, local GSA-eligible entities formed the Salinas Valley Basin Groundwater Sustainability Agency (SVBGSA) to develop and implement the GSPs for the Salinas Valley. The SVBGSA is a Joint Powers Authority (JPA) with membership comprising the County of Monterey, Monterey County Water Resources Agency (MCWRA), City of Salinas, City of Soledad, City of Gonzales, City of King, Castroville Community Services District, and Monterey One Water. The SVBGSA is governed by an eleven-member Board of Directors, representing public and private groundwater interests throughout the Salinas Valley Groundwater Basin. In addition, an Advisory Committee ensures participation by, and input to, the Board by constituencies whose interests are not directly represented on the Board.

The Salinas Valley Groundwater Basin consists of 9 subbasins, of which 6 are entirely or partially under the SVBGSA's jurisdiction. One of the 9 subbasins, the Seaside Subbasin, is adjudicated and not managed by the SVBGSA. Another 2 subbasins, the Paso Robles and Atascadero Subbasins, lie completely in San Luis Obispo County and are managed by other groundwater sustainability agencies.

The SVBGSA developed this GSP Update for the 180/400-Foot Aquifer Subbasin (DWR subbasin number 3-004.01) to align with the GSPs for the 5 other Salinas Valley subbasins managed by SVBGSA: the Eastside Aquifer Subbasin (DWR subbasin number 3-004.02), the Forebay Aquifer Subbasin (DWR subbasin number 3-004.04), the Upper Valley Aquifer Subbasin (DWR subbasin number 3-004.05), the Langley Area Subbasin (DWR subbasin number 3-004.09) and the Monterey Subbasin (DWR subbasin number 3-004.10). Having a single GSA prepare all or part of the six plans promotes coordination and cooperation across subbasin boundaries.

This GSP Update covers the entire 89,700 acres of the Subbasin, as shown on the figure below. The GSP Update describes current groundwater conditions, develops a hydrogeologic conceptual model, establishes the water budget, outlines locally defined sustainable management criteria, and provides projects and management actions that can be used to reach sustainability by 2040.



180/400-Foot Aquifer Subbasin

ES-2 COMMUNICATIONS AND PUBLIC ENGAGEMENT (GSP UPDATE CHAPTER 2)

The SVBGSA designed all phases of SGMA implementation to be open collaborative processes with active stakeholder engagement that allows stakeholders and public participants opportunities to provide input and to influence the planning and development process and subsequently GSP implementation. The communications and public engagement process included the following:

- **GSA formation and coordination.** SVBGSA formation and coordination took place from 2015 through 2017 and included completing a Salinas Valley Groundwater Stakeholder Issues Assessment which resulted in recommendations for a transparent, inclusive process for the local implementation of SGMA and formation of the SVBGSA.
- **GSP preparation.** Given the importance of the Subbasin and the development of the GSP to the communities, residents, landowners, farmers, ranchers, businesses, and others, it is essential that inclusive stakeholder input is a primary component of the GSP process. A rigorous review process for each chapter in this GSP and for the final plan ensured that stakeholders had multiple opportunities to review and comment on the draft GSP.
- **Subbasin Implementation Committee.** The 180/400-Foot Aquifer Subbasin Implementation Committee provides overall direction for GSP development. It comprises local stakeholders and a Board of Directors member, all of whom were appointed by the Board following a publicly noticed application process by the GSA. This Committee represents constituencies that are considered important stakeholders in the Subbasin, and who may not be represented on the Board of Directors. During the planning process of this GSP Update, the SVBGSA held 12 planning meetings.
- **Communication and public engagement actions (CPE Actions).** CPE Actions provide the SVBGSA Board and staff a guide to ensure consistent messaging about SVBGSA requirements and other related information. CPE Actions provide ways that beneficial users and other stakeholders can provide timely and meaningful input into the GSA decision-making process, are informed of milestones, and offered opportunities to participate in GSP implementation and plan updates.
- **Underrepresented communities (URCs) and disadvantaged communities (DACs).** During development of the 2022 GSPs SVBGSA assessed how URCs and DACs may be engaged with the GSA and how to develop GSA materials that are accessible and culturally responsive (visual and in Spanish). These materials will communicate impacts of groundwater management on local water conditions to engage URCs and DACs into GSA plan reviews and develop pathways for future involvement.

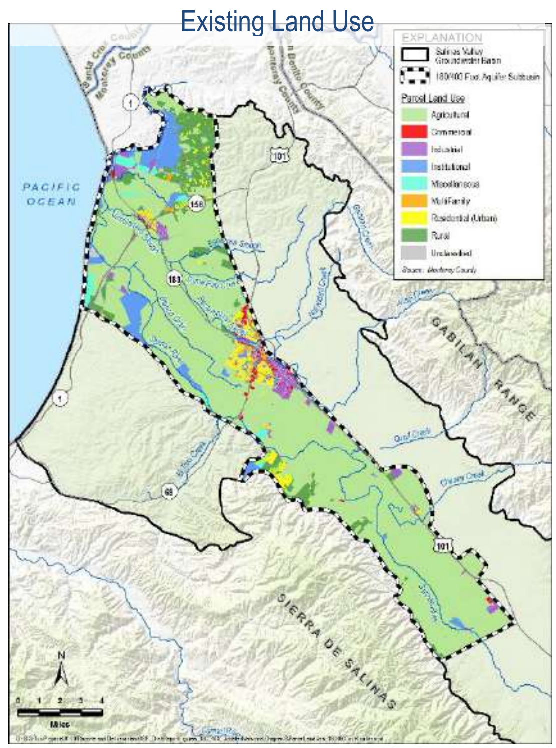
SVBGSA supports public participation by the development of an interactive website that allows access to all planning and meeting materials, data sets, and meeting notifications. The website can be accessed at: https://svbgsa.org.

ES-3 DESCRIPTION OF PLAN AREA (GSP UPDATE CHAPTER 3)

The 180/400-Foot Aquifer Subbasin is in northwestern Monterey County. The Salinas River flows into the Subbasin from the south and discharges into Monterey Bay in the north. The Subbasin contains portions of the City of Salinas, City of Gonzales, City of Marina, Castroville, Moss Landing, Elkhorn, Boronda, Spreckels, and Chualar. The figure at right shows that the majority of land in the Subbasin is used for agriculture. Accordingly, the primary water use sector is agriculture. Groundwater is the main water source in the Subbasin; however, surface water diversions and recycled water also provide water for agricultural use.

The Subbasin is within the jurisdiction of the SVBGSA, Marina Coast Water District, and Monterey County GSA. This GSP Update takes into consideration and incorporates existing water resource management, monitoring, and regulatory programs. The sustainability goal, sustainable management criteria, and projects and management actions in this GSP Update reflect and build on existing local plans and programs. Any potential limits to operational flexibility have already been incorporated into this GSP Update. Implementation of this GSP Update is not anticipated to affect water supply assumptions of relevant land use plans over the planning and implementation horizon. The GSA does not have authority over land use planning.

However, the GSA will coordinate with the County on General Plans and land use planning/zoning as needed when implementing the GSP Update.



ES-4 HYDROGEOLOGIC CONCEPTUAL MODEL (GSP UPDATE CHAPTER 4)

The geology of the 180/400-Foot Aquifer Subbasin is characterized by alluvium, terrace deposits, the Paso Robles Formation, and the Aromas Red Sands Formation and is a result of fluvial sedimentary deposits from the Salinas River and marine deposits from the Pacific Ocean (DWR, 2004a). The northern boundary follows the current course of Elkhorn Slough and corresponds to a paleo-drainage of the Salinas River that limits groundwater flow between basins (Durbin, *et al.*, 1978). The northeastern boundary with the Langley Subbasin is based on a topographic change from the valley floor to an elevated foothill area, but there is no hydraulic barrier to groundwater flow. To the east, hydraulic connectivity is restricted by depositional changes along the border with the Eastside Aquifer. To the southeast, there is hydraulic connectivity with the Forebay Subbasin. To the southwest, the boundary with the Monterey Subbasin is based on topographic rise that coincides with a buried trace of the Reliz fault, which may act as a groundwater flow barrier (Durbin, *et al.,* 1978).

There is no sign of the fault affecting groundwater flow in the sediments that contain the 180-Foot Aquifer or the 400-Foot Aquifer based on observed groundwater elevation and seawater intrusion conditions across the Subbasin boundary (HLA, 1994; Feeney and Rosenberg, 2003). However, more data are needed to determine the extent of hydraulic connectivity in all principal aquifers. Finally, there is no hydraulic barrier between the 180/400-Foot Aquifer Subbasin and Monterey Bay.

The shallowest water-bearing sediments are not considered a principal aquifer because they are thin, laterally discontinuous, and a minor source of water. Groundwater in these shallow sediments is hydraulically connected to the Salinas River but poorly connected to the underlying productive principal aquifers: the 180-Foot, 400-Foot, and Deep Aquifers. The base of the shallow sediments is the Salinas Valley Aquitard, which overlies and confines the 180-Foot Aquifer. The 180-Foot Aquifer consists of interconnected sand and gravel beds that are 50 to 150 feet thick. Below the 180-Foot Aquifer, the 180/400-Foot Aquitard confines the 400-Foot Aquifer. The 400-Foot Aquifer is a relatively permeable horizon that is approximately 200 feet thick near Salinas; but in other areas the aquifer is split into multiple permeable zones by clay layers (DWR, 1973). Below the 400-Foot Aquifer, the 400-Foot/Deep Aquitard confines the Deep Aquifers, also referred to as the 900-Foot and 1500-Foot Aquifers. There are limited data available for the Deep Aquifers. The figure below shows a geologic cross section of the Subbasin.

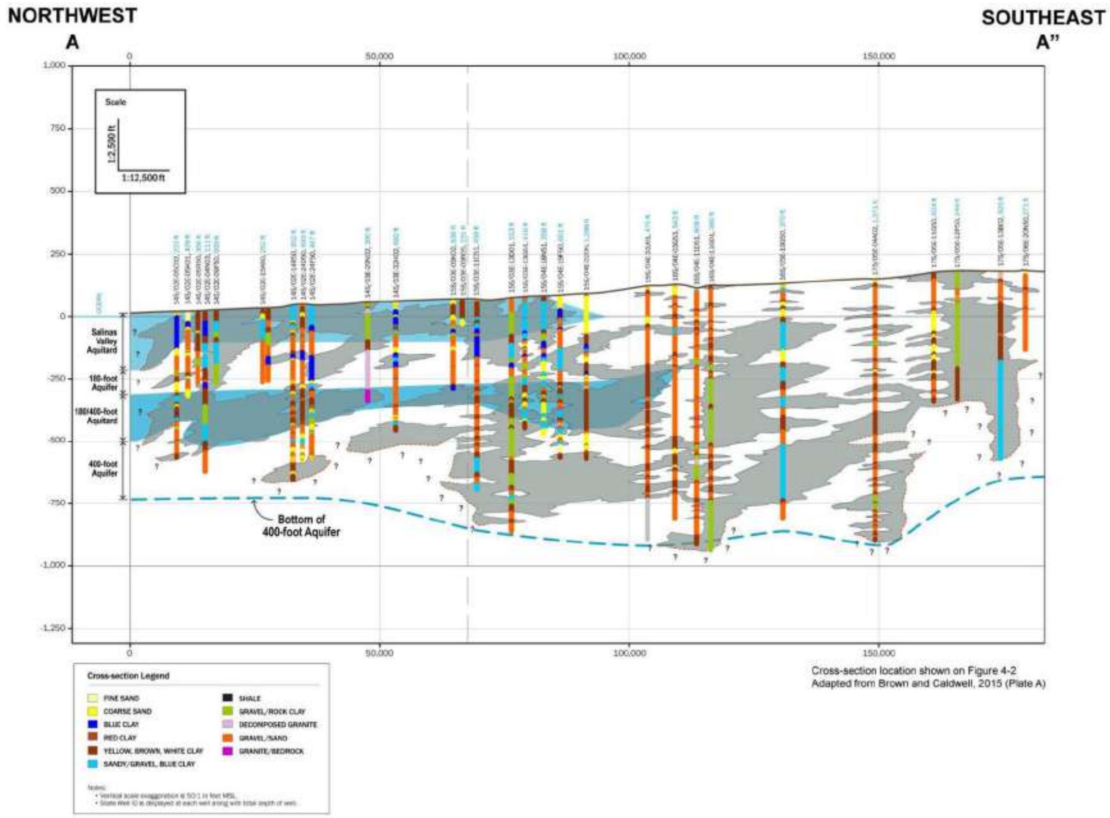
This GSP adopts the base of the Subbasin defined by the USGS (Durbin, et al., 1978). The base of the Subbasin is defined by the sharp interface between alluvium and the underlying granitic rocks that exists near the Gabilan Range; however, the Subbasin does not have a well-defined base across the entire Subbasin. The usable portion of the Subbasin does not always include the full thickness of alluvium and with depth the viability of the sediments as productive freshwater principal aquifer becomes increasingly limited.

Detailed aquifer property values (storativity, conductivity, and transmissivity) for the principal aquifer were not available at the time of GSP Update development. The SVBGSA will fill this data gap during GSP implementation. Specific capacity data is used as a proxy for transmissivity data and indicate that the principal aquifer is relatively transmissive with moderate well yields.

Natural groundwater recharge occurs through infiltration of surface water from the Salinas River, deep percolation of excess applied irrigation water, deep percolation of infiltrating precipitation, and subsurface inflow from adjacent subbasins. The areas with the highest potential for surficial recharge are found along the Salinas Valley. Although there are other areas of good potential recharge in the Subbasin, recharge to the principal aquifer is very limited because of the low permeability of the Salinas Valley Aquitard. It is likely that only limited surficial recharge in the Subbasin reaches the productive 180-Foot Aquifer or the 400-Foot Aquifer. Subsurface recharge is primarily from inflow from adjacent Subbasins (DWR, 2004a).

Groundwater can leave the aquifer in locations where surface water and groundwater are interconnected. There are potential locations of interconnected surface water (ISW) mainly along the Salinas River where the Salinas Valley Aquitard does not exist. In areas of interconnection, groundwater dependent ecosystems (GDEs) may depend on groundwater emerging from aquifers or on groundwater occurring near the ground surface, and they may discharge groundwater through evapotranspiration (ET).

Cross-Section A-A'



ES-5 GROUNDWATER CONDITIONS (GSP UPDATE CHAPTER 5)

Historical groundwater conditions in the Subbasin occurred before January 1, 2015, and current conditions occurred after January 1, 2015. This GSP Update uses 2020 as the representative current year where possible, updating the 2017 data in the original GSP.

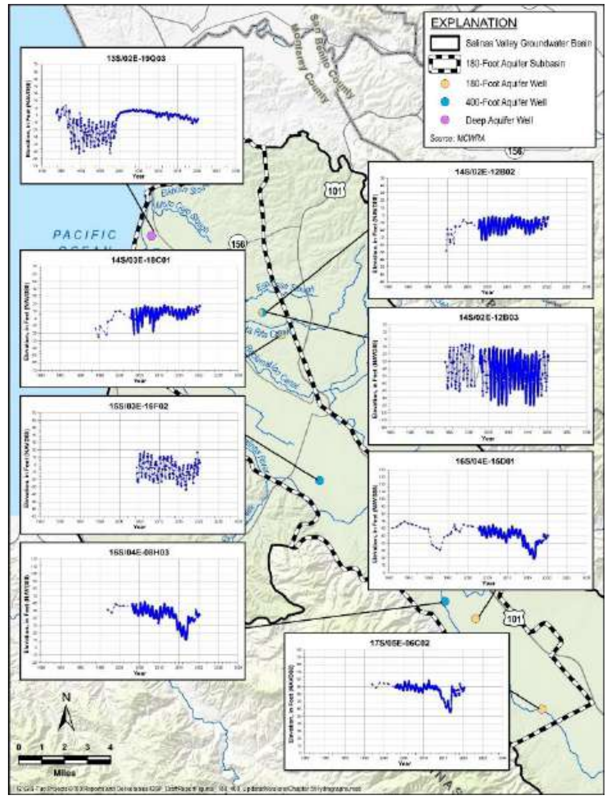
- **Groundwater elevations.** Historically, groundwater hydrographs show a decline in groundwater elevations throughout most of the Subbasin, in all principal aquifers. Groundwater elevations have been chronically lowered due to pumping and are lowest during higher irrigation seasons. Groundwater elevations near the boundary with the Forebay Aquifer Subbasin have generally been more stable than the rest of the Subbasin. The figure at right shows example hydrographs for the Subbasin.

- **Change in groundwater storage.** The historical average annual loss of storage based on groundwater elevation change between 1995 and 2019 is approximately 800 acre-feet per year (AF/yr) in the non-seawater intruded portion of the Subbasin, defined as the average change in groundwater that can be safely used for domestic, industrial, or agricultural purposes. Average annual storage loss due to seawater intrusion from 1995 to 2019 was 12,600 AF/yr. Total historical average annual change in storage is 13,400 AF/yr.

- **Seawater intrusion.** The 180/400-Foot Aquifer Subbasin and adjacent Monterey Subbasin have been subject to seawater intrusion for more than 70 years. 85% of the seawater intruded area in the 180-Foot Aquifer and 83% in the 400-Foot Aquifer occurs in the 180/400-Foot Aquifer Subbasin. The rate of seawater intrusion has slowed in recent years in the 180-Foot Aquifer.

- **Groundwater quality.** Elevated nitrate concentrations in groundwater were locally present in the 1960s and significantly increased in 1970s and 1980s. In 2018, nitrate levels exceeded the drinking water MCL in 26% of on-farm domestic wells Subbasin (CCRWQCB, 2018). Other constituents found at levels of concern for either potable or irrigation uses include vinyl chloride, iron, 1,2,3-trichloropropane, specific conductance, and total dissolved solids.
- **Subsidence.** No measurable subsidence has been recorded anywhere in the Subbasin between June 2015 and June 2020.
- **Interconnected surface water.** Provisional model results show that depletion of interconnected surface water (ISW) due to groundwater pumping averages about 2,600 AF/yr from June to September when MCWRA makes conservation releases to the Salinas River and 5,800 AF/yr from May to October.

Map of Example Hydrographs



ES-6 WATER BUDGETS (GSP UPDATE CHAPTER 6)

Water budgets provide an accounting and assessment of the total annual volume of surface water and groundwater entering and leaving the Subbasin. This GSP presents water budgets for 3 time periods – historical (1980 to 2016), current (2016), and projected with estimated 2030 and 2070 climate change factors. Water Year 2016 was the last year included in the models that could be used to develop water budgets for the GSP. Water Year 2016 meets the definition of current year found in the SGMA regulations (23 California Code of Regulations §354.18 (c)(1)); however, Water Year 2016 was preceded by multiple dry or dry-normal years and may not necessarily represent average current conditions. This chapter presents the surface water budget and groundwater budget for each time period. The groundwater budget contains aggregate numbers for the Subbasin and is not differentiated spatially.

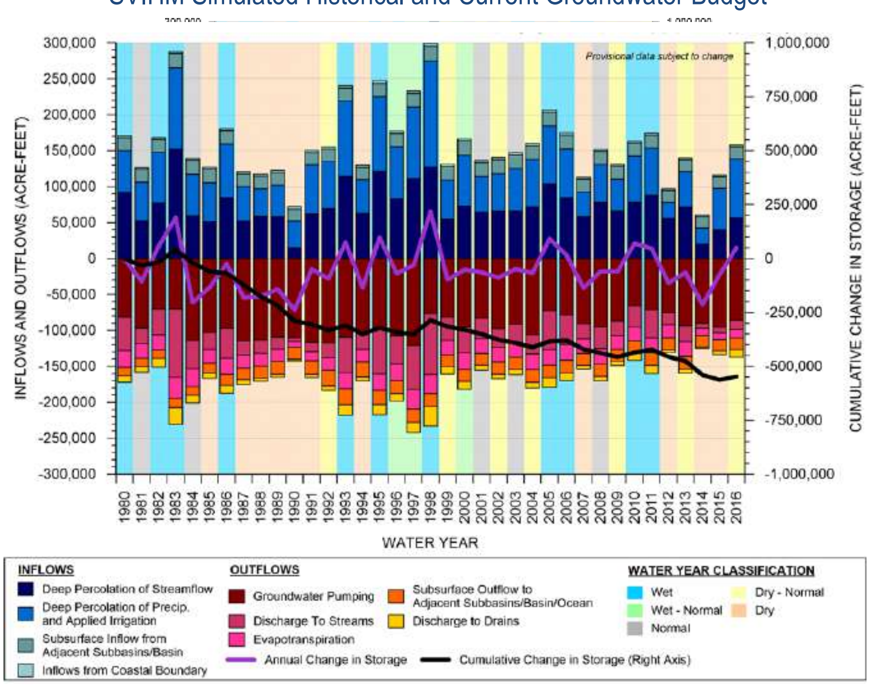
The water budgets are developed using the historical Salinas Valley Integrated Hydrologic Model (SVIHM) and the predictive Salinas Valley Operational Model (SVOM), both developed by the USGS. These models are provisional and results are subject to change in future GSP updates after the SVIHM and SVOM are released by the USGS. The models are representations of natural conditions and are limited by assumptions and uncertainty associated with the data upon which they are based. The water budgets produced by the models are adjusted with reported extraction data and calculated change in groundwater storage to ensure the water budgets are based on the best available science and data.

Historical and Current Water Budgets and Historical Sustainable Yield. The groundwater budget accounts for the inflows and outflows to and from the Subbasin's groundwater system. This includes subsurface inflows and outflows of groundwater at the Subbasin boundaries, recharge, pumping, ET, and net streambed exchange.

The historical groundwater budget figure below shows the annual groundwater inflows and outflows, annual change in groundwater storage, and cumulative change in storage. Changes in groundwater storage are strongly correlated with changes in deep percolation of precipitation and stream flows. However, estimated cumulative change in groundwater storage has steadily declined over time with slight increases in response to wet periods. Based on calculated change in storage based on observed groundwater levels and seawater intrusion, it is estimated that the Subbasin has historically been in overdraft on the order of 13,400 AF/yr. When this change in storage is subtracted from a range of the historical pumping, the estimated historical sustainable yield ranges from 101,400 to 123,200 AF/yr. The sustainable yield of the Subbasin is an estimate of the quantity of groundwater that can be pumped on a long-term average annual basis without causing any of the 6 undesirable results (Chapter 8). The current sustainable yield represents a snapshot in time and is not used for groundwater management planning.

Projected Water Budgets and Projected Sustainable Yield. Projected water budgets for 2030 and 2070 are extracted from the SVOM, which simulates future hydrologic conditions with assumed climate change based on the climate change factors recommended by DWR. Results are then adjusted based on extraction to produce the water budget based on best available data. The projected water budget includes a surface water budget and groundwater budget, each quantifying all inflows and outflows. The average change in storage for the sustainable yield calculations is set to a loss of 13,400 AF/yr as is done in the historical water budget. Subtracting the average change in storage of 13,400 AF/yr from the projected

SVIHM Simulated Historical and Current Groundwater Budget



pumping, results in a projected sustainable yield of 124,600 AF/yr and 130,300 AF/yr for 2030 and 2070, respectively.

The projected sustainable yield is the long-term estimate of the quantity of groundwater that can be pumped once all 6 undesirable results have been addressed; however, it does not include projects, management actions, or pumping reductions needed to avoid undesirable results and reach sustainability according to the 6 sustainability indicators. Although the sustainable yield values provide guidance for achieving sustainability, simply increasing groundwater recharge or reducing pumping to within the sustainable yield is not proof of sustainability. Sustainability must be demonstrated through avoiding all 6 undesirable results. The projected water budgets are based on a provisional version of the SVOM and are subject to change. Model information and assumptions are based on provisional documentation on the model. The sustainable yield value will be updated in future GSP updates as more data are collected and additional analyses are conducted. The table to the right summarizes the historical and projected sustainable yields for the Subbasin.

Summary of Historical and Projected 2070 Sustainable Yields in AF/yr

	Historical Sustainable Yield Range (AF//yr.)	2070 Projected Sustainable Yield
Groundwater Pumping	114,800 to 136,600	130,300
Change in Storage due to Seawater Intrusion	-12,600	-12,600
Change in Storage due to Groundwater Levels	-800	-800
Sustainable Yield	101,400 to 123,200	116,900

This data (model and/or model results) are preliminary or provisional and are subject to revision. This model and model results are being provided to meet the need for timely best science. The model has not received final approval by the U.S. Geological Survey (USGS). No warranty, expressed or implied, is made by the USGS or the U.S. Government as to the functionality of the model and related material nor shall the fact of release constitute any such warranty. The model is provided on the condition that neither the USGS nor the U.S. Government shall be held liable for any damages resulting from the authorized or unauthorized use of the model.

ES-7 MONITORING NETWORKS (GSP UPDATE CHAPTER 7)

Monitoring networks are developed for data collection of sufficient quality, frequency, and distribution to characterize groundwater and related surface water conditions in the Subbasin and to evaluate changing conditions that occur as the Plan is implemented. The SVBGSA developed monitoring networks for each of the 6 sustainability indicators, based on existing monitoring sites to the extent possible. The monitoring networks for groundwater elevations and ISW have been expanded since the original GSP. Remaining data gaps will be filled to improve the SVBGSA's ability to demonstrate sustainability and refine the hydrogeologic conceptual model.

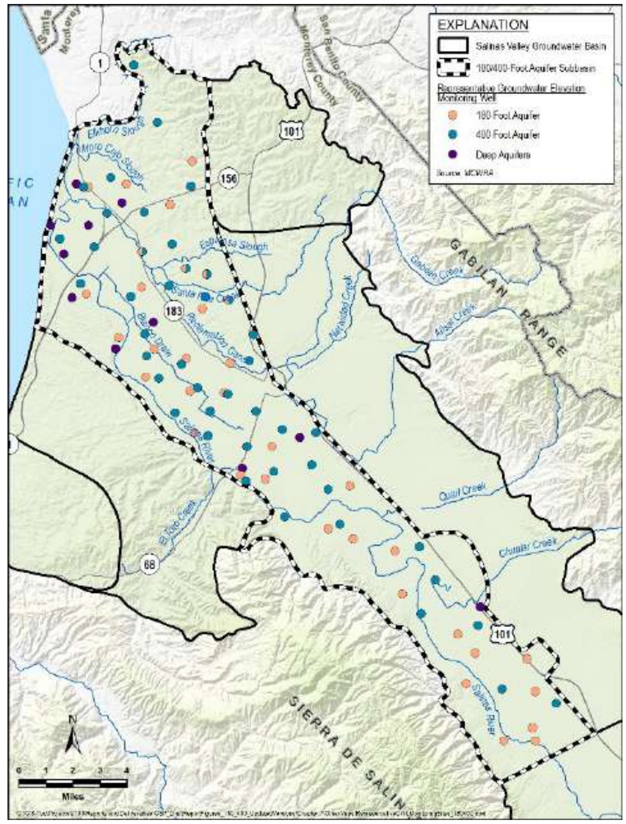
- **Groundwater levels** are measured in 91 designated monitoring wells that form a network sufficient to demonstrate groundwater occurrence, flow directions, and hydraulic gradients. The figure to the right shows the existing monitoring network, all monitoring is conducted by MCWRA.

- **Groundwater storage** is measured by groundwater elevations; thus, the groundwater storage and groundwater level monitoring networks are identical.

- **Seawater intrusion** is evaluated based on a 500 mg/L chloride concentration isocontour derived from measurements at a specific network of monitoring wells in the 180/400-Foot Aquifer Subbasin and the adjacent Monterey and Eastside Subbasins. Monitoring and development of the chloride isocontour maps are done by MCWRA.

- **Groundwater quality** is evaluated by monitoring groundwater quality at a network of existing water supply wells. Drinking water constituents of concern will be assessed at public water system supply wells through the Division of Drinking Water program and at on-farm domestic wells through the Irrigated Lands Regulatory Program (IRLP), shown on the figures at right and on the following page, respectively. Agricultural constituents of concern will be assessed at irrigation supply wells that are also monitored through the ILRP.

180/400-Foot Aquifer Subbasin Representative Monitoring Network for Groundwater Levels



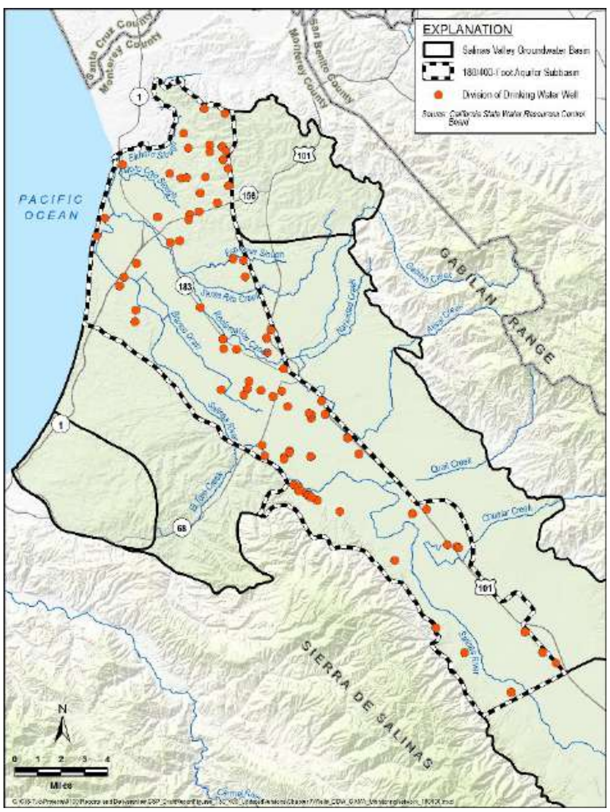
- **Land subsidence** is assessed based on the land subsidence data DWR has collected with InSAR satellite data.

- **Interconnected surface water** is assessed through monitoring shallow groundwater elevations near locations of interconnection. Given the lack of shallow wells near location of interconnection, 2 new shallow wells will be identified or installed along the Salinas River.

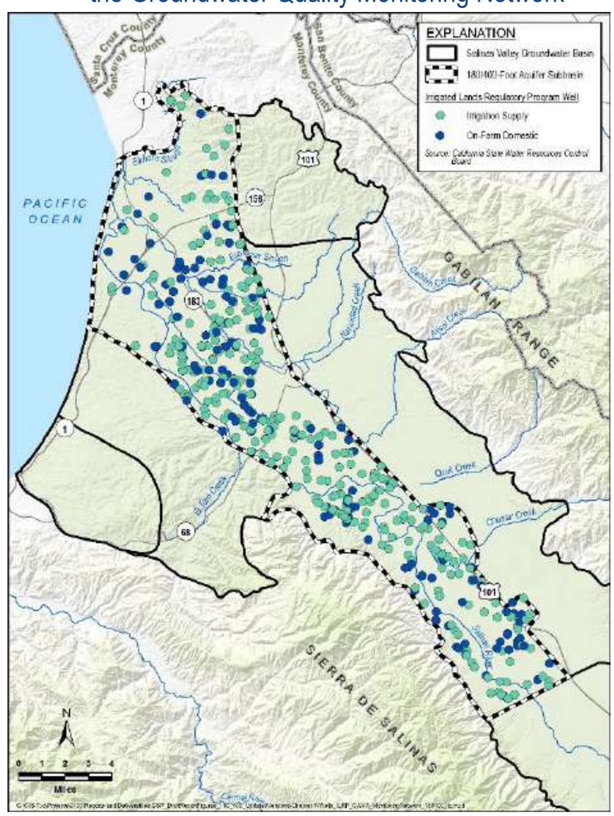
- **Other monitoring networks** are not necessary to monitor the 6 sustainability indicators in the Subbasin; however, DWR requires annual reporting of pumping and surface water use in the Subbasin.
  - **Groundwater extraction** monitoring includes municipal and agricultural pumping reported to the MCWRA.
  - **Salinas River Watershed Diversion** data from the Electronic Water Rights Information Management System (eWRIMS) is used to monitor the surface water diversions in the Subbasin.

The SVBGSA has developed a Data Management System (DMS) to store, review, and upload data collected as part of GSP development and implementation. The DMS includes a publicly accessible web-map hosted on the SVBGSA website; accessed at https://svbgsa.org/gsp-web-map-and-data/.

DDW Public Water System Supply Wells in the Groundwater Quality Monitoring Network



ILRP On-Farm Domestic and Irrigation Supply Wells in the Groundwater Quality Monitoring Network



ES-8 SUSTAINABLE MANAGEMENT CRITERIA (GSP UPDATE CHAPTER 8)

The sustainability goal of the 180/400-Foot Aquifer Subbasin is to manage groundwater resources for long-term community, financial, and environmental benefits to the Subbasin's residents and businesses. The goal of this GSP is to ensure long-term viable water supplies while maintaining the unique cultural, community, and business aspects of the Subbasin. It is the express goal of this GSP to balance the needs of all water users in the Subbasin.

Sustainable Management Criteria (SMC) define the conditions that constitute sustainable groundwater management. The following table provides a summary of the SMC for each of the 6 sustainability indicators. Measurable objectives reflect the subbasin's goals for desired groundwater conditions for each sustainability indicator. These provide operational flexibility above the minimum thresholds. The minimum thresholds are quantitative indicators of the Subbasin's locally defined significant and unreasonable conditions. The undesirable result is a combination of minimum threshold exceedances that show a significant and unreasonable condition across the Subbasin. This GSP is designed avoid undesirable results, and achieve the sustainability goals within 20 years, along with interim milestones every 5 years that show progress. The management actions and projects provide sufficient options for reaching the measurable objectives within 20 years and maintaining those conditions for 30 years for all 6 sustainability indicators.

Sustainable Management Criteria Summary

Sustainability Indicator	Minimum Threshold	Measurable Objective	Undesirable Result
Chronic lowering of groundwater levels	Minimum thresholds are set to 1 foot above 2015 groundwater elevations.	Measurable objectives are set to 2003 groundwater elevations.	More than 15% of groundwater elevation minimum thresholds are exceeded. Allows for 5 exceedances per year in the 180-Foot Aquifer; 7 in the 400-Foot Aquifer; and 2 in the Deep Aquifers.
Reduction in groundwater storage	Minimum threshold is set to 626,000 AF below the measurable objective. This reduction is based on the groundwater level and seawater intrusion minimum thresholds. This number does not include the Deep Aquifers and will be refined as additional data are collected and other projects are implemented.	Measurable objective is set to zero when the groundwater elevations are held at the groundwater level and seawater intrusion measurable objectives. Since the goal is to manage to the measurable objective, additional water in storage is needed until groundwater elevations are at their measurable objectives.	There is an exceedance of the minimum threshold.
Seawater intrusion	Minimum threshold is the 2017 extent of the 500 mg/L chloride isocontour as developed by MCWRA for the 180-Foot and 400-Foot Aquifers. The minimum threshold is the line defined by Highway 1 for the Deep Aquifers.	Measurable objective is the line defined by Highway 1 for the 180-Foot, 400-Foot, and Deep Aquifers.	Any exceedance of the minimum threshold, resulting in mapped seawater intrusion beyond the 2017 extent of the 500 mg/L chloride isocontour.
Degraded groundwater quality	Minimum thresholds and measurable objectives are zero additional exceedances of the regulatory drinking water standards (potable supply wells) or the Basin Plan objectives (irrigation supply wells) beyond those observed in 2017 for groundwater quality COC. Exceedances are only measured in public water system supply wells and ILRP on-farm domestic and irrigation supply wells.		Future or new minimum thresholds exceedances are caused by a direct result of GSA groundwater management action(s), including projects or management actions and regulation of groundwater extraction.
Land subsidence	Minimum threshold and measurable objective are zero net long-term subsidence, with no more than 0.1 foot per year of estimated land movement to account for InSAR errors.		There is an exceedance of the minimum threshold for subsidence due to lowered groundwater elevations.
Depletion of interconnected surface water	Minimum thresholds are established by proxy using shallow groundwater elevations 1 foot higher than those observed in 2015 near locations of ISW.	Measurable objectives are established by proxy using shallow groundwater elevations observed in 2003 near locations of ISW.	There is an exceedance of the minimum threshold in a shallow groundwater monitoring well used to monitor ISW.

ES-9 PROJECTS AND MANAGEMENT ACTIONS (GSP UPDATE CHAPTER 9)

This GSP Update identifies projects and management actions that provide stakeholders with options to reach sustainability. The set of projects and actions achieve the following objectives:

- Attaining groundwater sustainability by 2040 by meeting Subbasin-specific SMC
- Providing equity between who benefits from projects and who pays for projects
- Providing incentives to constrain groundwater pumping within the sustainable yield

The projects and management actions included in this GSP Update outline a framework for reaching sustainability; however, many details must be negotiated before any of the projects and management actions can be implemented. The set of projects and management actions provides sufficient options for reaching and maintaining sustainability throughout the planning horizon, but they do not all necessarily need to be implemented.

This GSP Update is developed as part of an integrated effort by the SVBGSA to achieve groundwater sustainability in all 6 subbasins of the Salinas Valley under its authority. Therefore, the projects and actions included in this GSP are part of a larger set of integrated projects and actions for the entire Valley.

This GSP Update focuses on the projects that directly help the 180/400-Foot Aquifer Subbasin reach its sustainability goals, but also includes cross-boundary projects outside the Subbasin that will likely benefit the Subbasin and reduce the need for additional projects and management actions. In addition, the chapter includes implementation actions that contribute to groundwater management and GSP implementation but do not directly help the Subbasin reach or maintain sustainability. The projects, management actions, and implementation actions for this GSP are listed in the following table

Projects and Management Actions

Project/ Management Action #	Name	Description	Project Benefits
	MA – MANAGEMENT ACTIONS		
MA1	Demand Planning	Proactively determines how extraction should be controlled and planned for	Decreases extraction if needed
MA2	Fallowing, Fallow Bank, and Agricultural Land Retirement	Includes voluntary fallowing, a fallow bank whereby anybody fallowing land could draw against the bank to offset lost profit from fallowing, and retirement of agricultural land	Decreased groundwater extraction for irrigated agriculture
MA3	Conservation and Agricultural BMPs	Promote agricultural best management practices and support use of ET data as an irrigation management tool for growers	Better tools assist growers to use water more efficiently; decreased groundwater extraction
MA4	Reservoir Reoperation	Collaborate with MCWRA to evaluate potential reoperation scenarios, which could be paired with projects such as the Interlake Tunnel, seasonal reservoir releases with aquifer storage and recovery (ASR), or other potential projects	More regular annual reservoir releases, including dry years, which could provide water for seasonal storage through ASR in the northern Salinas Valley
MA5	Undertake and Operationalize Guidance from Deep Aquifers Study	Complete study of the Deep Aquifers to enable better management of groundwater and seawater intrusion and operationalize guidance	Increase understanding of Deep Aquifers; protect Deep Aquifers from seawater intrusion and groundwater level decline
MA6	MCWRA Drought Reoperation	Support the existing Drought Technical Advisory Committee (D-TAC) when it develops plans for how to manage reservoir releases during drought	Multi-subbasin benefits: more regular seasonal reservoir releases; drought resilience

Project/ Management Action #	Name	Description	Project Benefits
MA1	Demand Planning	Proactively determines how extraction should be controlled and planned for	Decreases extraction if needed
	P – PROJECTS		
P1	Multi-benefit Stream Channel improvements	Prune native vegetation and remove non-native vegetation, manage sediment, and enhance floodplains for recharge. Includes 3 components: Stream Maintenance Program Invasive Species Eradication Floodplain Enhancement and Recharge	Groundwater recharge, flood risk reduction, returns streams to a natural state of dynamic equilibrium
P2	CSIP System Optimization	Infrastructure and program implementation improvements to better accommodate diurnal and seasonal fluctuation in irrigation demand in the CSIP system, maximize use of recycled and Salinas River water, and further reduce groundwater extraction	Decreased groundwater extraction
P3	Modify M1W Recycled Water Plant	Infrastructure upgrades to prevent the winter maintenance shutdown and allow delivery of tertiary treated wastewater to CSIP instead of groundwater when water demand is low	Decreased groundwater extraction
P4	CSIP Expansion	Expand service area of CSIP to provide a combination of Salinas River water, recycled water, and, when needed, groundwater in lieu of groundwater extraction	Decreased groundwater extraction
P5	Seawater Intrusion Extraction Barrier	Install a series of wells in the 180-Foot and 400-Foot Aquifers to extract groundwater and form a hydraulic barrier that prevents seawater intrusion from advancing inland of the wells	Prevention of seawater intrusion inland of wells, provision of brackish water that could be desalted for an additional water supply
P6	Regional Municipal Supply Project	Build a regional brackish treatment plant that will treat water extracted from seawater intrusion barrier and supply drinking water to municipalities in the Eastside Subbasin and other subbasins	Less groundwater pumping, reduced risk of seawater intrusion
P7	Seasonal Release with ASR	Release flows from reservoirs during the winter/spring, for groundwater recharge and then diversion at the SRDF. Diverted water will be treated and then injected into the 180-Foot and 400-Foot Aquifers for seasonal storage, and then extracted for delivery to CSIP during the peak irrigation season and/or delivered for direct municipal use.	Seasonal storage of winter/spring flows in the northern Salinas Valley; reduced coastal pumping during peak irrigation season
P8	Irrigation Water Supply Project (or Somavia Road Project)	Extract groundwater during the peak irrigation season to induce greater groundwater recharge and storage during the winter/spring	Less groundwater pumping in area where extracted water is delivered
CROSS-BOUNDARY PROJECTS ***(projects outside the Subbasin that will likely have indirect benefits for the 180/400 Subbasin that may reduce the need for other projects and management actions)***			
R1	**Eastside Floodplain Enhancement and Recharge**	**Restore creeks and floodplains to slow the flow of water**	**More infiltration, less erosion, less flooding**
Project/ Management Action #	Name	Description	Project Benefits

R2	11043 Diversion at Chualar	Build a new facility near Chualar that would be allowed to divert water from the Salinas River when streamflow is high	Less groundwater pumping, moderately less seawater intrusion in other subbasins
R3	11043 Diversion at Soledad	Build a new facility near Soledad that would be allowed to divert water from the Salinas River when streamflow is high	Less groundwater pumping, slightly less seawater intrusion in other subbasins
M1	MCWD Demand Management Measures	Provides in-lieu recharge through reducing groundwater demands.	Reduced pumping in the principal aquifers resulting in an in-lieu recharge benefit; slightly less seawater intrusion.
M2	Stormwater Recharge Management	Existing policies will facilitate and result in additional stormwater catchment and infiltration over time as redevelopment occurs	Groundwater recharge, urban flood risk reduction
M3	Indirect Potable Reuse	Direct non-potable irrigation use and/or injection of advanced treated water from Monterey One Water (M1W) and extraction using existing MCWD wells or new production wells.	Reduced pumping in the principal aquifers resulting in an in-lieu recharge benefit; slightly less seawater intrusion.
C1	Corral de Tierra Pumping Allocation and Control	Proactively determine how extraction should be fairly divided and controlled in the Corral de Tierra Management Area	Decreased extraction; range of potential benefits, which may include increased flows to the 180/400-Foot Subbasin
G - IMPLEMENTATION ACTIONS			
I1	Well Registration	Register all production wells, including domestic wells	Better informed decisions, more management options
I2	Groundwater Extraction Management System (GEMS) Expansion and Enhancement	Update current GEMS program by collecting groundwater extraction data from wells in areas not currently covered by GEMS and improving data collection	Better informed decisions
I3	Dry Well Notification System	Develop a system for well owners to notify the GSA if their wells go dry. Refer those owners to resources to assess and improve their water supplies. Form a working group if concerning patterns emerge.	Support affected well owners with analysis of groundwater elevation decline
I4	Water Quality Coordination Group	Form a working group for agencies and organizations to collaborate on addressing water quality concerns	Improve water quality
I5	Land Use Jurisdiction Coordination Program	Review land use plans and efforts to coordinate with land use planning agencies to assess activities that potentially create risks to groundwater quality or quantity.	Better aligned land use and water use planning

Mitigation of Overdraft. The 180/400-Foot Aquifer Subbasin has historically been in overdraft and it is projected to still be in overdraft throughout the GSP planning horizon unless projects and management actions bring extraction in line with the sustainable yield. The overdraft can be mitigated by reducing pumping or recharging the subbasin, either through direct or in-lieu means. The potential projects and management actions in this chapter are sufficient to mitigate existing overdraft. These include potential demand management through pumping allocations to be used if other projects and management actions do not reach sustainability goals and mitigate overdraft.

ES-10 IMPLEMENTATION (GSP UPDATE CHAPTER 10)

This GSP Update lays out progress to date and a roadmap for addressing all of the activities needed for GSP implementation between 2022 and 2042, focusing mainly on the activities between 2022 and 2027. Progress towards GSP Implementation include activities of SVBGSA and MCWRA that promote groundwater sustainability and are important for reaching the GSP sustainability goal, including coordination and engagement, data and monitoring, planning, and project and implementation activities. Implementing this GSP requires the following further formative activities:

Data, monitoring, and reporting. SGMA requires submittal of annual monitoring data and development of an annual report to track groundwater conditions with respect to the SMC. Monitoring will mostly rely on existing monitoring programs, and expansion of those programs. The groundwater level, ISW, and groundwater extraction monitoring networks will be improved to provide sufficient temporal coverage. Data from the monitoring programs will be maintained in the DMS and evaluated annually. SVBGSA also plans to fill the aquifer properties and lithologic and hydrostratigraphic data gaps in the HCM to gain a better understanding of the principal aquifer.

Continuing communication and stakeholder engagement. The SVBGSA website will be maintained as a communication tool for posting data, reports, and meeting information. Additionally, the SVBGSA will routinely report information to the public about GSP implementation, progress towards sustainability, and the need to use groundwater efficiently.

Refining and implementing projects and management actions. The projects and management actions in this GSP have been identified as beneficial and sufficient for reaching and maintaining sustainability in the 180/400-Foot Aquifer Subbasin. During GSP implementation, they will be refined and prioritized, and impacts of projects and management actions on adjacent subbasins will be analyzed as part of the project selection process. The SVBGSA Board of Directors will approve projects and management actions that are selected for funding.

Adapting management with the 5-year update. SGMA requires assessment reports every 5 years to assess progress towards sustainability, a description of significant new information or data, and whether the GSP needs to be adapted. The 5-year update will include updating the SVIHM and SVOM with newly collected data and updating model scenarios to reflect both the additional data and refinements in project design or assumptions.

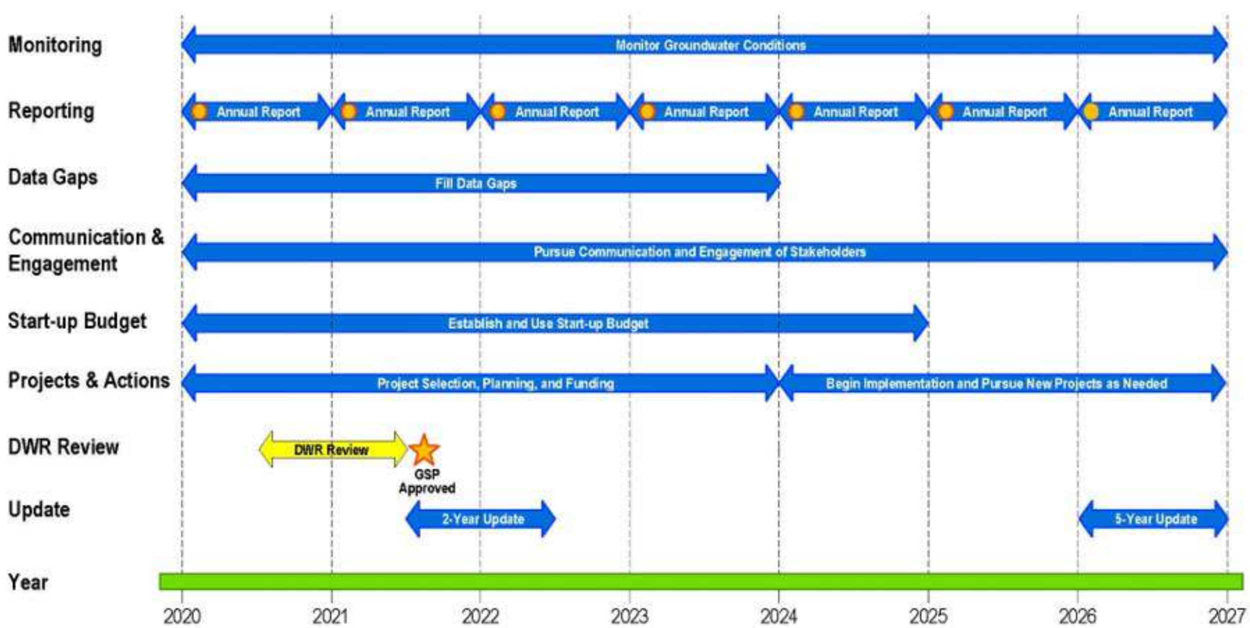
Developing a funding strategy. SVBGSA established a valley-wide Regulatory Fee to fund the typical annual operational costs of its regulatory program authorized by SGMA, including regulatory activities of management groundwater to sustainability (such as GSP development), day-to-day administrative operations costs, and prudent reserves. The cost is relatively low because SVBGSA can spread its administrative costs over the 6 subbasins it manages. In addition, this GSP Update provides an estimate of the start-up budget needed to continue to implement this GSP within the 180/400-Foot Aquifer Subbasin. The SVBGSA estimates that these planned activities will cost $5,688,400 over the next 5 years of implementation in the Subbasin. The start-up budget does not include funding for implementing specific projects and management actions. For projects funded by SVBGSA or funding SVBGSA raises to contribute to the implementation of projects, this GSP includes a list of potential funding mechanisms, and

SVBGSA will evaluate the most appropriate mechanism for each project.

Schedule. Implementation of the 180/400-Foot Aquifer Subbasin GSP must be integrated with that of the 5 other GSPs in the Salinas Valley to ensure all subbasins can reach and maintain sustainability. The general implementation schedule for the next 5 years of GSP implementation, provided in the figure below, includes 6 main tasks and DWR's review and approval process. For projects and management actions, implementation will begin with implementation actions and prioritization of projects and management actions to reach sustainability.

Throughout GSP implementation, projects and management actions will be continually updated as new data and analyses are available. The GSP is intended to include adaptive management that will refine the implementation and direction of this GSP over time.

General Schedule of 5-Year Start-Up Plan



1 INTRODUCTION TO THE 180/400-FOOT AQUIFER SUBBASIN GROUNDWATER SUSTAINABILITY PLAN 2022 UPDATE

1.1 Introduction and Purpose

The 2014 Sustainable Groundwater Management Act (SGMA) requires groundwater basins or subbasins that are designated as medium or high priority to be managed sustainably. In general, satisfying the requirements of SGMA requires four activities:

1. Forming one or more Groundwater Sustainability Agency(s) (GSAs) in the basin
2. Developing a Groundwater Sustainability Plan (GSP, or Plan)
3. Implementing the GSP and managing to measurable, quantifiable objectives
4. Providing regular reports to the California Department of Water Resources (DWR)

DWR has designated the Salinas Valley – 180-400-Foot Aquifer Subbasin (Subbasin) as a high priority basin. The 180-400-Foot Aquifer Subbasin is one of nine subbasins in the Salinas Valley, and it is located at the northern end of the Salinas Valley and is bounded by the Monterey Bay to the northwest (Figure 1-1).

Groundwater conditions in the 180/400-Foot Aquifer Subbasin have deteriorated in recent decades, including seawater intrusion, a decline in groundwater elevations in specific areas, and an overall decline in groundwater storage. Seawater intrusion poses groundwater quality concerns, with TDS values range from 223 to 1,013 mg/L (DWR, 2004a). The purpose of this GSP Update is to outline how the Salinas Valley Basin Groundwater Sustainability Agency (SVBGSA) will address the declining groundwater conditions and achieve groundwater sustainability in the Subbasin. Sustainability is the absence of undesirable results for any of the six sustainability indicators applicable in the subbasin: groundwater level declines, groundwater storage reductions, seawater intrusion, groundwater quality degradations, land subsidence, and surface water depletion from groundwater use. Sustainability must by achieved in 20 years and maintained for an additional 30 years.

In 2020, SVBGSA submitted the groundwater sustainability plan (GSP) for the 180/400-Foot Aquifer Subbasin that outlined how it would adaptively manage groundwater. In 2022, the 5 other Salinas Valley subbasins under the authority of SVBGSA submitted GSPs. This 2022 GSP Update to the 180/400-Foot Aquifer Subbasin GSP (GSP Update) is developed to align all SVBGSA GSPs in approach and timing. This GSP Update incorporates additional data about current conditions, adds clarifications identified during development of the 2022 Salinas Valley GSPs, addresses recommended actions from DWR's review of the original GSP, and incorporates additional regulatory requirements. This 2022 Update is submitted to DWR as an amendment according to GSP Regulation § 355.10 and replaces the original 2020 GSP. It continues to meet all of the GSP regulatory requirements and additionally includes an assessment of the original GSP submitted in 2020, meeting GSP Regulations § 356.4.

This GSP Update first presents the stakeholders, plan area, geologic and hydrogeologic data, groundwater conditions, and water budget necessary to develop an informed and robust plan. This GSP Update is based on best available data and analyses. As additional data are collected and analyses are refined, the GSP will be modified to reflect changes in the local understanding.

Following the foundational information, the GSP Update introduces the current agreed-to sustainability goal for the Subbasin. It also locally defines significant and unreasonable conditions, which underpin the quantifiable minimum thresholds, measurable objectives, and interim milestones for each of the corresponding sustainability indicators. The final chapters detail projects and actions that could be implemented to achieve sustainability and provide a plan for implementing the GSP. The GSP is intended to include adaptive management that will refine the implementation and direction of this GSP over time.

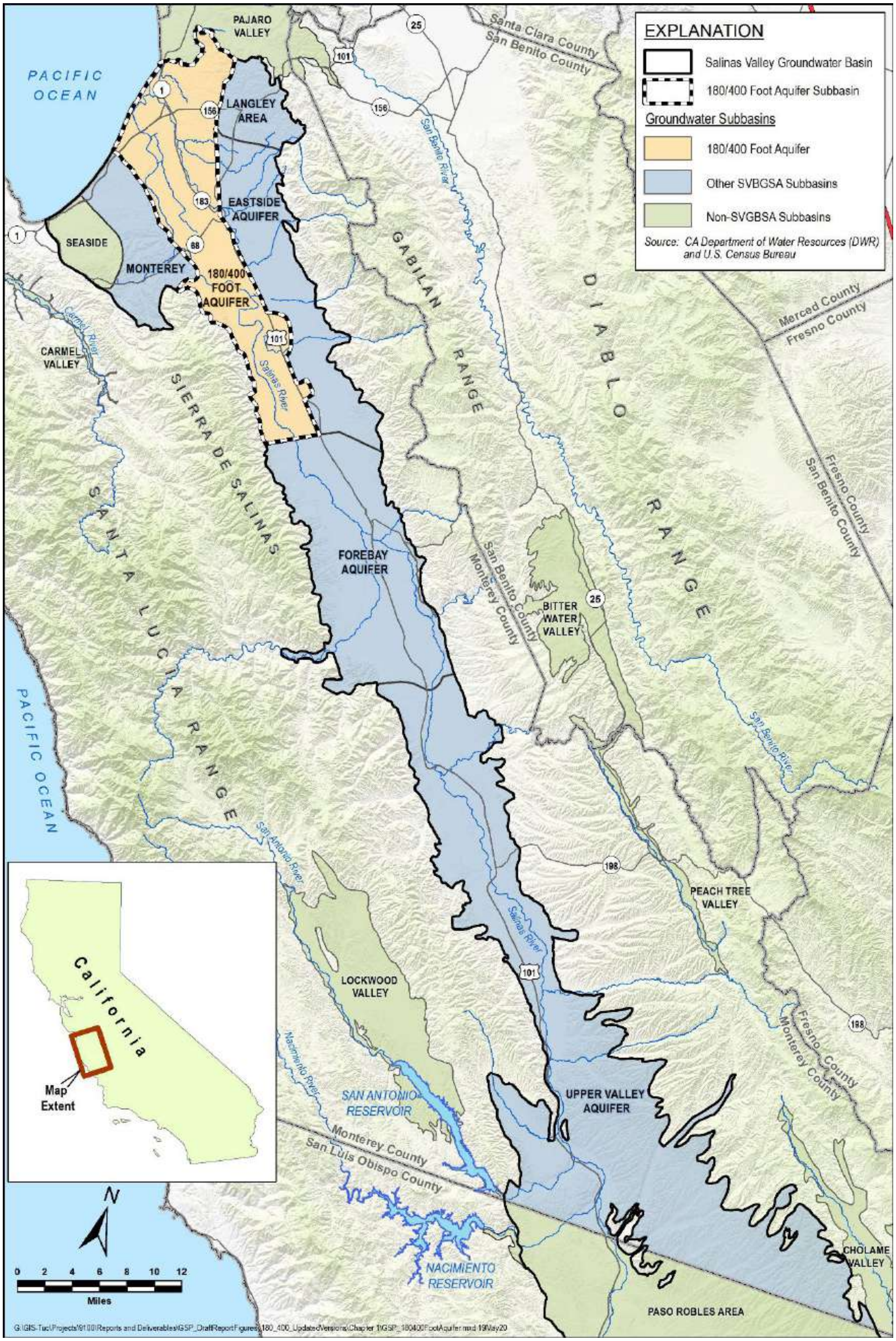


Figure 1-1. 180/400-Foot Aquifer Subbasin Location

1.2 Agency Information

The 180/400-Foot Aquifer Subbasin falls within the jurisdiction of three GSAs: the SVBGSA, Marina Coast Water District GSA (MCWD GSA), and County of Monterey Groundwater Sustainability Agency (Monterey County GSA). This GSP was developed by the SVBGSA with input and assistance from the MCWD GSA and the County GSA. Each is an exclusive GSA for its respective portion of the Subbasin. The Subbasin boundary is shown on Figure 1-2.

1.2.1 Agency Name, Mailing Address, and Plan Manager

Pursuant to California Water Code § 10723.8, the name and contact information for each GSA are:

Salinas Valley Basin Groundwater Sustainability Agency
Attn.: Piret Harmon, General Manager
1441 Schilling Place
Salinas, CA 93901
https://svbgsa.org

Marina Coast Water District Groundwater Sustainability Agency
Attn.: Remleh Scherzinger, General Manager
11 Reservation Road
Marina, CA 93933
http://www.mcwd.org

County of Monterey Groundwater Sustainability Agency
Attn: Ms. Susan K. Blitch, County Counsel
169 W Alisal St, 3rd Floor
Salinas, CA 93901
https://www.co.monterey.ca.us/

The Plan Manager and her contact information are:

Ms. Piret Harmon, General Manager
Salinas Valley Basin Groundwater Sustainability Agency
1441 Schilling Place
Salinas, CA 93901 | (831) 682-2592
harmonp@svbgsa.org
https://svbgsa.org

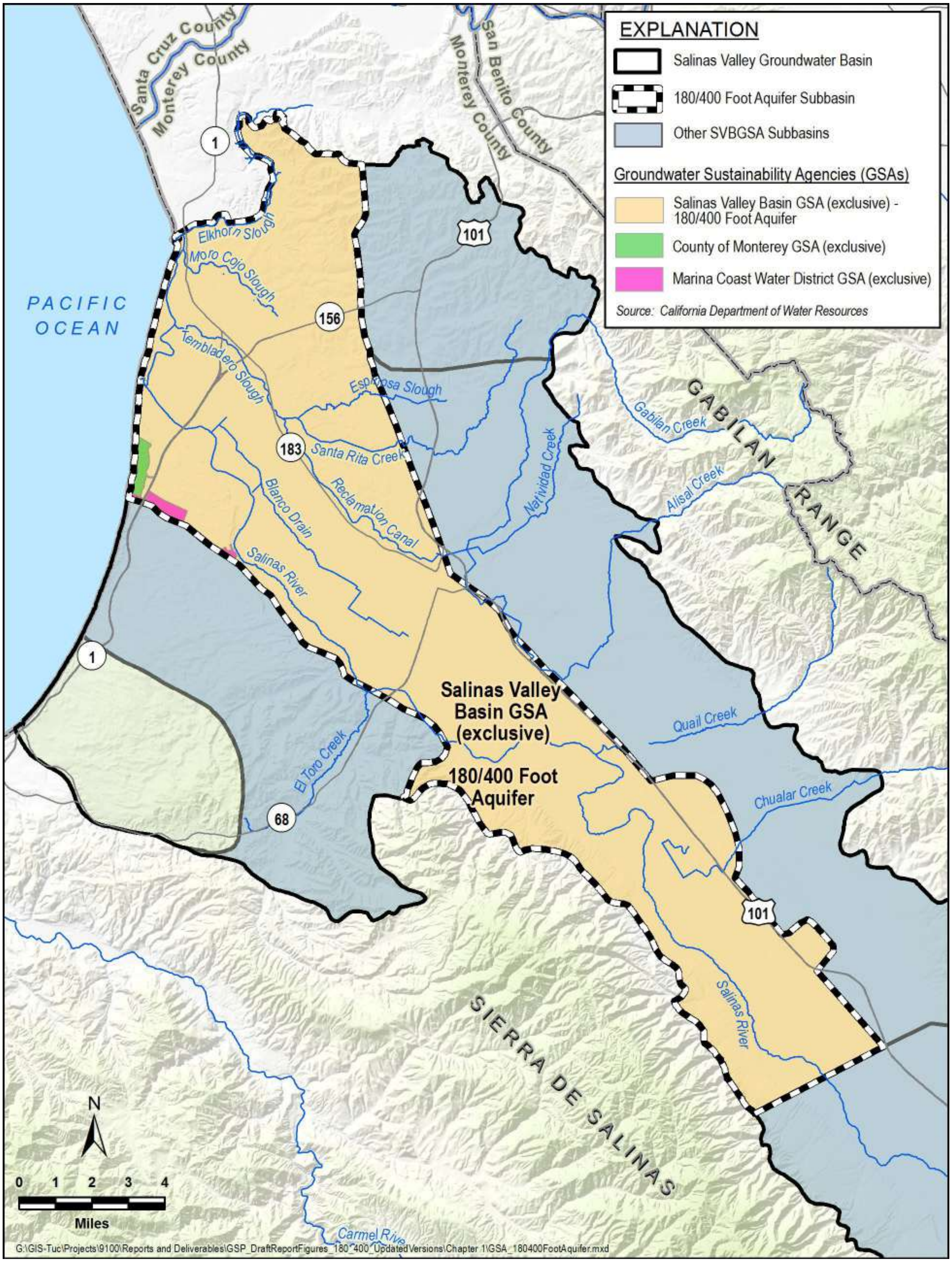


Figure 1-2. Map of Area Covered by the SVBGSA in the 180/400-Foot Aquifer Subbasin

1.2.2 Agencies' Organization and Management Structure

1.2.2.1 SVBGSA

Local GSA-eligible entities formed the SVBGSA in 2017. The SVBGSA represents agriculture, public utility, municipal, county, and environmental stakeholders, and is partially or entirely responsible for developing GSPs in 6 of the Salinas Valley Groundwater Subbasins.

The SVBGSA is a Joint Powers Authority (JPA), and its membership includes the County of Monterey, Monterey County Water Resources Agency (MCWRA), City of Salinas, City of Soledad, City of Gonzales, City of King (King City), the Castroville Community Services District (CSD), and Monterey One Water (formerly the Monterey Regional Water Pollution Control Agency). The SVBGSA is governed and administered by an 11-member Board of Directors, representing public and private groundwater interests throughout the Valley. When a quorum is present, a majority vote is required to conduct business. Some business items require a super majority vote or a super majority plus vote. A super majority requires an affirmative vote by eight of the 11 Board members. A super majority vote is required for:

- Approval of a GSP
- Amendment of budget and transfer of appropriations
- Withdrawal or termination of Agency members

A super majority plus requires an affirmative vote by 8 of the 11 Board members, including an affirmative vote by 3 of the 4 agricultural representatives. A super majority plus vote is required for:

- Decisions to impose fees not requiring a vote of the electorate or property owners
- Proposals to submit to the electorate or property owners (as required by law) decisions to impose fees or taxes
- Limitations on well extractions (pumping limits)

In addition to the Board of Directors, SVBGSA includes a Budget and Finance Committee consisting of five Directors, an Executive Committee consisting of 5 Directors, a Planning Committee consisting of five Directors, and an Advisory Committee consisting of Directors and non-directors. The Advisory Committee is designed to ensure participation by constituencies whose interests are not directly represented on the Board. The SVBGSA's activities are coordinated by a general manager. The SVBGSA established individual subbasin committees to advise the Board of Directors on each of the subbasins under its jurisdiction for which it is developing a 2022 GSP. This GSP Update, as well as GSP implementation, is guided and reviewed by the 180/400-Foot Aquifer Subbasin Implementation Committee, which comprises local representatives from the Subbasin.

1.2.2.2 MCWD GSA

MCWD GSA is a single agency GSA formed by MCWD and covering the areas within the MCWD service area within Monterey Subbasin, except for those areas owned by a federal government entity and thus not subject to SGMA. MCWD is by a five-member Board of Directors who each serve four-year terms. Board members are elected at large. Decisions on all GSA-related matters require an affirmative vote of a majority of the five Board of Directors members. The MCWD GSA activities are coordinated by the MCWD's existing staff.

1.2.2.3 Monterey County GSA

The Monterey County GSA is governed by the Board of Supervisors of the County of Monterey. The Board of Supervisors is composed of five members who are elected by their respective geographical districts within the County. The County's GSA activities are coordinated by the County Administrative Officer (CAO) or designee.

1.2.3 Authority of Agency

1.2.3.1 SVBGSA

The SVBGSA was formed in accordance with the requirements of California Water Code §10723 *et seq*. This section lists its specific authorities for GSA formation and groundwater management.

SVBGSA is a JPA that was formed for the Salinas Valley Groundwater Basin in accordance with the requirements of California Government Code § 6500 *et seq*. The JPA agreement is included in Appendix 1A. In accordance with California Water Code § 10723 *et seq.*, the JPA signatories are all local agencies under California Water Code § 10721 with water or land use authority that are independently eligible to serve as GSAs:

- The County of Monterey has land use authority over the unincorporated areas of the County, including areas overlying the 180/400-Foot Aquifer Subbasin.
- The MCWRA is a California Special Act District with broad water management authority in Monterey County.
- The City of Salinas is incorporated under the laws of the State of California. The City provides water supply and land use planning services to its residents.
- The City of Soledad is incorporated under the laws of the State of California. The City provides water supply and land use planning services to its residents.
- The City of Gonzales is incorporated under the laws of the State of California. The City provides water supply and land use planning services to its residents.
- King City is incorporated under the laws of the State of California. The City provides

water supply and land use planning services to its residents.

- The Castroville CSD is a local public agency of the State of California, organized and operating under the Community Services District Law, Government Code §6100 *et seq*. Castroville CSD provides water services to its residents.
- Monterey One Water is itself a joint powers authority whose members include many members of the SVBGSA.

Upon establishing itself as a GSA, the SVBGSA retains all the rights and authorities provided to GSAs under California Water Code § 10725 *et seq*. as well as the powers held in common by the members.

1.2.3.2 Authority of MCWD GSA

MCWD GSA was formed in accordance with California Water District Law, California Water Code § 34000, and is responsible for water supply in a portion of the Subbasin. MCWD is therefore a local agency under California Water Code § 10721 with the authority to establish itself as a GSA. Upon establishing itself as a GSA, MCWD retains all the rights and authorities provided to GSAs under California Water Code § 10725 *et seq*.

1.2.3.3 Authority of County GSA

Pursuant to California Water Code section § 10724, the Board of Supervisors of the County of Monterey elected to be the exclusive GSA for the approximately 400-acre parcel within the 180/400-Foot Aquifer Subbasin commonly known as the CEMEX site.

1.2.3.4 Coordination Agreement

Because the SVBGSA is developing a single GSP for the entire 180/400-Foot Aquifer Subbasin, with input of MCWD GSA and County GSA, coordination agreements with MCWD GSA and Monterey County GSA are not required (California Water Code § 10720.7). However, the SVBGSA and MCWD GSA developed agreements to cooperatively develop this GSP. Likewise, the SVBGSA and Monterey County GSA developed a Cooperation Agreement to ensure that GSP implementation in the 180/400-Foot Aquifer Subbasin is synchronized, and the legal authorities to implement the GSP for the entire Subbasin exist. According to these agreements, MCWD GSA and Monterey County GSA will adopt those aspects of the SVBGSA's 180/400-Foot Aquifer Subbasin GSP that apply to their respective jurisdictions within the 180/400-Foot Aquifer Subbasin. These agreements to cooperatively develop this GSP are included in Appendix 1B.

1.3 Agency Coordination

1.3.1 Coordination Between GSAs

SVBGSA continues to coordinate with agencies involved in water management within the 180/400-Foot Aquifer Subbasin, the adjacent Pajaro Valley Groundwater Basin, and the adjacent Salinas Valley subbasins. MCWD GSA, Arroyo Seco GSA, and MCWRA have representation on the Advisory Committee (which assumes responsibilities of the Integrated Implementation Committee), as described in Chapter 2. [SVBGSA also solicited input from Monterey County, City of Salinas, City of Marina, and City of Gonzales prior to submitting the GSP Update.]

1.3.2 Coordination with Land Use Agencies

SVBGSA acknowledges the critical importance of coordinating water management and land use planning. The SVBGSA will be coordinating with land use authorities within the Subbasin, including the County of Monterey, and the Cities of Salinas, Marina, and Gonzales. During 2020 and 2021, SVBGSA began coordination with land use agencies through meeting with the City of Salinas. SVBGSA also drafted a Land Use Coordination Program Implementation Action that is included in Chapter 9. This implementation action provides for more robust, on-going coordination between the GSA and land use agencies during GSP implementation.

1.4 Overview of this GSP 2022 Update

The SVBGSA, with input from MCWD and County GSA, developed this GSP Update for the entire 180/400-Foot Aquifer Subbasin. This GSP Update is developed in concert with GSPs for five other Salinas Valley Groundwater Basin subbasins under SVBGSA jurisdiction: the Eastside Aquifer Subbasin, the Forebay Aquifer Subbasin, the Upper Valley Aquifer Subbasin, the Langley Area Subbasin and the Monterey Subbasin. While this GSP is focused on the 180/400-Foot Aquifer Subbasin, the GSP will be implemented in accordance with SVBGSA's role in maintaining and achieving sustainability for all subbasins within the Salinas Valley Groundwater Basin The 180/400-Foot Aquifer Subbasin is referred to as the Subbasin throughout this GSP Update, and the collection of Salinas Valley Groundwater Subbasins that fall partially or entirely under SVBGSA jurisdiction are collectively referred to as the Basin or the Valley.

The SVBGSA used a collaborative process to develop this GSP. Chapter 2 details the stakeholders that participated, and process followed, to develop this GSP. Stakeholders worked together to gather existing information, define sustainable management criteria (SMC) for the Subbasin, and develop a list of projects and management actions.

This GSP Update describes the basin setting, presents the hydrogeologic conceptual model (HCM), and describes historical and current groundwater conditions. It further establishes estimates of the historical, current, and future water budgets based on the best available information. This GSP Update defines local SMC, details required monitoring networks, and outlines projects and management actions for reaching sustainability in the Subbasin by 2040.

The SVBGSA developed this GSP as part of an adaptive management process. This GSP will be updated and adapted as new information and more refined models become available. This includes updating SMC and projects and management actions to reflect updates and future conditions. Adaptive management will be reflected in the required 5-year assessment and annual reports.

2 COMMUNICATIONS AND PUBLIC ENGAGEMENT

2.1 Introduction

The SVBGSA was formed in 2017 to implement SGMA locally within the Salinas Valley Groundwater Basin. GSA formation and coordination took place from 2015 through 2017 and included completing a Salinas Valley Groundwater Stakeholder Issues Assessment which resulted in recommendations for a transparent, inclusive process for the local implementation of SGMA and the formation of the SVBGSA. Through the development and implementation of the GSPs SVBGSA is committed to following the requirements for stakeholder engagement as defined by SGMA:

- Consider the interests of all beneficial uses of water and users of groundwater (§ 10723.2)
- Encourage the active involvement of diverse social, cultural, and economic elements of the population within the groundwater basin (§ 10727.8)
- Establish and maintain a list of persons interested in receiving notices regarding plan preparation, meeting announcements and availability of draft plans, maps, and other relevant documents (§ 10723.4)
- Make available to the public and DWR a written statement describing the manner in which interested parties may participate in the development and implementation of the GSP (§ 10723.2)

2.2 Defining and Describing Stakeholders for Public Engagement

The SVBGSA stakeholders are highly diverse. Groundwater supports economic activities from small domestic scale to large industrial scale. Groundwater is an important supply for over 400,000 people living within the Salinas Valley Groundwater Basin. Beneficial users in the Basin are the key stakeholders targeted for robust public engagement for GSP development and implementation. Beneficial users in the Basin are listed below:

Agriculture. Includes row crops, field crops, vineyards, orchards, cannabis, and rangeland. The Salinas Valley agricultural region supports a $4.25 billion dollar production value and produces a large percentage of the nation’s produce and healthy foods including 61% of the leaf lettuce, 57% of celery, 56% of head lettuce, 40% of broccoli, and 38% of spinach. Agriculture is the largest user of groundwater in the Basin accounting for approximately 250,000 irrigated acres and 94% of pumping in the Basin.

Domestic Water Users. Includes urban water use assigned to non-agricultural water uses in the cities and census-designated places and rural residential wells used for drinking water. Urban water use includes small local water systems, small state water systems, and small and large public water systems.

Industrial Users. Includes industrial water users, such as quarries and oil production. There is little industrial use within the Basin.

Environmental Users. Environmental users include the habitats and associated species maintained by conditions related to surface water flows such as steelhead trout and groundwater dependent ecosystems (GDE) including brackish and freshwater marsh and riparian habitats. Environmental users include native vegetation and managed wetlands.

Stakeholders associated with these beneficial users and uses include the following. These users are also represented on the SVBGSA Board and Advisory Committees as described in the next section.

- **Environmental organizations.** Environmental organizations that are stakeholders include Sustainable Monterey County, League of Women Voters of Monterey County, Landwatch Monterey County, Friends and Neighbors of Elkhorn Slough, California Native Plant Society Monterey Chapter, Trout Unlimited, Surfriders, the Nature Conservancy and the Carmel River Steelhead
- **Underrepresented communities (URCs) and Disadvantaged Communities (DACs).** URCs and DACs include the City of Greenfield, the City of Salinas, Castroville Community Services District, San Jerardo Cooperative, San Ardo Water District, San Vicente Mutual Water Company, Environmental Justice Coalition for Water
- **City and county government.** Cities of Gonzales, Soledad, Greenfield, King City, Marina, and Salinas, Monterey County, Monterey County Environmental Health Department
- **Land use nonprofits.** Sustainable Monterey County, League of Women Voters of Monterey County, Landwatch Monterey County, Friends and Neighbors of Elkhorn Slough
- **Residential well owners.** Represented by public members and members of mutual water companies and local small or state small water systems.
- **Water agencies.** Monterey County Water Resource Agency, Marina Coast Water District, Arroyo Seco Groundwater Sustainability Agency, Castroville Community Services District, Monterey 1 Water, Monterey Peninsula Water Management District (MPWMD)

- **CPUC-regulated water companies.** Alco Water Corporation, California Water Service Company, California American Water.

2.3 SVBGSA Governance Structure

SVBGSA is governed by a local and diverse 11-member Board of Directors (Board) and relies on robust science and public involvement for decision-making. The Board meets monthly, and all meetings are open to the public. The Board is the final decision-making body for adoption of Groundwater Sustainability Plans completed by the GSA.

The SVBGSA Advisory Committee advises the SVBGSA Board. The Advisory Committee is comprised of 25 members. The Advisory Committee strives to include a range of interests in groundwater in the Salinas Valley and outlined in SGMA. Advisory Committee members live in the Salinas Valley or represent organizations with a presence or agencies with jurisdiction in the Basin including:

- All groundwater users
- Municipal well operators, Public-Utilities Commission-Regulated water companies, and private and public water systems
- County and city governments
- Planning departments/land use
- Local landowners
- URCs
- Business and agriculture
- Rural residential well owners
- Environmental uses

The Advisory Committee, at this time, does not include representation from:

- Tribes
- Federal government

The Advisory Committee will review its charter following GSP completion for additional members if identified as necessary by the Board. The Advisory Committee provides input and recommendations to the Board and uses consensus to make recommendations to the Board. The Advisory Committee was established by Board action and operates according to a Committee Charter which serve as the bylaws of the Advisory Committee. The Advisory Committee reviews and provides recommendations to the Board on groundwater-related issues that may include:

- Development, adoption, or amendment of the GSP
- Sustainability goals
- Monitoring programs
- Annual work plans and reports
- Modeling scenarios
- Inter-basin coordination activities
- Projects and management actions to achieve sustainability
- Community outreach
- Local regulations to implement SGMA
- Fee proposals
- General advisory

Subbasin planning committees were established in May 2020 by the Board to inform and guide planning for the five 5 GSPs submitted in January 2022. In July 2021 the SVBGSA Board voted for the creation of Subbasin Implementation Committees upon submittal of a GSP. Together the Board, Advisory Committee, and Subbasin Implementation committees are working to complete the six 6 GSPs required within the SVBGSA jurisdiction. In addition, SVBGSA will complete a Salinas Valley Basin-wide Integrated Implementation Plan (IIP) that will detail project portfolios and groundwater sustainability programs to meet SGMA compliance for subbasins by 2040 and maintain sustainability through 2050.

The following graphic captures the phases of GSA development and GSP planning, and implementation intended by the SVBGSA through 2050.

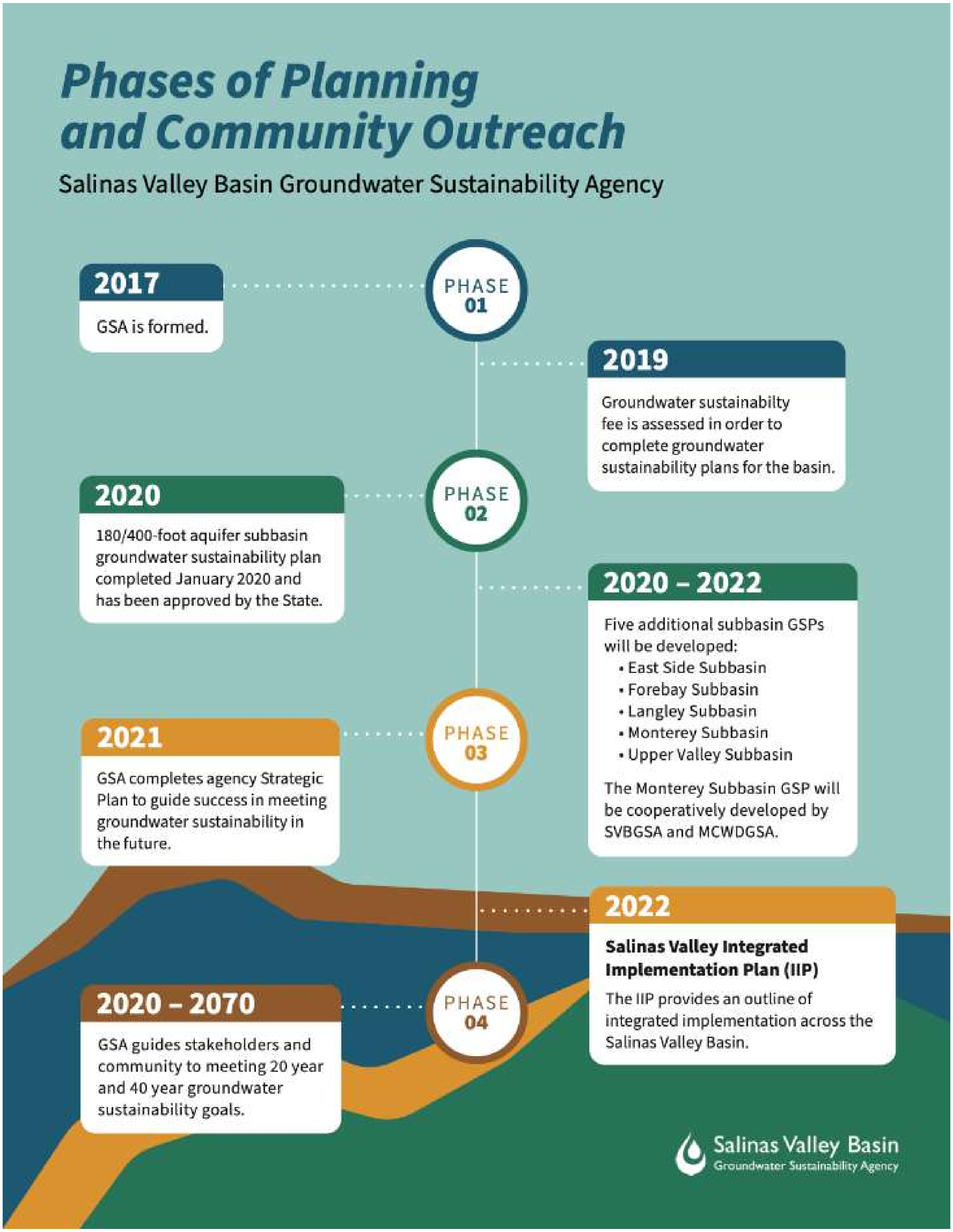


Figure 2-1. Phases of Planning and Community Outreach

2.4 180/400-Foot Aquifer Subbasin GSP Preparation and GSP Update

Given the importance of the Basin and the development of the 180/400-Foot Aquifer Subbasin GSP to the communities, residents, landowners, farmers, ranchers, businesses, and others, inclusive stakeholder input was a primary component of the 180/400-Foot Aquifer Subbasin GSP process. In order to encourage ongoing stakeholder engagement SVBGSA deployed the following strategies in the preparation of the 180/400-Foot Aquifer Subbasin GSP and GSP Update:

- An inclusive outreach and education process conducted that best supports the success of a well-prepared GSP that meets SGMA requirements.
- Kept the public informed by distributing accurate, objective, and timely information.
- Invited input and feedback from the public at every step in the decision-making process.
- In 2018, established the180/400-Foot Aquifer Subbasin Planning Committee that completed a comprehensive planning process that engaged the Advisory Committee in discussion of key plan elements and the Board of Directors on review of the Plan.
- In 2021, established the 180/400-Foot Aquifer Subbasin Implementation Committee that completed a comprehensive planning process, including engagement on key items with the Advisory Committee and Board of Directors.
- Publicly noticed drafts of the 180/400-Foot Aquifer Subbasin GSP and allowed for required public comment periods as required by SGMA. Public comments received are included in Appendix 2A.
- Followed consistent stakeholder outreach for GSP Update.

Additionally, a rigorous review process for each chapter in the 180/400-Foot Aquifer Subbasin GSP and for the final plan was completed. This process ensured that stakeholders had multiple opportunities to review and comment on the development of the chapters.

2.5 180/400-Foot Aquifer Subbasin Planning and Implementation Committees

Subbasin planning/implementation committees are comprised of local stakeholders and Board members and are appointed by the Board of Directors following a publicly noticed application process by the GSA. After the 180/400-Foot Aquifer Subbasin Planning Committee completed the GSP submitted in January 2020, SVBGSA convened the 180/400-Foot Aquifer Subbasin Implementation Committee in October 2021. Subbasin implementation committees do the comprehensive work of reviewing monitoring data, project and management action prioritization/funding, general GSP implementation, and plan updates, with assistance provided by SVBGSA staff and technical consultants.

These committees represent constituencies that are considered important stakeholders to implementing comprehensive subbasin plans for the Salinas Valley or are not represented on the Board. A list of the 180/400-Foot Aquifer Subbasin Implementation Committee is included in the Acknowledgements section of this GSP Update.

Subbasin implementation committee meetings are Brown Act meetings and noticed publicly on the SVBGSA website. Public comment is taken on all posted agenda items. Subbasin implementation committees have been engaged in an iterative planning process that combines education of pertinent technical topics through presentations and data packets and receiving GSP chapters for review and comment. All GSP chapters were posted for public review and comment.

GSP chapters that were taken to the Subbasin Planning Committee were also taken to the Advisory Committee for further review and comments. Community engagement and public transparency on SVBGSA decisions is paramount to building a sustainable and productive solution to groundwater sustainability in the Basin. At the conclusion of the planning process in 2022 for the 180/400-Foot Aquifer Subbasin GSP 2022 Update, the SVBGSA held more than 12 planning meetings.

2.6 Communication and Public Engagement Actions

SVBGSA is focused on communication and public engagement targeted at the public, including beneficial users, regarding the development of the SVBGSA's GSP for the 180/400-Foot Aquifer Subbasin**.** Communication and public engagement actions (CPE Actions) that have taken place during GSP development will continue during implementation of all SVBGSA GSPs. Communication and public engagement actions provide the SVBGSA Board and staff a guide to ensure consistent messaging about SVBGSA requirements and other related information. CPE Actions provide ways that beneficial users and other stakeholders can provide timely and meaningful input into the GSA decision-making process. CPE Actions also ensure beneficial users and other stakeholders in the Basin are informed of milestones and offered opportunities to participate in GSP implementation and plan updates. Appendix 2B includes the SVBGSA's marketing and communications plan.

Notice and communication, as required by GSP Regulations § 354.10, was focused on providing the following activities during the development of the 180/400-Foot Aquifer Subbasin GSP**:**

- Clear decision-making process on GSP approvals and outcomes
- Robust public engagement opportunities
- Encouragement of active involvement in GSP development

2.6.1 Goals for Communication and Public Engagement

Ultimately, the success of the 180/400-Foot Aquifer Subbasin GSP will be determined by the collective action of every groundwater user. In order to meet ongoing water supply needs, both for drinking water and for economic livelihoods, the Subbasin must achieve and maintain sustainability into the future. This outreach strategy engages the public early and frequently, and keeps the internal information flow seamless among staff, consultants, committee members and the SVBGSA Board regarding the goals and objectives of the 180/400-Foot Aquifer Subbasin GSP and associated monitoring and implementation activities.

Critical to the success of the 180/400-Foot GSP implementation will be public understanding of the projects and management actions planned for sustainability, as well as sustainability implementation actions and other groundwater management activities. These important actions are identified below and specifically described in Chapter 9 of the 180/400-Foot GSP.

Management Actions

- Demand Planning
- Fallowing, Fallow Bank, and Agricultural Land Retirement
- Conservation and Agricultural BMPs
- Reservoir Reoperation
- Undertake and Operationalize Guidance from Deep Aquifers Study
- MCWRA Drought Reoperation

Projects

- Multi-benefit Stream Channel Improvements
- CSIP System Optimization
- Modify M1W Recycled Water Plant
- CSIP Expansion
- Seawater Intrusion Extraction Barrier
- Regional Municipal Supply Project
- Seasonal Release with ASR
- Irrigation Water Supply Project (or Somavia Road Project)

Cross-Boundary Projects

- Eastside Floodplain Enhancement and Recharge
- 11043 Diversion at Chualar
- 11043 Diversion at Soledad
- MCWD Demand Management Measures
- Stormwater Recharge Management
- Indirect Potable Reuse
- Corral de Tierra Pumping Allocation and Control

Implementation Actions

- Well Registration
- Groundwater Extraction Management System (GEMS) Expansion and Enhancement
- Dry Well Notification System
- Water Quality Coordination Group
- Land Use Jurisdiction Coordination Program

An additional important action of GSP implementation is the production of the required Annual Report by April 1 each year for the 180/400-Foot Aquifer Subbasin. The Annual Report covers annual data collected each water year from October 1 through September 30. The Annual Report provides an annual benchmark for SVBGSA to provide to the public and stakeholders to assess progress towards sustainability. The Annual Report also includes assessment of the 6 SMC for the subbasin. The Annual Report provides an important opportunity to reengage the 180/400-Foot Aquifer Subbasin Committee in its review and to discuss sustainability status and goals.

CPE Actions provide outreach during the Subbasin planning efforts and assists SVBGSA in being receptive to stakeholder needs through communication tools. The CPE Actions also forecast how SVBGSA will communicate during GSP implementation.

The goals of the CPE Actions are:

1. To keep stakeholders informed through the distribution of accurate, objective, and timely information while adhering to SGMA requirements for engagement (noted above).
2. To articulate strategies and communications channels that will foster an open dialogue and increase stakeholder engagement during the planning process.

3. To invite input from the public at every step in the decision-making process and provide transparency in outcomes and recommendations.
4. To ensure that the Board, staff, consultants, and committee members have up-to-date information and understand their roles and responsibilities.
5. To engage the public on GSP Implementation progress especially for project and management actions and Annual Reports.

2.6.2 Communication and Outreach Objectives

The following are the communications and outreach objectives of the CPE Actions:

- Expand Audience Reach
  - Maintain a robust stakeholder list of interested individuals, groups and/or organizations.
  - Secure a balanced level of participants who represent the interests of beneficial uses and users of groundwater.
- Increase Engagement
  - Keep interested stakeholders informed and aware of opportunities for involvement through email communications and/or their preferred method of communications.
  - Publish meeting agendas, minutes, and summaries on the SVBGSA website (www.svbgsa.org).
  - Inform and obtain comments from the general public through GSP online comment form and public meetings held on a monthly basis.
  - Facilitate productive dialogues among participants throughout the GSP planning process.
  - Seek the input of interest groups during the planning and implementation of the GSP and any future planning efforts.
- Increase GSP Awareness
  - Provide timely and accurate public reporting of planning milestones through the distribution of outreach materials and posting of materials on the SVBGSA website for the GSP.
  - Secure quality media coverage that is accurate, complete, and fair.
  - Utilize social media to engage with and educate the general public.
- Track Efforts

  - Maintain an active communications tracking tool to capture stakeholder engagement and public outreach activities and to demonstrate the reporting of GSP outreach activities.

2.6.3 Target Audiences and Stakeholders

SVBGSA stakeholders consist of other agencies and interested parties including all beneficial users of groundwater or representatives of someone who is. Under the requirements of SGMA, all beneficial uses and users of groundwater must be considered in the development of GSPs, and GSAs must encourage the active involvement of diverse social, cultural, and economic elements of the population.

There are a variety of audiences targeted within the Basin whose SGMA knowledge varies from high to little or none. Given this variance, SVBGSA efforts are broad and all-inclusive. Target audiences include:

- SVBGSA Board of Directors, Advisory Committee and Subbasin Planning Committees
- SVBGSA Groundwater Sustainability Fee Payers
- Partner agencies including Monterey County Environmental Health Department, County of Monterey, Monterey County Water Resources Agency, and the Greater Monterey County Integrated Regional Water Management Group
- Municipal and public water service providers
- Private and local small or state small water system providers
- Local municipalities and communities
- Elected officials within the Basin
- Beneficial uses and users of groundwater including, agriculture, domestic wells and local small or state small water systems, and environmental uses such as wetlands
- Diverse social, cultural, and economic segments of the population within the Basin including URCs
- The general public

Stakeholder involvement and public outreach is critical to the GSP development because it helps promote the plan based on input and broad support. The following activities summarize involvement opportunities and outreach methods to inform target audiences and stakeholders. It is important to note that levels of interest will evolve and shift according to the GSP's implementation opportunities and priorities.

2.6.4 Stakeholder Database

A stakeholder database of persons and organizations of interest will be created and maintained. The database will include stakeholders that represent the region's broad interests, perspectives, and geography. It will be developed by leveraging existing stakeholder lists and databases and by conducting research of potential stakeholders that may be interested in one or all of the following categories: municipal users and groundwater users including agricultural, urban, industrial, commercial, institutional, rural, environmental, URCs, state lands and agencies, and integrated water management.

2.6.5 Key Messages and Talking Points

SVBGSA developed key messages focused on getting to know your GSA, an overview of groundwater sustainability planning for our community, and how we intend to continue outreach through implementation. These messages were guided by the underlying statements:

- The GSP process, both planning and implementation, is transparent and direct about how the GSP will impact groundwater users.
- SVBGSA represents the groundwater interests of all beneficial uses/users of the basin equitably and transparently to ensure that the basin achieves and maintains sustainable groundwater conditions.
- SVBGSA is committed to working with stakeholders using an open and transparent communication and engagement process.
- As the overall GSP will be more comprehensive with an engaged group of stakeholders providing useful information, SVBGSA will create as many opportunities as possible to educate stakeholders and obtain their feedback on the GSP implementation and plan updates.

These messages are being used as the basis for specific talking points/Q&A to support effective engagement with audiences. The SVBGSA Key Messages are also used to support communication with audiences (Appendix 2C).

2.6.6 Engagement Strategies

SVBGSA utilizes a variety of tactics to achieve broad, enduring, and productive involvement with stakeholders during the development and implementation of the GSPs. Below are activities that SVBGSA uses to engage the public currently and anticipated activities for GSP implementation:

- Develop and maintain a list of interested parties
- Offer public informational sessions and subject-matter workshops and provide online access via Facebook Live or via Zoom

- Basin tours (currently on hold due to COVID restrictions)
- SVBGSA Web Map
- Annual Report presentations
- FAQS – Offer FAQs on several topics including SGMA, SVBGSA, GSP, projects, Monitoring Program, Annual Report, Programs and Groundwater Sustainability Fee
- Science of Groundwater – new examples (studies, etc.)
- Board, Advisory Committee, and other Committee Meetings
  - Regular public notices and updates; Brown Act compliance
  - Develop talking points for various topics and evolve as necessary
- Subbasin Implementation Committees
  - Each subbasin's planning committee for GSP development will transition to a subbasin implementation committee to be convened for GSP updates and annual report reviews.
- Online communications
  - SVBGSA website: maintain with current information
  - SVBGSA Facebook page: maintain and grow social media presence
  - Direct email via Mailchimp newsletter
- Mailings to most-impacted water users and residents – topics to include: Annual Report dashboard, What does your GSA do with the Sustainability Fee?, newsletter that accompanies each tax bill.
- Media coverage. Appendix 2D includes SVBGSA's media policy.
  - Op-eds in the local newspapers
  - Press releases
  - Radio interviews
- Promote/Celebrate National Groundwater Week (held in December)
- Co-promotional opportunities and existing channels with agencies, committees, and organizations including email newsletters, social media, board meetings and mailings to customers.
- Talks and presentations to various stakeholder groups, associations, community organizations, and educational institutions.
- Educational materials

2.6.7 CPE Actions Timeline and Tactics

CPE Actions and GSP milestone requirements by phase include:

- Prior to initiating plan development: Share how interested parties may contact the GSA and participate in development and implementation of the plan submitted to DWR. (23 California Code of Regulations § 353.6)
- Prior to GSP development: Establish and maintain an interested persons list. (California Water Code § 10723.4)
- Prior to and with GSP submission:
  - Record statements of issues and interests of beneficial users of basin groundwater including types of parties representing the interests and consultation process
  - Lists of public meetings
  - Inventory of comments and summary of responses
  - Communication section in GSP (23 California Code of Regulations §354.10) that includes: agency decision-making process, identification of public engagement opportunities and response process, description of process for inclusion, and method for public information related to progress in implementing the plan (status, projects, actions)
- Supporting tactics to be used to communicate messages and supporting resources available through GSP development and GSP implementation:
  - SVBGSA website, updated regularly to reflect meetings and workshop offerings
  - Direct email via Mailchimp sent approximately monthly to announce board meetings, special workshop offerings and other opportunities for engagement
  - Outreach to local media to secure coverage of announcements and events, radio interviews, op-ed placement
  - Workshops, information sessions and other community meetings
  - Social media, specifically Facebook, updated regularly to share information and support other outreach efforts

2.6.8 CPE Actions – Annual Evaluation and Assessment

CPE Actions and GSP milestone requirements by phase include:

- What worked well?
- What didn't go as planned?
- Are stakeholders educated about the GSP development process and their own role?

- Is the timeline for implementation of the GSP clear?
- Has the GSA received positive press coverage?
- Do diverse stakeholders feel included?
- Has there been behavior changes related to the program goals? Or improved trust/relationships among participants?
- Community meeting recaps and next steps
- Lessons learned
- Budget analysis

2.7 Underrepresented Communities and Disadvantaged Communities Strategic Engagement and Communications

During development of the 2022 GSPs SVBGSA conducted the scoping of an engagement strategy for URCs and DACs that would provide both an assessment of how URCs and DACs may be engaged with the GSA and to develop GSA materials that are accessible and culturally responsive (visual and in Spanish). These materials will communicate impacts of groundwater management on local water conditions in order to engage URCs and DACs into GSA plan reviews and develop pathways for future involvement.

2.7.1 Underrepresented Communities and Disadvantaged Communities in the Salinas Valley

In this GSP Update, URCs and DACs are considered communities that currently have little or no representation in water management, or who historically have had disproportionately less representation in public policy decision making. URCs and DACs are inclusive of Severely Disadvantaged Communities (SDACs), Economically Distressed Areas (EDAs) and other communities that are traditionally underrepresented. The cities of Salinas and Gonzales and the community of Chualar have URCs and DACs within their boundaries.

The basin-wide SVBGSA program area also has well documented DAC designation including 7 Census Designated Places, 60 Block Groups and 20 Tracts. Additionally, work conducted by the Greater Monterey County Integrated Regional Water Management Program (IRWMP) identified 25 small DACs, SDACs, and suspected DACs in unincorporated areas of the IRWMP region (RWMG, 2018). Figure 2-2 shows where DACs, SDACs, and EDAs are located within the Salinas Valley Groundwater Basin, and Appendix 2E further describes DACs.

SVBGSA seeks to engage more constructively with URCs and DACs moving forward in subbasin planning processes and ultimately GSP implementation. In August 2019, SVBGSA hired the Consensus Building Institute (CBI) to conduct an assessment with URC and DAC community leaders via formal interviews. The purpose of the assessment was to capture insights and recommendations to inform an engagement strategy for URCs and DACs. CBI conducted 14 interviews and summarized findings from the assessment to identify initial strategic steps for work with URCs and DACs for GSP planning and implementation. Based on this work, an initial set of short and middle term actions were identified, and work will continue on these items during GSP implementation. The Board affirmed these short and middle term actions on February 11, 2021, and are intended for focus during implementation of the GSP. The *Spectrum of Community to Ownership* will be utilized as a guide in further shaping SVBGSA work with URCs and DACs communities in the Basin in consultation with community leaders.

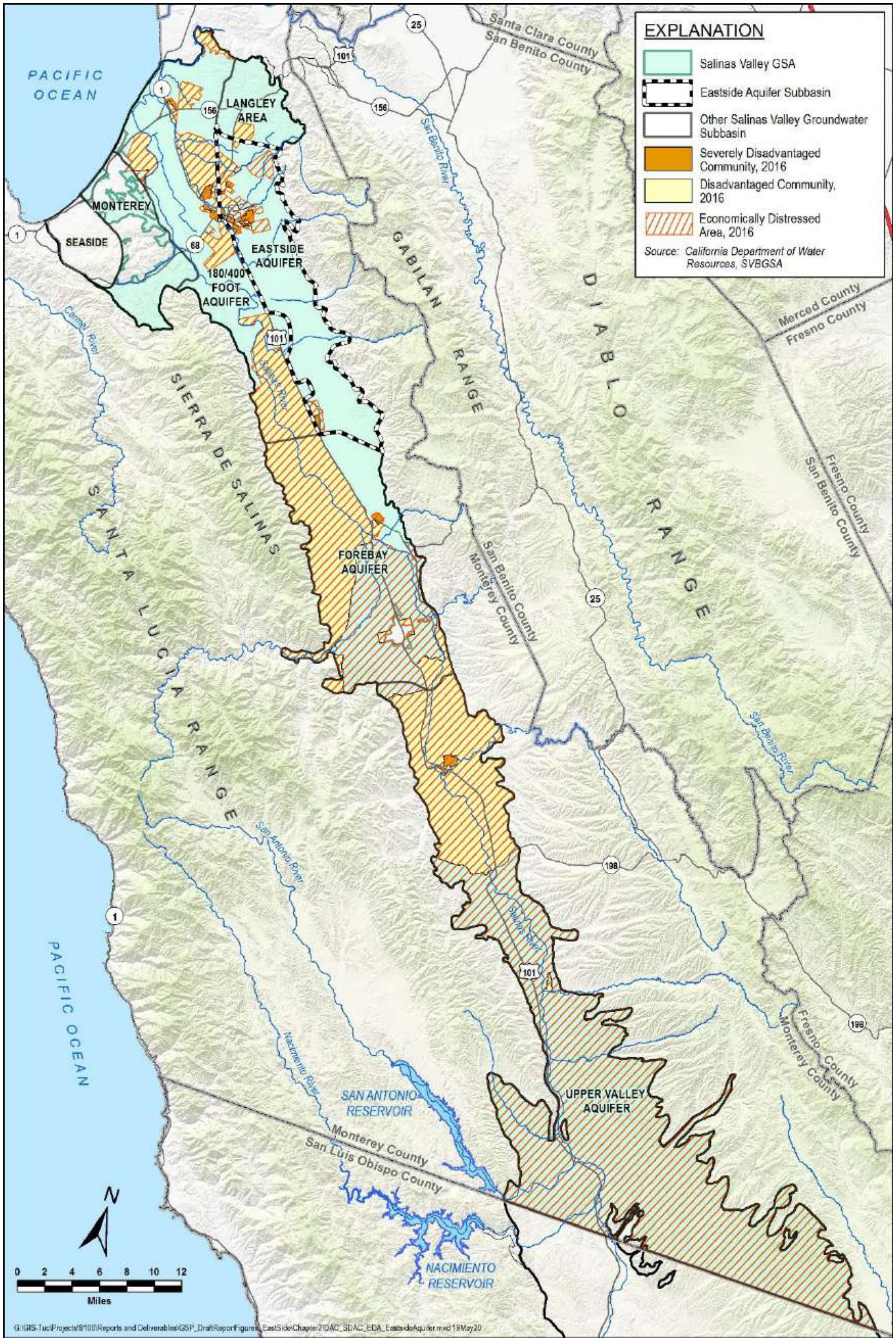


Figure 2-2. Disadvantaged Communities in the Salinas Valley Groundwater Basin

2.7.2 Additional activities scoped for engagement of Underrepresented Communities and Disadvantaged Communities

Additional activities scoped for engagement of URCs and DACs include:

- Conduct workshops with partners on importance of water and groundwater sustainability
- Identify URC and DAC concerns and needs for engagement
- Plan listening sessions around GSA milestones
- Coordinate with partner organizations to develop a "resource hub" where people can go for support
- Identify community allies in groundwater engagement work and bring down barriers for participation
- Consider particular URC and DAC impacts during routine GSA proceedings
- Convene a working group on domestic water, including URCs and DACs

3 DESCRIPTION OF PLAN AREA

This GSP Update covers the entire 180/400-Foot Aquifer Subbasin, as shown on Figure 3-1. This includes the areas within the Subbasin under the jurisdiction of the MCWD GSA and County GSA, as shown on Figure 1-2. The 180/400-Foot Aquifer Subbasin lies in northwestern Monterey County and includes the northern end of the Salinas River Valley. The Subbasin covers an area of 89,700 acres, or 140 square miles (DWR, 2004). It is bounded by the Eastside Aquifer and Langley Area Subbasins to the east (DWR subbasin numbers 3-004.02 and 3-004.09, respectively), the Forebay Aquifer Subbasin (DWR subbasin number 3-004.05) to the south, the Monterey Subbasin (DWR subbasin number 3-004.10) to the west, and the Monterey Bay to the north. The boundaries of the Subbasin, combined with those of the Monterey and Seaside subbasins, are generally consistent with MCWRA's Pressure Subarea (MCWRA, 2006). When this report refers to the 180/400-Foot Aquifer Subbasin, it refers to the area under the jurisdiction of the SVBGSA, MCWD, and County GSA.

The Salinas River drains the Subbasin, discharging into Monterey Bay. The Subbasin contains the municipalities of Salinas and Gonzales, part of Marina, and the census-designated places of Castroville, Moss Landing, Elkhorn, Boronda, Spreckels, and Chualar. United States Highway 101 runs generally north-south along the eastern border of the Subbasin. State Highways 1, 156, 183, and 68 also cross the Subbasin. Rivers and streams, urban areas, and major roads are shown on Figure 3-1.

This description of the plan area has been prepared in accordance with the GSP Regulations § 354.8. Information from existing water resource monitoring, management, and regulatory programs have been incorporated into this GSP Update through the development of the sustainability goal, SMC, and projects and management actions. This GSP Update has been developed to reflect the principles outlined in existing local plans, programs, and policies, and will build off them during GSP implementation.

3.1 Summary of Adjudicated and Jurisdictional Areas

3.1.1 Adjudicated Areas, Other GSAs, and Alternatives

The 180/400-Foot Aquifer Subbasin is not adjudicated. The only adjudicated area in the Salinas Valley Groundwater Basin is the Seaside Subbasin (DWR subbasin number 3-004.08), which is not adjacent to the 180/400-Foot Aquifer Subbasin.

No alternative plans have been submitted for any part of the Subbasin, or for any other Salinas Valley Groundwater Subbasins.

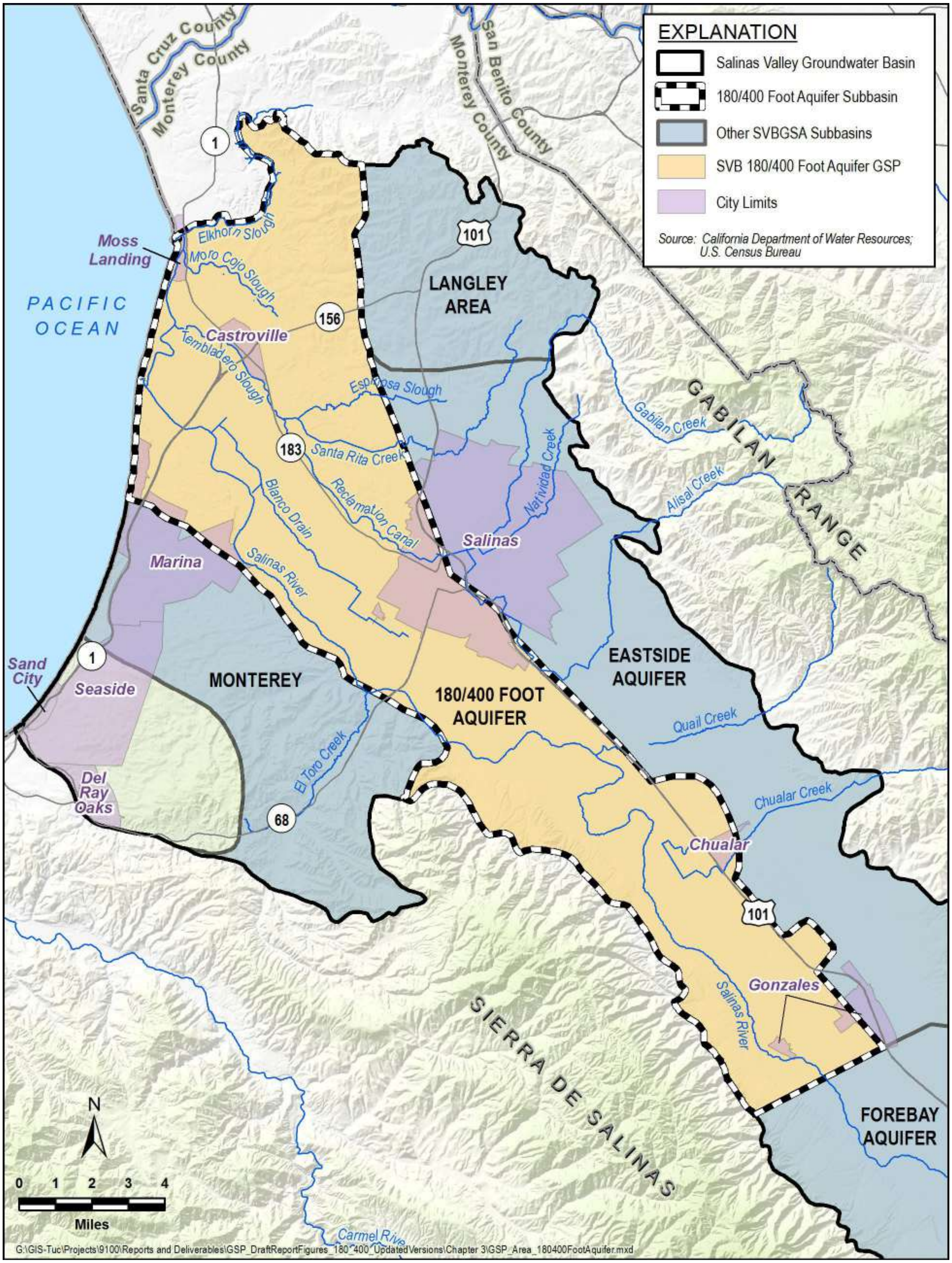


Figure 3-1. 180/400-Foot Aquifer Subbasin Area Covered by GSP

3.1.2 Jurisdictional Areas

3.1.2.1 Federal and State Jurisdictional Areas

Areas under federal jurisdiction are shown on Figure 3-2. Maps of federal and state jurisdictional areas are based on data from the U.S. Bureau of Land Management National Surface Management Agency National Geospatial Data Asset (BLM, 2020). The United States Department of Fish and Wildlife manages the Salinas River National Wildlife Refuge. A portion of the Fort Ord former Army base lies in the Subbasin and encompasses the Marina Municipal Airport. Although the DWR land use dataset depicts this area as federal land, this land has been transferred to civilian use and is no longer under federal jurisdiction. The Subbasin does not contain any tribal lands (Greater Monterey County Regional Water Management Group, 2018).

Areas under State jurisdiction are also shown on Figure 3-2. The California Department of Fish and Wildlife owns and operates the Elkhorn Slough Ecological Reserve, the Moro Cojo Slough State Marine Reserve (SMR), Elkhorn Slough State Marine Conservation Area (SMCA), Elkhorn SMR, and the Moss Landing Wildlife Area. The California Department of Parks and Recreation manages several areas in the Subbasin near Moss Landing including: Moss Landing State Beach, Salinas River Dunes Natural Preserve, Salinas River State Beach, and the Salinas River Mouth Natural Preserve.

3.1.2.2 County Jurisdiction

The County of Monterey has jurisdiction over the entire Subbasin. There are no County conservation areas or parks within the Subbasin (BLM, 2020).

MCWRA has broad water management authority in Monterey County, with its jurisdiction covering the entire 180/400-Foot Aquifer Subbasin, as shown on Figure 3-2. MCWRA manages, protects, stores, and conserves water resources in the Monterey County for beneficial and environmental use. Originally formed under a different name for flood control and management, it also has jurisdiction over water conservation, purveying water, and preventing extractions that are harmful to the groundwater basin. Key assessment zones for various projects and programs administered by MCWRA are shown on Figure 3-3. MCWRA is governed by a 9-member Board of Directors who are appointed by the 5-member MCWRA Board of Supervisors. The Board of Supervisors of the County is ex oficio the Board of Supervisors of MCWRA (Monterey County Water Resources Agency Act, Sec. 15).

3.1.2.3 City and Local Jurisdiction

The jurisdictional boundaries of cities and local jurisdictions shown on Figure 3-2 (U.S. Census Bureau, 2018). Part of the cities of Salinas, Gonzales, and Marina and the town of Castorville are located within the Subbasin and have water management authority. The City of Salinas is served by 2 private water supplies: California Water Company and Alisal Water Corporation (Alco). In

Gonzales, the City supplies drinking water. The Castroville CSD provides water and sewer collection services in the town of Castroville. The MCWD provides water and sewer collection services within its jurisdictional boundaries. A small portion of the MCWD's service area extends from the Monterey Subbasin into the 180/400-Foot Aquifer Subbasin. Pajaro/Sunny Mesa Community Services District provides water service to part of the northern Subbasin.

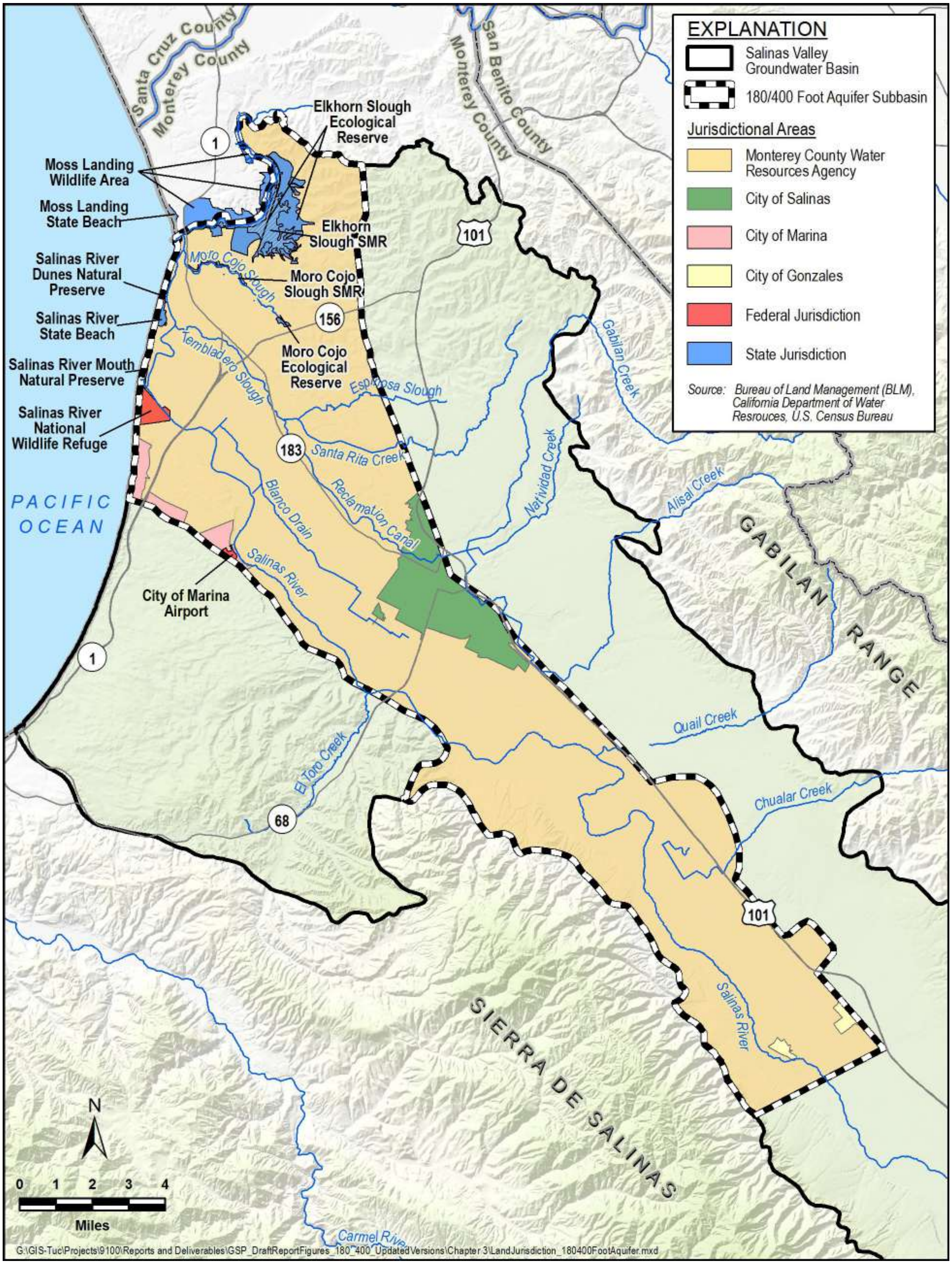


Figure 3-2. Federal, State, County, City, and Local Jurisdictional Areas

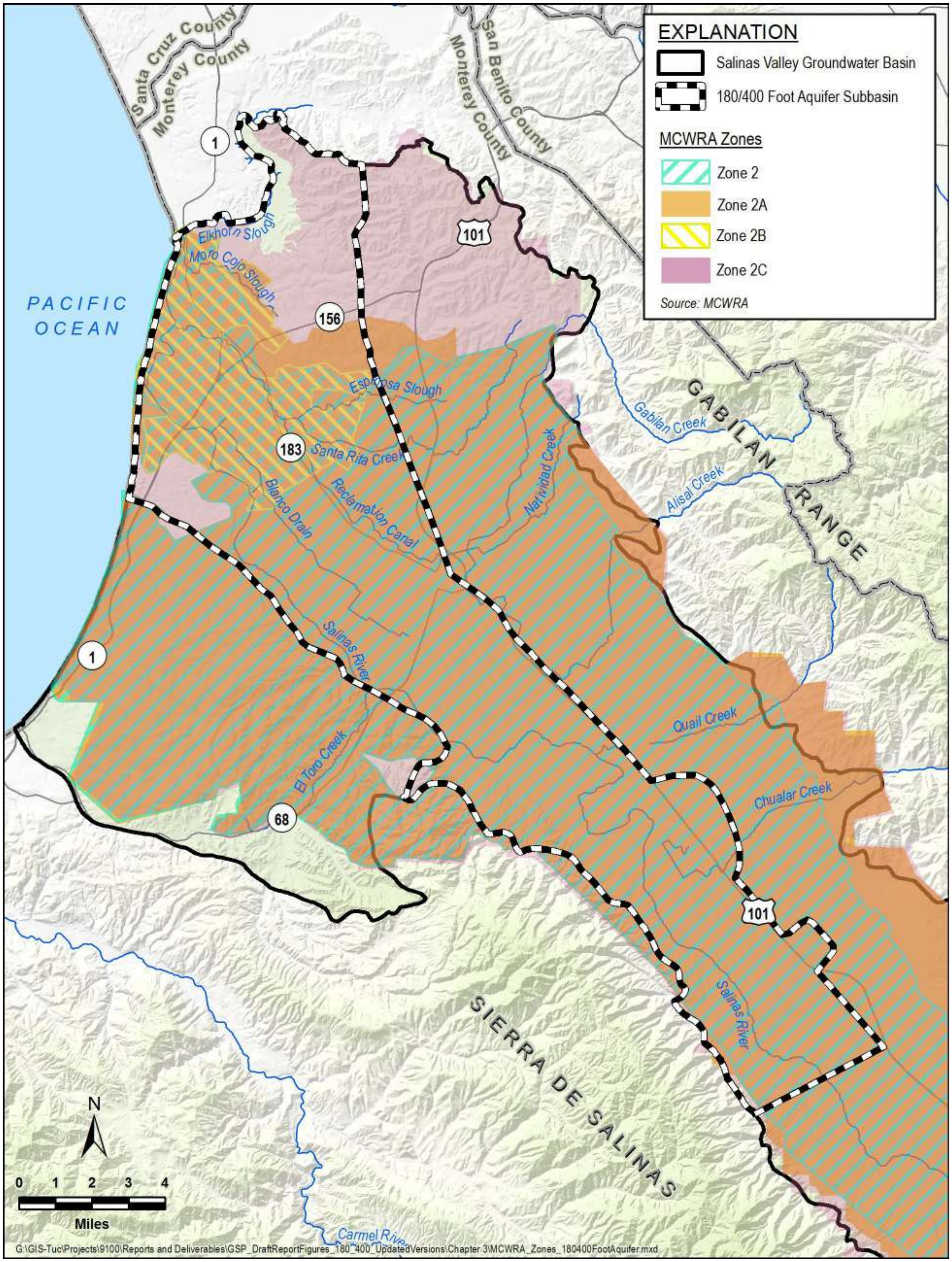


Figure 3-3. MCWRA Zones in the 180/400-Foot Aquifer Subbasin

3.2 Land Use

The Monterey County Assessor's office maintains a Geographic Information System (GIS) database of land use at the parcel level. Current (2019) land use in the 180/400-Foot Aquifer Subbasin is shown on Figure 3-4 and summarized by major category in Table 3-1. The difference between the land use area in Table 3-1 and the total Subbasin area of 89,000 arecres is the result of 1) MCWD parcels not being included in the table, 2) some parcels having null land use values, and 3) small gaps between parcels that are not counted.

Table 3-1. Land Use Summary

Category	Area in Subbasin (acres)
Agriculture (Irrigated)	62,806
Agriculture (Dry)	2,757
Commercial	822
Industrial	2,017
Institutional	5,672
Miscellaneous	1,761
Multi-Family	573
Residential (Urban)	2,605
Rural	6,815
Other	554
Total	**86,382**

Source: Monterey County Assessor's Office parcel data

The majority of land in the Subbasin is used for agriculture; the top three crops by value in Monterey County in 2017 were lettuce, strawberries, and broccoli (Monterey County Agriculture Commissioner, 2018). Vineyards are also a major crop in Monterey County. Other crops included under irrigated agriculture are various row crops, field crops, alfalfa, pasture, orchards (fruits and nuts), and irrigated agricultural preserves.

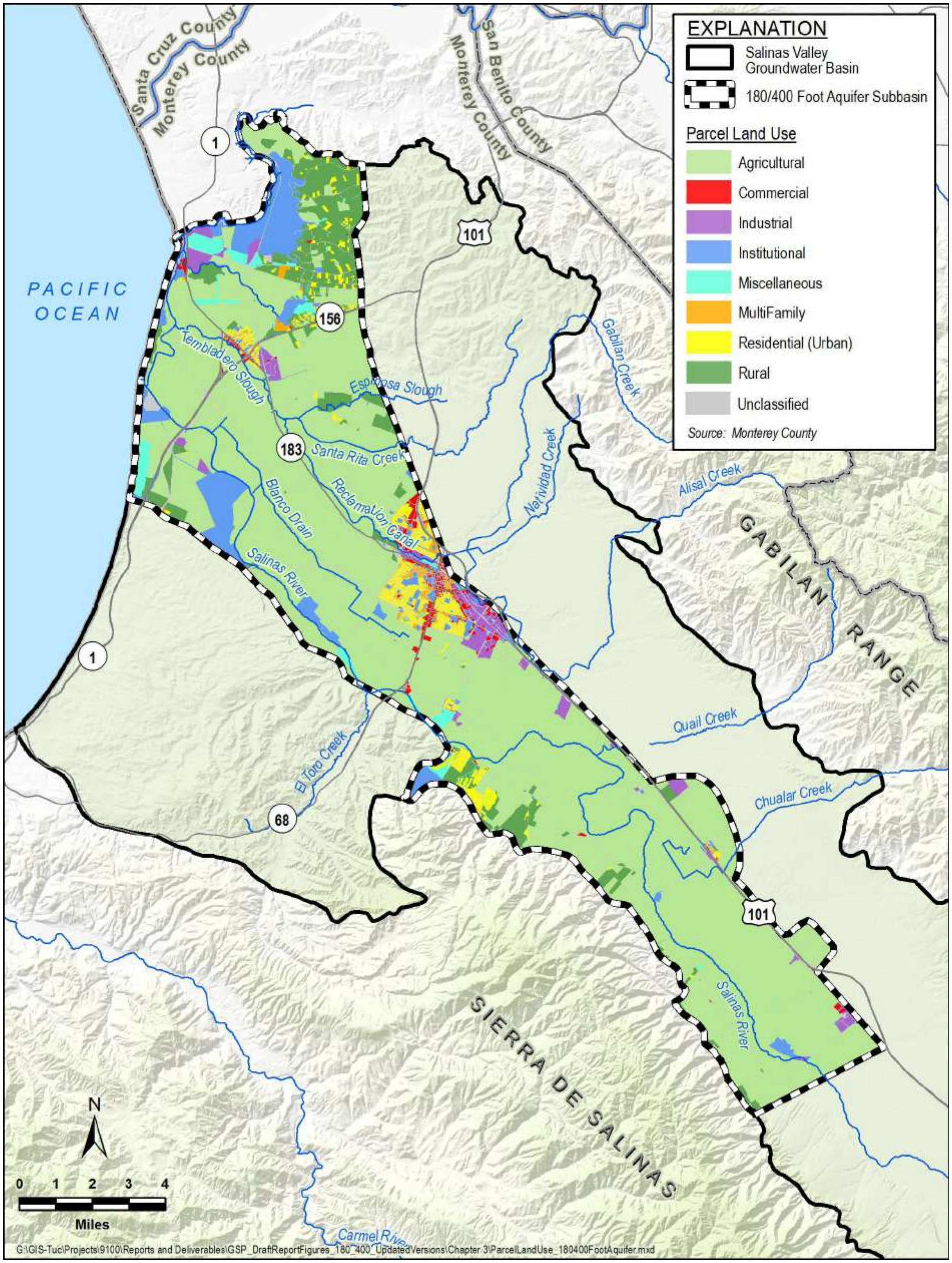


Figure 3-4. Existing Land Use

3.2.1 Water Source Types

Surface water diversions within the Salinas River watershed are reported to the State Water Resources Control Board (SWRCB) under Electronic Water Rights Information Management System (eWRIMS). The locations of the reported surface water diversions are shown on Figure 3-5. This figure does not show land that is dependent on the reported diversions, but rather infers areas through locations of diversion permits. Some reported surface water diversions are also reported to MCWRA as groundwater extractions. Based on an initial analysis comparing WY 2018 SWRCB diversion data and MCWRA pumping data, the estimated locations that reported both surface water diversions and groundwater pumping are identified with pink dots on Figure 3-5. The initial analysis suggests approximately 2,000 AF of water was reported to both MCWRA and SWRCB. Further review indicated that the eWRIMS data do not include the river diversions of the Salinas River Diversion Facility (SRDF), discussed below.

Groundwater is the primary water source for all water use sectors in the Subbasin. Communities that depend on groundwater are shown on Figure 3-6. The large public water systems shown on this figure are derived from data provided by Tracking California (Tracking California, 2020). Monterey County provided the boundaries for the small public water systems and the local small or state small water systems shown on Figure 3-6. More information on these water systems can be found on SVBGSA's Web Map, accessible at https://portal.elmontgomery.com. Groundwater is also used for rural residential areas, small community systems, and small commercial operations such as wineries and schools. The complete list of water systems and their number of connections, if available, are listed in Appendix 3A.
Costal farmland surrounding Castroville receives a combination of recycled water, groundwater, and surface water through the Castroville Seawater Intrusion Project (CSIP). Surface water diversions provide water to agriculture, and additional surface water is diverted through a pneumatic diversion dam known as the SRDF. This dam is located on the Salinas River near Marina. The SRDF provides surface water to the CSIP distribution system to offset groundwater pumping. Figure 3-6 shows the CSIP distribution area. CSIP delivers water to the agricultural land shown in orange. Recycled water is also used for irrigation in the Las Palmas Ranch development.

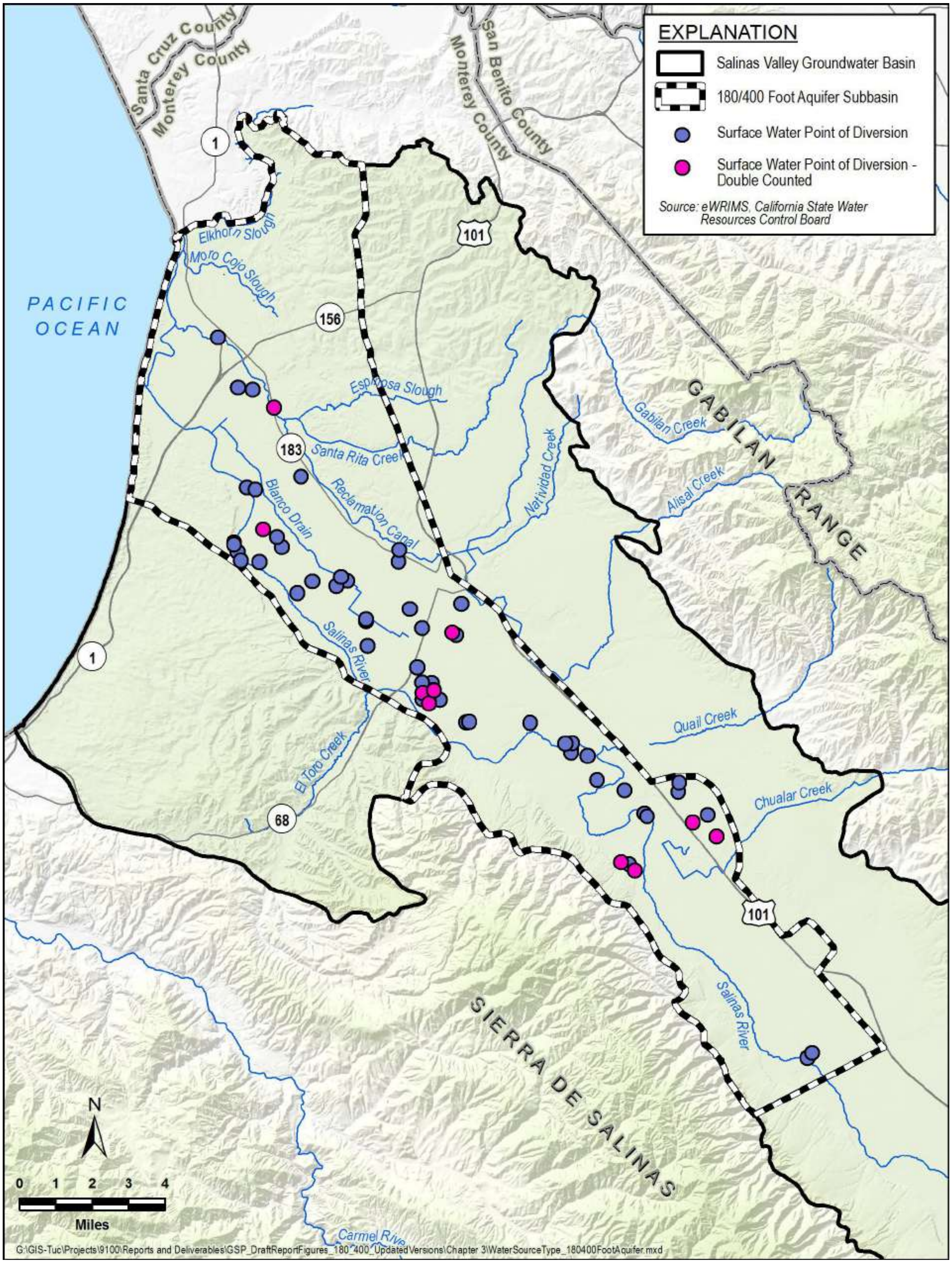


Figure 3-5. Salinas River Watershed Surface Water Points of Diversion in the 180/400-Foot Aquifer Subbasin

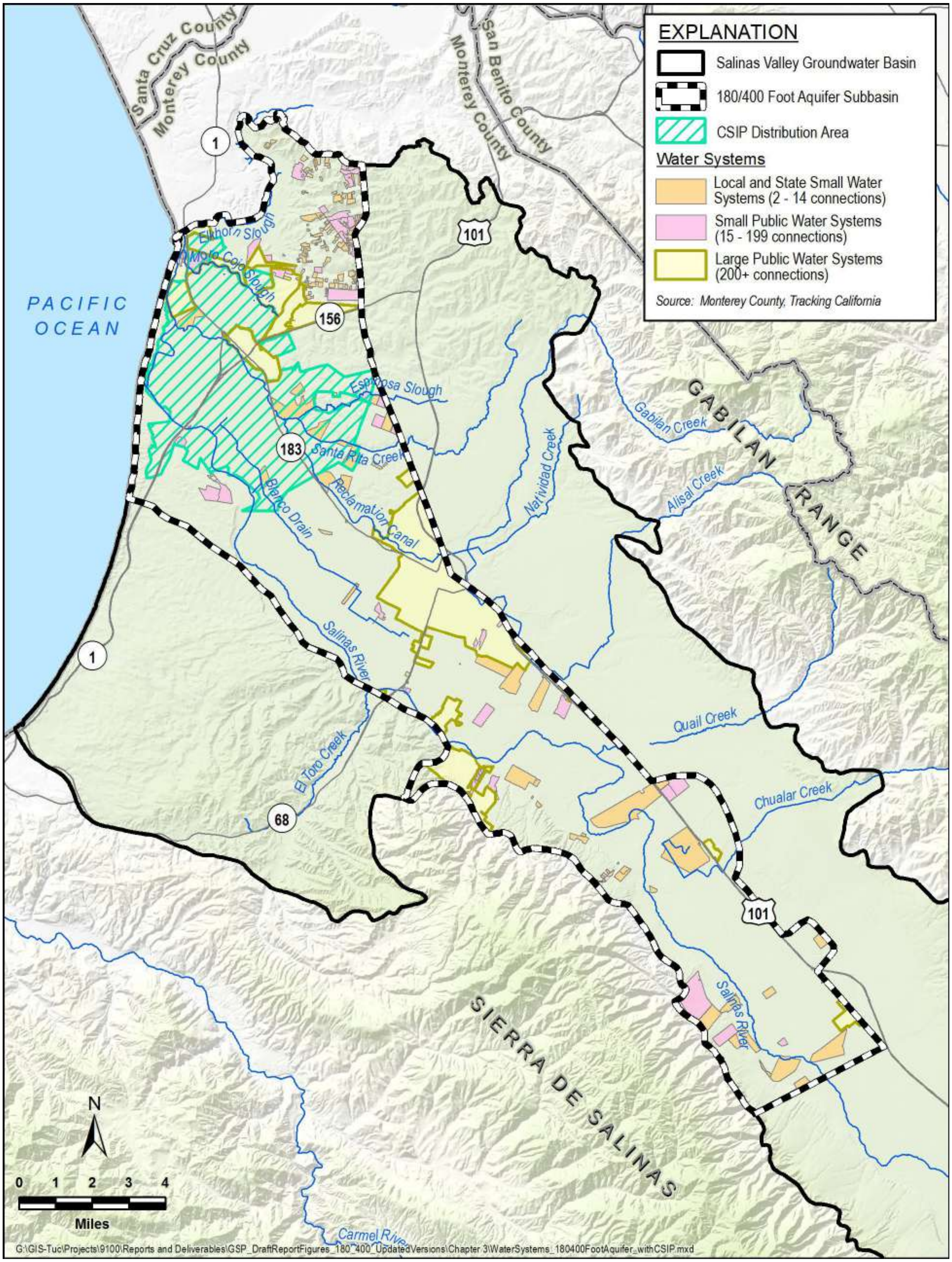


Figure 3-6. Communities Dependent on Groundwater

3.2.2 Water Use Sectors

Groundwater demands in the Subbasin are classified into the 6 water use sectors identified in the GSP Regulations. The water use sectors are shown on Figure 3-7.

- **Urban**. Urban water use is assigned to non-agricultural water uses in the cities and census-designated places. Domestic use outside of census-designated places is not considered urban use.
- **Industrial**. There is limited industrial use in the Subbasin.
- **Agricultural**. This is the largest water use sector in the Subbasin.
- **Managed wetlands**. DWR land use records indicate that there is one managed wetland in the Subbasin, an 11.2-acre wetland owned by the State of California and located northeast of the Monte De Lago neighborhood, between state highway 156 and Castroville Boulevard. The water use of this wetland is unknown.
- **Managed recharge**. There is no managed recharge in the Subbasin. Wastewater treated by the Salinas Valley Reclamation Project (SVRP) is distributed by the CSIP distribution system and used to offset agricultural groundwater pumping within the CSIP service area resulting in in-lieu recharge.
- **Native vegetation.** Groundwater use by native vegetation is minimal. Although not a native species, water use by *Arundo donax* is estimated at between 32,000 and 64,000 acre-feet per year (AF/yr) in the entire Salinas Valley Groundwater Basin (Giessow, 2011); an unknown quantity occurs within the 180/400-Foot Aquifer Subbasin.
- **Other.** This includes rural residential water use and any water use not captured in the other water use sectors.

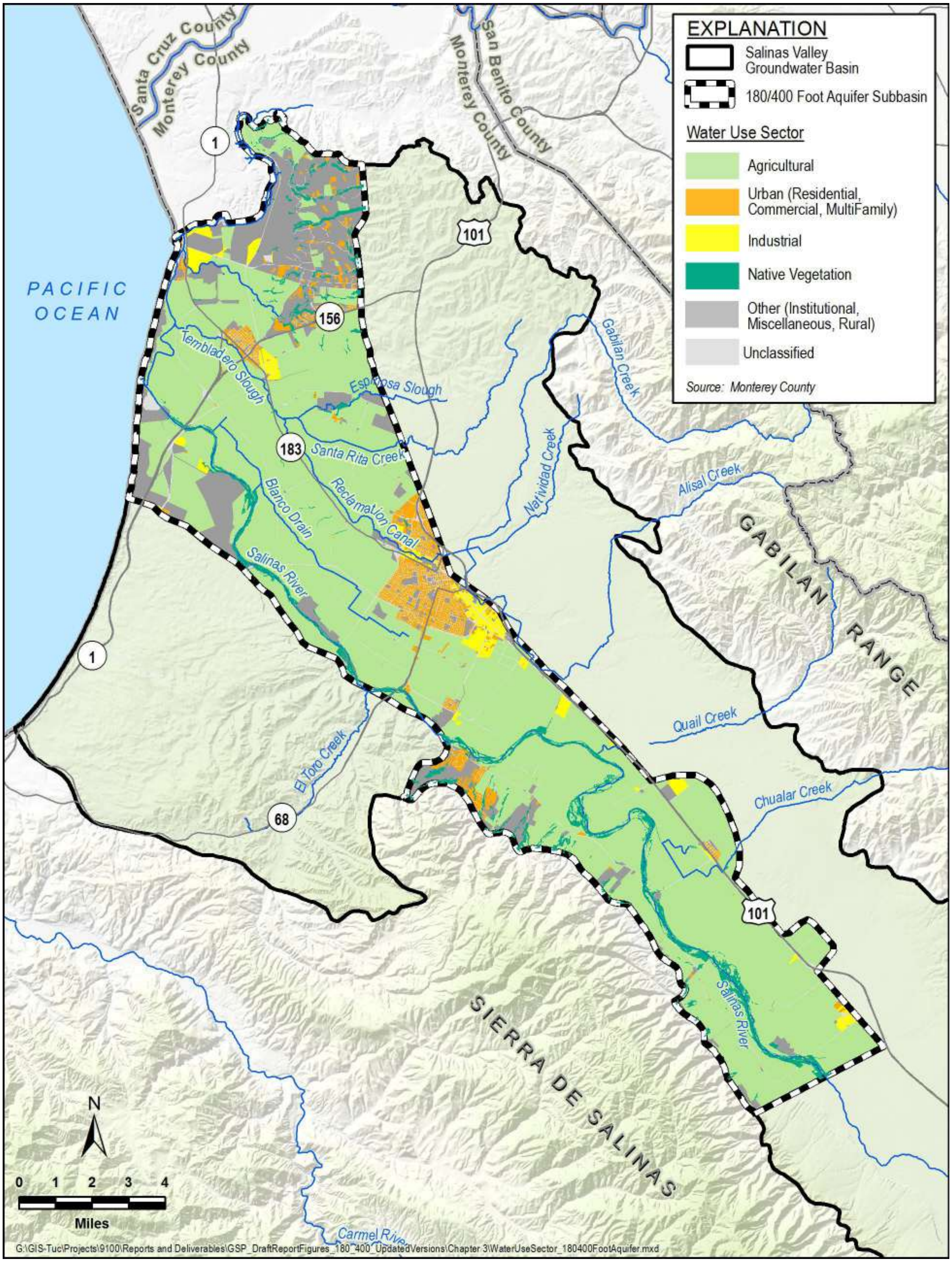


Figure 3-7. Map of Water Use Sectors

3.3 Existing Well Types, Numbers, and Density

Well density data were derived from DWR's Online System for Well Completion Report (OSWCR) Map Application (DWR, 2020a). Other data sources are available from MCWRA or other sources, and they may result in different well densities that are not reflected in DWR's OSWCR database. However, the DWR data were used for simplicity and consistency with other DWR data used in this GSP Update.

DWR's Well Completion Report Map Application classifies wells as domestic, production, and public supply; production wells include wells that are designated as irrigation, municipal, public, or industrial, and only exclude those designated as domestic. Fewer than 3% of wells in the Subbasin are classified as public supply wells, even though groundwater is the primary water source for urban and rural communities in the Subbasin. Domestic wells account for most of the remaining wells and have an average depth of approximately 362 feet. Some of the domestic wells identified by DWR may be classified as *de minimis* extractors, defined as pumping less than 2 AF/yr for domestic purposes. Well counts in the Subbasin are summarized in Table 3-2, with public supply wells subtracted from the production category so as to not double count. DWR provides well counts by Public Land Survey System sections; well counts for sections that are only partially in the Subbasin use the proportion of the section in the subbasin to proportion the well count. Figure 3-8, Figure 3-9, and Figure 3-10 show the density of domestic, production, and public supply wells, respectively, in the Subbasin, with the production wells being inclusive of the public supply wells.

Table 3-2. Well Count Summary

Category	Number of Wells
Domestic	691
Production	780
Public Supply	43
Total	1,514

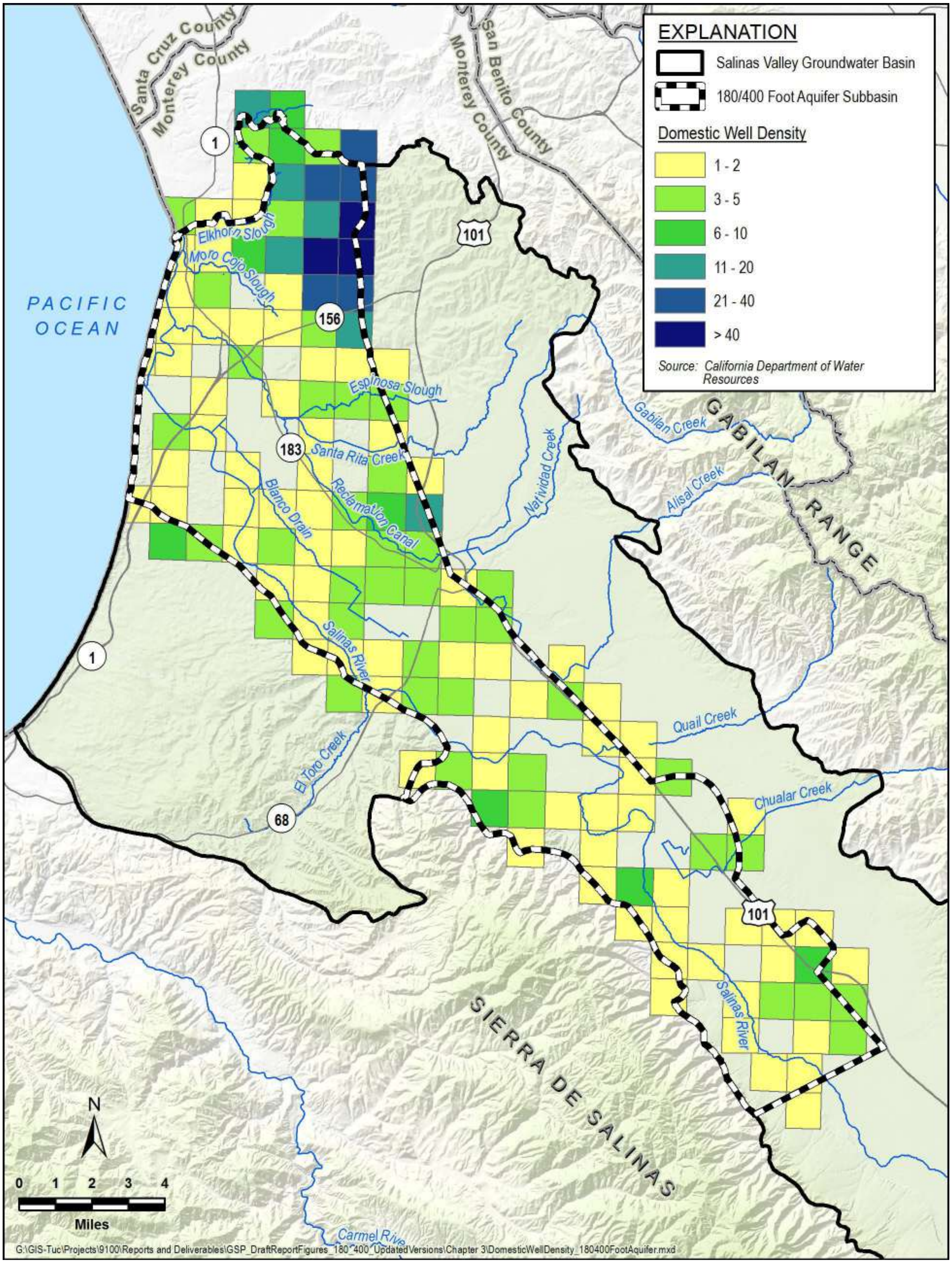


Figure 3-8. Density of Domestic Wells (Number of Wells per Square Mile)

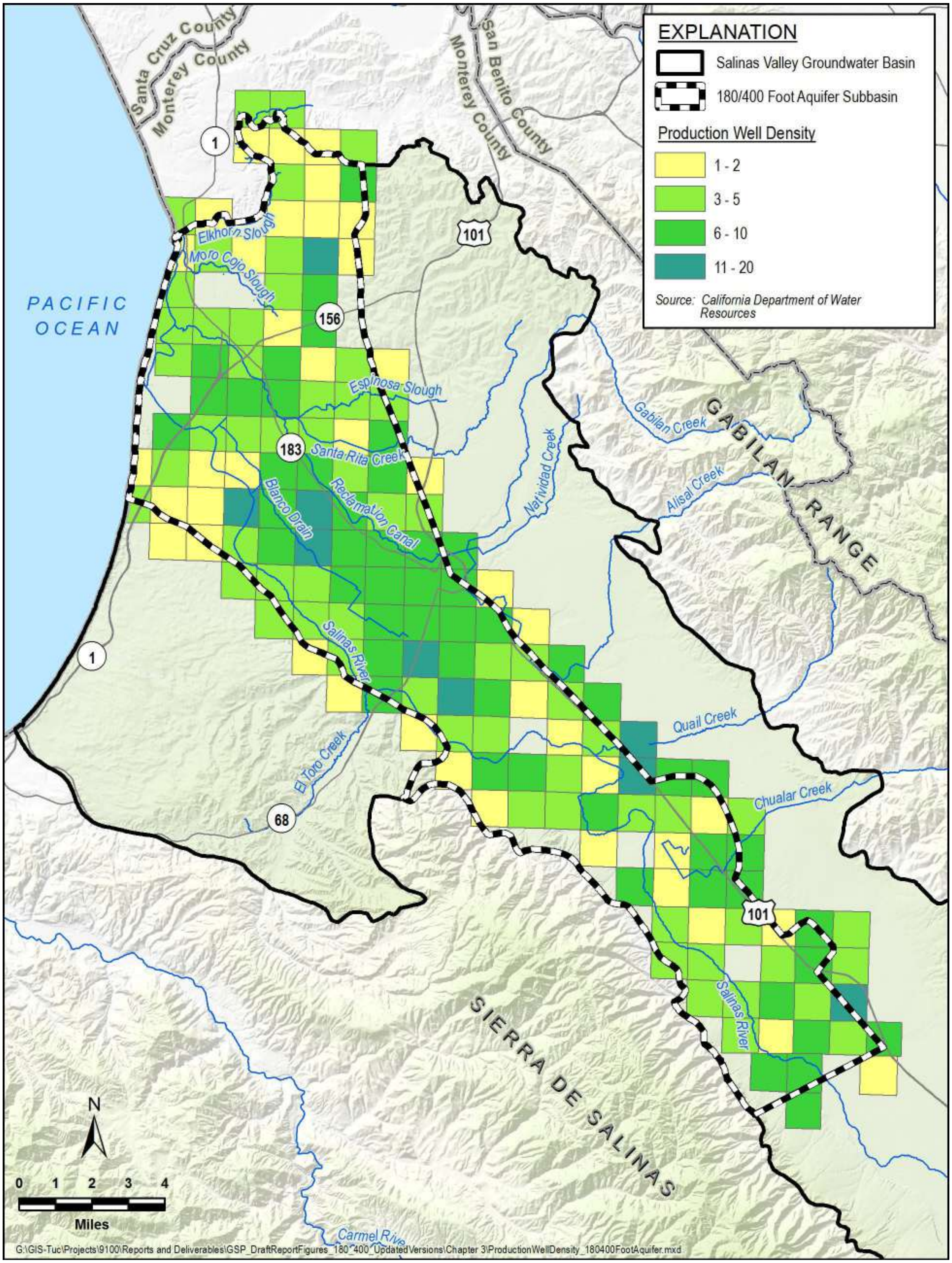


Figure 3-9. Density of Production Wells (Number of Wells per Square Mile)

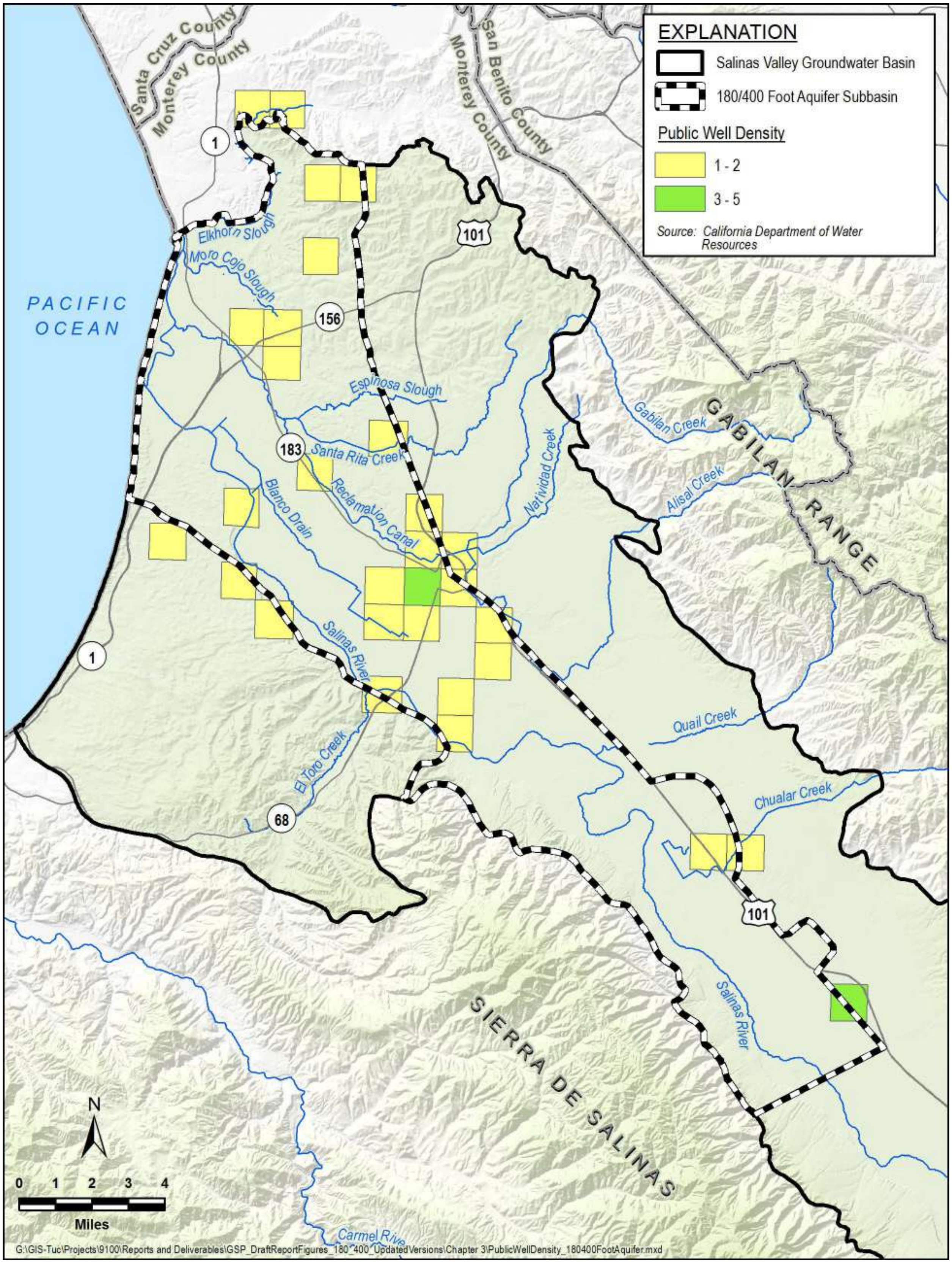


Figure 3-10. Density of Public Wells (Number of Wells per Square Mile)

3.4 Existing Monitoring Programs

3.4.1 Groundwater Elevation Monitoring

MCWRA operates existing groundwater elevation monitoring programs in the Salinas Valley Groundwater Basin, which are incorporated into the monitoring plan of this GSP Update as appropriate. MCWRA has annual fall, August, and monthly groundwater elevation monitoring programs, and is the responsible agency for the California Statewide Groundwater Elevation Monitoring (CASGEM) program in most areas of Monterey County. The existing groundwater elevation monitoring programs will be updated and improved to document the avoidance of undesirable results in the principal aquifers in the Subbasin.

MCWRA historically has monitored 21 wells within the 180/400-Foot Aquifer Subbasin as part of the CASGEM network. Twelve of the 180/400-Foot CASGEM monitoring wells are owned by MCWRA and the others are privately owned by owners who have volunteered the well for inclusion in the CASGEM program. MCWRA collects monthly groundwater elevation data from the CASGEM wells, except for a few that are monitored biannually, and reports the groundwater elevation data to DWR twice per year. The CASGEM wells have been migrated to the SGMA monitoring network and will be supplemented with 71 other wells that are already part of the MCWRA groundwater elevation monitoring networks. Groundwater elevation data from all wells in the monitoring network are publicly available. This network will be used for water elevation monitoring under this GSP Update, as described further in Chapter 7. It will be updated and improved as needed to monitor groundwater elevations for this Subbasin.

3.4.2 Groundwater Extraction Monitoring

MCWRA collects groundwater extraction information from all wells within Zones 2, 2A and 2B that have discharge pipes of 3 inches or greater in internal diameter. These zones include all of the 180/400-Foot Aquifer Subbasin. These data have been collected since 1993.

This network will be used for groundwater extraction monitoring under this GSP, as described in Chapter 7. SVBGSA will work with MCWRA to update and enhance the program to enable it to sufficiently monitor groundwater extractions for this Subbasin.

3.4.3 Groundwater Quality Monitoring

3.4.3.1 MCWRA Seawater Intrusion Monitoring

MCWRA monitors seawater intrusion in the Salinas Valley Groundwater Basin with a network of 156 dedicated monitoring and production wells, of which 136 located in the 180/400-Foot Aquifer Subbasin. The seawater intrusion monitoring network comprises a combination of production wells and dedicated monitoring wells. This network will be used for seawater intrusion monitoring under this GSP, as described in Chapter 7.

3.4.3.2 Other Groundwater Quality Monitoring

Groundwater quality is monitored under several different programs and by different agencies including the following:

- Municipal and community water purveyors must collect water quality samples on a routine basis for compliance monitoring and reporting to the SWRCB Division of Drinking Water (DDW). These purveyors include municipal systems; community water systems; non-transient, non-community water systems; and non-community water systems that provide drinking water to at least 15 service connections or serve an average of at least 25 people for at least 60 days a year.
- Local small or state small water system wells are regulated by the Monterey County Department of Public Health. Local small water systems serve 2 to 4 service connections and state small water systems serve 5 to 14 connections.
- To fulfill the groundwater quality regulatory requirements of the Irrigated Lands Regulatory Program (ILRP), the Central Coast Regional Water Quality Control Board (CCRWQCB) requires monitoring of both on-farm domestic wells and agricultural wells for irrigation and livestock supply.
- In addition to the ILRP, the CCRWQCB conducts groundwater quality monitoring at multiple sites as part of investigation or compliance monitoring programs. These sites are discussed further in Chapter 5.

For this GSP, groundwater quality data will be downloaded and reviewed from SWRCB's DDW for municipal public water system supply wells and the ILRP irrigation supply wells and on-farm domestic wells monitored under the CCRWQCB's Agricultural Order, as described in Section 3.6.2.

3.4.4 Surface Water Monitoring

Streamflow gauges operated by the U.S. Geological Survey (USGS) within the 180/400-Foot Aquifer Subbasin include:

- Reclamation Ditch near Salinas (USGS Site #11152650)
- Salinas River near Chualar (USGS Site #11152300)
- Salinas River near Spreckels (USGS Site #11152500)

Water levels in the Salinas River Lagoon are measured by MCWRA at Monte Road and near the slide gate to the Old Salinas River. The locations of the surface-water monitoring facilities are depicted on Figure 3-11.

On years when there are conservation releases from the Nacimiento and San Antonio Reservoirs, the MCWRA and USGS conduct the Salinas River Discharge Measurement Series (River Series) to monitor changes in streamflow along different river reaches. Reservoir releases are held constant for 5 days to ensure that the discharge measurements account for losses to the aquifer, stream vegetation, or evapotranspiration.

The SWRCB eWRIMS is used to collect surface water rights data in the Salinas River watershed for the points of diversion in the Subbasin that are shown on Figure 3-5. This includes monthly surface water diversions from the Salinas River and its tributaries.

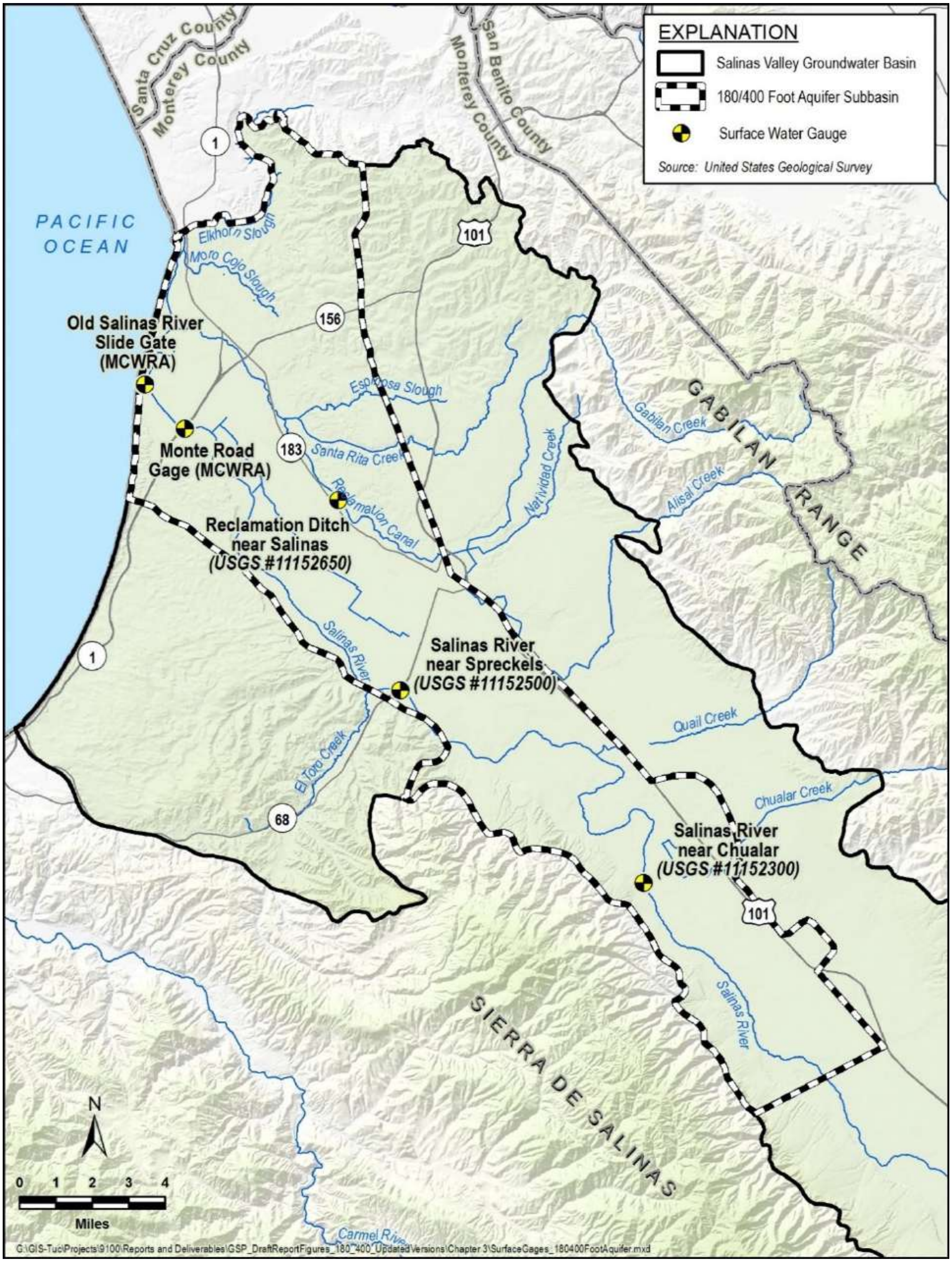


Figure 3-11. Surface Water Gauge Location

3.5 Existing Water Management Plans

3.5.1 Monterey County Groundwater Management Plan

MCWRA developed a Groundwater Management Plan (GMP) that is compliant with AB3030 and SB1938 legislation (MCWRA, 2006). This GMP exclusively covered the Salinas Valley Groundwater Basin in Monterey County. The original 2020 GSP supplanted the GMP as the management plan for the Subbasin, and this GSP Update replaces the 2020 GSP.

The GMP identified 3 objectives for groundwater management:

Objective 1: Development of Integrated Water Supplies to Meet Existing and Projected Water Requirements

Objective 2: Determination of Sustainable Yield and Avoidance of Overdraft

Objective 3: Preservation of Groundwater Quality for Beneficial Use

To meet these 3 objectives, the GMP identified 14 elements that should be implemented by MCWRA:

Plan Element 1: Monitoring of Groundwater Elevations, Quality, Production, and Subsidence

Plan Element 2: Monitoring of Surface Water Storage, Flow, and Quality

Plan Element 3: Determination of Basin Yield and Avoidance of Overdraft

Plan Element 4: Development of Regular and Dry Year Water Supply

Plan Element 5: Continuation of Conjunctive Use Operations

Plan Element 6: Short-Term and Long-Term Water Quality Management

Plan Element 7: Continued Integration of Recycled Water

Plan Element 8: Identification and Mitigation of Groundwater Contamination

Plan Element 9: Identification and Management of Recharge Areas and Wellhead Protection Areas

Plan Element 10: Identification of Well Construction, Abandonment, and Destruction Policies

Plan Element 11: Continuation of Local, State, and Federal Agency Relationships

Plan Element 12: Continuation of Public Education and Water Conservation Programs

Plan Element 13: Groundwater Management Reports

Plan Element 14: Provisions to Update the Groundwater Management Plan

3.5.2 Integrated Regional Water Management Plan

The Integrated Regional Water Management (IRWM) Plan for the Greater Monterey County Region was developed by the Greater Monterey County Regional Water Management Group (RWMG), which consists of government agencies, nonprofit organizations, educational organizations, water service districts, private water companies, and organizations representing agricultural, environmental, and community interests.

The 180/400-Foot Aquifer Subbasin falls within the IRWM Plan area. The IRWM Plan consists of a set of goals and objectives that were identified by the RWMG as being critical to address water resource issues within the planning area in the areas of:

- Water Supply
- Water Quality
- Flood Protection and Floodplain Management
- Environment
- Regional Communication and Cooperation
- Disadvantaged Communities
- Climate Change

The IRWM Plan includes more than 25 projects that could assist regional groundwater management (Greater Monterey County Regional Water Management Group, 2018).

3.5.3 Urban Water Management Plans

This section describes the urban water management plans (UWMPs) developed by California Water Service for part of the City of Salinas, California American Water Company for a satellite system near Chualar, and Marina Coast Water District. ALCO Water Service also provides water to the City of Salinas and sent its Validated Water Loss Audit Report to DWR in 2017. Upon review, DWR found that the report addresses all the code requirements, and therefore ALCO Water Service did not need to submit an urban water management plan. The City of Gonzales is not required to have an urban water management plan.

3.5.3.1 California Water Service (Salinas District) Urban Water Management Plan

California Water Service serves a portion of the City of Salinas. Its 2015 UWMP (California

Water Service, 2016) describes the service area; reports historic and projected population; identifies historical and projected water demand by category such as single-family, multi-family, commercial, industrial, institutional/government, and other; and describes the distribution system and identifies system losses.

The UWMP describes the system's reliance on groundwater and California Water Service's support for efforts to avoid overdraft, including working cooperatively with MCWRA and participating in the development of this GSP Update. Specific activities that California Water Service intends to conduct include:

- Outreach to public agencies to ensure that the Company's presence, rights and interests, as well as historical and current resource management concerns are honored/incorporated within the GSA and GSP formulation process(es).
- Outreach to applicable local and regulatory agencies to ensure the Company's full participation, while also meeting the requirements and expectations set forth by SGMA.
- The enhanced use of digital/electronic groundwater monitoring equipment and other new technology aimed at measuring withdrawal rates, pumping water elevations, and key water quality parameters within the context of day-to-day operations.
- Full participation in the development of GSPs and formulation of groundwater models constructed in basins where the Company has an operating presence.
- Full participation in individual and/or joint projects aimed at mitigating seawater intrusion and other undesirable results.
- Inclusion of sound groundwater management principles and data in all applicable technical reports, studies, facility master plans, and urban water management, particularly as these undertakings relate or pertain to water resource adequacy and reliability.
- Inclusion of sound groundwater management principles and data in all general rate case filings and grant applications to ensure that resource management objectives remain visible and central to California Water Service's long-term planning/budgeting efforts.

The UWMP also addresses California Water Service's position on alternative supplies currently being developed for the Salinas Valley Groundwater Basin. California Water Service is evaluating the possibility of using up to 10,000 AF/yr of water from the proposed Deep Water Desal LLC desalination plant at Moss Landing.

The UWMP addresses the need for California Water Service to implement a well replacement program to mitigate water quality impacts from nitrates, uranium, Methyl Tertiary Butyl Ether (MTBE), and sand contamination.

California Water Service's UWMP notes that groundwater will continue to remain as its sole supply due to uncertainties regarding the cost and implementation other options, such as surface water diversion or desalination. However, the UWMP recognizes that it would be beneficial for California Water Service to diversify its supply portfolio. California Water Service evaluated the impact of climate change on its water supply. The study found that climate change could result in a supply reduction of 6% to 7% by the end of the century.

3.5.3.2 California American Water Company (Chualar)

Cal-Am operates a satellite water system serving approximately 1,000 residents near Chualar. The operation of this system is described in Cal-Am's 2010 UWMP. The Cal-Am UWMP provides a description of the system, historical and projected water demands, and an assessment of current and future water supplies. Although the Cal-Am UWMP discusses future water supply options such as desalination, aquifer storage and recovery, and recycled water, none of these are applicable to the Chualar satellite system.

The Chualar system is entirely dependent on groundwater from the 180-Foot Aquifer and is far enough inland that it is not considered susceptible to seawater intrusion. The UWMP reports that water quality from the Chualar system wells is generally good.

3.5.3.3 Marina Coast Water District Urban Water Management Plan

The MCWD most recently updated its UWMP in 2015 (MCWD, 2016). The UWMP describes the service area; reports historical and projected population; identifies historical and projected water demand by category such as single-family, multi-family, commercial, industrial, institutional/government, and other; and describes the distribution system and identifies losses.

The MCWD currently relies solely on groundwater, although the UWMP notes that, "The District is located along the Salinas River, and MCWD Board of Directors has considered purchasing surface water rights in the Salinas River Basin as a means of meeting long-term (beyond 2030) demands." The UWMP further notes that, "…the total Ord Community groundwater supply of 6,600 AF/yr falls short of the total 2030 Ord Community demand of 8,293 AF/yr by 1,693 AF/yr [and] …the Central Marina service area is not projected to exceed its current SVGB groundwater allocation from the Fort Ord Reuse Authority (FORA) within the planning period."

The MCWD UWMP includes a number of demand management measures including:

- Water Waste Prevention Ordinances
- Metering
- Conservation Pricing

- Public Education and Outreach
- Programs to Assess and Manage Distribution System Real Loss
- Water Conservation Program Coordination and Staffing Support
- Water Survey Programs for Residential Customers
- Residential Plumbing Retrofits
- Residential Ultra-Low Flow Toilet Replacement Programs
- High-Efficiency Washing Machine Rebate Programs
- Commercial, Industrial, and Institutional Accounts
- Landscape Conservation Programs and Incentives

3.6 Existing Water Regulatory Programs

3.6.1 Groundwater Export Prohibition

The MCWRA Act, § 52.21 prohibits the export of groundwater for uses outside the Salinas Valley Groundwater Basin from any part of the Basin, including the 180/400-Foot Aquifer Subbasin. In particular, the Act states:

> *For the purpose of preserving [the balance between extraction and recharge], no groundwater from that basin may be exported for any use outside the basin, except that use of water from the basin on any part of Fort Ord shall not be deemed such an export. If any export of water from the basin is attempted, the Agency may obtain from the superior court, and the court shall grant, injunctive relief prohibiting that exportation of groundwater.*

3.6.2 Agricultural Order

In 2021 the CCRWQCB issued Agricultural Order No. R3-2021-0040, the Proposed General Waste Discharge Requirements for Discharges from Irrigated Lands (CCRWQCB, 2021). The permit requires that growers implement practices to reduce nitrate leaching into groundwater and improve receiving water quality. Specific requirements for individual growers are structured into 3 phases based on the relative risk their operations pose to water quality. Each of the 3 phases encompass a different area of the Central Coast Basin. Monitoring results from this new Agricultural Order (Ag Order 4.0) will be incorporated into this GSP Update's groundwater quality network.

3.6.3 Water Quality Control Plan for the Central Coast Basins

The Water Quality Control Plan for the Central Coastal Basin (Basin Plan) was most recently updated in June 2019 (SWRCB, 2019). The objective of the Basin Plan is to outline how the quality of the surface water and groundwater in the Central Coast Region should be managed to provide the highest water quality reasonably possible. Water quality objectives for both groundwater and surface water are provided in the Basin Plan.

The Basin Plan lists beneficial users, describes the water quality that must be maintained to allow those uses, provides an implementation plan, details SWRCB and CCRWQCB plans and policies to protect water quality, and describes statewide and regional surveillance and monitoring programs. Present and potential future beneficial uses for waters in the Basin are municipal supply; agricultural supply; groundwater recharge; recreation; sport fishing; warm fresh water habitat; wildlife habitat; rare, threatened or endangered species habitat; and spawning, reproduction, and/or early development of fish.

3.6.4 Title 22 Drinking Water Program

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

The DDW enforces the monitoring requirements established in Title 22 of the California Code of Regulations (CCR) for public water system wells, and all the data collected must be reported to the DDW. Title 22 also designates the Maximum Contaminant Levels (MCLs) and Secondary Maximum Contaminant Levels (SMCLs) for various waterborne contaminants, including volatile organic compounds, non-volatile synthetic organic compounds, inorganic chemicals, radionuclides, disinfection byproducts, general physical constituents, and other parameters.

3.6.5 County Ordinance 5302 and 5303 Regarding Deep Aquifer Wells

Due to identified concerns regarding the risk of seawater intrusion into the Deep Aquifers the Monterey County Board of Supervisors adopted Ordinance No. 5302 in May 2018, pursuant to Government Code Section 65858. The ordinance was an Interim Urgency Ordinance, which took effect immediately upon adoption. The ordinance prohibited the acceptance or processing of any applications for new Deep Aquifer Wells beneath areas impacted by seawater intrusion, with stated exceptions including municipal wells and replacement wells. The ordinance was originally only effective for 45 days, but at the June 26, 2018 Monterey County Board of Supervisors meeting, the Board of Supervisors extended the ordinance to May 21, 2020, by adoption of Ordinance No. 5303. The Ordinance also required that all new wells in the Deep Aquifers meter groundwater extractions, monitor groundwater elevations and quality, and all data submitted to MCWRA and SVBGSA. Ordinances 5302 and 5303 have expired.

In December 2020, County ordinance No. 5339 was adopted and placed a 90-day moratorium on new well construction permit applications. The moratorium was adopted so the County could study the impact of the California Supreme Court's decision on 27 August 2020 in the case Protecting Our Water and Environmental Resources et al., v. County of Stanislaus, et al., (10 Cal.5th 479 (2020); "Protecting Our Water"). The decision may require environmental review, pursuant to the California Environmental Quality Act ("CEQA"), when the County considers applications to construct, repair, or destroy water wells if the decision to issue the permit involves the exercise of discretion by the decision-making authority. The County is currently waiting to finalize proposed modifications to its well construction ordinance and the moratorium on well construction permit applications has expired. Applications are currently being considered on a case-by-case basis.

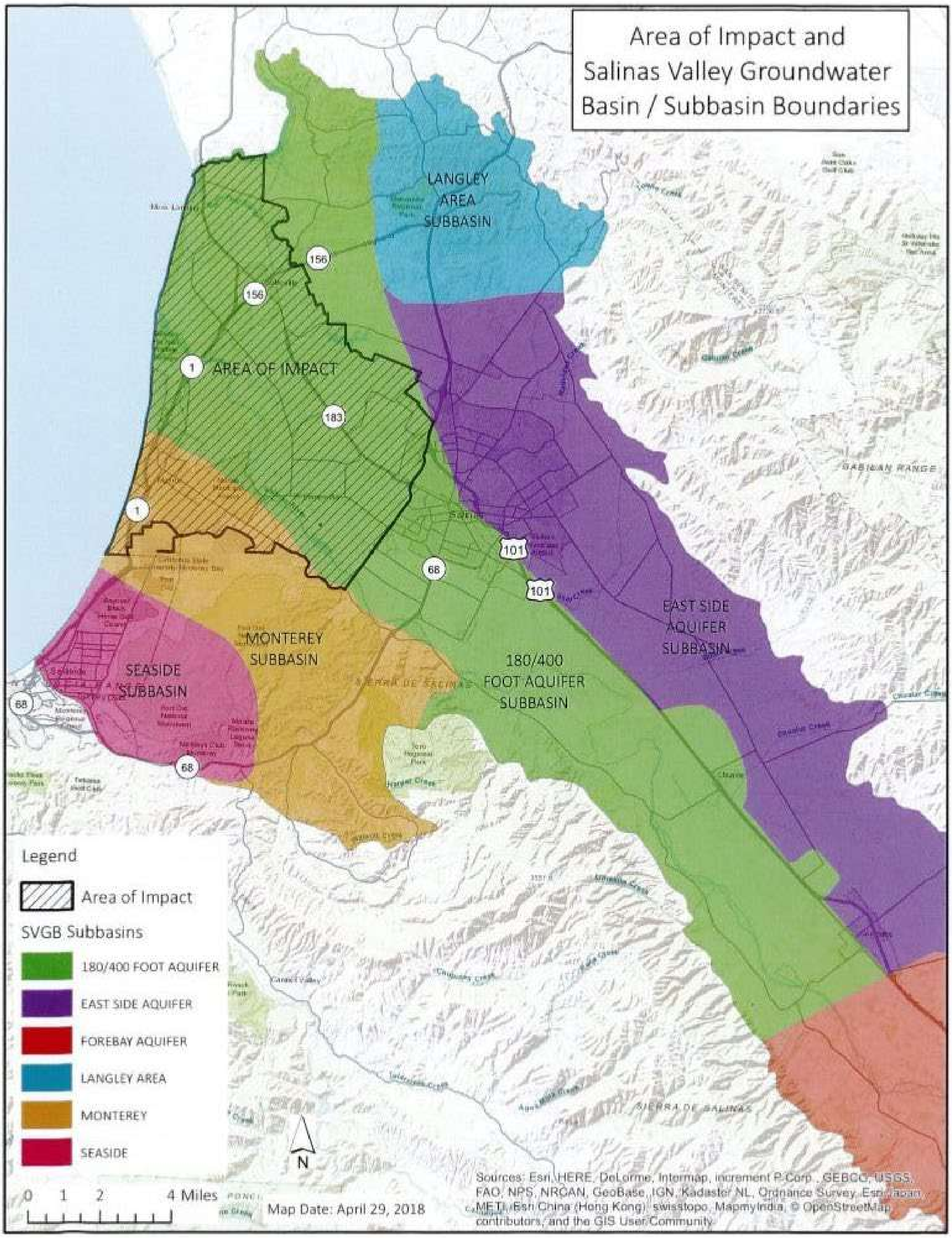


Figure 3-12. Map of Ordinance No. 5302 Area of Impact (Monterey County Board of Supervisors, 2018)

3.6.6 Water Resources Agency Ordinance 3709

Ordinance 3709, passed in 1993 by the Board of Supervisors of the Water Resources Agency, prohibits groundwater extractions and the drilling of new extraction wells in certain portions of the 180-Foot Aquifer after January 1, 1995. The Ordinance pertains to Territory A and Territory B.

3.6.7 Water Resources Agency Ordinance 3790

Ordinance 3790, passed in 1994, establishes regulations for the classification, operation, maintenance and destruction of groundwater wells in the Castroville Seawater Intrusion Project area, known as Zone 2B.

3.7 New Regulations, Ordinances, Enforcement, and Legal Action

SVBGSA has not promulgated any new regulations or ordinance since the original GSP submittal in January 2020. The status and any updates to existing ordinances of other agencies are included in their respective sections above. SVBGSA took no legal action in 2020 and 2021.

3.8 County Public Policy of Safe and Clean Water

To recognize the Human Right to Water, in December 2018 the County of Monterey established a public policy that every human being has the right to safe, clean, affordable, and accessible water adequate for human consumption, cooking, and sanitary purposes and that the human right to water extends to all residents of Monterey County, including disadvantaged individuals and groups and communities in rural and urban areas. The County intended for the policy to inform the County when implementing policies and regulations affecting water supply and usage and to help the County to focus on the issue of drinking water pollution in certain Monterey County domestic wells and water systems as well as potential future threats due to drought and a lack of available drinking water, while not impacting water rights or expanding or creating new County obligations.

3.9 Incorporating Existing Programs into the GSP and Limits on Operational Flexibility

Information from existing water resource monitoring, management, and regulatory programs have been incorporated into this GSP Update. They are taken into consideration during the preparation of the Sustainability Goal, when establishing Sustainable Management Criteria, and when developing Projects and Management Actions. This GSP Update has been developed to reflect the principles outlined in those existing local plans and builds off existing plans during GSP implementation. Some of the existing management plans and ordinances may limit operational flexibility. These potential limits to operational flexibility have already been incorporated into the projects and management actions included in this GSP Update. Examples of limits on operational flexibility include:

- The groundwater export prohibition included in the Monterey County Water Resources Agency Act prevents export of water out of the Salinas Valley Groundwater Basin. This prohibition is not expected to adversely affect SVBGSA's ability to reach sustainability.
- The Basin Plan and the Title 22 Drinking Water Program restrict the quality of water that can be recharged into the Subbasin.
- The Habitat Conservation Plan being developed by MCWRA on the Salinas River will limit operational flexibility for Nacimiento and San Antonio reservoir releases for groundwater recharge in the Basin.

The other monitoring, management, and regulatory programs do not limit the operational flexibility in this Subbasin.

3.10 Conjunctive Use Programs

The one conjunctive use project that operates in the 180/400-Foot Aquifer Subbasin is the SVWP. The SVWP is a conjunctive use project that includes reservoir releases for groundwater recharge and later use within the CSIP. CSIP provides a combination of recycled water, Salinas River water, and groundwater to irrigate 12,000 acres in the seawater-intruded coastal farmland surrounding Castroville. The extent of the current CSIP distribution area is shown on Figure 3-6. Recycled water from Monterey One Water's tertiary treatment Reclamation Plant is combined with surface water diverted at the Salinas River Diversion Facility and, when necessary, groundwater pumped from CSIP supplemental wells. When river water is available and the SRDF is operating, grower groundwater pumping has been reduced by about 80% during peak irrigation demand periods. However, it is currently necessary to conjunctively manage all three water sources to match irrigation demands with water supplies. Although CSIP has slowed the rate of seawater intrusion over the past twenty years, it has not halted seawater intrusion altogether, and the Subbasin is also experiencing declining groundwater elevations and overdraft.

3.11 Land Use Plans

3.11.1 Land Use Plans in the Subbasin

Land use is an important factor in water management. Monterey County and the cities of Gonzales, Marina, and Salinas have land use authority over all or portions of the 180/400-Foot Aquifer Subbasin. Each of these entities has developed a general plan that guides land use in the Subbasin. General descriptions of these land use plans and how implementation may affect groundwater management in the 180/400-Foot Aquifer Subbasin are included in Appendix 3B.

3.11.2 Land Use Plans Outside of Basin

Monterey County's General Plan is applicable throughout the unincorporated area of the County, including the adjoining Eastside Aquifer Subbasin, Forebay Aquifer Subbasin, Langley Area Subbasin, and Monterey Subbasin. The cities of Greenfield and Soledad have general plans with land use elements in the neighboring Forebay Aquifer Subbasin. Each of these entities has developed a general plan that guides land use in the Forebay Aquifer Subbasin. Because Soledad is a member of the SVBGSA, SVBGSA will strive to coordinate management actions with that city and the County. The SVBGSA and ASGSA have developed an Implementation Agreement that establishes that the ASGSA will implement the GSP in the Arroyo Seco Cone Management Area. The ASGSA was formed through agreement with the City of Greenfield. Therefore, it is unlikely that these land use plans will affect the ability of the SVBGSA to achieve sustainable groundwater management.

3.11.3 Well Permitting

The Public Service element of the Monterey County General Plan addresses permitting of individual wells in rural or suburban areas. Table 3-3 summarizes the Monterey County General Plan's water supply guidelines for the creation of new residential or commercial lots (Monterey County Housing and Community Development, 2010, Table PS-1). Table 3-4 depicts the decision matrix from the Monterey County General Plan for permitting new residential or commercial wells for existing lots (Monterey County Housing and Community Development, 2010, Table PS-2).

On August 29, 2018, the State Third Appellate District Court of Appeal published an opinion in *Environmental Law Foundation v. State Water Resources Control Board* (No. C083239), a case that has the potential to impact future permitting of wells near navigable surface waters to which they may be hydrologically connected. The Court of Appeal found that while groundwater itself is not protected by the public trust doctrine, the doctrine does protect navigable waters from harm caused by extraction of groundwater if it adversely affects public trust uses. Further, it found that Siskiyou County, as a subdivision of the State, shares responsibility for administering the public trust. Similarly, Monterey County is responsible for well permitting. Therefore, it has a responsibility to consider the potential impacts of groundwater withdrawals on public trust resources when permitting wells near areas where groundwater may be interconnected with navigable surface waters.

Moreover, California Supreme Court's decision in *Protecting Our Water and Environmental Resources v. County of Stanislaus* (2020) held that Stanislaus County could not categorically classify its issuance of groundwater well construction permits as ministerial decisions exempt from environmental review under the CEQA. Chapter 15.08 of the Monterey County Code sets forth the application and decision-making process for the County in considering applications for well construction permits. The Chapter sets forth certain technical requirements that appear to be purely ministerial in their application; however, the Chapter also gives the Health Officer discretion to impose unspecified conditions on a permit, grant variances, and deny an application if in his/her judgment it would defeat the purposes of the Chapter. The Monterey County Code has not yet been amended, so permits are currently issued according to Chapter 15.08 and the 2010 General Plan, as applicable. The Monterey County Health Department, Environmental Health Bureau issues well permits and receives input from the County of Monterey Housing & Community Development to determine what, if any, level of CEQA review is necessary.

Table 3-3. Monterey County Water Supply Guidelines for the Creation of New Residential or Commercial Lots

Major Land Groups	Water Well Guidelines
Public Lands	Individual Wells Permitted in Areas with Proven Long-Term Water Supply
Agriculture Lands	Individual Wells Permitted in Areas with Proven Long-Term Water Supply
Rural Lands	Individual Wells Permitted in Areas with Proven Long-Term Water Supply
Rural Centers	Public System; Individual Wells Allowed in limited situations
Community Areas	Public System

Table 3-4. Monterey County Well Permitting Guidelines for Existing Residential and Commercial Lots

Characteristics of Property	Water Connection Existing or Available from the Water System	Not Within a Water System or a Water Connection Unavailable
Greater than or equal to 2.5 Acres connected to a Public Sewage System or an on-site wastewater treatment system	Process Water Well Permit	Process Water Well Permit
Less than 2.5 Acres and connected to a Public Sewage System	Process Water Well Permit	Process Water Well Permit
Less than 2.5 Acres and connected to an on-site wastewater treatment system	Do not Process Water Well Permit	Process Water Well Permit

3.11.4 Effects of Land Use Plan Implementation on Water Demand

The GSA does not have authority over land use planning. However, the GSA will coordinate with the County on general plans and land use planning/zoning as needed when implementing the GSP.

A lawsuit filed against the County of Monterey's 2010 General Plan led to a settlement agreement that affects water supplies. The settlement agreement requires the County of

Monterey to develop a study of the Basin within Zone 2C which largely overlaps the Basin and includes, among other items:

- An assessment of whether the total water demand for all uses designated in the General Plan for the year 2030 are likely to be reached or exceeded
- An evaluation and conclusions regarding future expected trends in groundwater elevations
- An evaluation and conclusions regarding expected future trends in seawater intrusion

Should the study conclude that:

- Total water demand for all uses is likely to be exceeded by 2030, or
- Groundwater elevations are likely to decline by 2030, or
- The seawater intrusion boundary is likely to advance inland by 2030

Then the study shall make recommendations on how to address those conditions.

The outcomes from this study may affect the GSP implementation. However, the GSP Update will consider multiple approaches to reach sustainable yield through the measures laid out in Chapter 9. The study and GSP implementation are two parallel efforts, and the results of the County's study will be reviewed when finalized and considered during GSP implementation. SGMA may preempt implementation of the County's study if it were to conflict with the purposes of SGMA and the efforts of the SVBGSA to attain sustainability in the Basin.

Monterey County has chosen to retain the USGS to develop the Salinas Valley Integrated Hydrologic Model (SVIHM), which will be used during implementation of this GSP Update. The USGS is currently planning to publicly release it in 2022.

3.11.5 Effects of GSP Implementation on Water Supply Assumptions

Implementation of this GSP Update is not anticipated to affect water supply assumptions of relevant land use plans over the planning and implementation horizon. This GSP Update lists potential projects and management actions to bring extraction within the sustainable yield, including the potential for pumping controls if needed. Changes in the cost of groundwater may affect whether surface water or groundwater is used. Land use changes may occur as a result of these activities and based on financial decisions by individual growers. However, there is no direct impact from the GSP implementation on land use management.

4 HYDROGEOLOGIC CONCEPTUAL MODEL

The HCM characterizes the geologic and hydrologic framework of the Subbasin in accordance with the GSP Regulations § 354.14. It is based on best available data, technical studies, and qualified maps that characterize the physical components and surface water/groundwater interaction in the Subbasin. This HCM provides comprehensive written descriptions and illustrated representations of subsurface conditions. The chapter describes the Subbasin characteristics and processes that govern the flow of water across the Subbasin boundaries and outlines the general groundwater setting that may be encountered in the subsurface environment. Current and historical groundwater conditions are discussed in greater detail in the subsequent chapter. This current HCM in this GSP Update will be part of an iterative process where current conditions and data gaps are described, investigated, and then updated accordingly.

4.1 Subbasin Setting and Topography

The 180/400-Foot Aquifer Subbasin is at the northern, down-gradient end of the Salinas Valley Groundwater Basin, an approximately 90-mile-long alluvial basin underlying the elongated, intermountain valley of the Salinas River. The Subbasin is oriented southeast to northwest, with the Salinas River draining towards the northwest into the Pacific Ocean at Monterey Bay (Figure 4-1).

The colored bands on Figure 4-1 show the topography of the Subbasin, derived from the USGS Digital Elevation Model (DEM). The Subbasin slopes at an average grade of approximately 5 feet/mile to the northwest toward the Pacific Ocean. Land surface elevations in the Subbasin range from approximately 500 feet above sea level along its border with the Sierra de Salinas to sea level at Monterey Bay.

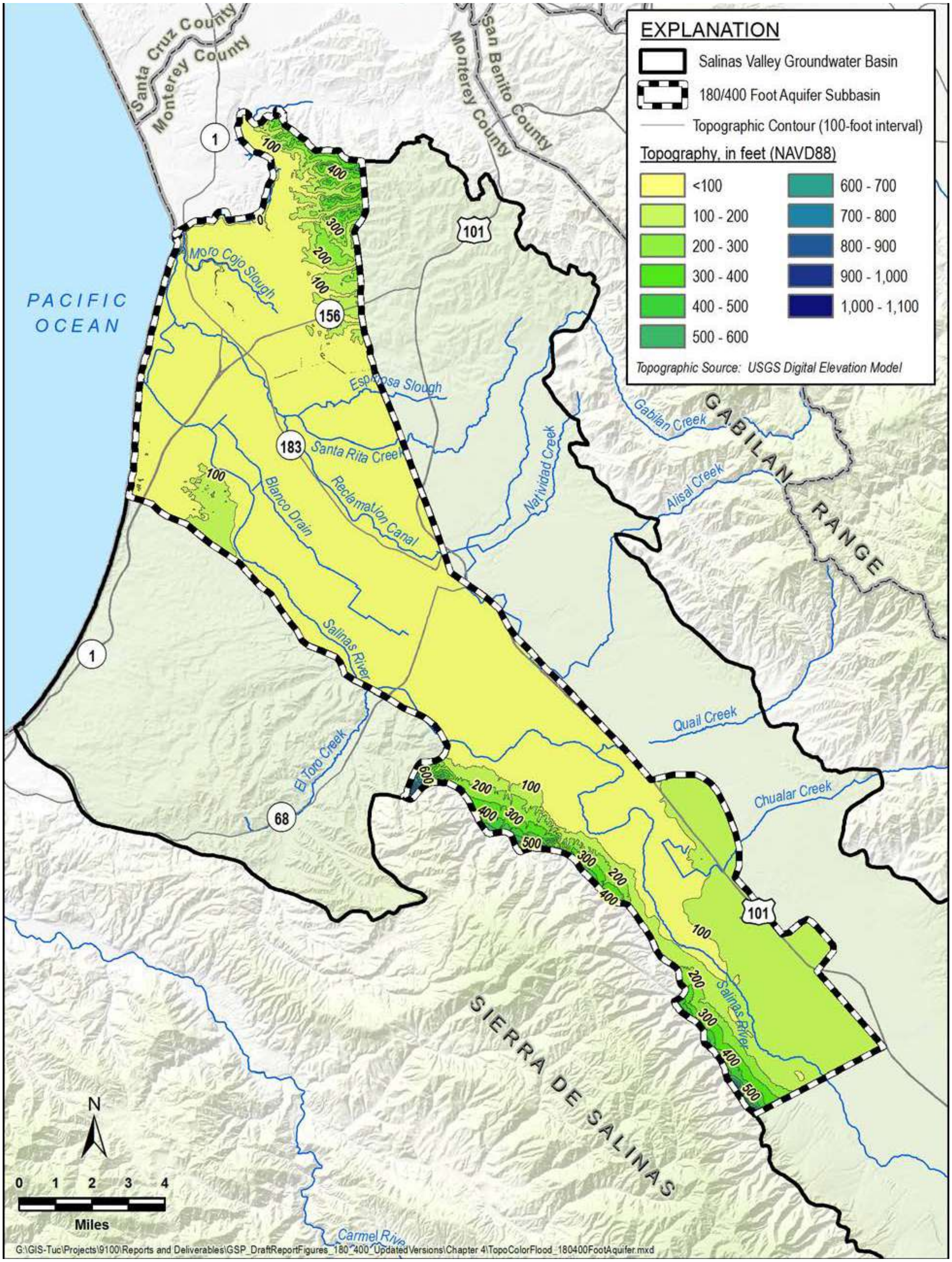


Figure 4-1. 180/400-Foot Aquifer Subbasin Topography

4.2 Subbasin Geology

The subbasin geology describes the physical framework in which groundwater occurs and moves. The geology of the Subbasin controls the locations and depths of aquifers and aquitards, as well as the subbasin boundaries. The geologic descriptions described here are derived from previously published scientific reports, and from investigations conducted by the USGS, State of California, and academic institutions.

The Subbasin was formed through periods of structural deformation and periods of marine and terrestrial sedimentation in a tectonically active area on the eastern edge of the Pacific Plate. Figure 4-2 presents a geologic map of the Subbasin and vicinity. This geologic map was adopted from the 2001 Digital Geologic Map of Monterey County as well as the California Geologic Survey's 2010 statewide geologic map (Rosenberg, 2001; Jennings, *et al.*, 2010). The locations of cross-sections used to define the principal aquifers in Section 4.4 are also shown on Figure 4-2. The legend on Figure 4-2 presents the age sequence of the geologic materials from the youngest unconsolidated Quaternary sediments to the oldest pre-Cambrian basement rock.

The geology of the 180/400-Foot Aquifer Subbasin is characterized by alluvium, terrace deposits, the Paso Robles Formation, and the Aromas Red Sands Formation (DWR, 2004a). The geology is a result of both fluvial sedimentary deposits from the Salinas River and marine deposits from the Pacific Ocean. The majority of the sediments in this subbasin are a mix of sands, gravels, and clays.

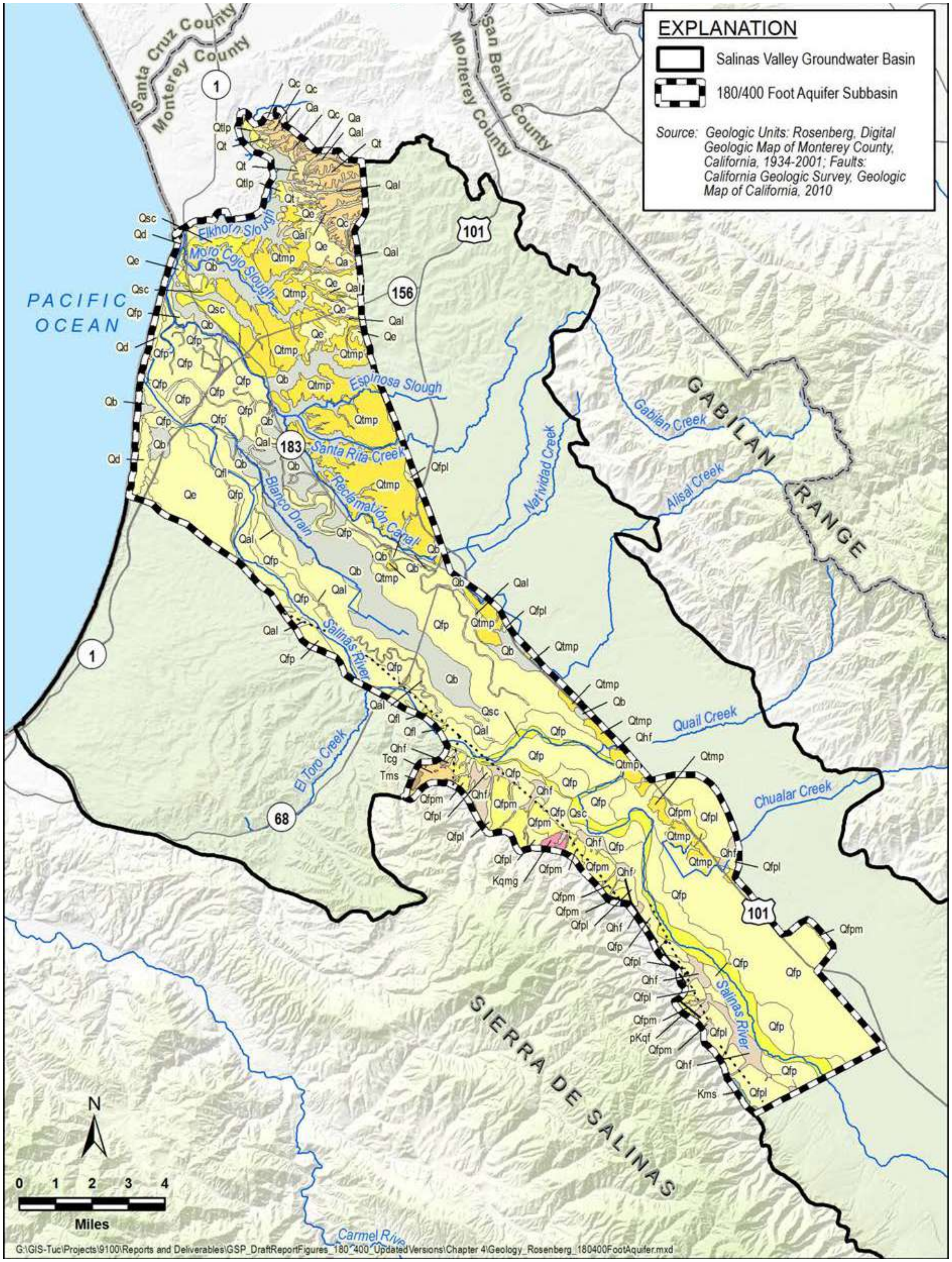


Figure 4-2. Subbasin Geology
(from Jennings, *et al*., 2010; Rosenberg, 2001)

FIGURE 4-2. EXPLANATION

QUATERNARY

- Qal Alluvial deposits, undifferentiated
- Qb Basin deposits
- Qd Dune deposits
- Qfl Artificial fill
- Qfp Flood-plain deposits, undifferentiated?
- Qfpl Alluvial fans, late Pleistocene
- Qfpm Alluvial fans, middle Pleistocene
- Qhf Alluvial fan deposits, Holocene
- Qsc Stream channel deposits
- Qa Aromas Sand, undifferentiated
- Qbs Beach sand
- Qc Colluvium
- Qe Eolian deposits
- Qt Fluvial terrace deposits, undifferentiated

QUATERNARY-TERTIARY

- Qtmp Fluvial terrace deposits, middle Pleistocene
- Qtlp Fluvial terrace deposits, late Pleistocene

TERTIARY

- Tcg Unnamed clastic sediments, sandstone and conglomerate
- Tms Unnamed clastic sediments

CRETACEOUS

- Kms Schist of Sierra de Salinas
- Kqmg Garnetiferous quartz monzonite of Pine Canyon
- pKm Marble
- pKqf Quartzofeldspathic rocks

GEOLOGIC FEATURES

- fault, certain
- fault, concealed

4.2.1 Geologic Formations

Major geologic units present in the 180/400-Foot Aquifer Subbasin are described below, starting at the surface and moving through the geologic layers from youngest to oldest. Geologic descriptions are derived from a combination of sources (Jennings, *et al.*, 2010; Clark, *et al.*, 2000; Johnson, *et al.*, 1988; DWR, 2004). The corresponding designations on Figure 4-2 are provided in parentheses.

Quaternary Deposits

- *Alluvium from streams and small drainages (*Qsc, Qal, Qb, and Qfp*)* – These youngest units are the loose sediment in and along streams and drainages, or where streams have recently flooded. Qsc fills the bed of the Salinas River. Qal is found in more minor drainages. Both are moderately sorted and consist mostly of silt and sand with some areas of gravel. Clays mixed with silt, sand, and organic material have collected at the bottoms of past and present basins (Qb). Salinas River floodplain deposits (Qfp) are the dominant feature of the northern subbasin, stretching all the way across the valley in places. These loose sand and silt deposits are the foundation for the Subbasin's fertile agricultural lands.

- *Aromas Red Sands and similar (*Qa, Qe, and Qc*)* – The Aromas Red Sands Formation is comprised of lower fluvial sand units and upper aeolian sand units generally separated by interbedded clays and silty clays (DWR, 2004a). The Aromas Red Sands include partly consolidated, moderately to poorly sorted, silty clay, sand, and gravel (Qa). This unit is located at the northeastern end of the Subbasin along the boundary with the Lanlgey Area Subbasin. Eolian deposits (Qe) are transported by wind and are exclusively sand and finer grains, as gravel is too heavy to be carried by wind. Sand matching that of the Aromas Red Sands is also found in windblown deposits (Qe). These deposits can also be found along the boundary with the Langley Area Subbasin and as well as along the boundary with the Monterey Subbasin. Colluvium collects gradually over time as a result of gravity (Qc). These small, isolated deposits are found at the northeastern end of the Subbasin, where the topography is steeper. These small Holocene deposits were transported by a combination of runoff and gravity, not streamflow. Some sources refer to the windblown deposits as the Upper Aromas Red Sands.

- *Alluvial fans* (Qhf, Qfpl and Qfpm*)* – Alluvial fans are sediments deposited in a distributary manner at the base of mountain fronts where streams emerge (Kennedy/Jenks, 2004). They consist of weakly to moderately consolidated, moderately to poorly sorted sand, silt, and gravel deposits. Gravel content increases toward the head of the alluvial fans, while finer sediments such as clay and silt increase towards the furthest extents of the fans, interfingering with the silts and clays often found in floodplain and stream-channel deposits Late and middle Pleistocene alluvial fans (Qfpl and Qfpm, respectively) can be weakly to moderately consolidated.

- *Terrace deposits (*Qt, Qtmp, and Qtlp*)* – Terrace occur as the erosional remnants of former stream channels and floodplains. In 180/400-Foot Aquifer Subbasin, they can be found around the eastern boundary with the Langley Area and Eastside Aquifer Subbasins (DWR, 2004a). They are partially consolidated and consist mostly of sand mixed with silt and gravel. Some are known to be from the middle Pleistocene (Qtmp) and late Pleistocene (Qtlp). Others are of indeterminate age (Qt).

These quaternary deposits are sometimes grouped together in other reports as Alluvium or Valley Fill Deposits.

Quaternary-Tertiary Deposits

- *Paso Robles Formation* (QTcl and QTp, not shown on map) – The Paso Robles Formation underlies the entire Subbasin but is rarely exposed at the surface. This Pliocene to lower Pleistocene unit is composed of lenticular beds of sand, gravel, silt, and clay from terrestrial deposition (Thorup, 1976; Durbin, et al., 1978). The depositional environment is largely fluvial but also includes alluvial fan, lake and floodplain deposition (Durbin, 1974; Harding ESE, 2001; Thorup, 1976; Greene, 1970). The alternating beds of fine and coarse materials typically have thicknesses of 20 to 60 feet (Durbin, et al., 1978). Durham (1974) reports that the thickness of the Formation is variable due to erosion of the upper part of the unit; and that the Formation is approximately 1,500 feet thick near Spreckels and 1,000 feet thick near the City of Salinas. Through much of the Subbasin, this is the deepest unit and the underlying marine deposits typically do not yield high rates of fresh water.

Tertiary Deposits

- *Purisima Formation* (Tp, not shown on map) – The Purisima Formation underlies much of the Subbasin; however, it is also not exposed at the surface (DWR, 2004a). This Pliocene unit consists of interbedded siltstone, sandstone, conglomerate, clay and shale deposited in a shallow marine environment (Greene, 1977; Harding ESE, 2001). The Purisima Formation ranges from 500 to 1,000 feet in thickness (WRIME, 2003).
- *Santa Margarita Sandstone* (Tsm, not shown on map) – The Santa Margarita Sandstone is not exposed at the surface in this Subbasin. Conformably overlying the Monterey Formation, this Miocene unit consists of white, arkosic sandstone made of very fine to coarse sand. It has very thick beds and some localized cross-bedding. In some areas, the Santa Margarita Sandstone directly underlies the Paso Robles Formation where the Purisima Formation is absent (Greene, 1977).
- *Monterey Formation* (Tm, not shown on map) – The Monterey Formation is also not exposed at the surface in this Subbasin. This Miocene unit consists of shale and mudstone

deposited in a shallow marine environment (Harding ESE, 2001; Greene, 1977). This unit typically underlies the Salinas Valley Groundwater Basin and acts as a boundary for vertical groundwater flow.

Cretaceous Rocks

The Sierra de Salinas, which borders the Subbasin to the southwest, is composed of metamorphic (Kms, pKm, and pKqf) and igneous (Kqmg) rocks and is important as a geologic boundary in the Subbasin and greater Salinas Valley Groundwater Basin as well.

4.2.2 Restrictions to Flow

There are no known structural features that restrict groundwater flow within the 180/400-Foot Aquifer Subbasin, such as geologic folds or faults.

4.2.3 Soils

The soils of the Subbasin are derived from the underlying geologic formations and influenced by the historical and current patterns of climate and hydrology. Soil types can influence groundwater recharge and the placement of recharge projects. Productive agriculture in the Subbasin is supported by deep, dark, fertile soils. The arable soils of the Subbasin historically are classified into 4 groups (Carpenter and Cosby 1925): residual soils, old valley-filling soils, young valley-filling soils, and recent-alluvial soils.

More recent surveys classify the soils into categories based on detailed soil taxonomy (U.S. Department of Agriculture, 2018). Figure 4-3 is a composite soil map of soils in the Subbasin from the USDA Natural Resources Conservation Service (NRCS) and the Gridded Soil Survey Geographic (gSSURGO) Database that is produced by the National Cooperative Soil Survey (NCSS).

The Subbasin is dominated by 4 soil orders: mollisols, entisols, vertisols, and alfisols. Minor soils include histosols and isceptisols. The 4 major soil orders are described below.

- **Mollisols** are the most widespread soil order in the 180/400-Foot Aquifer Subbasin. Mollisols are characterized by a dark surface horizon, indicative of high organic content. The organic content often originates from roots of surficial grasses or similar vegetation. They are highly fertile and often alkaline rich (calcium and magnesium). Mollisols can have any moisture regime, but enough available moisture to support perennial grasses is typical.
- **Entisols** are the predominant order along the river corridor. Entisols are mineral soils without distinct soil horizons because they have not been in place long enough for distinct horizons to develop. These soils are often found in areas of recent deposition

such as active flood plains, river basins, and areas prone to landslides. These soils may be found near active tributaries in the Subbasin.

- **Vertisols** are present in some areas on the Subbasin lowlands. Vertisols are predominantly clayey soils with high shrink-swell potential. Vertisols are present in climates that have distinct wet and dry seasons. During the dry season these soils commonly have deep, wide cracks. During the wet season these soils tend to have water pooling on the surface due to the high clay content.
- **Alfisols** are present along the margins of the Subbasin. Alfisols are known to have natural fertility both from clay acumination in the subsurface horizons and from leaf litter when under forested conditions. This order of soils is commonly associated with high base minerals such as calcium, magnesium, sodium, and potassium.

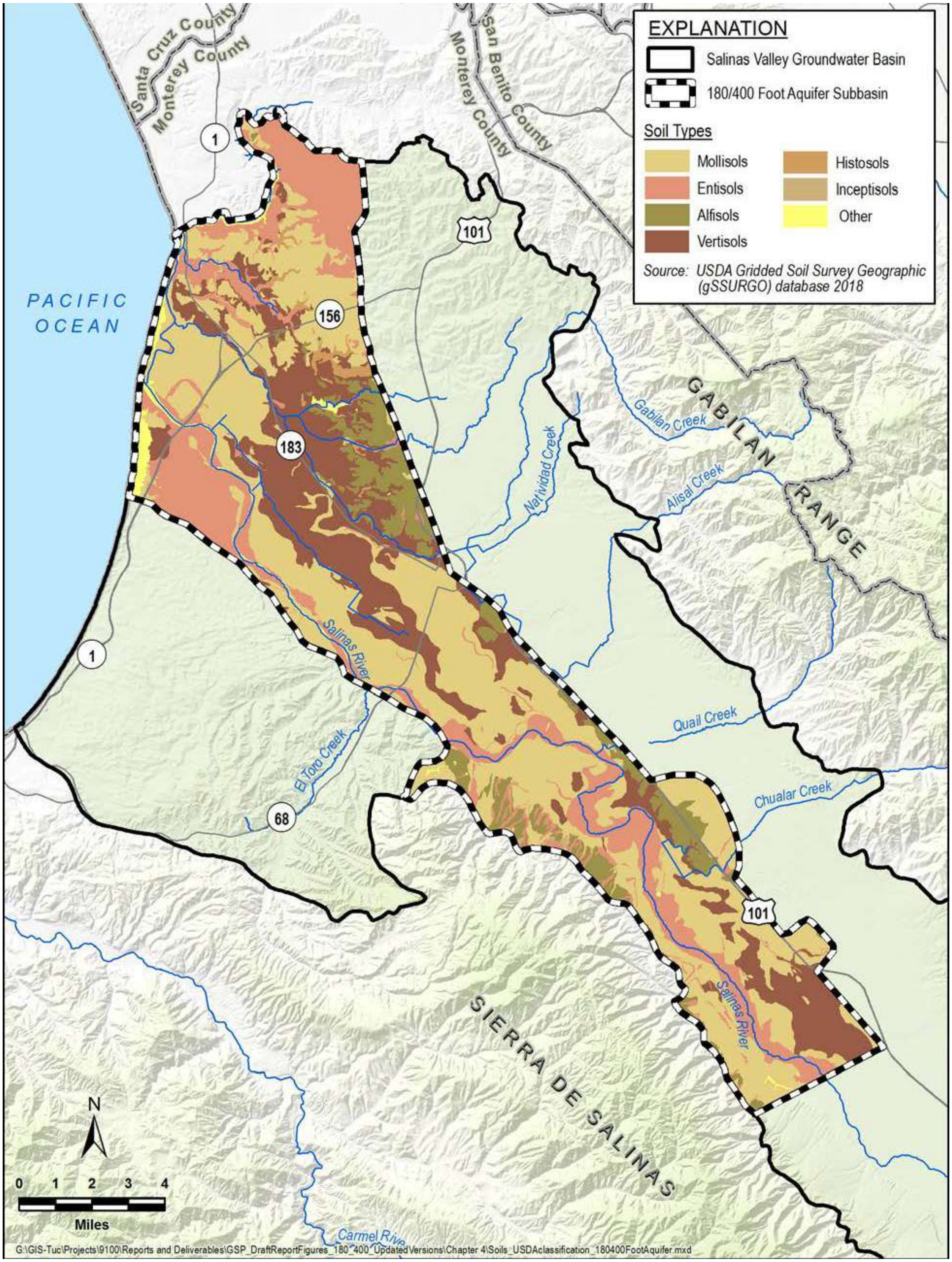


Figure 4-3. Composite Soils Map

4.3 Subbasin Extent

The subbasin extents describe both the lateral and vertical extents of the Subbasin. The Subbasin extents are defined by the California Department of Water Resources (DWR) and are documented in Bulletin 118, (DWR, 2003; DWR, 2016a). Figure 4-1 illustrates the extent of the Subbasin.

4.3.1 Lateral Subbasin Boundaries

The 180/400-Foot Aquifer Subbasin is laterally bounded by a combination of subbasin boundaries and physical boundaries of the Salinas Valley Groundwater Basin, all shown on Figure 1-1.

4.3.1.1 Boundaries with Adjacent Subbasins

The 180/400-Foot Aquifer Subbasin is bounded by the following subbasins:

- **The Forebay Aquifer Subbasin**. The southern boundary with the adjacent Forebay Subbasin is near the town of Gonzales (DWR, 2004a). It is the approximate southern limit of the regional clay layers that are the defining characteristic of the 180/400-Foot Aquifer Subbasin. There may be reasonable hydraulic connectivity with the Forebay Subbasin, although the principal aquifers change from relatively unconfined to confined near this boundary.
- **The Eastside Aquifer Subbasin**. The eastern boundary with the adjacent Eastside Subbasin generally follows the trace of Highway 101 and coincides with the northeastern limit of confining conditions in the 180/400-Foot Aquifer Subbasin. An analysis of stratigraphic correlations concluded that there is a change in the depositional facies near this boundary, with tributary alluvial fan deposits on the east side of the boundary and Salinas River fluvial deposits on the west side of the boundary (Kennedy-Jenks, 2004). Previous studies of groundwater flow across this boundary indicate that there is restricted hydraulic connectivity between the subbasins.
- **The Langley Area Subbasin**. The northern boundary with the Langley Subbasin generally coincides with the presence of Pleistocene Aromas Red Sands that are indicative of the Langley Subbasin (DWR, 2004b). Although the Langley Subbasin is not on the valley floor, there are no reported hydraulic barriers separating these subbasins and therefore the GSP needs to consider potential for groundwater flow between these adjacent subbasins.
- **The Monterey Subbasin**. The western boundary with the Monterey Subbasin is based on topographic rise that coincides with a buried trace of the King City-Reliz fault. This fault may impact groundwater flow between subbasins beneath a cover of Holocene sand

dunes (Durbin, et al., 1978). There is potential for groundwater flow between these 2 subbasins.

4.3.1.2 Physical Basin Boundaries

The 180/400-Foot Aquifer Subbasin is bounded by the following physical feature:

- **The Monterey Bay shoreline**. The northern Subbasin boundary is defined by the Monterey Bay shoreline. The Subbasin aquifers extend across this boundary into the subsurface underlying Monterey Bay and there are no hydrogeologic barriers limiting groundwater flow across this coastal boundary.
- **Elkhorn Slough**. The northern boundary of the Subbasin follows the current course of Elkhorn Slough; corresponding to a paleo-drainage of the Salinas River (DWR, 2003). Elkhorn Slough separates the 180/400-Foot Aquifer Subbasin from the Pajaro Valley Groundwater Basin. This paleo-drainage is a 400-Foot deep, buried, clay-filled boundary that limits groundwater flow between these basins (Durbin, et al., 1978).
- **The Sierra de Salinas**. The southwest extension of the King City fault corresponds to the contact between the Quaternary deposits and the low-permeability granitic and metamorphic basement rock of the Sierra de Salinas. This geologic contact creates a groundwater flow barrier and the southwestern hydrogeologic boundary of the Subbasin.

4.3.2 Vertical Subbasin Boundaries

The base, or bottom, of the Subbasin does not contain a sharp interface between permeable sediments and lower-permeability basement rock across the entire Subbasin. While a sharp interface between alluvium and the underlying granitic rocks exists near the Sierra de Salinas, the usable portion of the Subbasin does not always include the full thickness of Alluvium. Previous investigations have estimated that the entire sedimentary sequence in the Salinas Valley Groundwater Basin might range between 10,000 and 15,000 feet thick. However, the productive freshwater principal aquifers in this Subbasin are at shallower depths.

With increasing depth, 2 factors limit the viability of the sediments as productive, principal aquifers:

1. Increased consolidation and cementation of the sediments decrease well yields.
2. Deeper strata contain poor-quality brackish water unsuitable for most uses.

Because these factors gradually change with depth, there is not a sharp well-defined bottom of the aquifers throughout the Salinas Valley Groundwater Basin. This GSP adopts the bottom of the aquifer that was defined by the USGS (Durbin, *et al.*, 1978) and extrapolates that surface to the Subbasin's boundary. Figure 4-4 is a map of elevation contours of the bottom of the Subbasin. Figure 4-5 shows a contour map of depth to the bottom of the Subbasin prepared using the extrapolated bottom elevation and ground surface elevation.

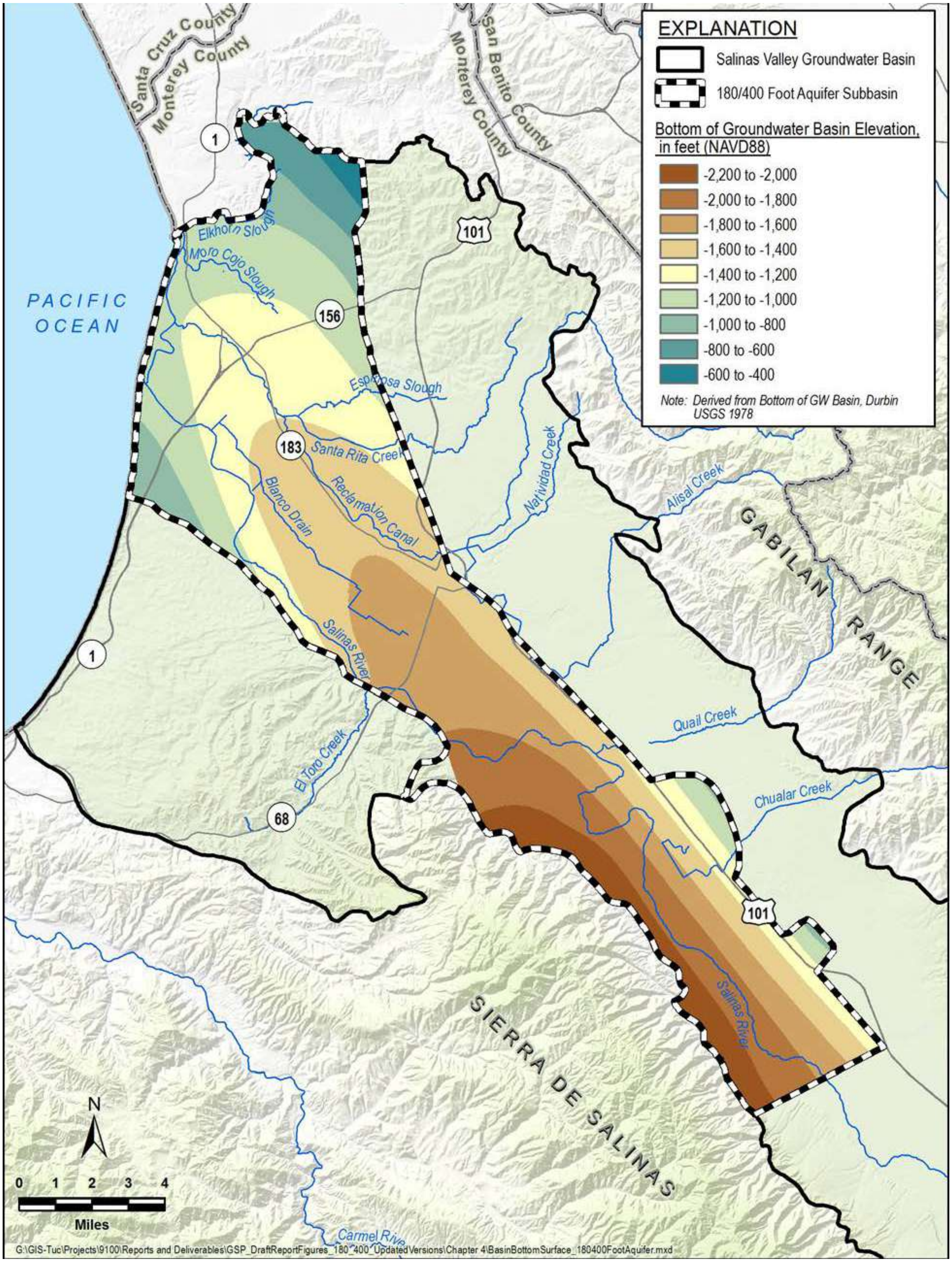


Figure 4-4. Elevation of the Bottom of the 180/400-Foot Aquifer Subbasin

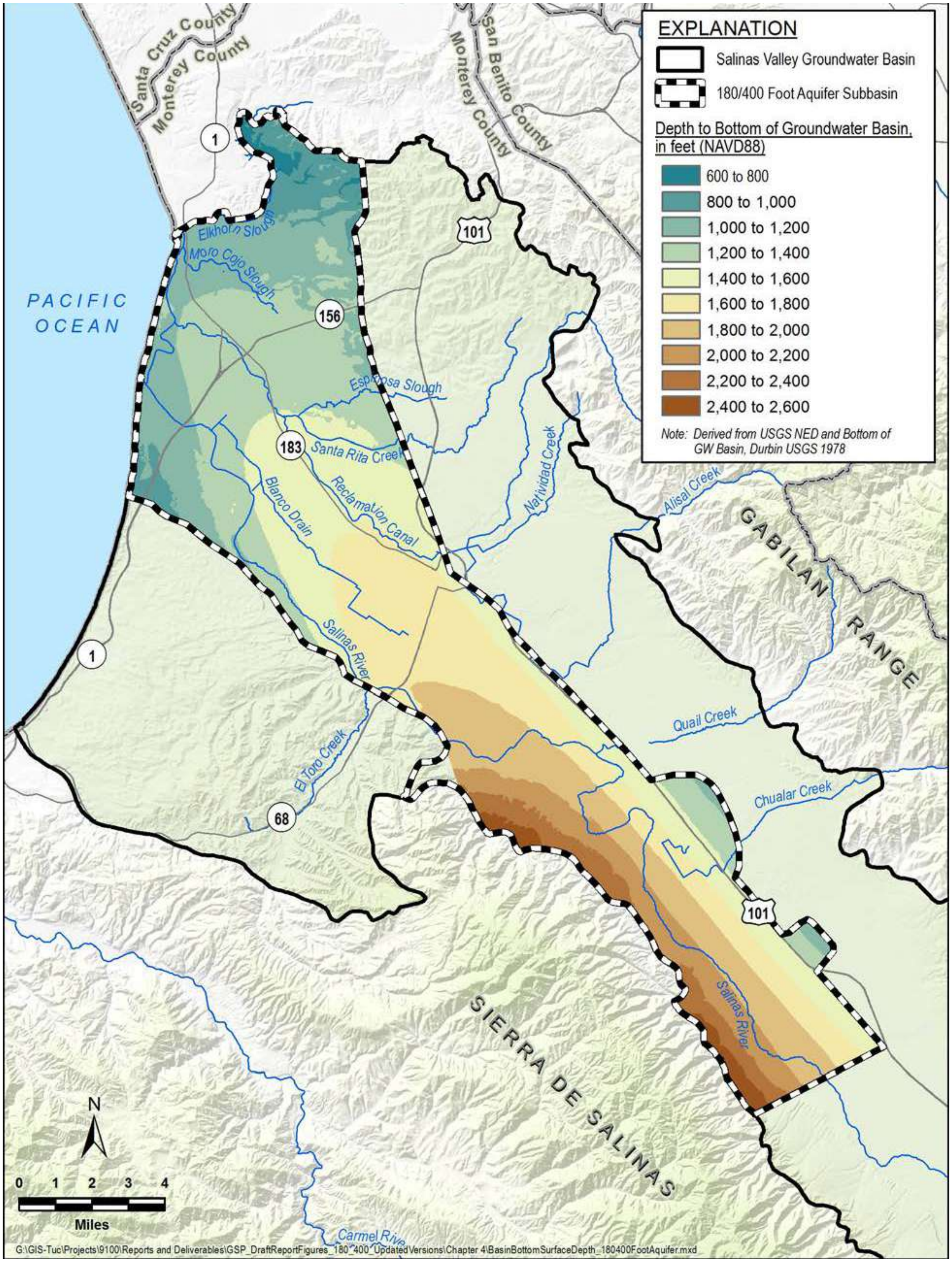


Figure 4-5. Depth to Bottom of the 180/400-Foot Aquifer Subbasin, in feet

4.4 Subbasin Hydrogeology

The Subbasin hydrogeology details the principal aquifers and aquitards that occur in the subbasin, inventories known aquifer properties, and identifies naturally occurring groundwater inputs and outputs which will be incorporated into the groundwater budgets described in Chapter 6. This section also includes cross-sections which give graphical representations of what is described in the following subsections.

Groundwater in the 180/400-Foot Aquifer Subbasin is primarily produced from alluvial deposits belonging to 3 geologic units: the Holocene Alluvium, the Quaternary Older Alluvium, and the Pliocene Paso Robles Formation described above. Although these 3 geologic formations differ in age, they have similar distributions of sediment type and layering; and in practice it is difficult to distinguish between these formations during borehole drilling. For purposes of groundwater development in the Subbasin, these geologic units are collectively referred to as alluvium.

Although groundwater can be found throughout most of the Holocene Alluvium and the Quaternary Older Alluvium, not all groundwater is part of a principal aquifer. SGMA defines a principal aquifer as "…aquifers or aquifer systems that store, transmit, and yield significant or economic quantities of groundwater to wells, springs, or surface water systems" (CCR, 2016). All the groundwater encountered in the Subbasin is a part of the overall groundwater system, but the focus of this GSP is on the principal aquifers. Within the 180/400-Foot Aquifer there are three principal aquifers: the 180-Foot Aquifer, the 400-Foot Aquifer, and the Deep Aquifers.

The most recent, detailed hydrostratigraphic analysis of the 180/400-Foot Aquifer Subbasin was published in 2004 with an update in 2015 (Kennedy/Jenks, 2004; Brown and Caldwell, 2015).

4.4.1 Principal Aquifers and Aquitards

The shallowest water-bearing sediments are thin, laterally discontinuous, and do not constitute a significant source of water for the Subbasin. These shallow sediments are therefore not considered a principal aquifer. These sediments are generally within 30 feet of the ground surface and are part of the Holocene Alluvium unit. Although these sediments are a minor source of water due to their poor quality and low yield, some small domestic wells draw water from this zone (Kennedy-Jenks, 2004; DWR, 2003; Showalter, 1984). Groundwater in these sediments is hydraulically connected to the Salinas River but is assumed to be relatively poorly connected to the underlying productive principal aquifers due to the presence of the underlying Salinas Valley Aquitard.

Beneath the shallow sediments, the following series of aquitards and principal aquifers have long been recognized in a multitude of studies and reports. They are the distinguishing hydrostratigraphic features of this Subbasin.

- Salinas Valley Aquitard
- 180-Foot Aquifer
- 180/400-Foot Aquitard
- 400-Foot Aquifer
- 400-Foot/Deep Aquitard
- Deep Aquifers

4.4.1.1 Salinas Valley Aquitard

The Salinas Valley Aquitard is the shallowest, relatively continuous hydrogeologic feature in the Subbasin. The aquitard is composed of blue or yellow sandy clay layers with minor interbedded sand layers (DWR, 2003). The Salinas Valley Aquitard correlates to the Pleistocene Older Alluvium stratigraphic unit and was deposited in a shallow sea during a period of relatively high sea level.

Figure 4-6 shows the lateral and vertical extent of the Salinas Valley Aquitard. Laterally, the Salinas Valley Aquitard extends from Monterey Bay in the north to Chualar in the south, and to an irregular contact in the east that is roughly represented by the DWR-designated boundary with the Eastside Subbasin (DWR, 2003). Most of the Salinas Valley Aquitard is generally encountered at depths of less than 30 feet. Close to Monterey Bay, the Salinas Valley Aquitard is over 100 feet thick but thins to 10 feet near the City of Salinas, eventually pinching out near Chualar and east of the City of Salinas (DWR, 1975). While this clay layer is relatively continuous in the northern portion of the Valley, it is not monolithic. The clay layer is missing in some areas and pinches out in certain areas. In these intermittent areas, the shallow sediments may be in hydrologic connection with the 180-Foot Aquifer and may be a conduit for recharge. This is especially pertinent for places where the Salinas River flows over these gaps and may provide recharge to the alluvial sediments and principal aquifers below. These locations are illustrated where there is no Salinas Valley Aquitard shading where the Salinas Valley River is mapped on Figure 4-6.

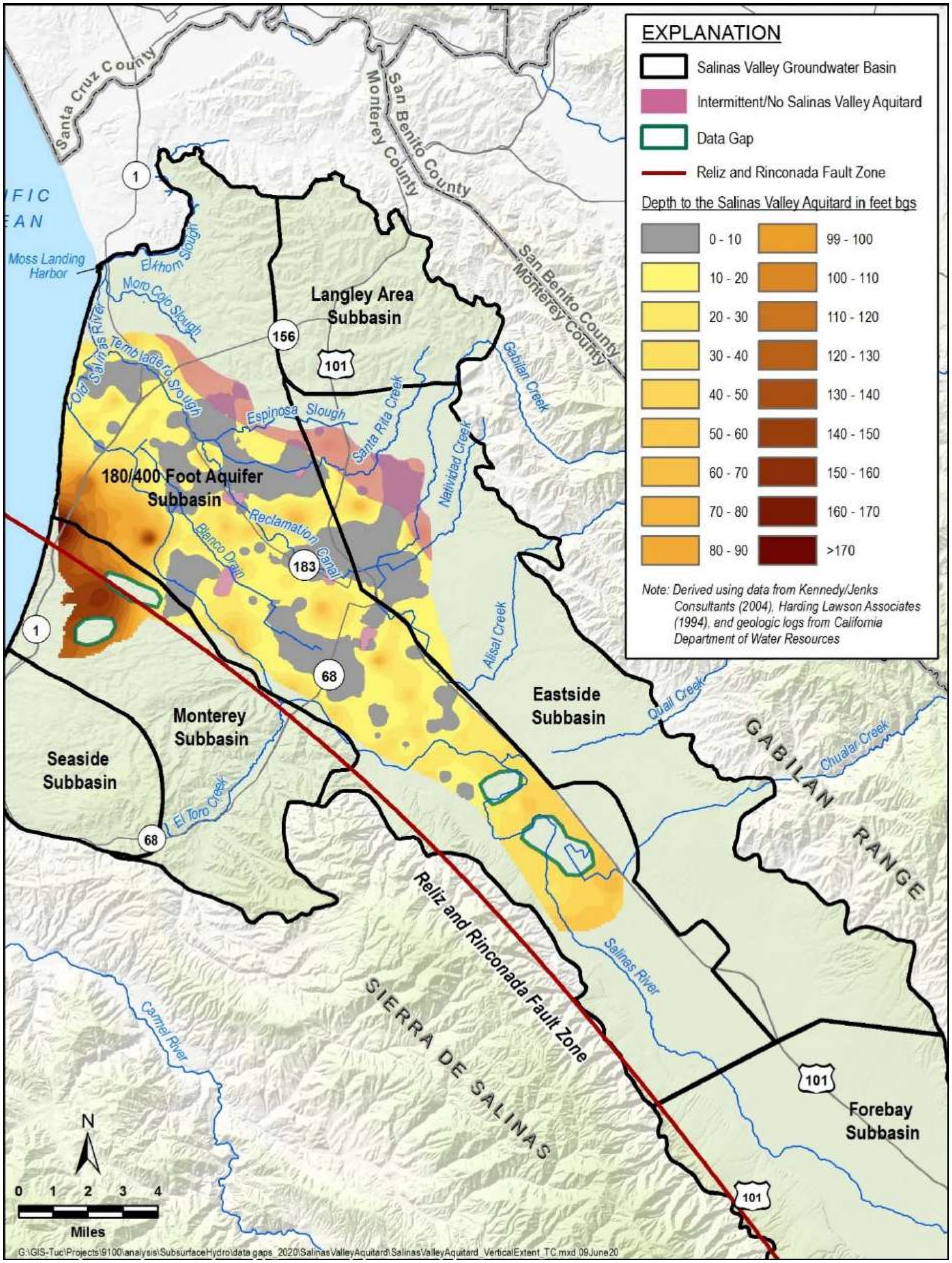


Figure 4-6. Lateral and Vertical Extent of the Salinas Valley Aquitard

4.4.1.2 180-Foot Aquifer

The Salinas Valley Aquitard overlies and confines the 180-Foot Aquifer. The 180-Foot Aquifer is the shallowest laterally extensive principal aquifer in the 180/400-Foot Aquifer Subbasin. This aquifer consists of interconnected sand and gravel beds that are from 50 to 150 feet thick. The sand and gravel layers are interlayered with clay lenses. This aquifer is correlated to the Older Alluvium or upper Aromas Sand formations (Harding ESE, 2001; Kennedy-Jenks, 2004). The 180-Foot Aquifer is exposed on the floor of the Monterey Bay (Todd Engineers, 1989).

The primary uses of the 180-Foot Aquifer are for domestic, irrigation, and municipal water supply.

4.4.1.3 180/400-Foot Aquitard

The base of the 180-Foot Aquifer is an aquitard consisting of interlayered clay and sand layers, including a marine blue clay layer similar to the Salinas Valley Aquitard (DWR, 2003). This aquitard is known as the 180/400-Foot Aquitard. It is widespread in the Subbasin but varies in thickness and quality, and areas of hydrologic connection between the 400-Foot and 180-Foot Aquifers are known to exist (Kennedy-Jenks, 2004). In areas where the 180/400-Foot Aquitard is thin or discontinuous, seawater in the 180-Foot Aquifer can migrate downward into the 400-Foot Aquifer in response to pumping (Kennedy-Jenks, 2004).

4.4.1.4 400-Foot Aquifer

The 180/400-Foot Aquitard overlies and confines the 400-Foot Aquifer. The 400-Foot Aquifer is a hydrostratigraphic layer of sand and gravel with varying degrees of interbedded clay layers. It is usually encountered between 270 and 470 feet below ground surface. This hydrogeologic unit correlates to the Aromas Red Sands and the upper part of the Paso Robles Formation. Near the City of Salinas, the 400-Foot Aquifer is a single permeable bed approximately 200 feet thick; but in other areas the aquifer is split into multiple permeable zones by clay layers (DWR, 1973). The upper portion of the 400-Foot Aquifer merges and interfingers with the 180-Foot Aquifer in some areas where the 180/400-Foot Aquitard is missing (DWR, 1973).

The primary uses of the 400-Foot Aquifer are for domestic, irrigation, and municipal water supply.

4.4.1.5 400-Foot/Deep Aquitard

The base of the 400-Foot Aquifer is the 400-Foot/Deep Aquitard. The 400-Foot/Deep Aquitard is primarily comprised of several blue marine clay layers. This aquitard can be several hundred feet thick (Kennedy-Jenks, 2004; Brown and Caldwell, 2015), consisting of mostly clay with sand and gravel lenses. This heterogeneous nature of the aquitard indicates there may be potential parthways for downward migration of water from the 400-Foot Aquifer to the Deep Aquifers.

4.4.1.6 Deep Aquifers

The 400-Foot/Deep Aquitard overlies and confines the Deep Aquifers. The Deep Aquifers, also referred to as the 900-Foot and 1500-Foot Aquifers, are up to 900 feet thick and have alternating sandy-gravel layers and clay layers which do not differentiate into distinct aquifer and aquitard units (DWR, 2003). The Deep Aquifers correlate to the lower Paso Robles, Purisima, and Santa Margarita formations where they exist. The Deep Aquifers overlie the low permeability Monterey Formation. While the Deep Aquifers are relatively poorly studied, some well owners have indicated that there are different portions of the Deep Aquifers with different water qualities. No public data exists to substantiate these statements.

The Deep Aquifers are used primarily for irrigation and municipal water supply, particularly where seawater has intruded overlying principal aquifers.

4.4.1.7 Cross Sections

Three cross-sections parallel and perpendicular to the long axis of the Subbasin are shown on Figure 4-7, Figure 4-8, and Figure 4-9. The cross-section on Figure 4-7 is adopted from the State of the Salinas River Groundwater Basin report (Brown and Caldwell, 2015). The cross-sections on Figure 4-8 and Figure 4-9 are adapted from the *Final Report, Hydrostratigraphic Analysis of the Northern Salinas Valley* (Kennedy-Jenks, 2004). The location of these cross-sections is depicted on Figure 4-2.

Cross-section A-A’ extends down the length of the 180/400-Foot Aquifer Subbasin. Cross-section C-C’ and cross-section E-E’ extend across the width of the Subbasin. The finer sediments are grouped in the regions with hatch lines, or the shaded regions for cross-section A-A’; the coarser sediments have no hatching or shading. The generalized relationships of finer or coarser sediments between boreholes should be interpreted with caution and an understanding the distal and proximal sedimentation of alluvial fans as it relates to the overall climatic setting over geologic time.

The cross-sections are based on geologic logs provided in California Department of Water Resources (DWR) Water Well Drillers Reports. Geologic log descriptions were grouped into hydrologic units as follows:

- Fine-grained sediments such as clay, silt, sandy clay, and gravelly clay are shown as aquitards.
- Coarse-grained sediments such as sand, gravel, and sand-gravel mixtures are shown as aquifers.
- Sediments logged as gravel/clay, sand/clay, and sand/gravel/clay are interpreted to consist of interbedded coarse-grained and fine-grained deposits and are included with aquifer materials.

In some cases, the logs may be old, the depth resolution poor, or the lithologic distinction suspect, and therefore the lithology shown on the well logs should not be viewed as precise.

The 3 cross-sections show the discontinuous and interbedded nature of the thin lenses of alluvial sediments. The cross-sections show generalized areas, both vertically and horizontally, where coarse material is prevalent, however, individual lenses of coarse material are not traceable over long distances and do not correlate well between boreholes (Kennedy/Jenks, 2004).

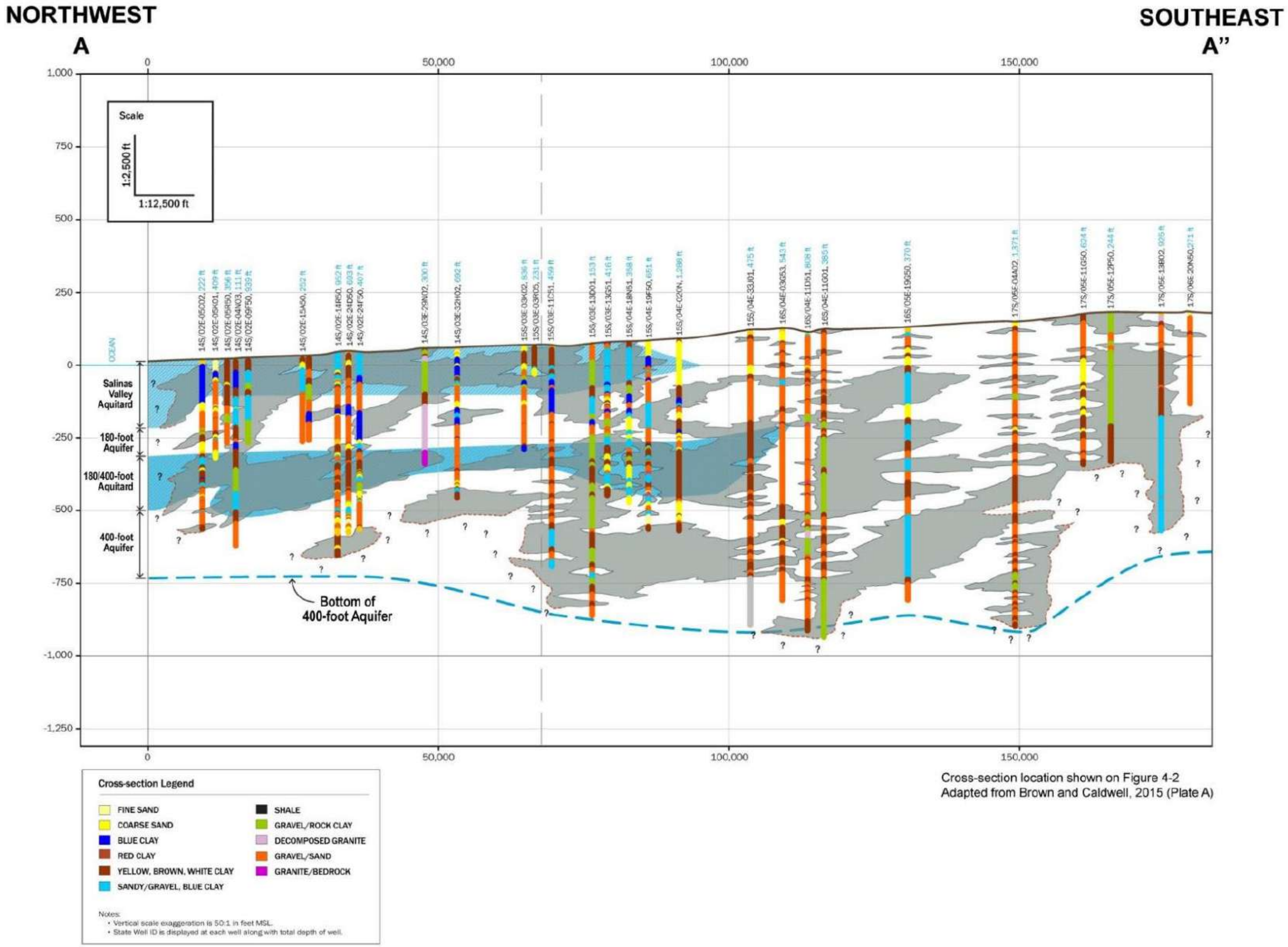


Figure 4-7. Cross-Section A-A'

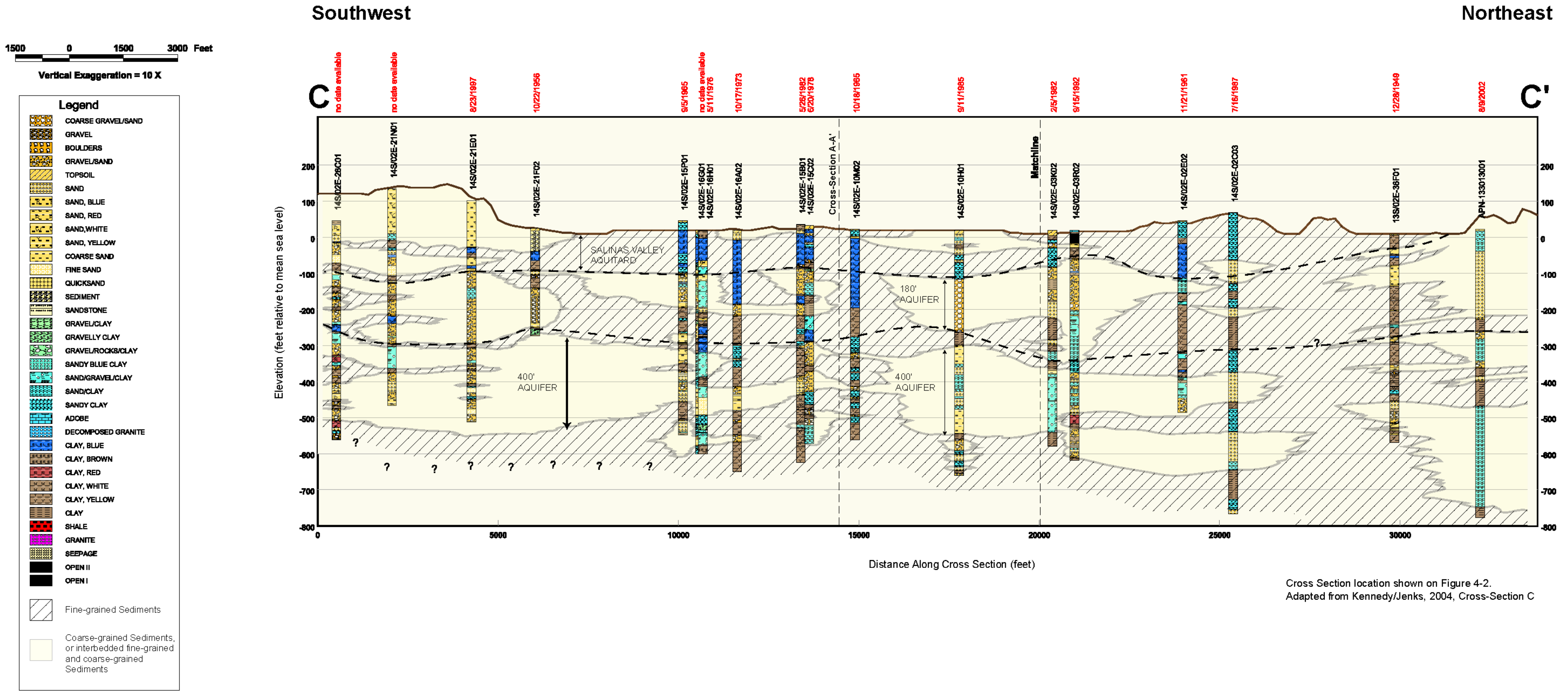


Figure 4-8. Cross-Section C-C'

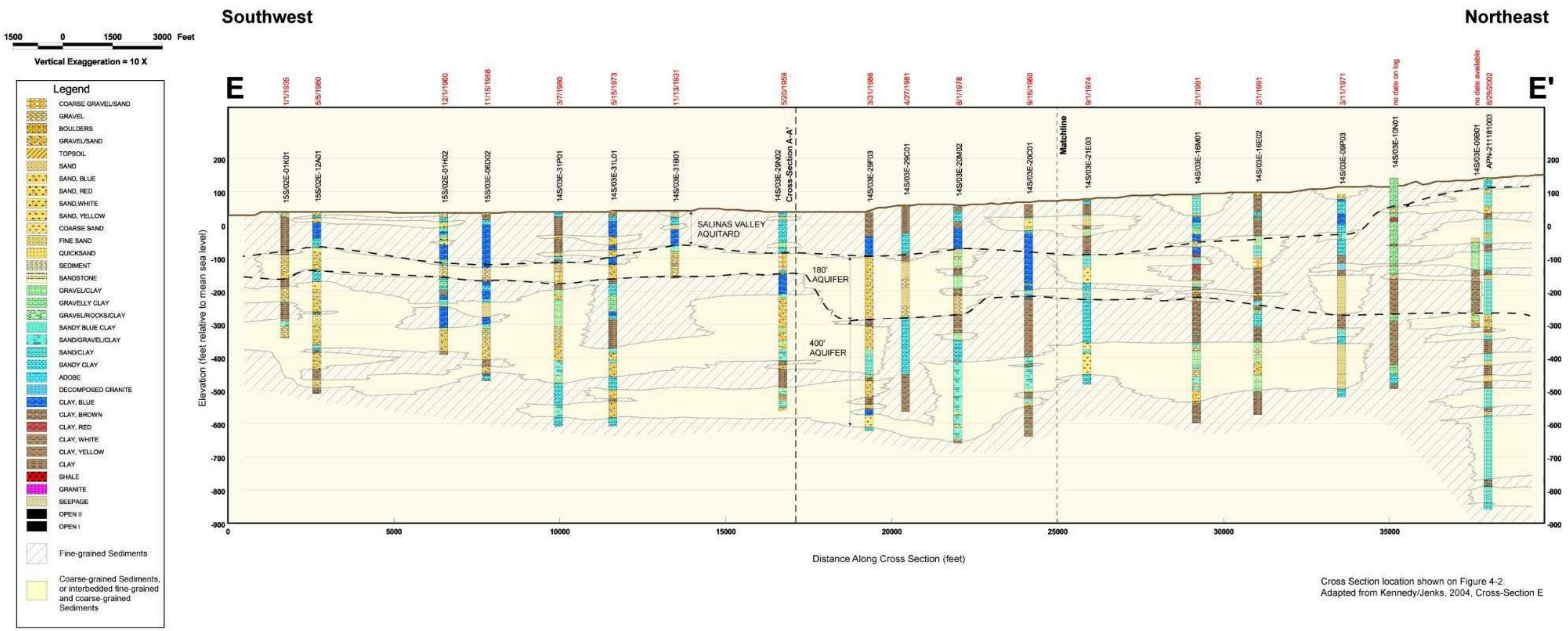


Figure 4-9. Cross-Section E-E'

4.4.2 Aquifer Properties

Aquifer properties define how groundwater is stored and how groundwater moves in the subsurface. This information is needed to understand current groundwater conditions, to predict future groundwater conditions, and to assess strategies for achieving sustainability.

The values and distribution of aquifer properties in the 180/400-Foot Aquifer Subbasin have not been well characterized and documented. The relatively sparse amount of measured aquifer properties throughout the Subbasin is considered a data gap that can be addressed during implementation of the GSP.

Although hydrogeologic properties have not been measured at many specific locations in the Subbasin, the aquifer properties have been estimated through the process of numerical model calibration. Aquifer property calibration has been completed for numerous published modeling studies including studies by Durbin (1974), Yates (1988), WRIME (2003), and the SVIHM that is used to develop this GSP.

There are 2 general types of aquifer properties relevant to groundwater management:

- **Aquifer storage properties.** These properties control the relationship between the volume of groundwater stored in the aquifer and the groundwater elevations measured in the aquifer.
- **Groundwater transmission properties.** These properties control the relationship between hydraulic gradients and the rate of groundwater flow.

4.4.2.1 Aquifer Storage Properties

The aquifer properties that characterize the relation between groundwater elevation and amount of water stored in an aquifer are specific yield for unconfined aquifers, and specific storage for confined aquifers. Storativity, or storage coefficient, is equal to specific storage multiplied by the aquifer saturated thickness for confined aquifers. Both specific yield and specific storage are measured in units of cubic feet of water per cubic feet of aquifer material. These ratios are often expressed as a percentage.

- **Specific yield**, or drainable porosity, is the amount of water that drains from pores when an unconfined aquifer is dewatered. Often specific yield values range from 8% to 20%. Estimated specific yield values complied by DWR for Subbasin range from 6% to 16% (DWR, 2004a).
- **Specific storage** is the amount of water derived from a unit volume of a confined aquifer due to a unit decline in pressure change in the aquifer. Specific storage values are dimensionless, and often on the order of $5x10^{-4}$ to $1x10^{-5}$. Estimated specific storage values compiled by the USGS for the Subbasin range from $1.2x10^{-4}$ to $2.9x10^{-4}$.

Detailed aquifer property values specific to the Subbasin were not available at the time of this GSP Update development. This is a data gap that will be filled during implementation.

4.4.2.2 Groundwater Transmission Properties

Hydraulic conductivity measures the ability of an aquifer to transmit water. Hydraulic conductivity is expressed in units of length per unit time, such as feet per day. Materials with higher hydraulic conductivities, such as sands and gravels, transmit groundwater more readily than units with lower hydraulic conductivities, such as clay. Transmissivity is equal to the hydraulic conductivity multiplied by the aquifer thickness. Few estimates of either hydraulic conductivity or transmissivity exist for the Subbasin.

Specific capacity of a well is sometimes used as a surrogate for estimating aquifer transmissivity. The specific capacity of a well is the ratio between the well production rate in gallons per minute (gpm) and the water level drawdown in the well during pumping, measured in feet. Specific capacity is moderately well correlated, and approximately proportional to, aquifer transmissivity. Durbin, et al. (1978) reported the following well yields and specific capacity estimates:

- Fluvial deposits that constitute the shallowest productive zones in most of the Subbasin, including the 180-Foot aquifer, have well yields of 500 to 4,000 gpm and an average specific capacity of approximately 70 gpm/ft.
- In the 400-Foot aquifer, well yields range from 300 to 4,000 gpm and average 1,200 gpm, with specific capacity averaging about 30 gpm/ft.

These values suggest that the principal aquifers have relatively high transmissivities and hydraulic conductivities. Wells completed in the principal aquifers can produce substantial amounts of water with limited drawdown.

4.4.3 Primary Aquifer Uses

The primary uses of groundwater from the three aquifers include domestic, irrigation, and municipal water supply uses (DWR, 2004a).

4.4.4 Natural Recharge Areas

Natural recharge areas allow rainfall, local runoff, and streamflow to replenish aquifers by percolating through the subsurface. Identifying areas of potentially significant natural recharge can inform water budgets and help government planners promote good groundwater management by incorporating recharge areas into land use plans. This section only identifies areas of natural recharge; quantitative information about all natural and anthropogenic (man-made) recharge is provided in Chapter 6.

Natural groundwater recharge occurs through the following processes:

- Infiltration of surface water from the Salinas River and tributary channels originating in the Sierra de Salinas and Gabilan Range
- Deep percolation of excess applied irrigation water
- Deep percolation of infiltrating precipitation
- Subsurface inflow from the adjacent Subbasins

The first three mechanisms of recharge are dependent on the absence of the Salinas Valley Aquitard to allow for hydrologic connection from the surface to the principal aquifers. Infiltration of surface water and deep percolation of precipitation are both surficial sources of natural groundwater recharge. An area's capacity for surficial groundwater recharge is dependent on a combination of factors, including steepness of grade, soil surface conditions such as paving or compaction, and ability of soil to transmit water past the root zone. To assist agricultural communities in California with assessing groundwater recharge potential, a consortium of researchers at University of California Davis developed a Soil Agricultural Groundwater Banking Index (SAGBI) and generated maps of recharge potential in agricultural areas of California (O'Geen, *et al.*, 2015). Figure 4-10 presents the SAGBI index map for the 180/400-Foot Aquifer Subbasin. This map ranks soil suitability for groundwater recharge based on 5 major factors including: deep percolation, root zone residence time, topography, chemical limitations, and soil surface condition. Areas with excellent recharge properties are shown in green. Areas with poor recharge properties are shown in red. Not all land is classified, but this map provides helpful guidance on where natural recharge likely occurs.

Areas with the highest potential for recharge are along the Salinas River. Although Figure 4-10 shows these areas of good potential recharge in the 180/400-Foot Aquifer Subbasin, recharge to the principal aquifers of the Subbasin is very limited because of the low permeability Salinas Valley Aquitard. It is likely that only limited surficial recharge in the 180/400-Foot Aquifer Subbasin reaches the productive 180-Foot Aquifer or the 400-Foot Aquifer. This demonstrates the limited utility of potential recharge maps that are based on soil properties. This map should not be used as the sole data source for identifying recharge areas that will directly benefit the extensive principal aquifers in the 180/400-Foot Aquifer Subbasin.

Subsurface recharge is primarily from inflow from the adjacent Forebay Aquifer Subbasin to the south (DWR, 2004a). This inflow is estimated to be 21,000 acre-feet on an annual basis. Total natural recharge is estimated to be 117,000 acre-feet (DWR, 2004a).

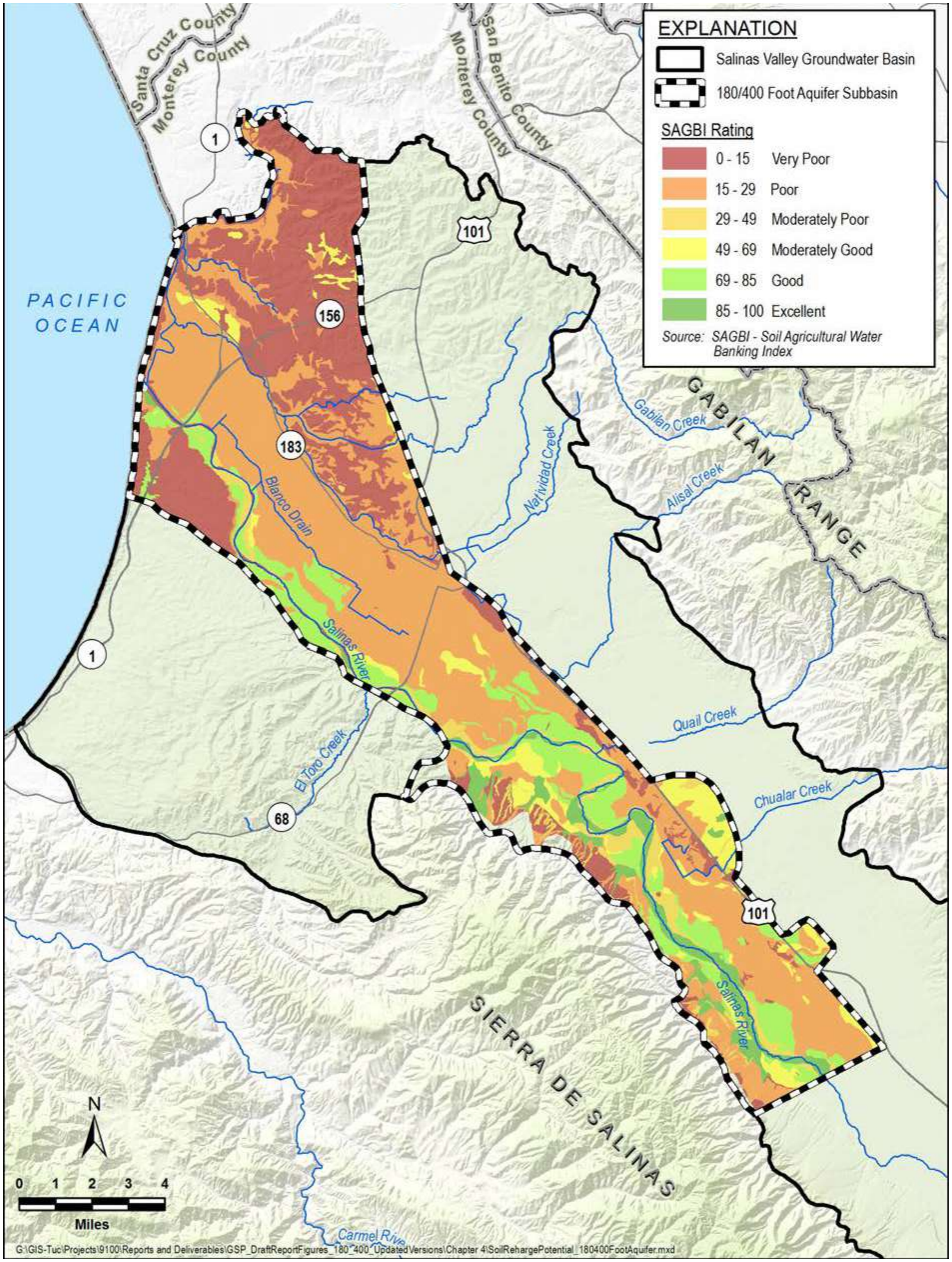


Figure 4-10. SAGBI Soils Map for the 180/400-Foot Aquifer Subbasin

4.4.5 Natural Discharge Areas

Natural discharge areas are areas where groundwater naturally leaves aquifers through flow to adjoining basins or percolation to the ground surface. Identifying areas of potentially significant natural discharge can inform water budgets and help locate important environmental uses of groundwater. Chapter 6 provides quantitative information about all natural and anthropogenic discharge.

Natural groundwater discharge areas within the Subbasin include wetlands and other surface water bodies that receive groundwater discharge to surface water bodies and evapotranspiration (ET) by vegetation types commonly associated with the sub-surface presence of groundwater. There are no springs and seeps in the Subbasin as identified in the National Hydrology Dataset (NHD). Natural groundwater discharge to streams–primarily, the Salinas River and its tributaries–has not been mapped to date.

4.4.5.1 Potential Interconnected Surface Water

Figure 4-11 shows locations of interconnected surface water, in the 180/400-Foot Aquifer Subbasin evaluated on a monthly basis over the entire model period from 1967 to 2017. This analysis also excludes the period from June to September assuming that the majority of flow in the river during these months is from conservation releases from the reservoirs. The blue cells indicate areas where surface water is connected to groundwater for more than 50% of the number of months in the model period and are designated as areas of interconnected surface water. The clear cells require further evaluation to determine whether the sustainable management criteria, discussed in Chapter 8, apply, because they represent areas that have interconnection less than 50% of the model period or are likely underlain by the Salinas Valley Aquitard and therefore surface water is disconnected from the principal aquifers. Interconnection between surface water and groundwater can vary both in time and space. Annual and seasonal analyses are currently under development. The gray cells show locations of canals, drains, or connectors and were excluded from the analysis. These ISW locations are based on simulated results from the preliminary SVIHM, which is calibrated to measured groundwater levels and streamflows. Although seepage along the ISW reaches is based on assumed channel and aquifer parameters as model inputs, the preliminary SVIHM is the best available tool to estimate ISW locations. The model construction and uncertainty are described in Chapter 6 of this GSP Update. This map does not show the extent of interconnection which will be estimated in Chapter 5. Interconnection between surface water and groundwater can vary both in time and space. A seasonal analysis is included in Appendix 4A. Figure 4-11 is based on provisional version of the SVIHM[1] and is subject to change.

[1] These data (model and/or model results) are preliminary or provisional and are subject to revision. This model and model results are being provided to meet the need for timely best science. The model has not received final approval by the U.S. Geological Survey (USGS). No warranty, expressed or implied, is made by the USGS or the U.S. Government as to the functionality of the model and related material nor shall the fact of release constitute any such warranty. The model is provided on the condition that neither the USGS nor the U.S. Government shall be held liable for any damages resulting from the authorized or unauthorized use of the model.

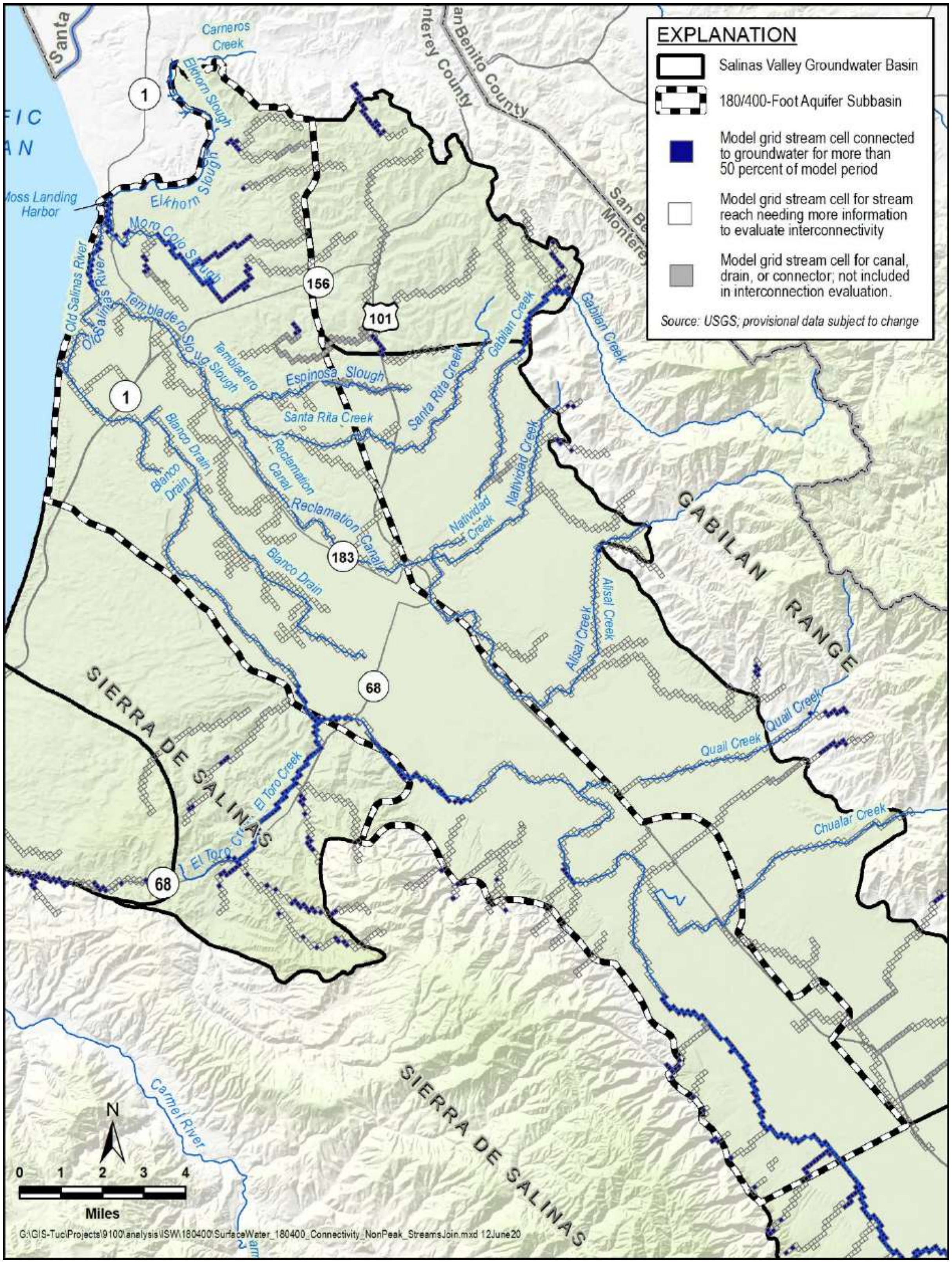


Figure 4-11. Locations of Interconnected Surface Water

4.4.5.2 Groundwater Dependent Ecosystems

GDEs refer to ecological communities or species that depend on groundwater emerging from aquifers or on groundwater occurring near the ground surface. Two main types of ecosystems are commonly associated with groundwater: wetlands associated with the surface expression of groundwater and vegetation that typically draws water from a shallow water table.

GDEs may provide critical habitat for threatened or endangered species. Areas designated as critical habitat for threatened or endangered species contain the physical or biological features that are essential to the conservation of these species, and may need special management or protection (USFWS, 2017). A list of threatened and endangered species that might rely on groundwater dependent ecosystems (GDEs) in the Subbasin was compiled using information from the U.S. Fish and Wildlife Service (USFWS), California Department of Fish and Wildlife (CDFW), and The Nature Conservancy (TNC). Several steps were taken to determine which threatened and endangered species were likely found in the Subbasin and of those, which were likely to rely on GDE habitat. A list of threatened and endangered species for Monterey County was downloaded from the USFWS website and cross-referenced to species identified in the CDFW California Natural Diversity Database. The threatened and endangered species for Monterey County was further cross-referenced with the TNC Critical Species LookBook to identify which species are likely to depend on groundwater, as indicated in Table 4-1.

Ten threatened and endangered species, including the Southern California Steelhead, and the California Red-legged Frog, were identified as likely to rely directly on groundwater in Monterey County, several of which may be found in the Subbasin. Ten species were identified as likely to rely indirectly on groundwater, and the remaining species are unknown with respect to whether they directly rely on GDEs or groundwater. All species listed have the potential for groundwater dependence. There are 8 species that appear in both the federal and state list for threatened or endangered species.

Table 4-1. Federal and State Listed Threatened and Endangered Species, and Respective Groundwater Dependence for Monterey County

Groundwater Dependence	Common Name	Federal Status	State Status
Direct	California black rail	-	Threatened
	California red-legged frog	Threatened	-
	California Ridgway's rail	Endangered	Endangered
	longfin smelt	-	Threatened
	Santa Cruz long-toed salamander	Endangered	Endangered
	steelhead - central California coast DPS	Threatened	-
	steelhead - south-central California coast DPS	Threatened	-
	Tidewater Goby	Endangered	-
	tricolored blackbird	-	Threatened
Direct and Indirect	arroyo toad	Endangered	-
Indirect	bald eagle	-	Endangered
	bank swallow	-	Threatened
	Belding's savannah sparrow	-	Endangered
	California condor	Endangered	Endangered
	California least tern	Endangered	Endangered
	least Bell's vireo	Endangered	Endangered
	southwestern willow flycatcher	Endangered	Endangered
	Swainson's hawk	-	Threatened
	willow flycatcher	-	Endangered
Unknown	Bay checkerspot butterfly	Threatened	-
	California tiger salamander	Threatened	Threatened
	foothill yellow-legged frog	-	Endangered
	San Joaquin kit fox	Endangered	Threatened
	short-tailed albatross	Endangered	-
	Smith's blue butterfly	Endangered	-
	vernal pool fairy shrimp	Threatened	-

The areas in the 180/400-Foot Aquifer Subbasin where GDEs may be found are mainly along the Salinas River, and in tributary canyons and washes where shallow alluvium is present. The shallow alluvium along the Salinas River may be saturated, but more investigation is needed to determine potential locations of a continuous saturated zone that connects to the principal aquifers. Moreover, the presence of the Salinas Valley Aquitard likely prevents connection of GDEs to the principal aquifer throughout much of the 180/400-Foot Aquifer Subbasin, except in areas where the Salinas Valley Aquitard is discontinuous or not present. For a more refined analysis of the connection of surface water to the principal aquifer below, a more detailed analysis of the near surface stratigraphy is needed, along with the extent and continuity of the Salinas Valley Aquitard.

Figure 4-12 shows the distribution of potential GDEs within the Subbasin based on the Natural Communities Commonly Associated with Groundwater (NCCAG) Dataset. However, vegetation above the Salinas Valley Aquitard are likely not connected to the principal aquifers, and therefore are not groundwater dependent. The NCCAG dataset maps vegetation, wetlands, springs, and seeps in California that are commonly associated with groundwater. These include: 1) wetland features commonly associated with the surface expression of groundwater under natural, unmodified conditions; and 2) phreatophytes. This map does not account for the depth to groundwater or level of interconnection between surface water and groundwater.

The NCCAG dataset and the additional shallow groundwater analysis are not a determination of GDEs by DWR or SVBGSA, but rather represent the best available data to provide a starting point for this GSP Update, as well as to direct monitoring, fill data gaps, guide implementation, and support other field activities initiated or partnered by the SVBGSA. Field data are needed to ascertain the degree to which identified ecosystems are groundwater dependent, rather than sustained by soil moisture. This field data will be gathered during GSP implementation through collaborative field studies and then added here for other GSP updates.

Additional resources that contributed to an initial mapping of GDE locations are the CDFW Vegetation Classification and Mapping program (VegCAMP), the USFWS National Wetlands Inventory, and the USFWS online mapping tool for listed species critical habitat, as described in the methodology for the NCCAG development which is publicly accessible on the NC dataset website: https://gis.water.ca.gov/app/NCDatasetViewer/.

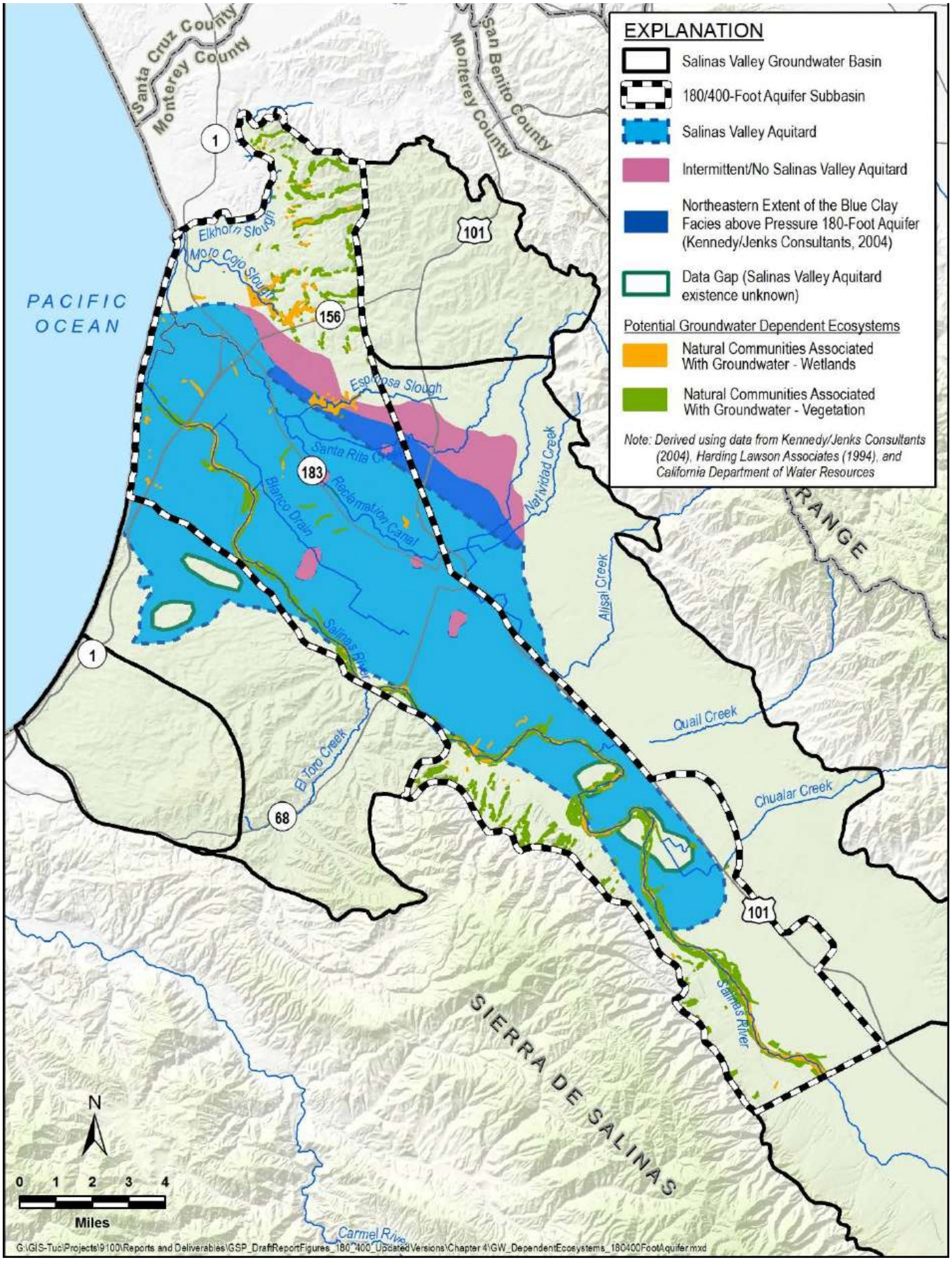


Figure 4-12. Natural Communities Associated with Groundwater

4.5 Surface Water Bodies

The primary surface water body in the Subbasin is the Salinas River. This river runs the entire length of the Subbasin and is fed by local tributaries (Figure 4-13). The following surface water bodies and river are located outside of the Subbasin but are important controls on the rate and timing of Salinas River flows into the Subbasin:

- Two reservoirs constructed to control flooding and to increase recharge from Salinas River are located outside of the Subbasin, but are important controls on the rate and timing of Salinas River flows in the Subbasin:
    - Nacimiento Reservoir, in San Luis Obispo County, was constructed in 1957 and has a storage capacity of 377,900 AF (MCWRA, 2015).
    - San Antonio Reservoir, in Monterey County, was constructed in 1967 and has a storage capacity of 335,000 AF (MCWRA, 2015).
- Arroyo Seco, a tributary with a 275 square mile drainage area that has no dams in its drainage basin and is characterized by both very high flood flows and extended dry periods.

Agricultural diversions and the construction of dams on the Salinas River and its tributaries have altered the river’s hydrology, and the river no longer exhibits the seasonal variation in flows that were observed before the mid-20th century. The restoration of natural flows to the Salinas River is not within the scope of this GSP.

Within the Subbasin, two constructed canals convey surface water across the valley floor, as shown on Figure 4-13. Reclamation Ditch #1665 (Rec Ditch) was originally constructed in 1917 and is operated in part by MCWRA for flood management. The ditch flows southeast to northwest and drains the stormwater detention from Smith Lake and Carr Lake before flowing northwest towards Castroville, discharging into Tembladero Slough, and then flowing into the Old Salinas River Channel and ultimately into Moss Landing Harbor. The Blanco Drain, also known as Storm Maintenance District No. 2, is a drainage system that covers approximately 6,400 acres of farmland, predominately receiving agricultural return flow from tile drains in the dry season and stormwater runoff in the wet season. The Blanco Drain discharges into the Salinas River.

The mouth of the Salinas River forms a lagoon; and its outflow to Monterey Bay is blocked by sand dunes except during winter high-water flows. MCWRA operates a slide-gate to transfer water through a culvert from the lagoon into Old Salinas River during the wet season for flood control (MCWRA, 2014). The Old Salinas River discharges through tide gates at Potrero Road into Moss Landing Harbor and ultimately the Monterey Bay.

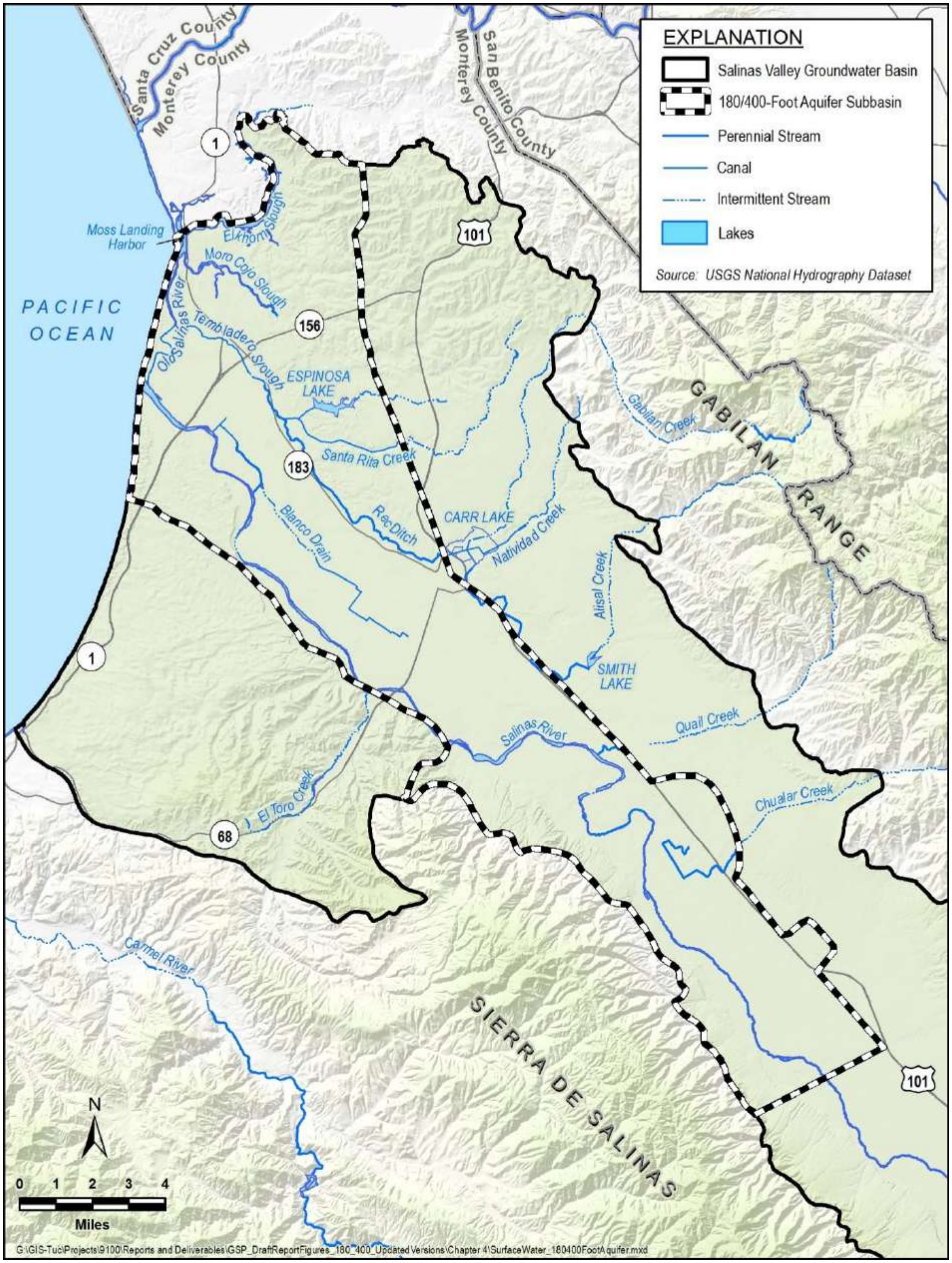


Figure 4-13. Surface Water Bodies in the 180/400-Foot Aquifer Subbasin

4.5.1 Watersheds

Figure 4-14 shows several watersheds that contribute small tributary streams to the Salinas River in the 180/400-Foot Aquifer Subbasin. From the boundary with the Forebay Subbasin to the Pacific Ocean from the Eastside Subbasin to the Sierra de Salinas and the Monterey Subbasin, the HUC12 watersheds within the 180/400-Foot Aquifer Subbasin are as follows:

- Limekiln Creek-Salinas River
- Johnson Creek
- Chualar Creek
- 180600051507-Salinas River
- El Toro Creek
- Quail Creek
- Alisal Creek-Salinas River
- Monterey Bay
- Natividad Creek-Gabilan Creek
- Alisal Slough-Tembladero Slough
- Elkhorn Slough

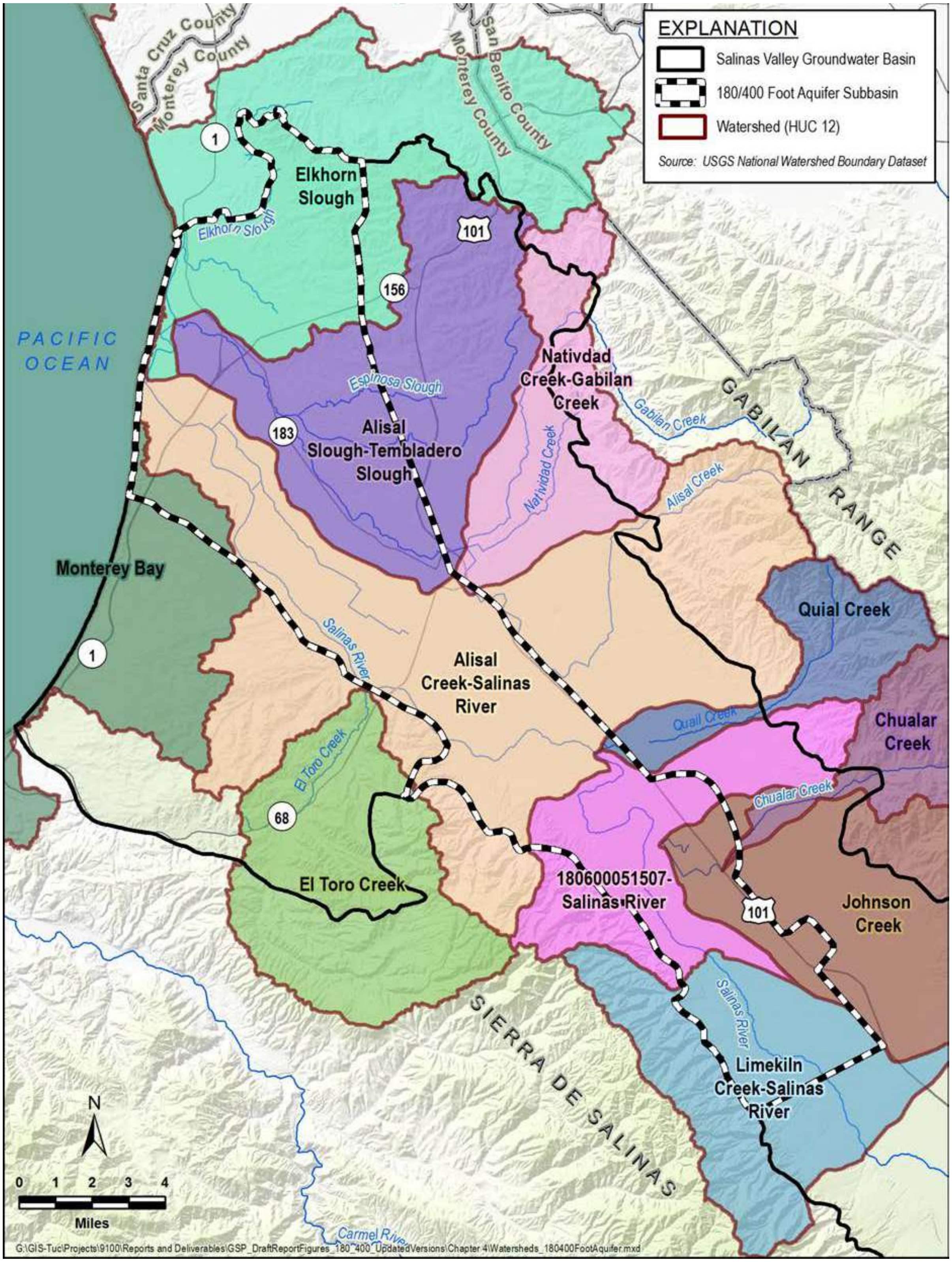


Figure 4-14. HUC12 Watersheds within the 180/400-Foot Aquifer Subbasin

4.5.2 Imported Water Supplies

There is no water imported into the 180/400-Foot Aquifer Subbasin from outside the Salinas River watershed.

4.6 Water Quality

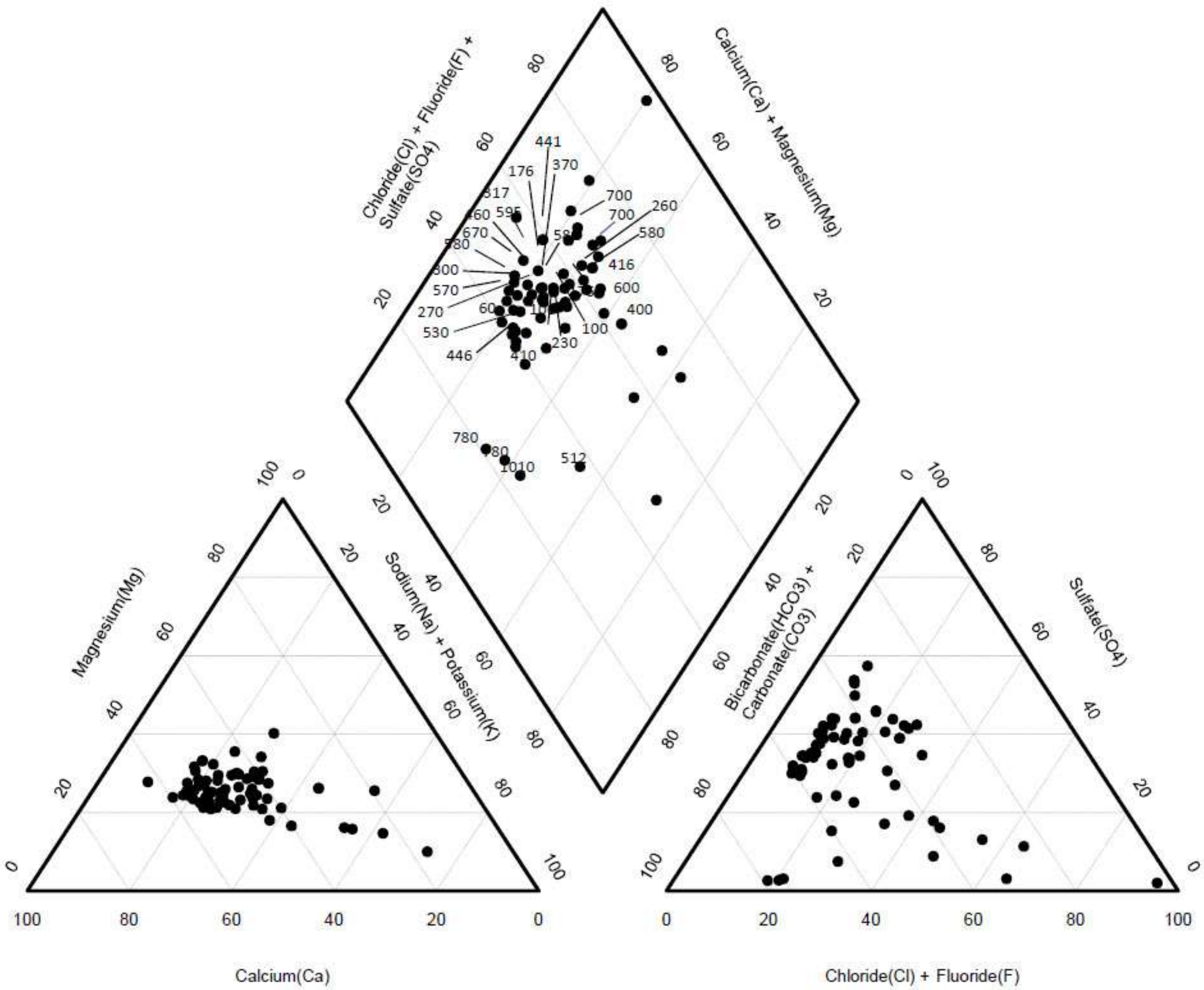
Natural groundwater quality can determine how much treatment may be needed prior to being used for municipal uses, or how the water may impact crop production. This chapter presents a general discussion of the natural groundwater quality in the Subbasin, focusing on general minerals. This discussion is based on data from previous reports. Discussion of the distribution and concentrations of specific constituents of concern (COC) is presented in Chapter 5.

4.6.1 General Mineral Chemistry

The major ion chemistry of the Salinas Valley Groundwater Basin groundwater is summarized on the *Distribution of Groundwater Nitrate Concentrations, Salinas Valley, California* report, prepared for the Central Coast Groundwater Coalition (CCGC) (HydroFocus, 2014). This report was a response to the Central Coast Regional Water Quality Control Board (CCRWQCB) requirement for monitoring elevated nitrate concentrations near drinking water supply wells. The report included the results of extensive groundwater quality sampling and thus provided a good characterization of the Subbasin's general mineral water quality.

General water chemistry provides a baseline of understanding of the water by showing major ions that are dissolved in the groundwater. The major ions that are dissolved can inform users if the water is more alkaline or more acidic. In many areas with more alkaline water, which has more dissolved cations such as calcium, magnesium, and sodium, many users report their water as being 'hard'.

Figure 4-15 presents a piper diagram from the CCGC report that plots major ion data from within and near the Subbasin. The diagram provides a means of representing the proportions of major anions and cations in water samples. The lower left triangle of the piper diagram plots the relative abundance of cations in groundwater samples. The lower right triangle of the piper diagram plots the relative abundance of anions in groundwater samples. The diamond in the middle of the diagram combines the cation and anion abundances into a single plot. Groundwater samples with similar general mineral chemistries will group together on these diagrams. The data plotted on Figure 4-15 show that most groundwater samples are of a similar type and plot in a single cluster. The samples are generally of a magnesium bicarbonate type, which is a more alkaline type of water. However, there are outlier samples that are higher in sodium and potassium than the other samples and are most noticeable in the dots that plot in the middle and right portions of the cation triangle. Piper diagrams do not provide spatial information about groundwater samples, and therefore it is difficult to assess the source of the sodium and/or potassium in the outlier samples.



Note: Well depths indicated when available.

Figure 4-15. Piper Diagram of 180/400-Foot Aquifer Subbasin Representing Major Anions and Cations in Water Samples (Source: CCGC, 2015)

4.6.2 Seawater intrusion

Groundwater pumping has lowered groundwater elevations to a point that allows seawater to flow into the Subbasin from the Monterey Bay. Increased salt concentrations from seawater intrusion, measured as TDS or chloride concentration, are considered a nuisance for domestic or municipal uses rather than a health or toxicity concern. Additionally, increased salt concentrations from seawater intrusion may impact the ability to use groundwater for irrigation.

The impact of seawater intrusion on the beneficial uses of groundwater occurs at concentrations much lower than that of seawater. The TDS of seawater is approximately 35,000 mg/L. The State of California has adopted a recommended Secondary Maximum Contaminant Level (SMCL) for TDS of 500 mg/L, and a short term maximum SMCL of 1,500 mg/L. Groundwater with total dissolved solids of 3,000 mg/L or less, however, is considered to be suitable, or potentially suitable, for beneficial uses in accordance with SWRCB Resolution No. 88-63 as adopted in its entirety in the Central Coast Regional Water Quality Control Board’s Basin Plan. The TDS limit for agricultural use is crop dependent: a 10% loss of yield in lettuce crops has been observed at a TDS of 750 mg/L; a 10% loss of yield in tomatoes has been observed at a TDS of 1,150 mg/L (Ayers and Westcot, 1985).

The current seawater intrusion conditions are described more fully in Chapter 5.

4.7 Data Gaps and Uncertainty of the HCM

Data gaps of the 180/400-Foot Aquifer Subbasin include:

- There are very few measurements of aquifer properties such as hydraulic conductivity and specific yield in the Subbasin, particularly to highlight the differences and connectivity between the principal aquifers.
- The hydrostratigraphy, vertical and horizontal extents, and potential recharge areas for the Deep Aquifers are poorly known.
- Areas of Salinas River recharge and discharge have not been mapped.

These data gaps have led to some minor uncertainties in how the principal aquifers function, and the SVBGSA will minimize these uncertainties by filling data gaps. As described in Chapter 7, the GSP Update will include ongoing data collection and monitoring recommendations that will allow continued refinement and quantification of the groundwater system. Chapter 10 includes activities to address the identified data gaps and improve the HCM.

5 GROUNDWATER CONDITIONS

This chapter describes the historical and current groundwater conditions in the 180/400-Foot Aquifer Subbasin in accordance with the GSP Regulations § 354.16. In this GSP, current conditions are any conditions occurring after January 1, 2015. This GSP Update uses 2020 as the representative current year where possible, thus updating the 2017 data in the original GSP. By implication, historical conditions are any conditions occurring prior to January 1, 2015. The chapter focuses on information required by the GSP regulations, and information that is important for developing an effective plan to achieve sustainability. This chapter provides a description of current and historical groundwater conditions at a scale and level of detail appropriate for meeting the GSP sustainability requirements under SGMA.

This chapter is organized to align the groundwater conditions descriptions with the 6 sustainability indicators relevant to this subbasin, including:

3. Chronic lowering of groundwater levels
4. Changes in groundwater storage
5. Seawater intrusion
6. Subsidence
7. Groundwater quality
8. Depletion of interconnected surface waters

In addition, to meet the GSP Regulations § 356.4 assessment requirements for GSP amendments, this chapter includes a section on water use.

5.1 Groundwater Elevations

5.1.1 Data Sources

The assessment of groundwater elevation conditions is largely based on data collected by MCWRA from 1944 through the present. MCWRA's monitoring programs are described in Chapter 3.

Groundwater elevation data are analyzed and presented with three sets of graphics:

- Maps of groundwater elevation contours show the geographic distribution of groundwater elevations at a specific time. These contours represent the elevation of the groundwater in feet, using the NAVD88 vertical datum. The contour interval is 10 feet, meaning each blue line represents an area where groundwater elevations are either 10 feet higher or 10 feet lower than the next blue line (Figure 5-1 to Figure 5-8).

- Hydrographs of individual wells show the variations in groundwater elevations at individual wells over an extended period of time Figure 5-9).
- Vertical hydraulic gradients in a single location assess the potential for vertical groundwater flow and its direction, as discussed in Section 5.1.4.

5.1.2 Groundwater Elevation Contours and Horizontal Groundwater Gradients

MCWRA annually produces groundwater elevation contour maps for the Salinas Valley Groundwater Basin using data from their annual August trough and fall measurement programs. August groundwater elevations are contoured to assess the driving force of seawater intrusion because this is usually when the aquifers are the most stressed. MCWRA also contours fall groundwater elevations because these measurements are taken from mid-November to December after the end of the irrigation season and before seasonal recharge from winter precipitation increases groundwater levels. The August measurements represent seasonal low conditions in the Subbasin, and the fall measurements represent the seasonal high. In 1995, data collected in March were more representative of seasonal high groundwater elevations.

The following 8 maps present the Current (2019) and Historical (1995) groundwater elevation contours.

Table 5-1. Figures Showing Current and Historical Groundwater Elevation Contours

Figure #	Year	Season	Aquifer
Figure 5-1	Current (2019)	Fall	180-Foot
Figure 5-2	Current (2019)	August Trough	180-Foot
Figure 5-3	Current (2019)	Fall	400-Foot
Figure 5-4	Current (2019)	August Trough	400-Foot
Figure 5-7	Historical (1995)	Fall	180-Foot
Figure 5-8	Historical (1995)	August Trough	180-Foot
Figure 5-7	Historical (1995)	Fall	400-Foot
Figure 5-8	Historical (1995)	August Trough	400-Foot

The groundwater elevation contours only cover the portions of the basin monitored by MCWRA. Contours do not always extend to subbasin margins. Furthermore, MCWRA does not produce groundwater elevation maps of the Deep Aquifers. Insufficient data currently exist to map flow directions and groundwater elevations in the Deep Aquifers. These are data gaps that will be addressed during GSP implementation.

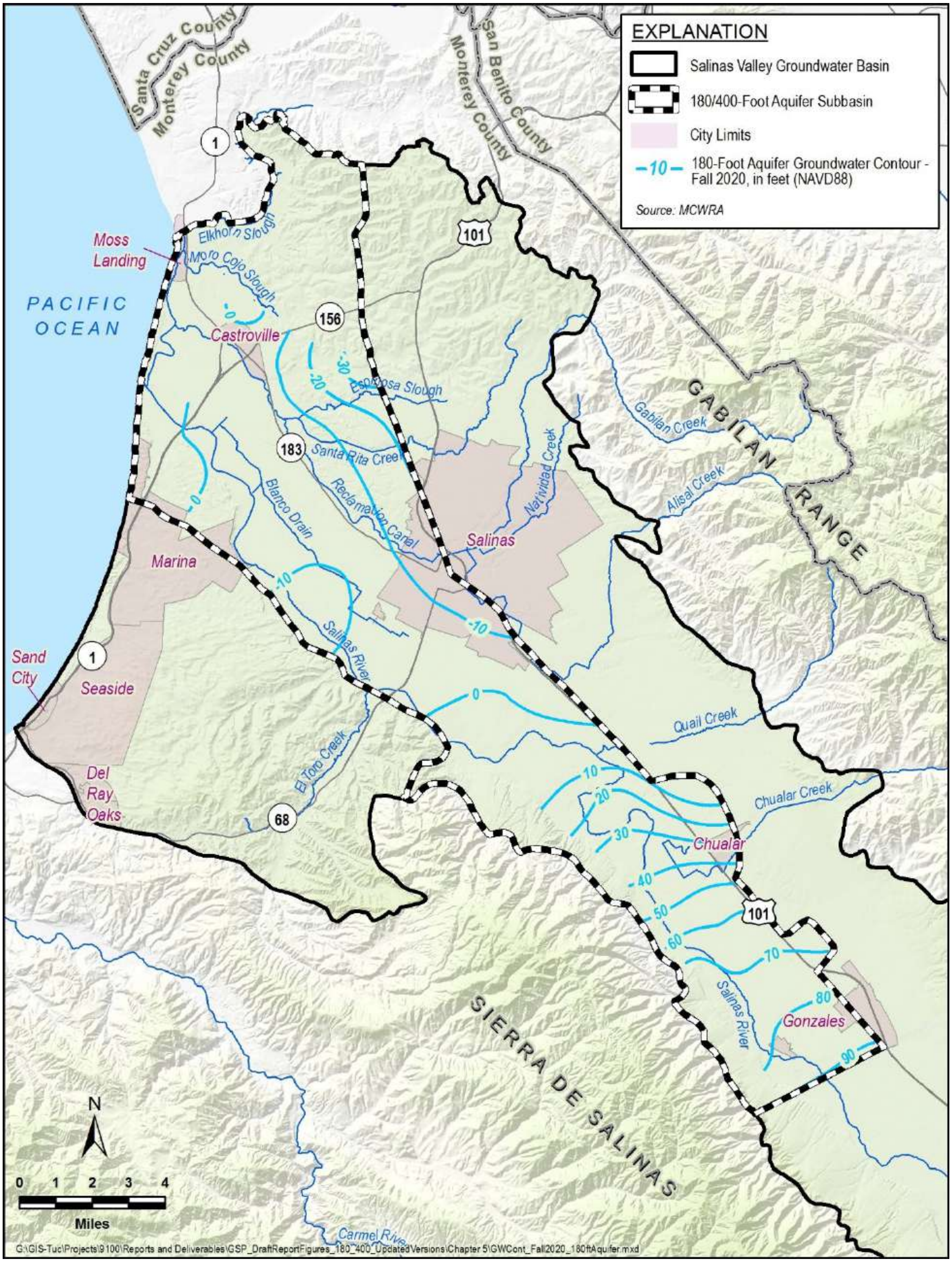


Figure 5-1. Fall 2020 180-Foot Aquifer Groundwater Elevation Contours

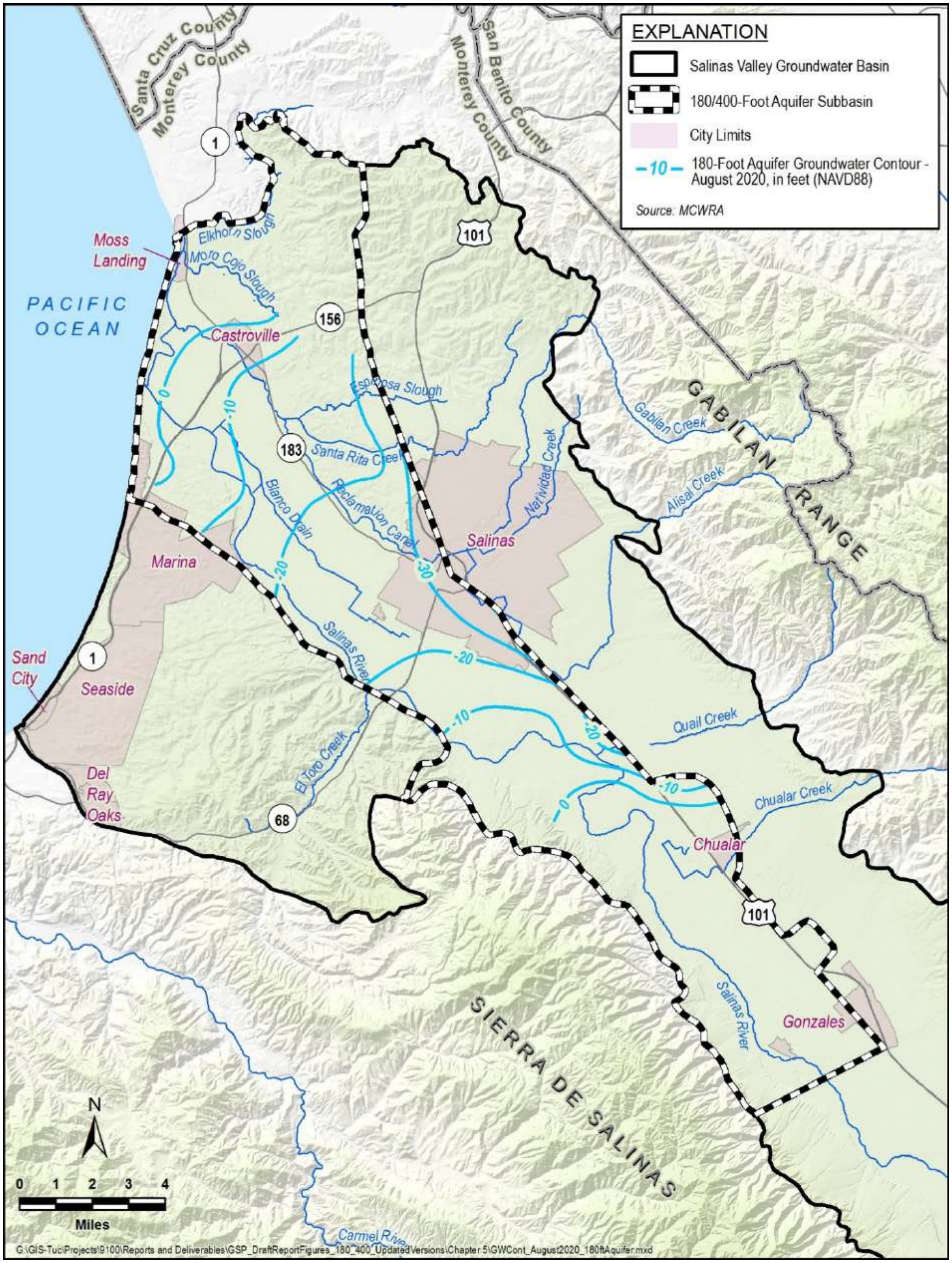


Figure 5-2. August 2020 180-Foot Aquifer Groundwater Elevation Contours

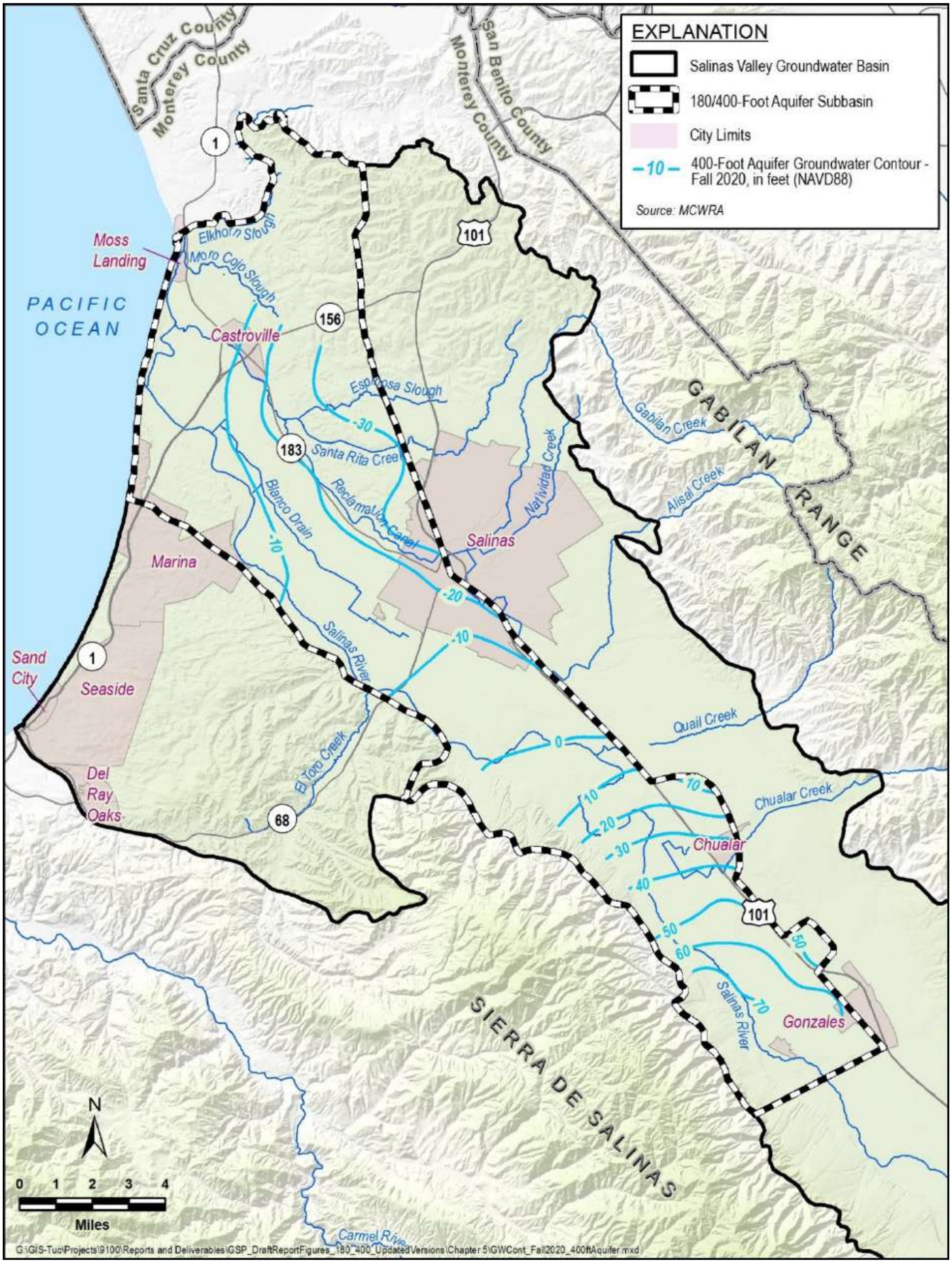


Figure 5-3. Fall 2020 400-Foot Aquifer Groundwater Elevation Contours

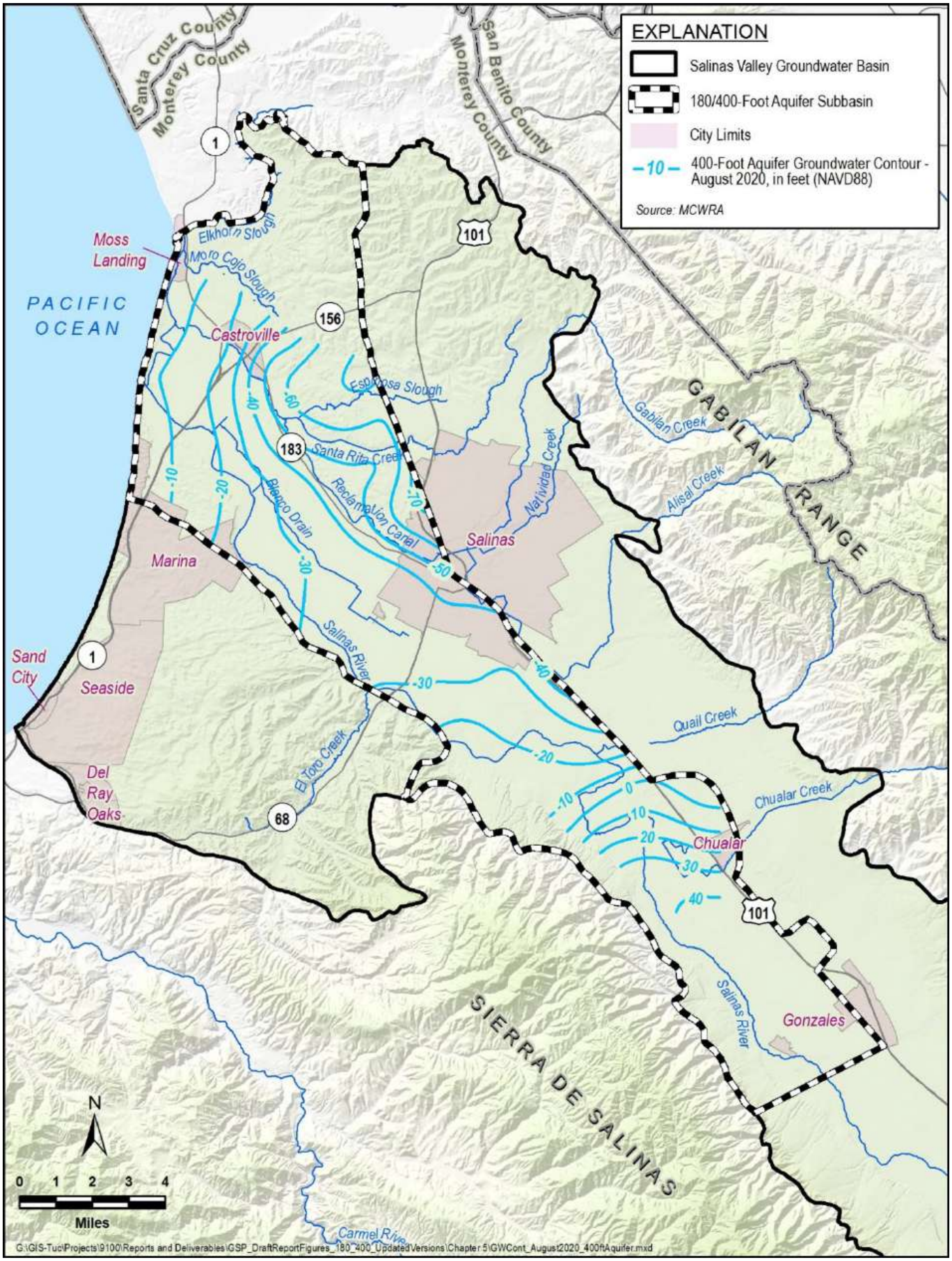


Figure 5-4. August 2020 400-Foot Aquifer Groundwater Elevation Contours

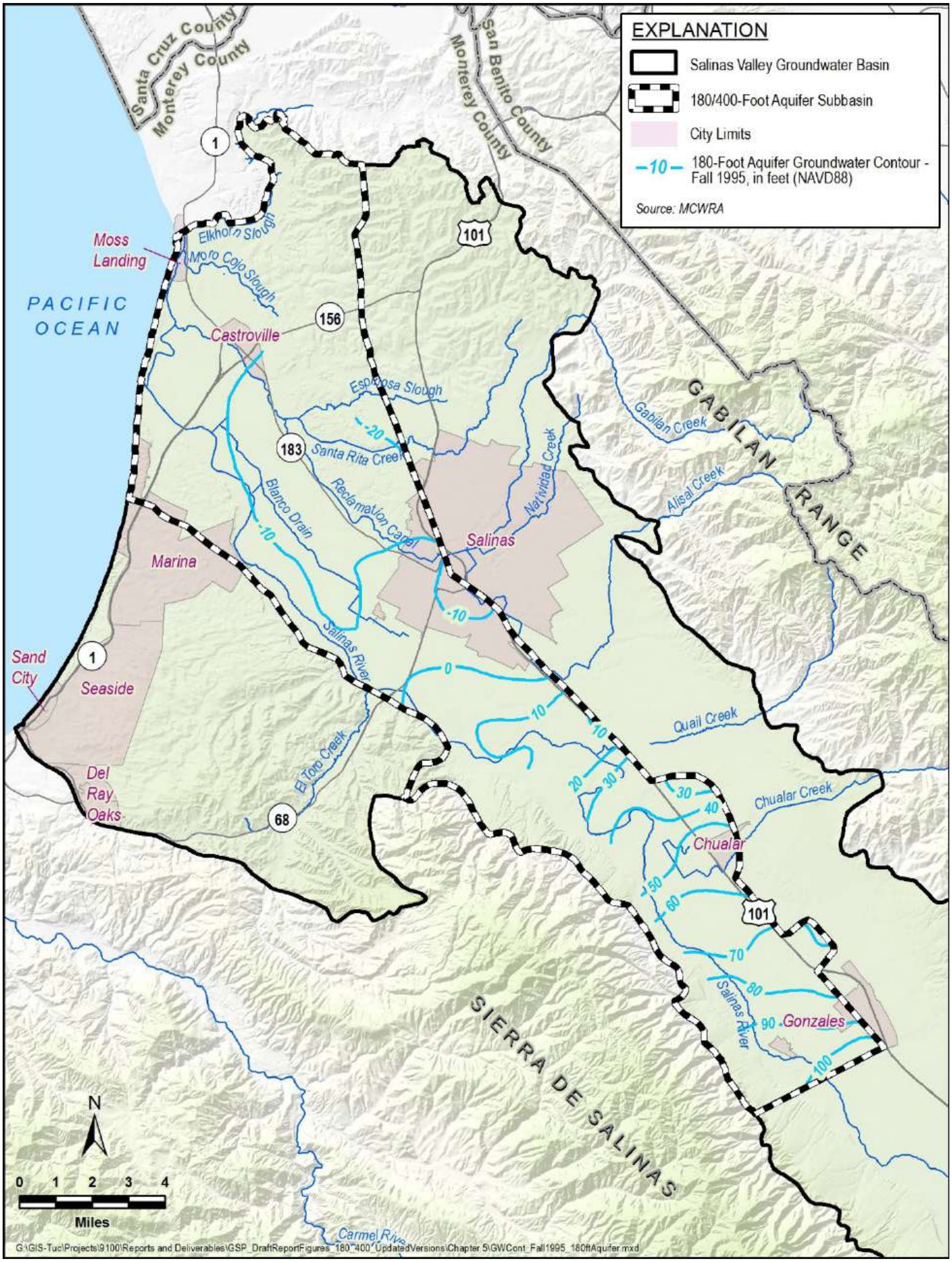


Figure 5-5. Fall 1995 180-Foot Aquifer Groundwater Elevation Contours

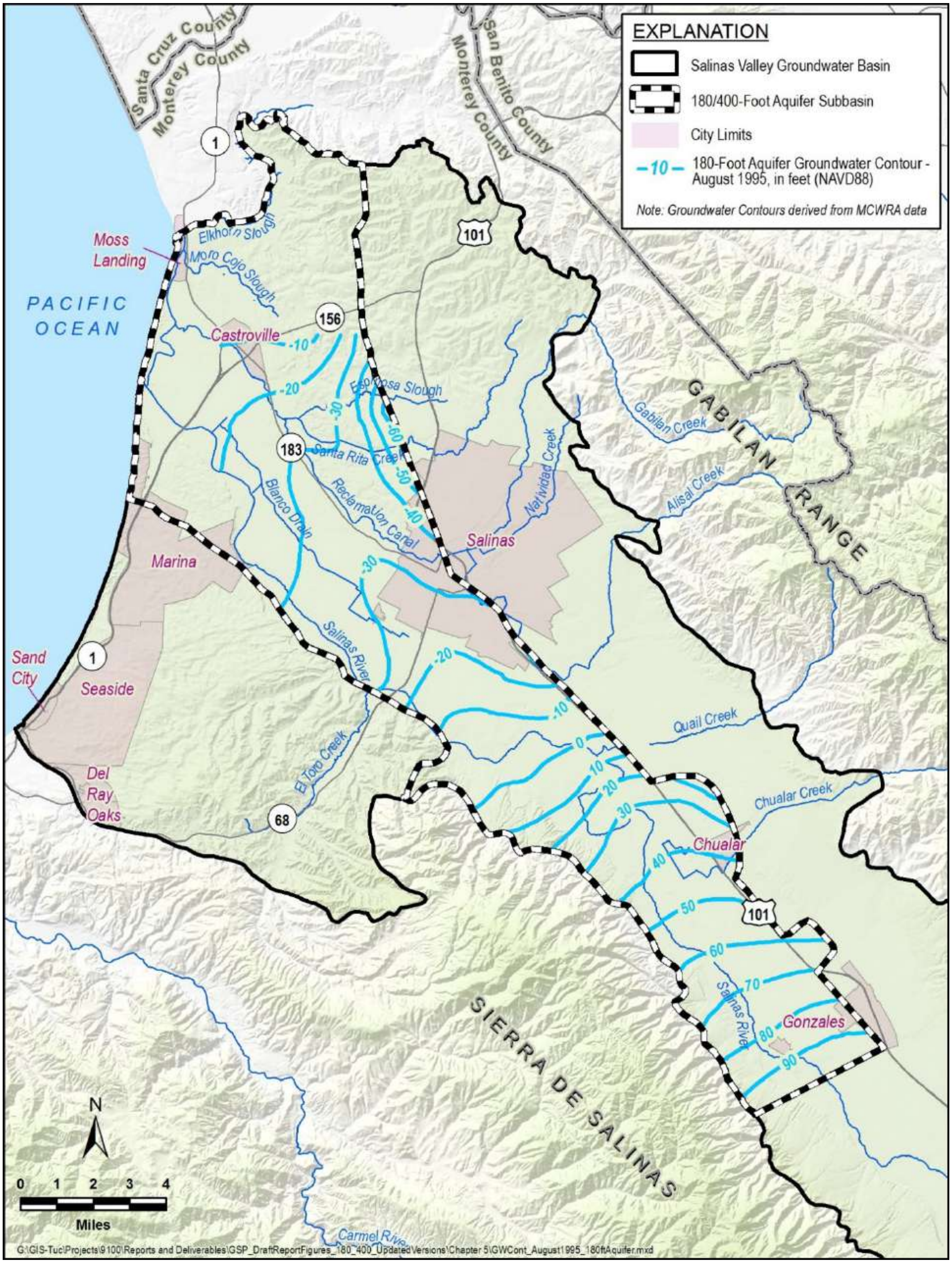


Figure 5-6. August 1995 180-Foot Aquifer Groundwater Elevation Contours

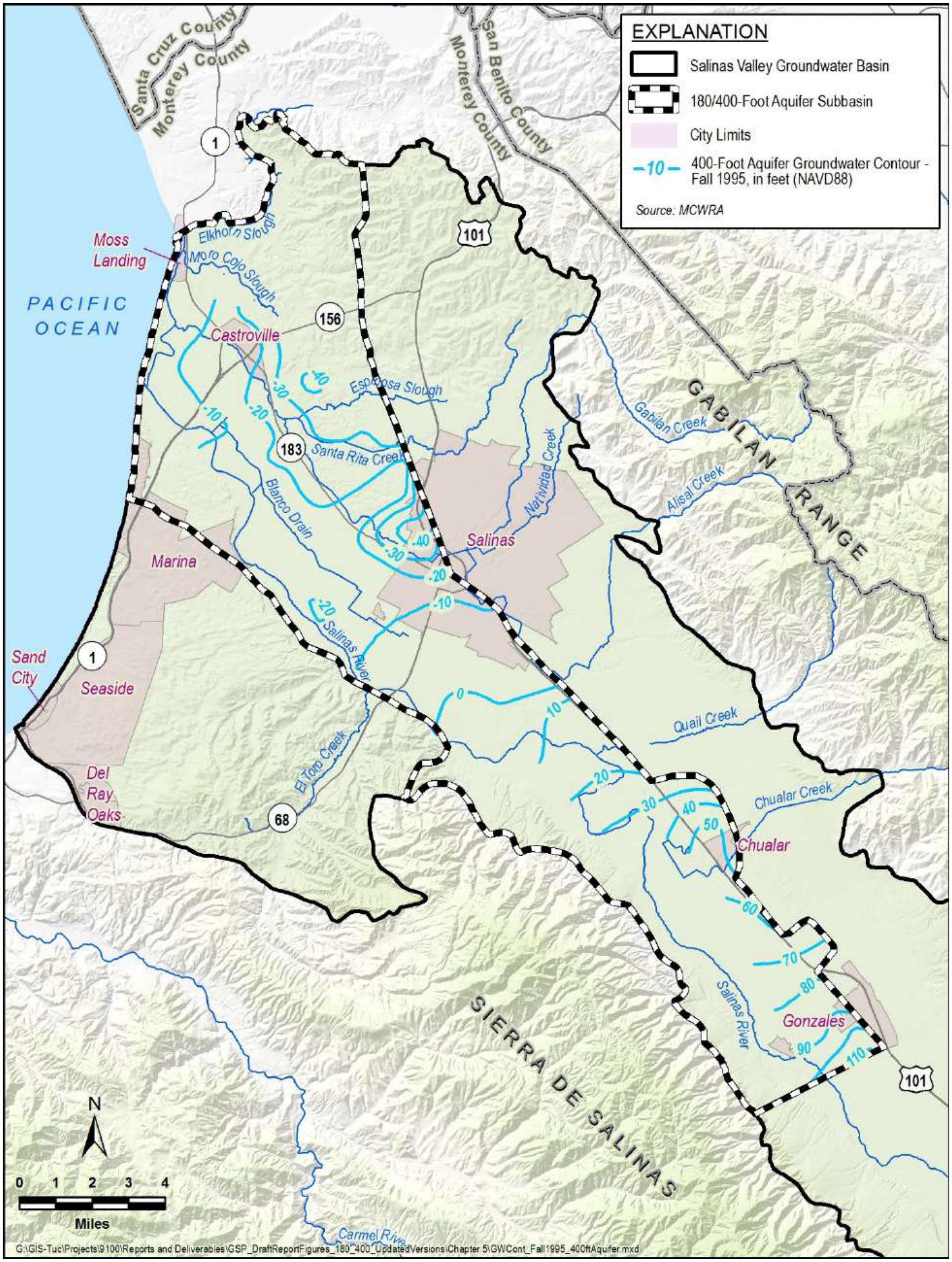


Figure 5-7. Fall 1995 400-Foot Aquifer Groundwater Elevation Contours

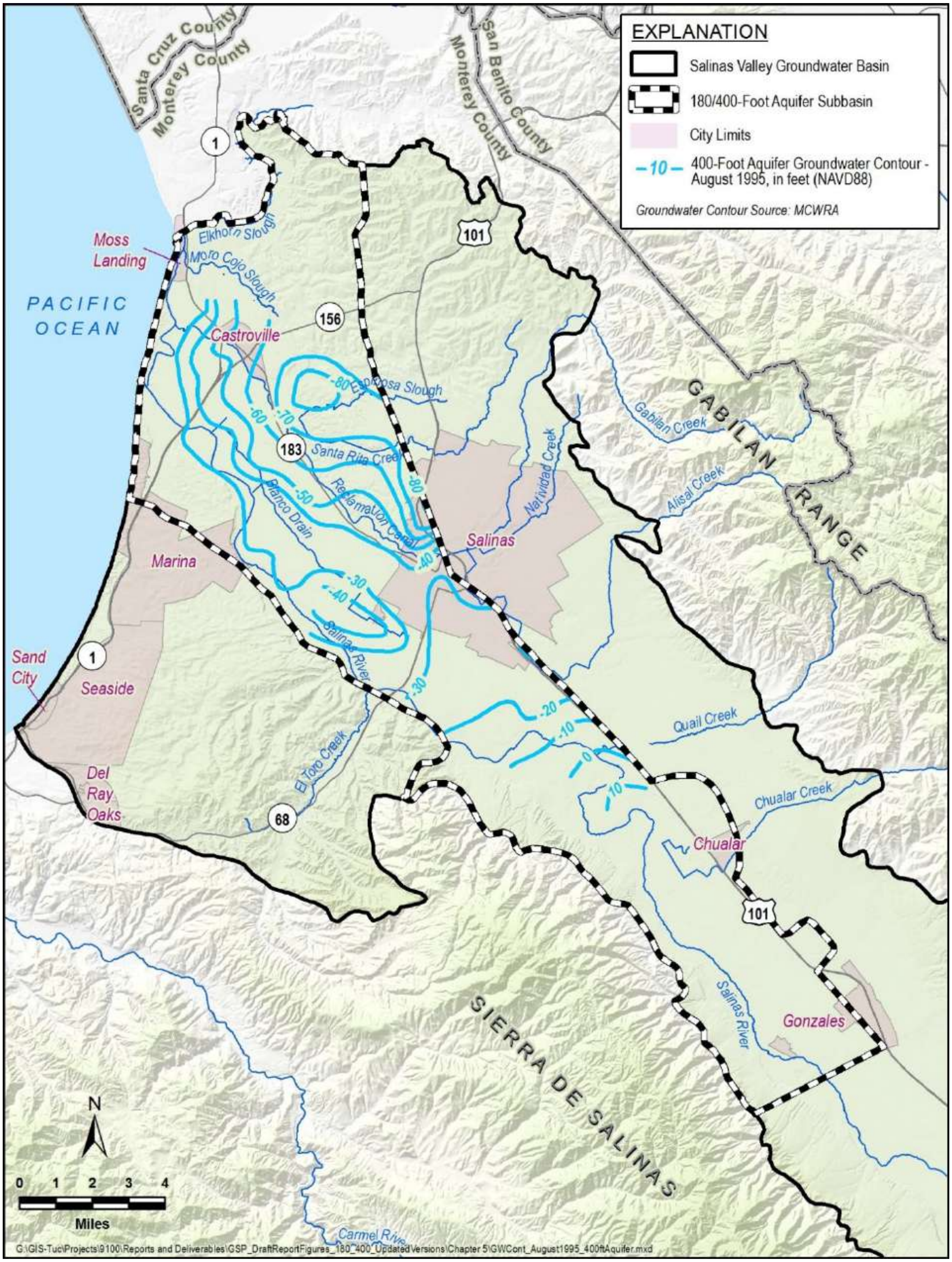


Figure 5-8. August 1995 400-Foot Aquifer Groundwater Elevation Contours

Groundwater generally flows from the south and from adjacent basins toward the north-northwest, with localized depressions around the pumping centers like those along the boundary with the Eastside Aquifer Subbasin northwest of the City of Salinas. The contours indicate that groundwater flow directions are similar in the 180-Foot and 400-Foot Aquifers. However, based on these contours, groundwater elevations in the 400-Foot Aquifer are generally lower than groundwater elevations in the 180-Foot Aquifer during both 1995 and 2019.

Under current conditions (Figure 5-1 to Figure 5-4), groundwater elevations in the northern half of the Subbasin are below sea level, estimated as zero feet NAVD88, as indicated by the negative values on the contour lines. The lowest groundwater elevations for both the 180-Foot and 400-Foot Aquifers occur northwest of the City of Salinas along the boundary with the Eastside Aquifer Subbasin. In the 180-Foot Aquifer, minimum groundwater elevations are approximately -30 ft NAVD88 during the fall measurements (Figure 5-1) and -40ft NAVD88 during the August measurements (Figure 5-2). In the 400-Foot Aquifer, minimum groundwater elevations are approximately -30 ft NAVD88 during the fall measurements (Figure 5-3) and -80 ft NAVD88 during the August measurements (Figure 5-4). The hydraulic gradients differ throughout the subbasin and are difficult to quantify based on variable groundwater elevations.

Groundwater elevations in the 180/400-Foot Aquifer Subbasin increase to the west toward the boundary with the Monterey Bay. They also increase toward the southern boundary with the Forebay Subbasin Aquifer where groundwater elevations are greater than 90 ft NAVD88 in the 180-Foot Aquifer (Figure 5-1 and Figure 5-2) and greater than 40 ft NAVD88 in the 400-Foot Aquifer (Figure 5-3 and Figure 5-4).

Under the historical conditions of 1995, a similar flow pattern to that of current conditions was present in both the 180-Foot and 400-Foot Aquifers; however, the magnitude of the pumping trough has varied over time. A discussion of historical groundwater elevation changes is presented in Section 5.1.3.

5.1.3 Hydrographs

Representative temporal trends in groundwater elevations can be assessed with hydrographs, which plot changes in groundwater elevations over time. Groundwater elevation data from wells within the Subbasin are available from monitoring conducted and reported by MCWRA.

Figure 5-9 depicts the locations and hydrographs of example monitoring wells in the Subbasin. Larger versions of the hydrographs for these wells, as well as all representative monitoring wells, are included in Appendix 5A. The locations of all the representative monitoring wells are shown on Figure 5-10 through Figure 5-12. Chapter 7 provides more information specific to the wells and the monitoring system.

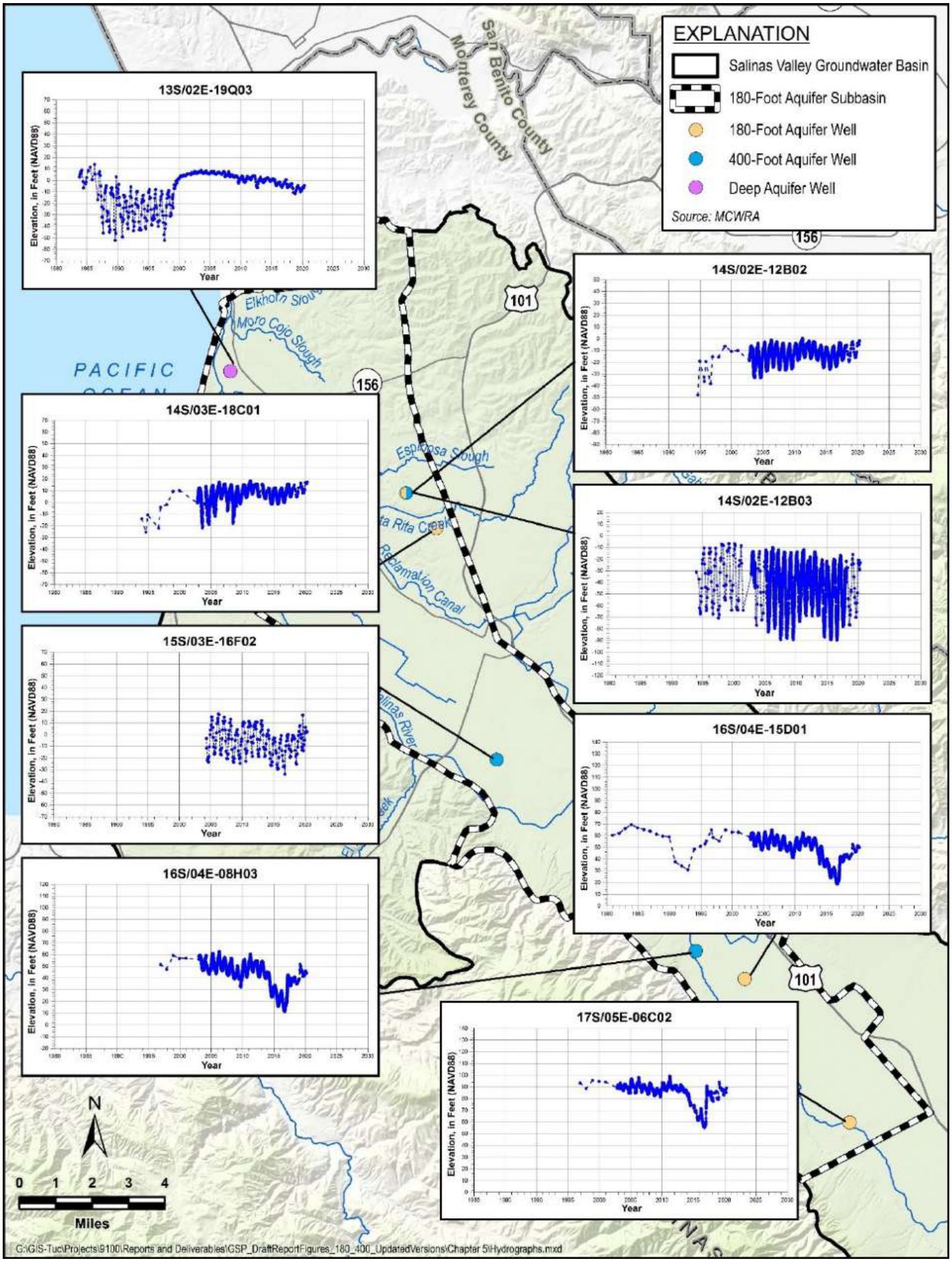


Figure 5-9. Map of Example Hydrographs

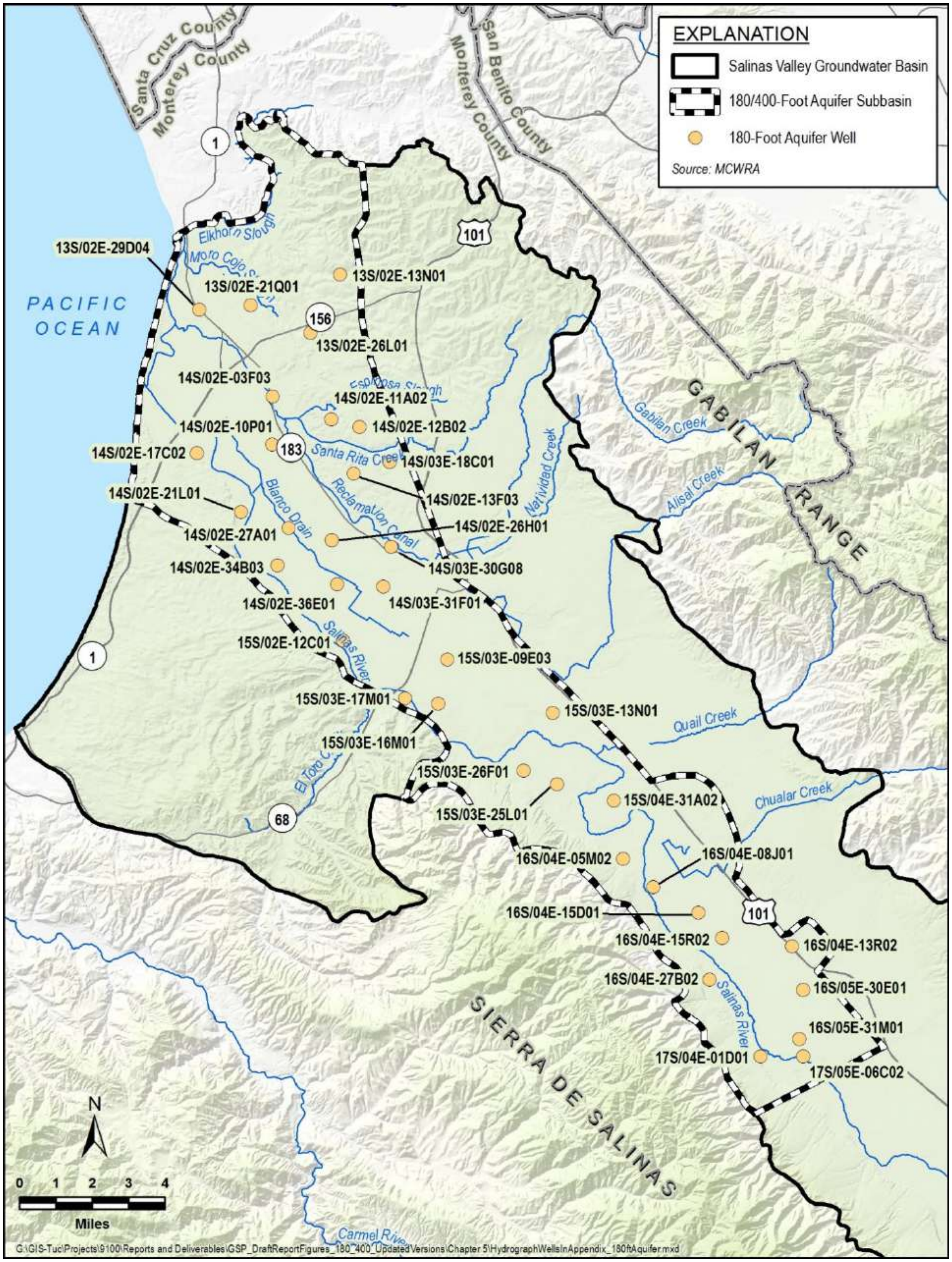


Figure 5-10. Locations of 180-Foot Aquifer Wells in the with Hydrographs Included in Appendix 5A

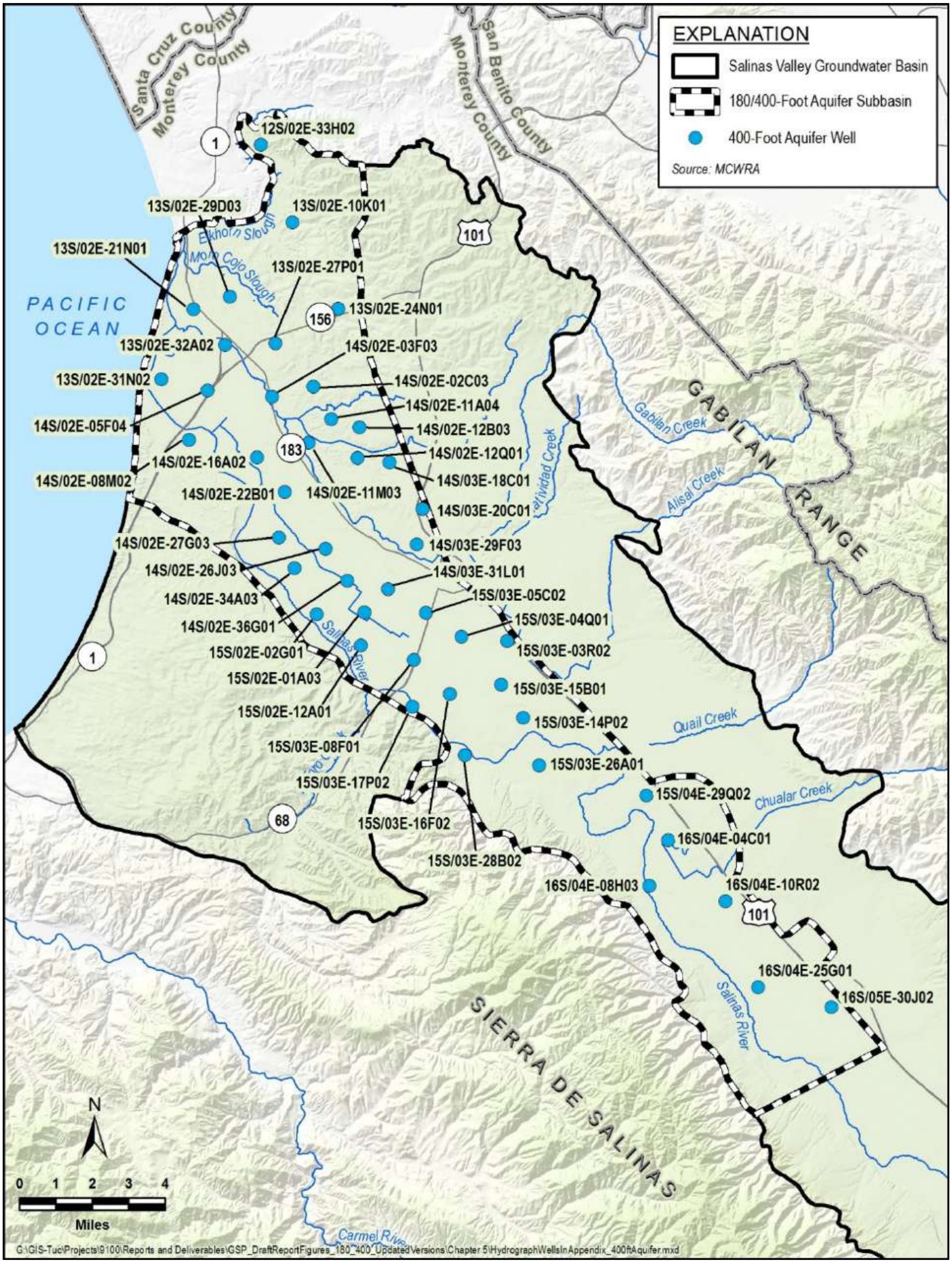


Figure 5-11. Locations of 400-Foot Aquifer Wells in the with Hydrographs Included in Appendix 5A

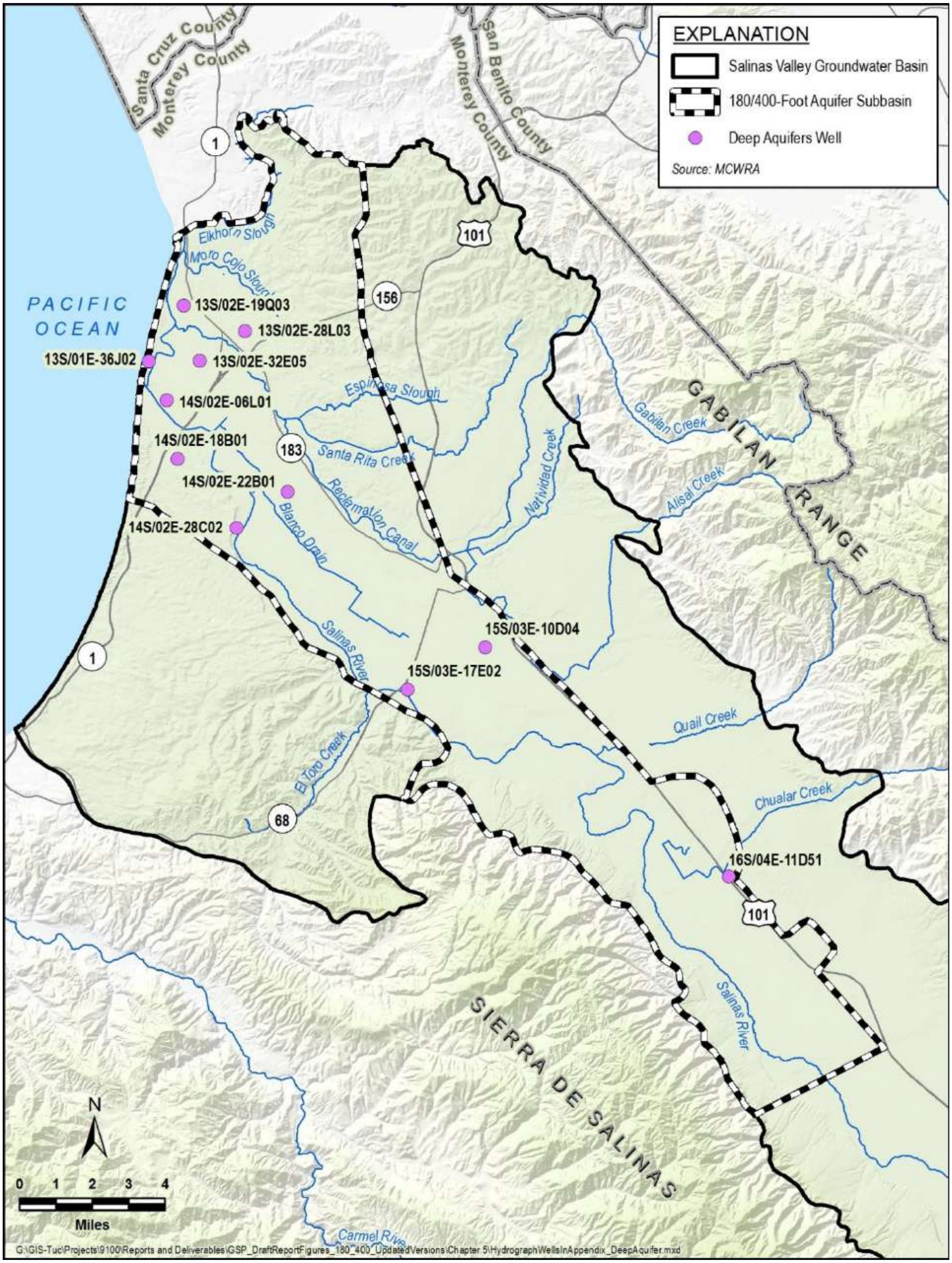


Figure 5-12. Locations of Deep Aquifers Wells in the with Hydrographs Included in Appendix 5A

Figure 5-14 presents a graph of cumulative groundwater elevation change for the 180/400-Foot Aquifer Subbasin. The graph was initially developed by MCWRA and is based on averaged change in fall groundwater elevations for designated wells in the Pressure subarea each year. The Pressure subarea used by MCWRA for its groundwater elevation change analyses overlaps the 180/400-Foot Subbasin, as well as small parts of the Eastside Aquifer Subbasin and most of the Monterey and Seaside Subbasins, as shown on Figure 5-15. The figure was adapted to reflect the cumulative change in groundwater elevations specific to the 180/400-Foot Aquifer Subbasin.

The cumulative change in groundwater elevation graph is developed by MCWRA and is based on averaged change in Fall groundwater elevations for designated wells in the subarea each year. MCWRA uses Fall groundwater elevations because these measurements are taken after the end of the irrigation season and before seasonal recharge from winter precipitation increases in groundwater levels. The cumulative groundwater elevation change plot is therefore an estimated average hydrograph for wells in the subarea. Although this plot does not reflect the groundwater elevation change at any specific location, it provides a general illustration of how the average groundwater elevation in the subarea changes in response to climatic cycles, groundwater extraction, and water-resources management at the subbasin scale.

The cumulative elevation change graph and the specific hydrographs presented in Appendix 5A show that groundwater elevations in the Subbasin show a long-term decline over time.

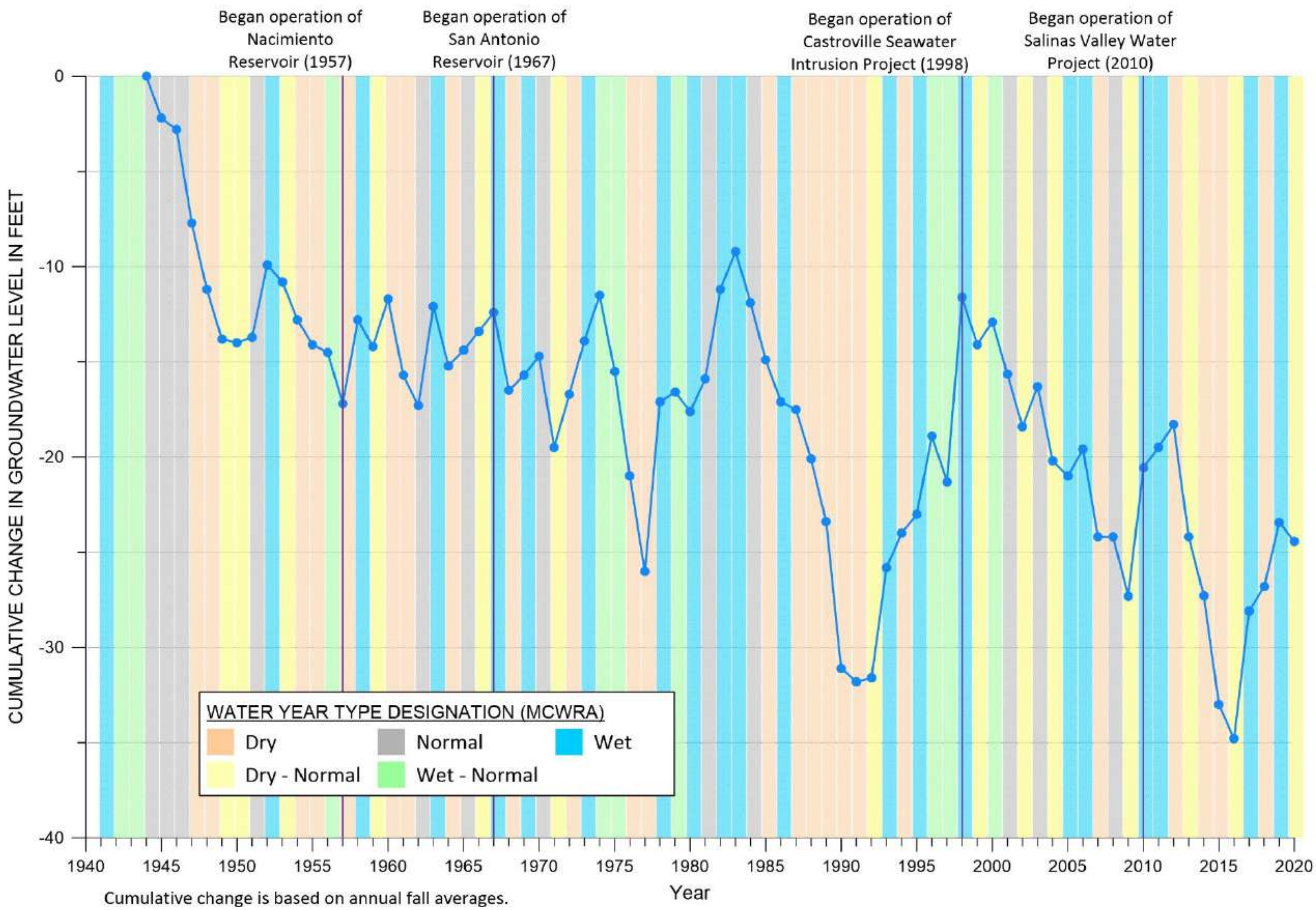


Figure 5-13. Cumulative Groundwater Elevation Change Graph for the 180/400-Foot Aquifer Subbasin
(Adapted from MCWRA, 2018a, personal communication)

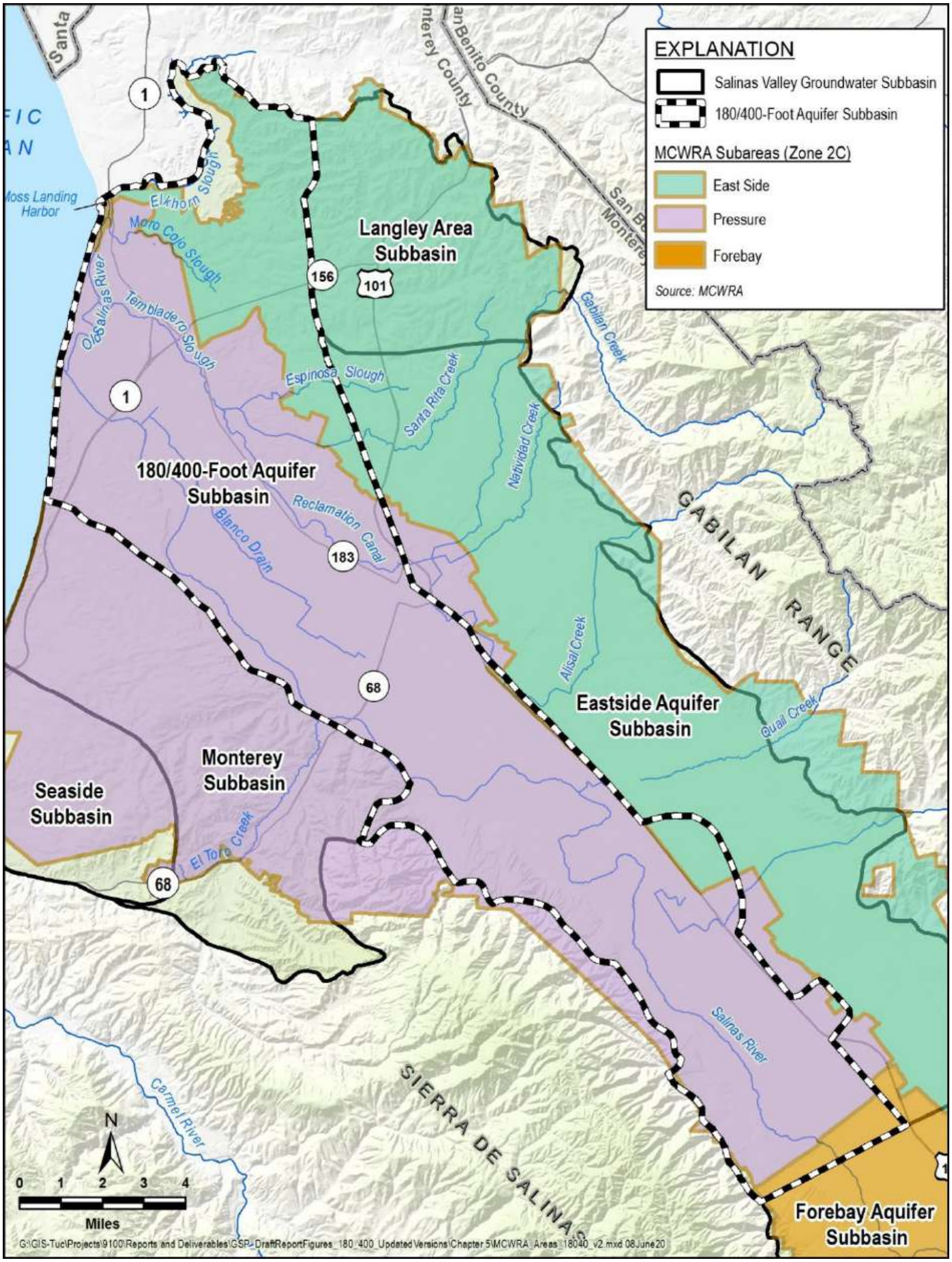


Figure 5-14. MCWRA Management Subareas

5.1.4 Vertical Groundwater Gradients

In the 180/400-Foot Aquifer Subbasin, the laterally extensive aquitards result in notable vertical hydraulic gradients: in some places groundwater elevations are approximately 20 to 50 feet lower in deeper wells than in shallower wells. Because the downward vertical gradients are caused by pumping, the magnitudes of the vertical gradients in many areas are greater during the irrigation season.

Figure 5-15 illustrates how vertical gradients at representative well pairs vary throughout the Subbasin. Each representative well pair consists of two adjacent wells with different well depths. The hydrographs for each well pair illustrate the difference in groundwater potentiometric elevation between wells of different depths at the same location. The two northernmost well pairs for the 180-Foot and 400-Foot Aquifers demonstrate similar fluctuating patterns between each well pair; however, groundwater elevations for the wells in the 180-Foot Aquifer are generally higher than those in the 400-Foot Aquifer. This likely indicates a lack of connection between the 180-Foot and 400-Foot Aquifers. On the contrary, the southern well pair for the 180-Foot and 400-Foot Aquifers does not demonstrate an appreciable difference in groundwater elevations which probably indicates a connection between the aquifers. There are not enough groundwater elevation records for wells in the Deep Aquifer to make a conclusion about the connection among the 180-Foot, 400-Foot, and Deep Aquifers.

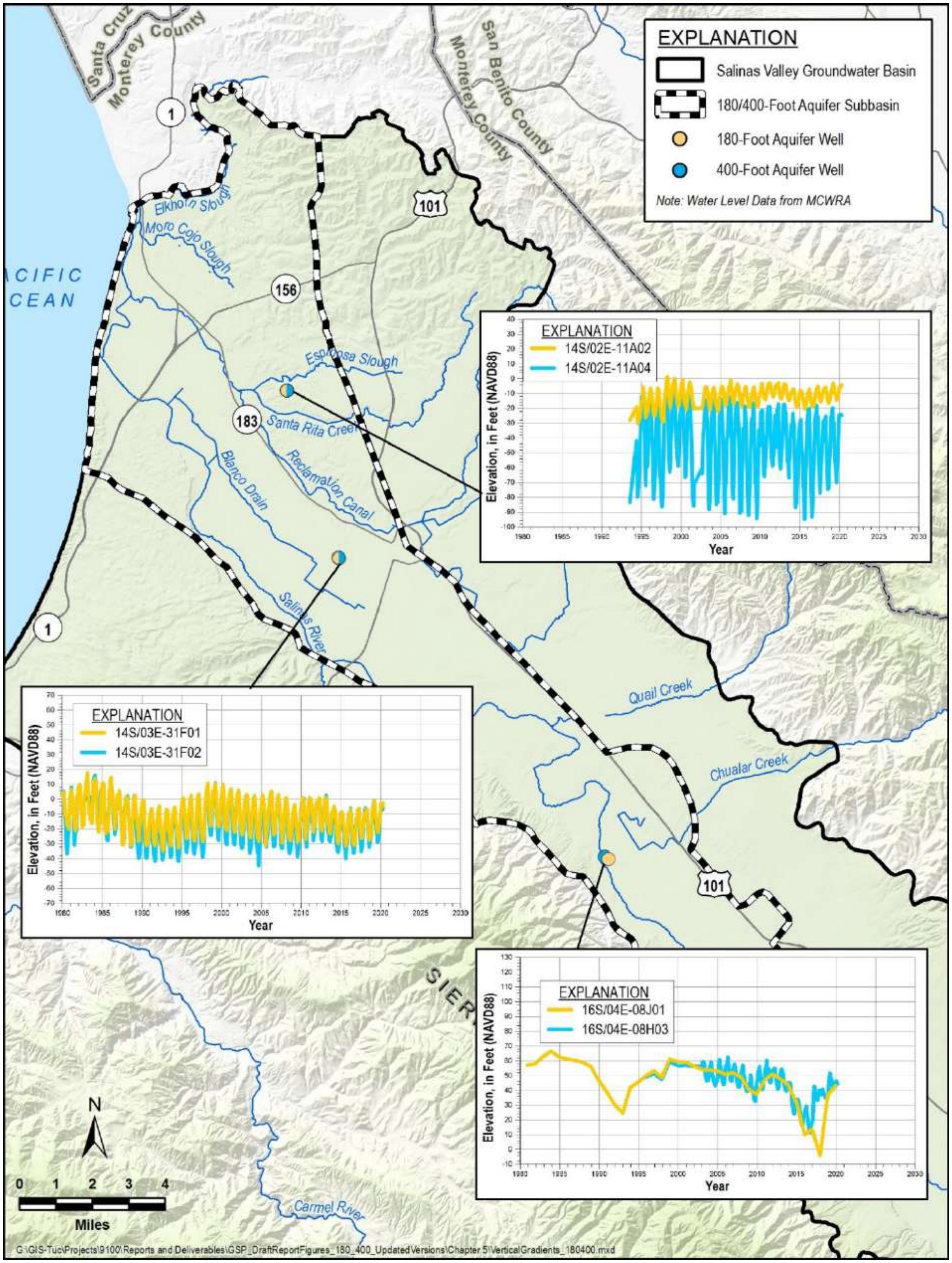


Figure 5-15. Vertical Gradients

5.2 Change in Groundwater Storage

Change in groundwater storage is calculated as the sum of the change in storage due to groundwater elevations outside of the seawater intruded area; and change in storage due to seawater intrusion within the seawater intruded area. This approach calculates the change in usable groundwater in storage rather than a change in total groundwater in storage. This is a common approach that best addresses the intent of SGMA.

Changes in groundwater elevations directly relate to fluctuation of groundwater storage; thus, the change in storage outside of the seawater intruded area is based on the change in groundwater elevations. As seawater intrusion advances inland, freshwater storage is decreased by the intruding seawater. Therefore, inside the seawater intruded area, the change in storage is the change in volume of seawater in the aquifer. To calculate the total change in storage in the Subbasin, the change in storage due to groundwater elevations and seawater intrusion need to be summed together.

5.2.1 Data Sources

Change in storage due to changes in groundwater elevation is developed based on MCWRA's fall groundwater elevation measurements. Fall groundwater elevation contour maps are used because these measurements are taken after the peak irrigation season and before winter precipitation increases groundwater levels; therefore, fall groundwater levels are reflective of annual change in storage caused by recharge and withdrawals of groundwater=. These groundwater elevation measurements are used to create fall groundwater elevation contour maps; and MCWRA's fall 1995 and fall 2019 contour maps are used to determine the spatial distribution of historical storage changes.

The change in storage from 2019 to 2020 is included in this GSP to describe current conditions. However, current conditions reflect the change in storage over the course of only one year; and annual change in storage fluctuates significantly depending on annual groundwater elevation changes. The historical groundwater elevations used to develop the cumulative change in groundwater elevation graph (Figure 5-13) that is used to estimate change in groundwater storage over time are used to validate the storage change due to groundwater elevations.

Change in storage due to seawater intrusion is based on MCWRA's extent of seawater intrusion maps. MCWRA produces these maps annually. The maps identify the inferred extent of the 500 mg/L chloride concentrations in both the 180- and 400-Foot Aquifers. The change in storage calculations assume that all groundwater seaward of the 500 mg/L chloride isocontours is unusable.

5.2.2 Change in Groundwater Storage Due to Groundwater Elevation Changes

The calculation of change in storage using groundwater elevation changes for the non-seawater intruded area is based on the following relationship:

$$\Delta S = \Delta WL \times A \times SC$$

Where: ΔS = Annual change in storage volume in the Subbasin (AF/yr)

ΔWL= Annual change in average groundwater elevation in the Subbasin (ft/yr)

SC = Storage coefficient (ft^3/ft^3)

A = Non-seawater intruded land area of Subbasin (acres)

This GSP Update calculates change in storage due to groundwater elevations in two ways:

1) ***Aquifer-specific calculation***: aquifer-specific storage coefficients are used to calculate the storage change in the areas of the 180-Foot and 400-Foot Aquifers that are not seawater intruded.

2) ***Whole subbasin calculation***: a storage coefficient representing all aquifers and aquitards above the 400-Foot/Deep Aquitard is used together with an area that subtracts the seawater intruded area. This is considered more representative because it accounts for the unconfined conditions in part of the Subbasin and shallow sediments. This whole subbasin calculation is also used for the groundwater storage SMC calculation described in Chapter 8.

Both calculations use the same change in groundwater storage due to change in groundwater elevations in the Subbasin (ΔWL), but they differ in how they calculate the storage coefficient (SC) and land area (A).

Annual change in average groundwater elevations (ΔWL): This is calculated by first subtracting the fall 2019 groundwater elevation contours from the fall 1995 groundwater elevation contours. For the 180-Foot Aquifer, Figure 5-5 and Figure 5-16 show the fall 1995 and fall 2019 groundwater elevation contours, respectively. Figure 5-17 shows the estimated change in groundwater storage in the 180-Foot Aquifer calculated by subtracting these two fall groundwater elevation maps. Figure 5-18 shows the estimated change in groundwater storage from fall 2019 to fall 2020 calculated by subtracting the fall 2019 (Figure 5-16) and fall 2020 (Figure 5-1) groundwater elevation contours. Change in storage for the 180-Foot Aquifer was calculated over a non-seawater intruded area of approximately 66,000 acres.

Similarly, for the 400-Foot Aquifer, Figure 5-7 and Figure 5-19 show the fall 1995 and fall 2019 groundwater elevation contour maps, respectively, and Figure 5-20 shows the associated 400-Foot Aquifer change in groundwater storage from fall 1995 to fall 2019. Figure 5-21 shows the estimated change in groundwater storage from fall 2019 to fall 2020 calculated by subtracting the fall 2019 (Figure 5-19) and fall 2020 (Figure 5-3). Change in storage in the 400-Foot Aquifer was calculated over a non-seawater intruded area of approximately 75,000 acres.

Given the limited data available for the Deep Aquifers, the groundwater level data used for calculating change in storage is predominantly from the 180-Foot and 400-Foot Aquifers, not the Deep Aquifers. Change in storage in the Deep Aquifers will be evaluated in the future as more data and information are collected during GSP implementation.

While subbasin calculations of change in storage are averaged over the entire Subbasin, change in storage maps show geographically how change in storage varies across the Subbasin. Between 1995 and 2019, a loss in groundwater storage has occurred in the southern end of the Subbasin in both the 180-Foot and 400-Foot Aquifers near Chualar. The loss in storage in this area ranges from 0.1 to 0.3 AF per acre over an area of approximately 12,000 acres in the 180-Foot Aquifer and 0.1 to 0.3 AF per acre over an area of approximately 900 acres in the 400-Foot Aquifer. Other noticeable areas with loss of groundwater storage are seen around Gonzales. From 2019 to 2020, storage change mostly remained within 0.1 AF per acre in both the 180-Foot and 400-Foot Aquifers throughout the Subbasin, there was only a small area within 1,000 acres that experienced a los in storage within 0.1 to 0.2 AF per acre.

Storage coefficient (SC): The aquifer-specific calculation uses a specific storage estimates from the SVIHM of 8.2×10^{-5} ft^{-1} and 2.7×10^{-5} ft^{-1} for the 180-Foot and 400-Foot Aquifers, respectively. The specific storage estimates from the SVIHM are multiplied by the approximate thickness of 150 feet for the 180-Foot Aquifer and 200 feet for the 400-Foot Aquifer; yielding storage coefficients of 0.012 and 0.005 for the 180-Foot and 400-Foot Aquifers, respectively. When the SVIHM is finalized, its specific storage estimates are likely to change. However, these values are reasonable and are the best available data. The final SVIHM's specific storage estimates will be used when they are available.

For the whole subbasin calculation, the storage coefficient of 0.078 is used for the entire Subbasin. This estimate incorporates the 180-Foot, 400-Foot, and Deep Aquifers. More details and background on how the aquifer-specific and whole Subbasin storage coefficients were calculated are provided in Appendix 5B.

Non-seawater intruded land area of Subbasin (A): For the aquifer-specific calculation, the area used for each individual aquifer calculation differs based on the area covered by annual fall contours and seawater intruded area.

For the whole Subbasin calculation, the area was estimated by subtracting the total volume of seawater intruded groundwater from the total amount of water that can be held in storage above the bottom of the 400-Foot Aquifer. This volume was then divided by the depth to the bottom of the 400-Foot Aquifer to calculate an area. Calculating area in this manner accounts for the aquitards and shallow sediments, which hold some water and are factored into the whole subbasin storage coefficient of 0.078.

Annual Change in Storage Calculation: A summary of components used for estimating change in groundwater storage due to groundwater elevation changes is shown in Table 5-2. Using the aquifer-specific storage coefficients, average annual groundwater storage loss due to changes in groundwater elevation since 1995 was 130 AF/yr in the 180-Foot Aquifer and 40 AF/yr in the 400-Foot Aquifer. Using the estimated Subbasin-wide storage coefficient, the total average annual loss in storage due to changes in groundwater elevation was 770 AF/yr from 1995 to 2019 and 8,390 from 2019 to 2020. The total storage change in the individual aquifers do not add up to the Subbasin-wide storage change. This remaining loss in storage in the Subbasin possibly occurs in the Deep Aquifers and in the shallow sediments above the 180-Foot Aquifer, which are not designated as a principal aquifer. MCWRA does not produce groundwater elevation maps of the Deep Aquifers. Insufficient data currently exist to map groundwater elevations, and thus, groundwater storage changes, in the Deep Aquifers. This is a data gap that will be addressed during GSP implementation.

Table 5-2. Components Used for Estimating Change in Groundwater Storage Due to Groundwater Elevation Changes

Components	*Aquifer Specific Calculation*				*Whole Subbasin Calculation*	
	1995 to 2019		2019 to 2020		1995 to 2019	2019 to 2020
	180-Foot Aquifer	400-Foot Aquifer	180-Foot Aquifer	400-Foot Aquifer	Subbasin Total	Subbasin Total
Area of contoured portion of Subbasin minus Seawater Intrusion Area (acres)	65,600	75,500	65,600	75,300	76,000	76,000
Storage coefficient (ft^3/ft^3)	0.012	0.005	0.012	0.005	0.078	0.078
Average change in groundwater elevation (feet)	-4.00	-2.21	-1.89	-0.94	-3.11	-1.41
Change in groundwater storage (AF)	-3,230	-900	-1,530	-380	-18,410	-8,390
Average annual change in groundwater storage (AF/yr)	**-130**	**-40**	**-1,530**	**-380**	**-770**	**-8,390**
Total average annual change in groundwater storage (AF/yr)	**-170**		**-1,910**		**-770**	**-8,390**

Note: Negative values indicate loss, positive values indicate gain. The change from 1995 to 2019 is included to quantify historical change in storage and to be consistent with the other GSPs in the Salinas Valley. The change in storage from 2019 to 2020 is included in this GSP to describe current conditions and because it is based on one year it is largely dependent on annual groundwater elevation changes.

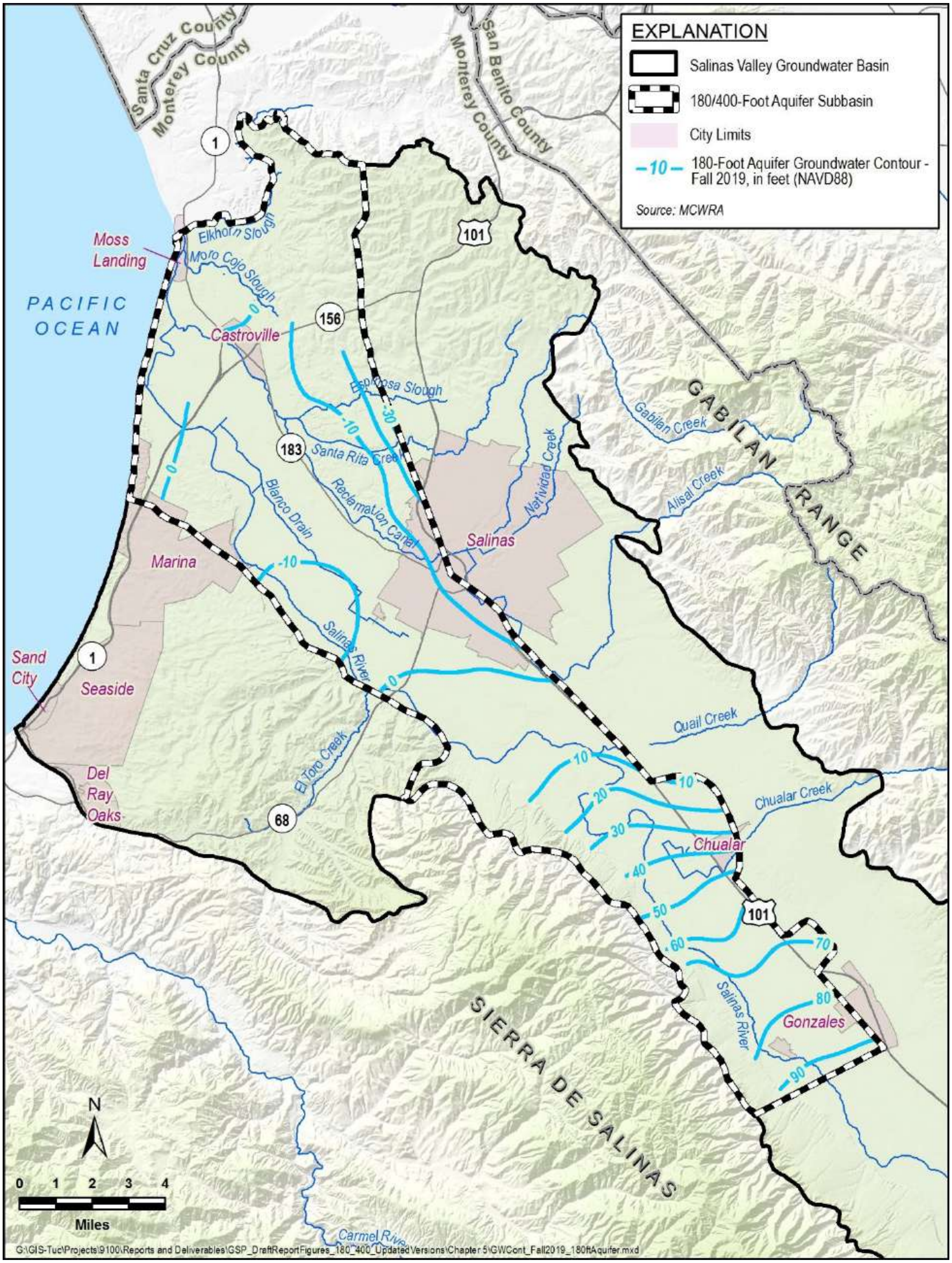


Figure 5-16. Fall 2019 180-Foot Aquifer Groundwater Elevation Contours

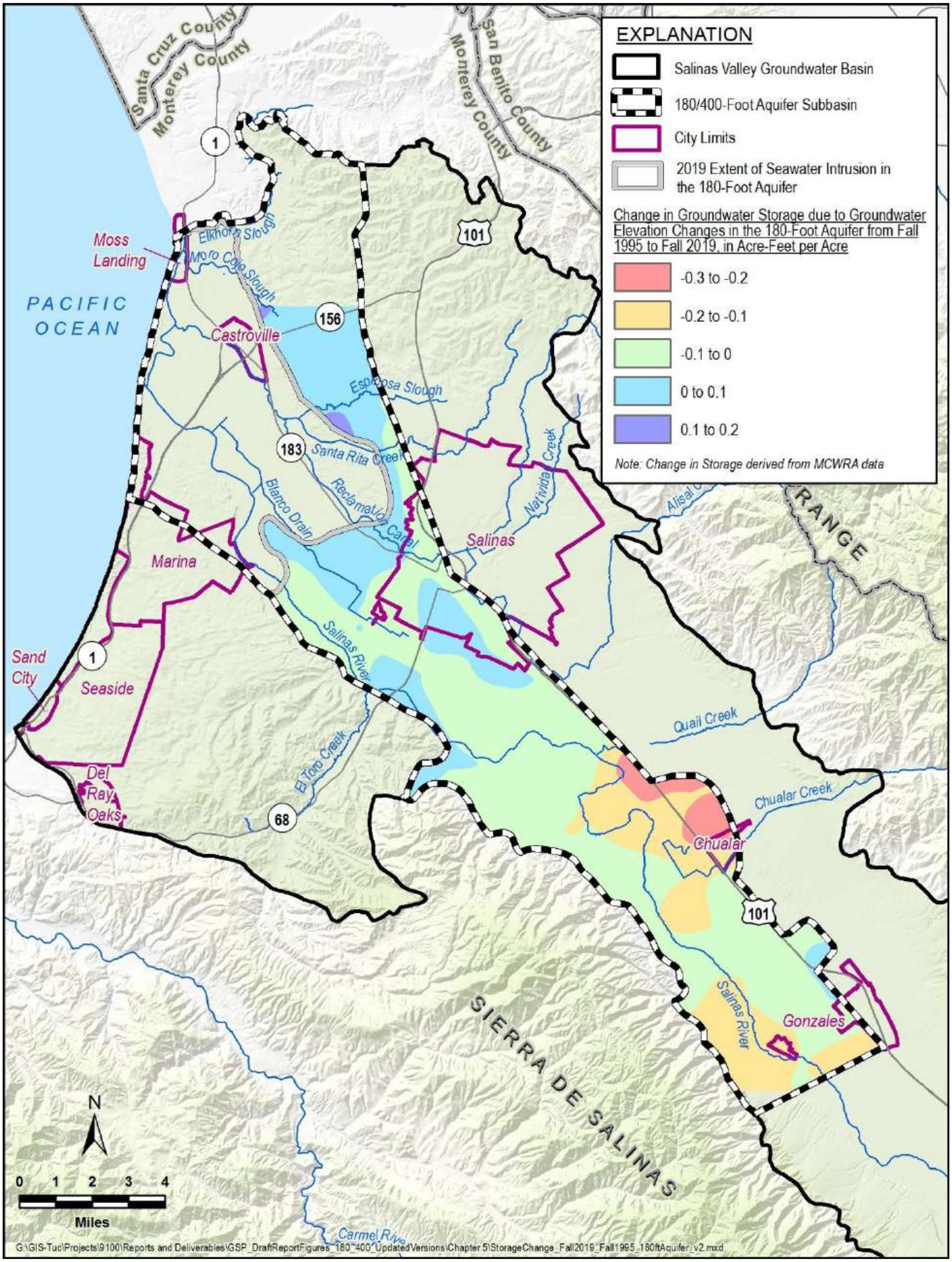


Figure 5-17. Change in Groundwater Storage in the 180-Foot Aquifer from Fall 1995 to Fall 2019

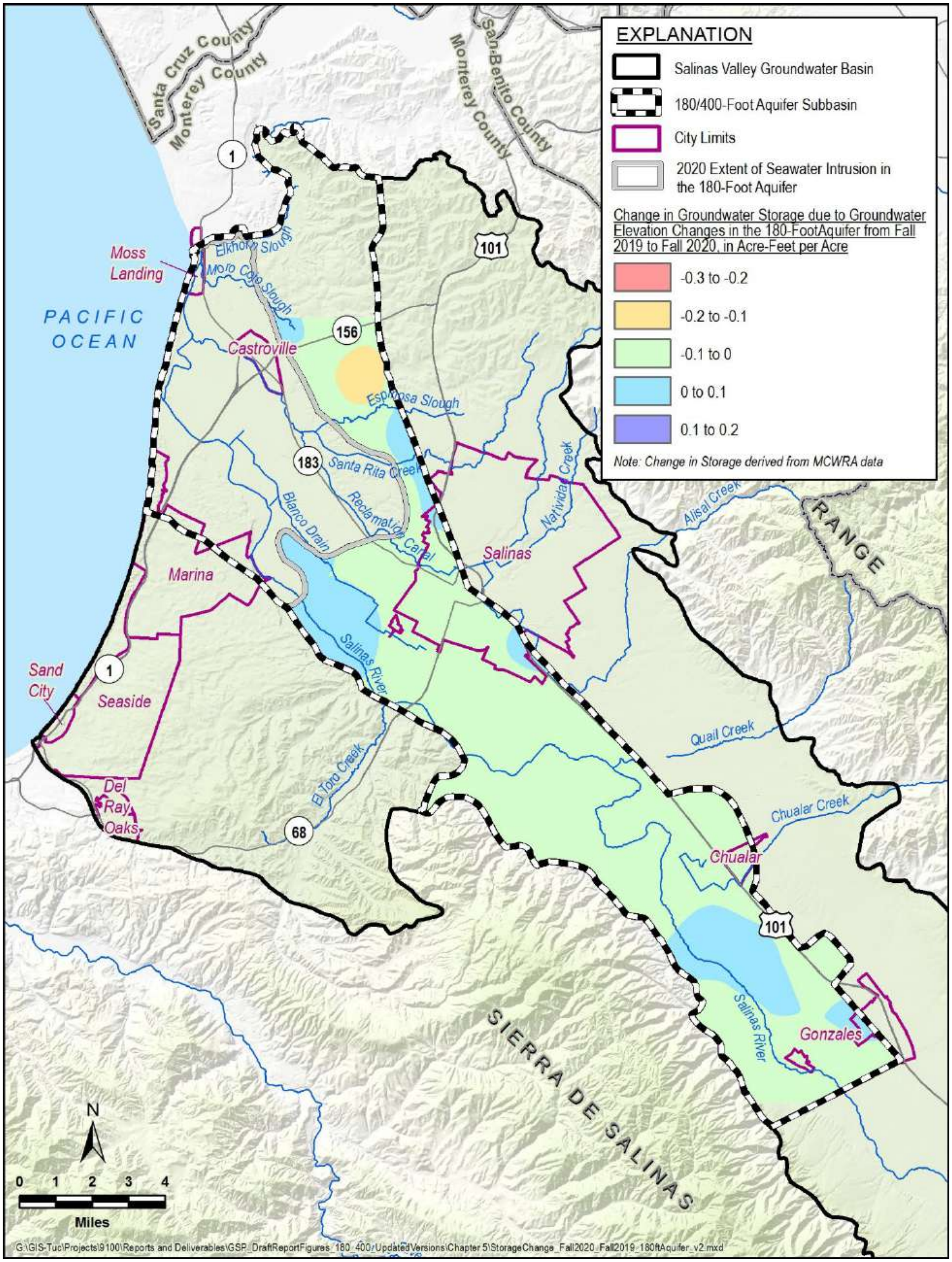


Figure 5-18. Change in Groundwater Storage in the 180-Foot Aquifer from Fall 2019 to Fall 2020

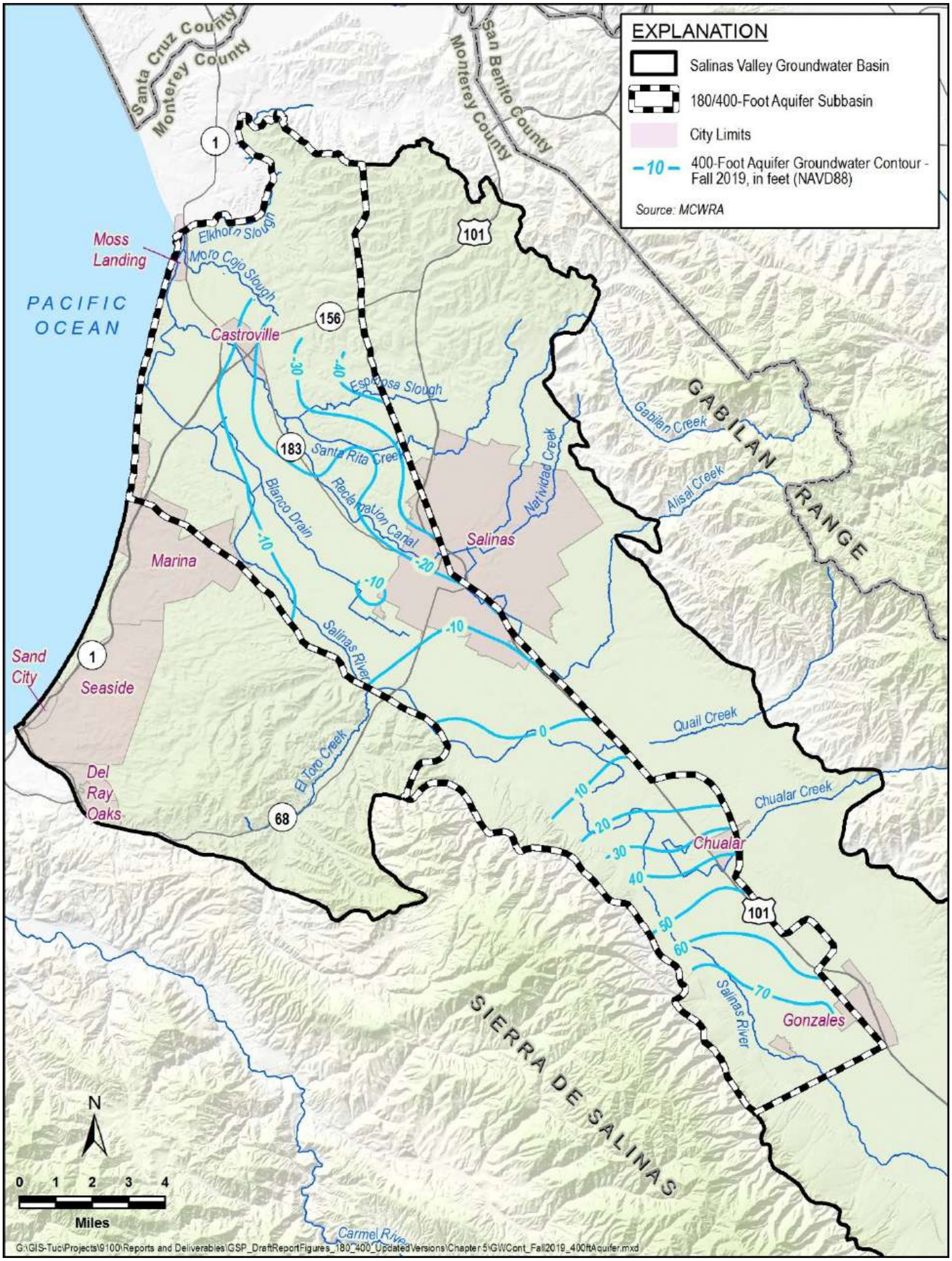


Figure 5-19. Fall 2019 400-Foot Aquifer Groundwater Elevation Contours

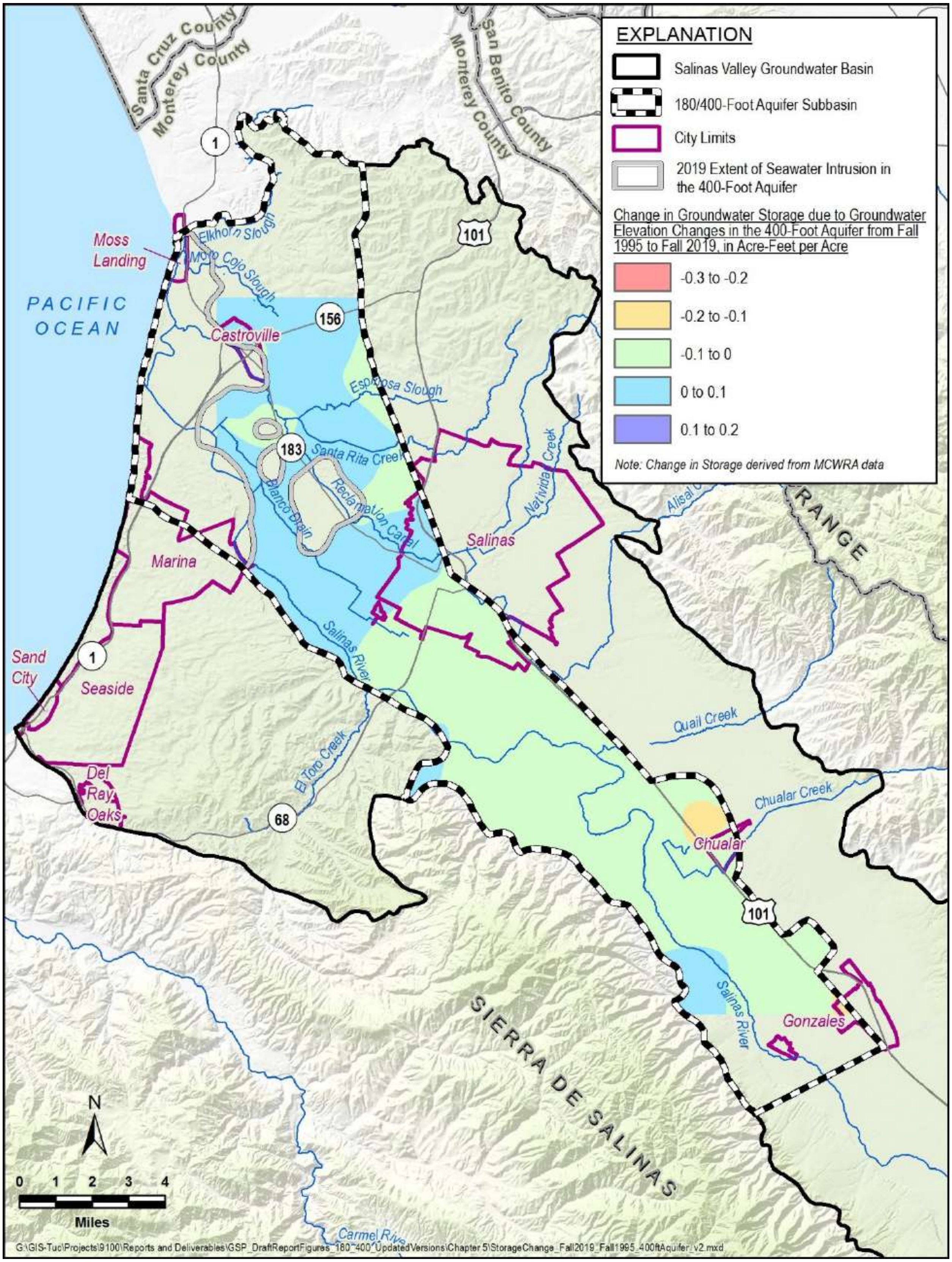


Figure 5-20. Change in Groundwater Storage in the 400-Foot Aquifer from Fall 1995 to Fall 2019

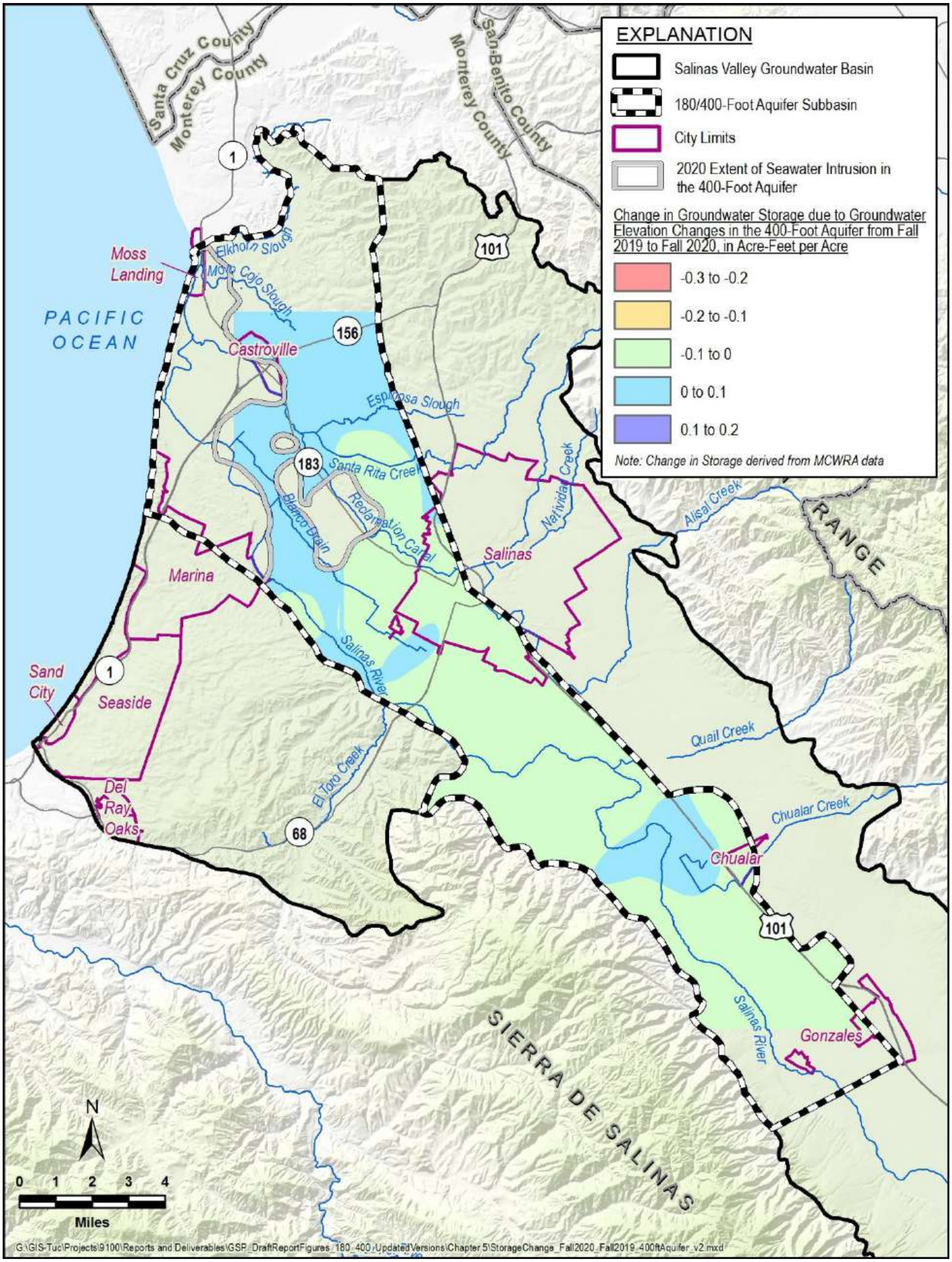


Figure 5-21. Change in Groundwater Storage in the 400-Foot Aquifer from Fall 2019 to Fall 2020

5.2.3 Change in Groundwater Storage Due to Seawater Intrusion

Groundwater storage losses due to seawater intrusion is estimated based on the change in seawater intrusion area, as mapped by MCWRA. The area of change is multiplied by an assumed aquifer thickness and effective porosity of 0.12, which is used in the SVIHM for the 180-Foot and 400-Foot Aquifers, to estimate the average annual loss of groundwater storage due to seawater intrusion. Average aquifer thickness is approximately 150 feet in the 180-Foot Aquifer and 200 feet in the 400-Foot Aquifer, based on descriptions provided in Chapter 4. Average annual groundwater storage loss due to seawater intrusion in the 180/400-Foot Aquifer Subbasin from 1995 to 2019 is -5,180 AF/yr in the 180-Foot Aquifer and -7,370 AF/yr in the 400-Foot Aquifer. From 2019 to 2020, storage losses due to seawater intrusion are -540 AF in the 180-Foot Aquifer and -5,280 AF in the 400-Foot Aquifer. This analysis considers the average historic change in storage due to seawater intrusion to be -12,550 AF/yr, which is the total of the 180-Foot and 400-Foot Aquifers storage changes. This storage loss is in addition to the change in groundwater storage due to changes in groundwater elevations. No seawater intrusion has been reported in the Deep Aquifers, thus, there likely is no change in storage due to seawater intrusion.

Table 5-3. Components Used for Estimating Loss in Groundwater Storage Due to Seawater Intrusion

Component	1995 to 2019		2019 to 2020	
	180-Foot Aquifer	400-Foot Aquifer	180-Foot Aquifer	400-Foot Aquifer
Change in seawater intrusion area (acres)	-6,910	-7,370	-30	-220
Effective porosity	0.12	0.12	0.12	0.12
Approximate aquifer thickness (feet)	150	200	150	200
Loss in groundwater storage (AF)	-124,380	-176,880	-540	-5,280
Average annual loss of storage (AF/yr)	-5,180	-7,370	-540	-5,280
Total average annual change in storage due to seawater intrusion (AF/yr)	**-12,550**		**-1,740**	

Note: Increases in acreage intruded by seawater are indicated by negative values. Negative values indicate loss, positive values indicate gain. The change from 1995 to 2019 is included to quantify historical change in storage and to be consistent with the other GSPs in the Salinas Valley. The change in storage from 2019 to 2020 is included in this GSP to describe current conditions.

5.2.4 Total Annual Average Change in Groundwater Storage

The total annual average change in groundwater storage is the sum of the changes in groundwater storage due to groundwater elevation changes and seawater intrusion. Table 5-4 summarizes the total average annual loss in storage from 1995 to 2019 and from 2019 to 2020. The total change in storage for the Subbasin in Table 5-4 is likely underestimated because the change in storage for the Deep Aquifers is not included. Groundwater elevations contours for the Deep Aquifers could not be drawn at the time of this GSP Update because of a lack of data. This is a data gap that will be filled during GSP implementation.

Table 5-4. Total Average Annual Change in Groundwater Storage

Component	*Aquifer Specific Calculation*				*Whole Subbasin Calculation*	
	1995 to 2019		2019 to 2020		1995 to 2019	2019 to 2020
	180-Foot Aquifer	400-Foot Aquifer	180-Foot Aquifer	400-Foot Aquifer	Subbasin Total	Subbasin Total
Annual storage loss due to groundwater elevation decrease (AF/yr)	-130	-40	-1,530	-380	-770	-8,390
Annual loss due to seawater intrusion (AF/yr)	-5,180	-7,370	-540	-5,280	-12,550	-5,820
Total annual loss of storage (AF/yr)	**-5,310**	**-7,410**	**-2,070**	**-5,660**	**-13,320**	**-14,210**

Note: Negative values indicate loss, positive values indicate gain. The change from 1995 to 2019 is included to quantify historical change in storage and to be consistent with the other GSPs in the Salinas Valley. The change in storage from 2019 to 2020 is included in this GSP to describe current conditions and because it is based on one year it is largely dependent on annual groundwater elevation changes.

To verify the change in storage calculation from declining groundwater levels in Section 5.2.2, the change in storage was also calculated using Figure 5-22. The orange line on Figure 5-22 shows estimated cumulative change in groundwater storage in the 180/400-Foot Aquifer Subbasin from 1944 through 2020. This graph is based on MCWRA’s cumulative change in groundwater elevation data (Figure 5-13). The groundwater storage changes are calculated by multiplying the annual groundwater elevation change by an assumed storage coefficient of 0.078 and size of the Subbasin. The black line on Figure 5-22 is the best fit linear rate of groundwater storage decline between 1995 and 2019. This black line shows that the average annual loss between 1995 and 2019 was 1,900 AF/yr in the Subbasin. This estimate does not exactly match what it presented in Table 5-4; however, the two estimates are similar enough for the purposes of verifying the calculation in Section 5.2.2. Figure 5-24 includes limited data for the Deep Aquifers, as more data becomes available for the Deep Aquifers the chart will be refined accordingly.

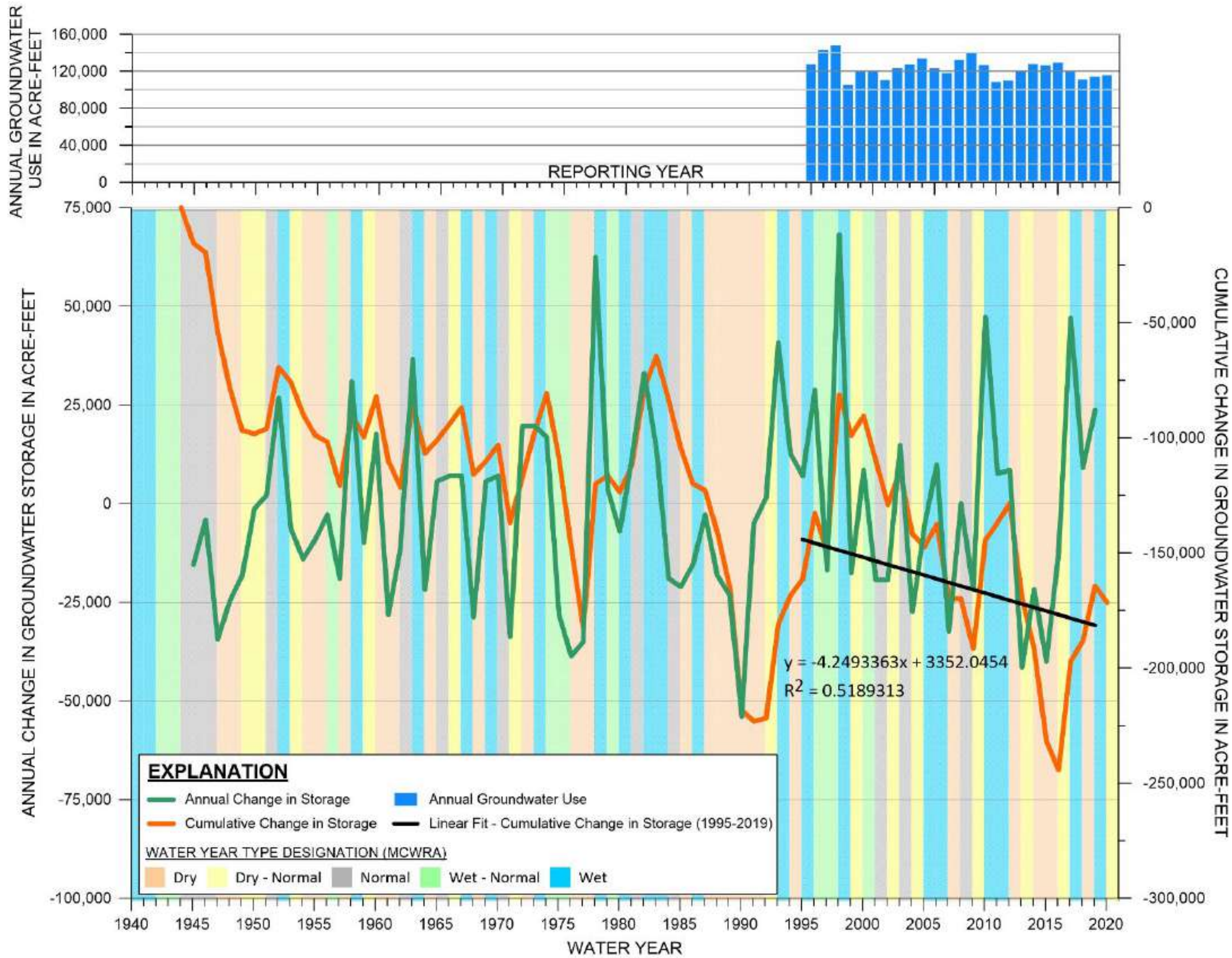


Figure 5-22. Annual and Cumulative Change in Groundwater Storage and Total Annual Groundwater Extraction in the 180/400-Foot Aquifer Subbasin, Based on Groundwater Elevations (adapted from MCWRA, 2018a, personal communication)

5.3 Seawater Intrusion

The 180-Foot and 400-Foot Aquifers have been subject to seawater intrusion for more than 70 years, as demonstrated by increased salt concentrations in wells near the Monterey Bay coastline. The negative impact of seawater intrusion on local water resources and the agricultural economy has been the primary motivation for many studies dating back to 1946 (DWR, 1946). MCWRA and others have implemented a series of engineering and management projects including well construction moratoriums, developing the CSIP system, and implementing the Salinas Valley Water Project (SVWP), among other actions to halt seawater intrusion. Although those actions have managed to slow the advance of intrusion and reduce its impacts, seawater intrusion remains an ongoing threat.

5.3.1 Data Sources

The extent and advance of seawater intrusion are monitored and reported by MCWRA. Monitoring seawater intrusion has been ongoing since the Agency formed in 1947, and currently includes a network of 156 dedicated monitoring and production wells in the Salinas Valley Groundwater Basin that are sampled twice annually in June and August. Most of the wells MCWRA monitors are located in the 180/400-Foot Aquifer Subbasin. The water samples are analyzed for general minerals; and the analytical results are used by MCWRA to analyze and report the following:

- Maps and graphs of historical chloride and specific conductivity trends
- Stiff diagrams and Piper diagrams
- Plots of chloride concentration vs. Na/Cl molar ratio trends

MCWRA publishes estimates of the extent of seawater intrusion every year. SVBGSA uses the MCWRA maps to define the extent of seawater intrusion as the location of the 500 mg/L chloride concentration isocontour. This chloride concentration is significantly lower than the 19,000 mg/L chloride concentration typical of seawater; however, it represents a concentration that may begin to impact beneficial uses. The 500 mg/L threshold is considered the Upper Limit Secondary Maximum Contaminant Level (SMCL) for chloride as defined by the EPA and is approximately ten times the concentration of naturally occurring groundwater in the Subbasin. SVBGSA and MCWDGSA are collaborating closely on the development and implementation of their GSPs for the 180/400 and Monterey Subbasins. MCWDGSA uses an isocontour derived based on a combination of TDS and chloride measurements and geophysical data. There are notable data gaps in the MCWRA seawater intrusion isocontour maps for the Monterey Subbasin, MCWDGSA chose these other data to more accurately map seawater intrusion in the Monterey Subbasin. During implementation, SVBGSA, MCWDGSA, and MCWRA will align the separate data sets with enhanced data-sharing and collaboration.

5.3.2 Seawater Intrusion Maps and Cross Section

Figure 5-23 and Figure 5-24 show the MCWRA mapped extents of current and historical seawater intrusion in the 180/400-Foot Subbasin in the 180-Foot and 400-Foot Aquifers, respectively. In each of the two figures, the maximum extent of the shaded contours represents the extent of groundwater with chloride exceeding 500 mg/L during the 2020 monitoring period. The historical progression of the 500 mg/L extent is also illustrated on these figures through the colored overlays that represent the extent of seawater intrusion observed during selected years.

Figure 5-23 and Figure 5-24 also show the mapped August 2020 groundwater elevations for the 180-Foot and 400-Foot Aquifer and the adjacent Eastside Aquifer Subbasin. These maps show the groundwater elevations that are persistently below sea levels that, when paired with a pathway, enable seawater intrusion. The groundwater elevation contours show that groundwater travels toward the depression at the northern end of the Eastside Aquifer Subbasin in both the Shallow and Deep Zones of the Eastside Aquifer that are generally equivalent to the 180-Foot and 400-foot Aquifers, respectively, in the 180/400-Foot Aquifer Subbasin.

A cross-section showing the vertical distribution of seawater intrusion is shown on Figure 5-25. The hydrostratigraphy shown on this cross section is adapted from the *Final Report, Hydrostratigraphic Analysis of the Northern Salinas Valley* (Kennedy-Jenks, 2004). The location of the cross-section is also shown on Figure 5-25 as line A-A'. The superposition of the seawater intrusion on the existing hydrostratigraphic cross-section was based on the 2020 500mg/L contour from MCWRA and recent groundwater quality data in the GSP database. The entire saturated thickness of the aquifer was assumed to be seawater intruded if any well in the aquifer indicated seawater intrusion.

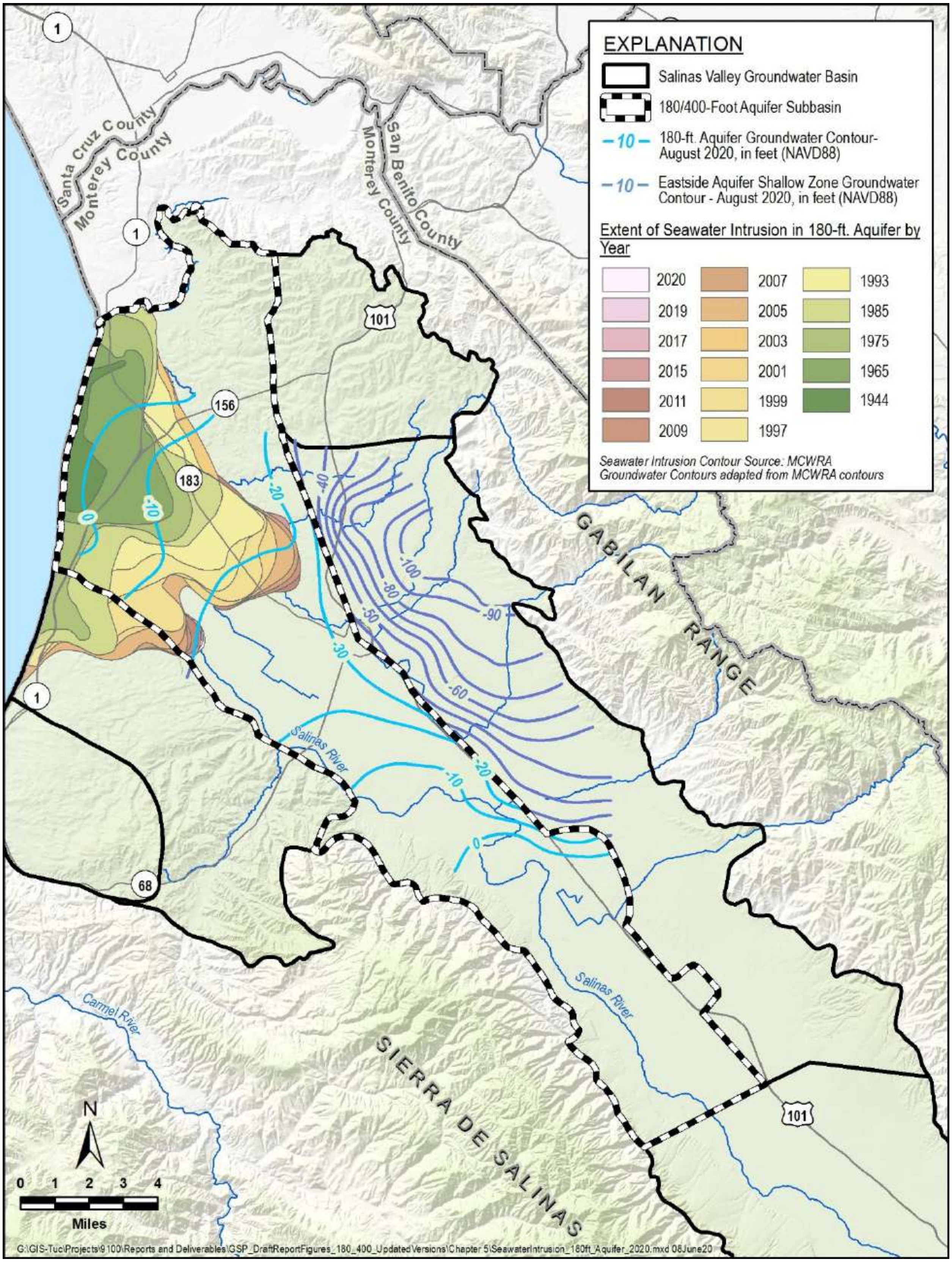


Figure 5-23. Seawater Intrusion in the 180-Foot Aquifer

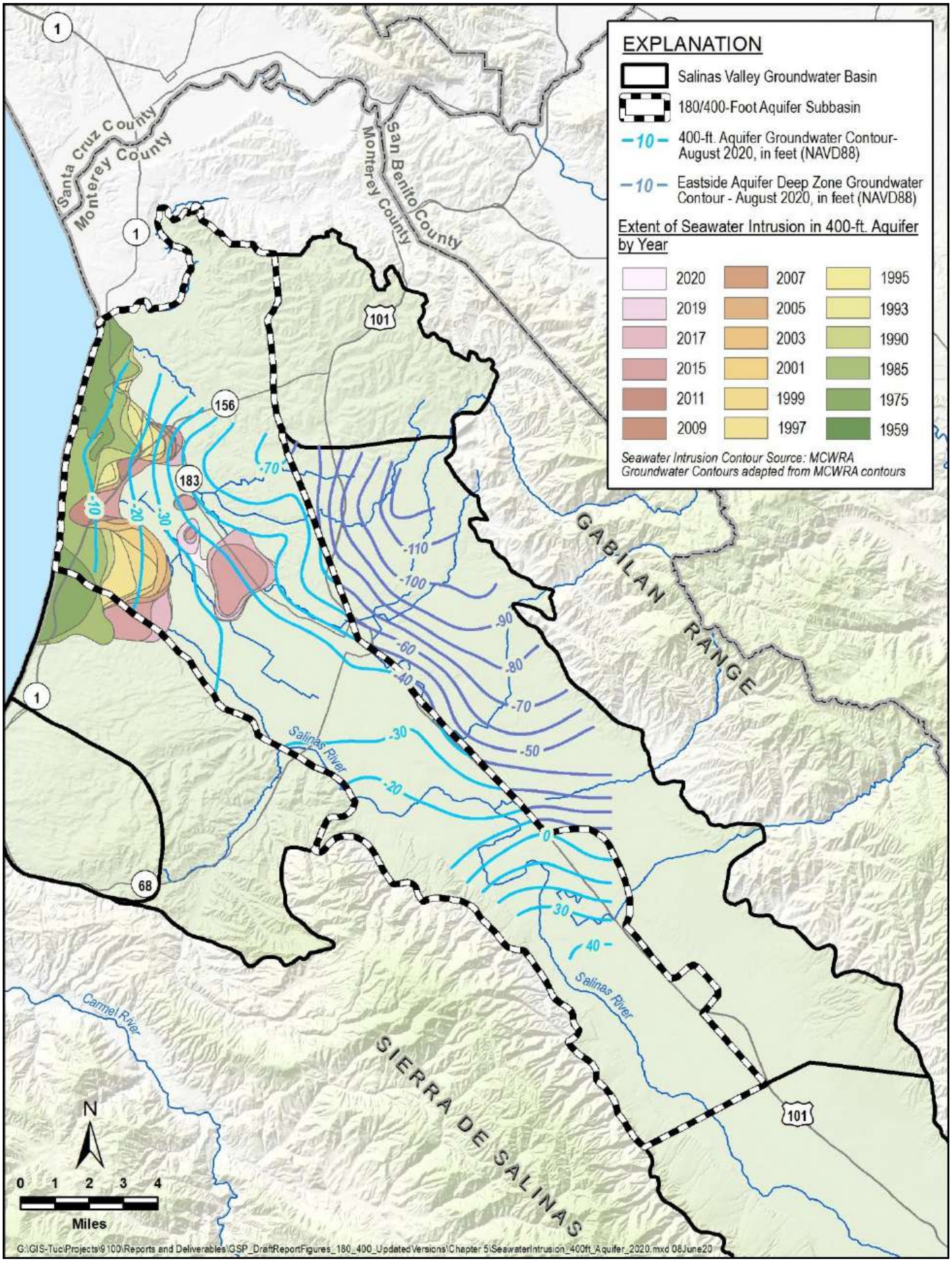


Figure 5-24. Seawater Intrusion in the 400-Foot Aquifer

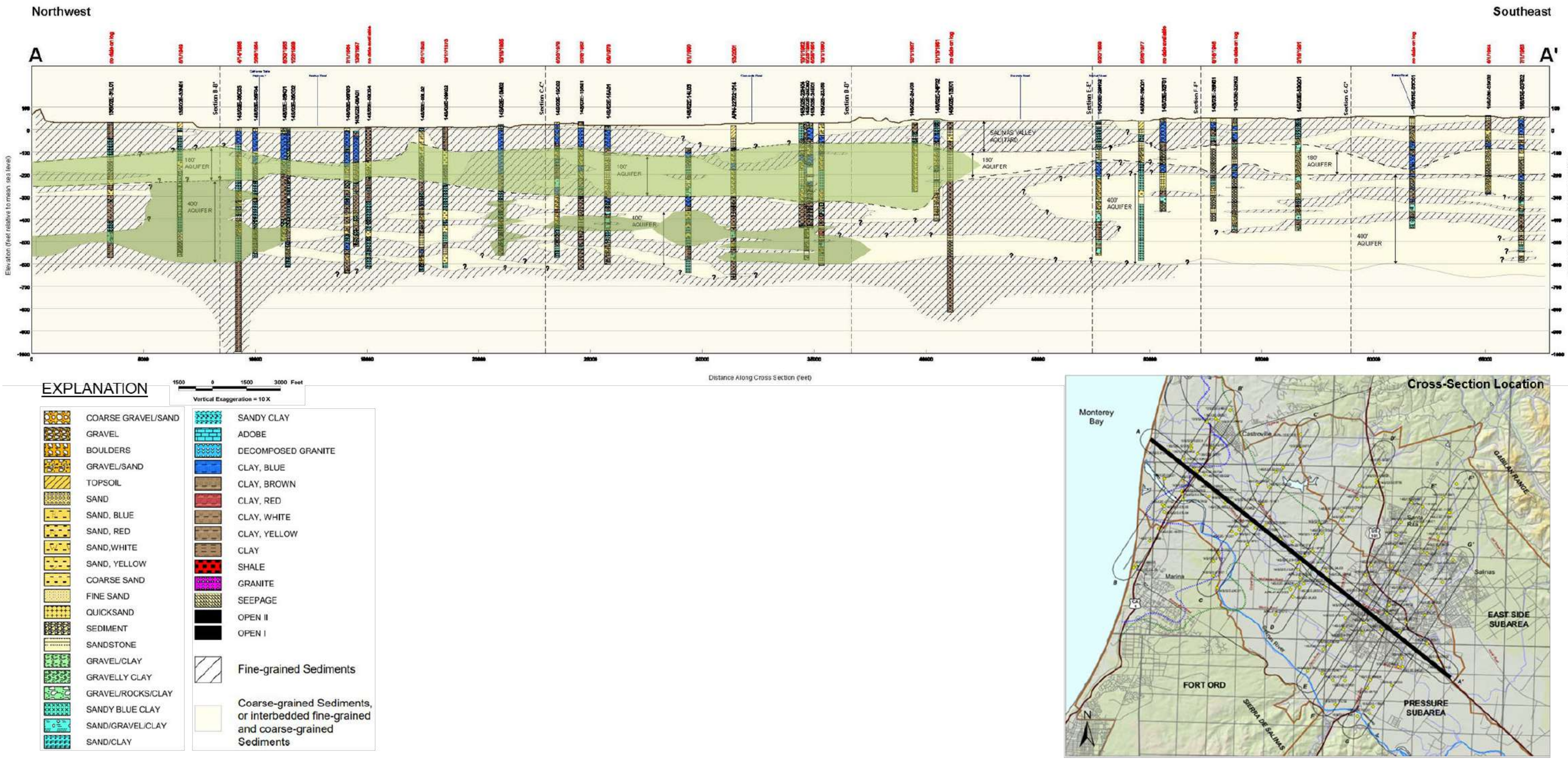


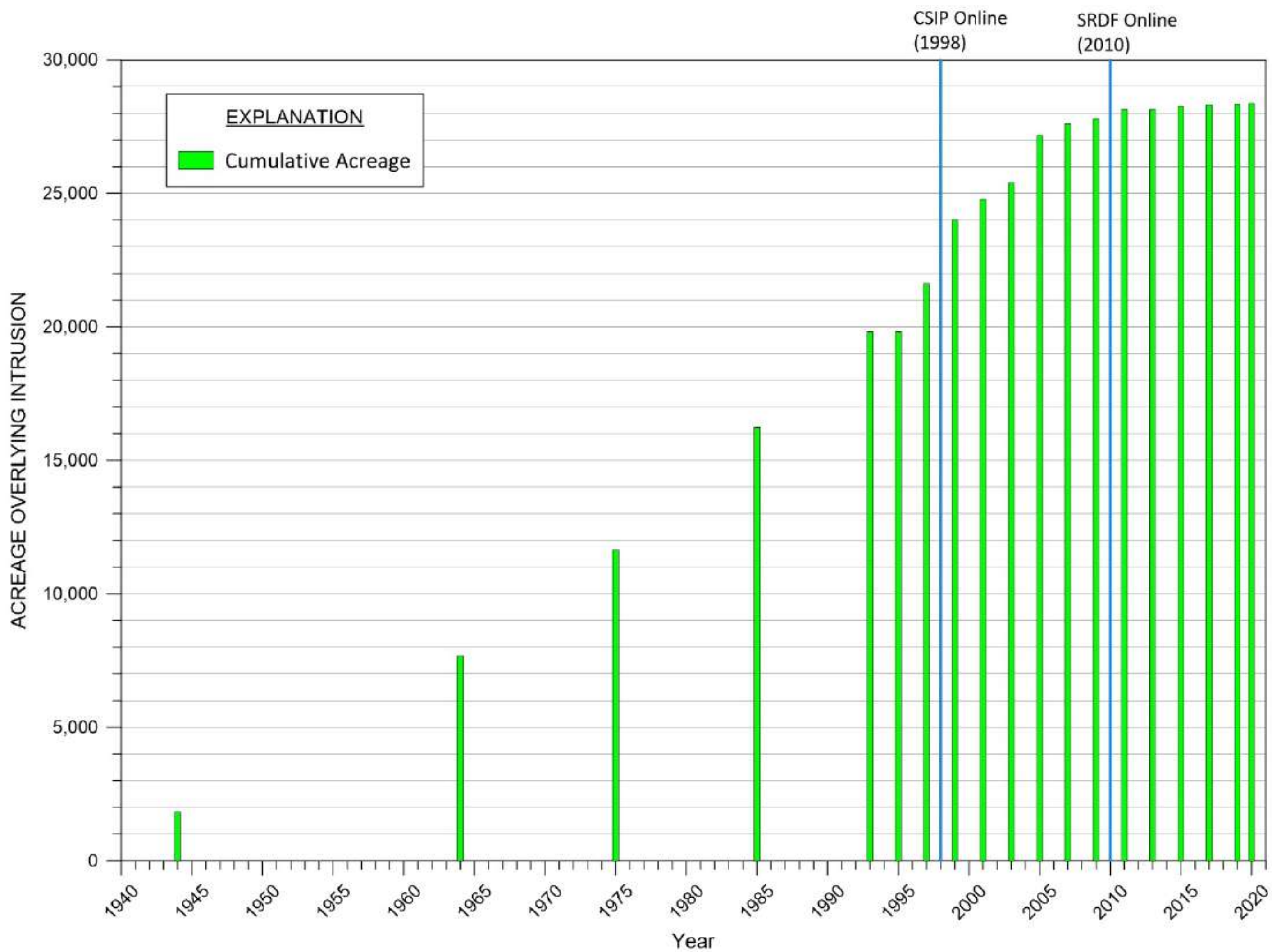
Figure 5-25. Cross-Section of Estimated Depth of Seawater Intrusion Based on Mapped 2020 Intrusion (Adapted from Kennedy-Jenks, 2004)

5.3.3 Seawater Intrusion Rates

Figure 5-26 and Figure 5-27 show time series graphs of the total acreage that overlies groundwater with chloride concentration greater than 500 mg/L. Figure 5-28 shows the time series of acreage overlying seawater intrusion in the 180-Foot Aquifer. In 2020 85% of this seawater intruded area was in the 180/400-Foot Aquifer Subbasin and the remainder was in the adjacent Monterey Subbasin. Figure 5-27 shows the time series of acreage overlying seawater intrusion in the 400-Foot Aquifer. In 2020, 83% of this seawater intruded area was in the 180/400-Foot Aquifer Subbasin and the remainder was in the adjacent Monterey Subbasin.

As shown on Figure 5-26, seawater intrusion into the 180-Foot Aquifer covered approximately 20,000 acres in 1995 and had expanded to approximately 28,000 acres by 2009. Since then, the rate of expansion has decreased, with an overlying area of approximately 28,300 in 2017 and 28,400 acres in 2020. Figure 5-27 shows that the area overlying seawater intrusion into the 400-Foot Aquifer is not as extensive as that in the 180-Foot Aquifer. The 400-Foot Aquifer had an overlying area of approximately 12,000 acres in 2009. However, between 2011 and 2015, the 400-Foot Aquifer experienced a significant increase in the area of seawater intrusion, from approximately 12,600 acres to approximately 15,700 acres. The acreage overlying seawater intrusion increased to about 16,900 acres in 2017 and to about 17,400 in 2020. This apparent rapid increase in this area is likely the result of localized downward migration of high chloride groundwater from the 180-Foot Aquifer to the 400-Foot Aquifer.

The process of downward migration between aquifers may be in part attributed to wells that are screened across both aquifers, discontinuous aquitards, or improperly abandoned wells, which can cause the isolated patches of seawater intrusion in the 400-Foot Aquifer. For example, the middle patch that greatly expanded from 2017 to 2019, is associated with a leaky well that connects the 180-Foot and 400-Foot Aquifers. This well was destroyed in November 2019. Regardless of the specific pathways, the presence of vertical downward hydraulic gradients from the 180-Foot Aquifer to the 400-Foot Aquifer presents a risk that eventually the intruded area of the 400-Foot Aquifer will be as large as that of the 180-Foot Aquifer.



Source: Special Joint Meeting of MCWRA BOD and Monterey County BOS

Figure 5-26. Acreage Overlying Seawater Intrusion in the 180-Foot Aquifer
(created with data from MCWRA)

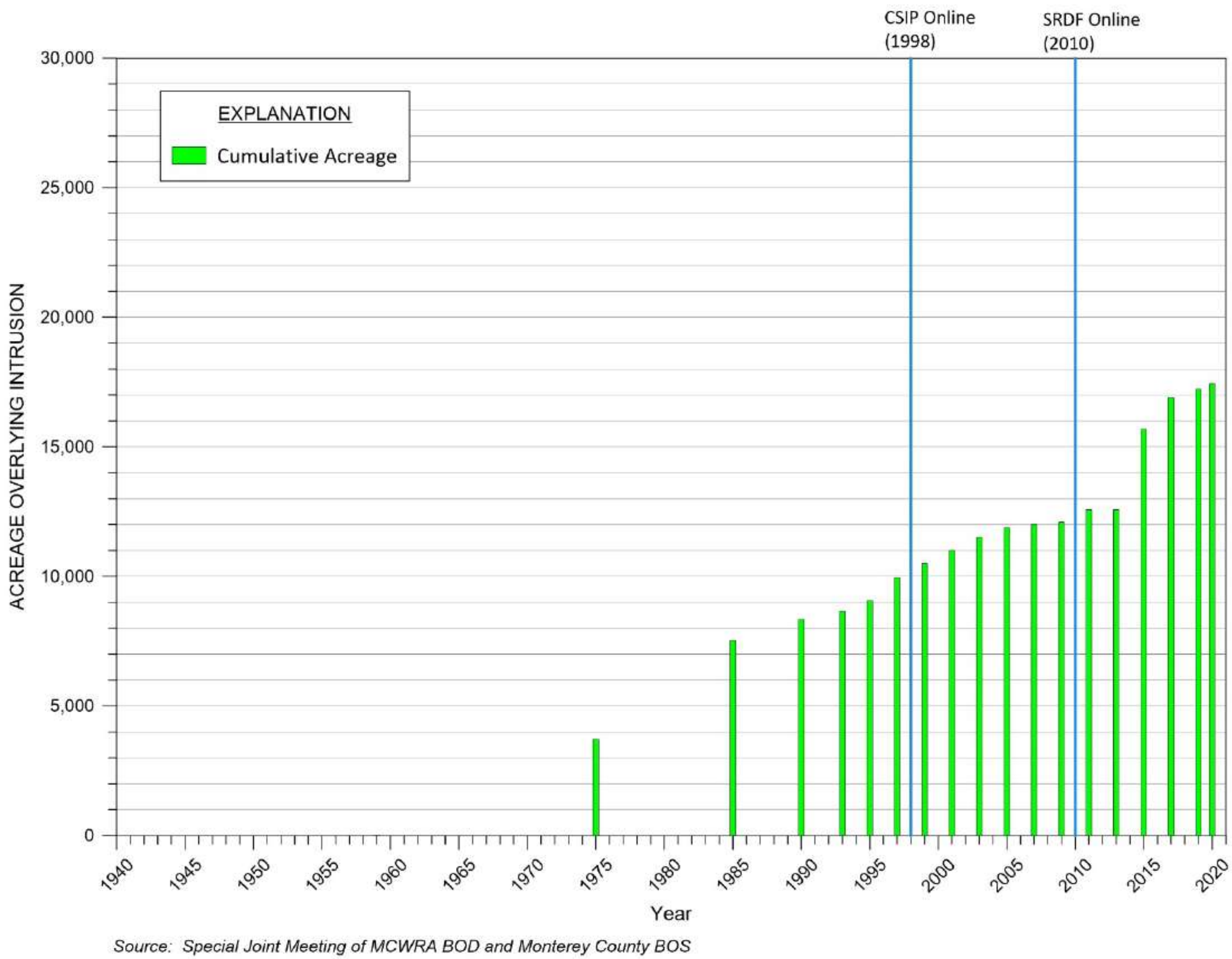


Figure 5-27. Acreage Overlying Seawater Intrusion in the 400-Foot Aquifer
(created with data from MCWRA)

Seawater intrusion has not been reported in the Deep Aquifers.

The volume of seawater flowing into the Subbasin every year does not strictly correspond to the acreages overlying the seawater-intruded area that are shown on Figure 5-26 and Figure 5-27. As the seawater intrusion front approaches pumping depressions, the front will slow down and stop at the lowest point in the pumping depression. When the seawater intrusion front stops at a pumping depression, no more acreage will be added every year. However, seawater will continue to flow in from the ocean towards the pumping depression.

The State of the Salinas River Groundwater Basin report estimated that approximately 11,000 acre-feet of seawater flows into the Pressure subarea every year. Previous estimates have ranged between 14,000 and 18,000 AF/yr of seawater intrusion (Brown and Caldwell, 2015). These seawater inflow estimates include portions of the Monterey Subbasin. The length of coastline subject to seawater intrusion is approximately 75% in the 180/400-Foot Aquifer Subbasin and therefore this GSP estimates the flow into the 180/400-Foot Aquifer Subbasin is between 8,250 and 13,500 AF/yr.

5.4 Groundwater Quality Distribution and Trends

The SVBGSA does not have regulatory authority over groundwater quality and is not charged with improving groundwater quality in the Salinas Valley Groundwater Basin. Projects and actions implemented by the SVBGSA are not required to improve groundwater quality; however, they must not further degrade it.

5.4.1 Data Sources

Groundwater quality samples have been collected and analyzed in the Subbasin for various studies and programs. Groundwater quality samples have also been collected on a regular basis for compliance with regulatory programs. Groundwater quality data for this GSP were collected from:

- The Northern Counties Groundwater Characterization report (CCGC, 2015)
- The USGS' Groundwater Ambient Monitoring and Assessment Program (GAMA) reports (Kulongoski and Belitz, 2005; Burton and Wright, 2018)
- State Water Resources Control Board's GeoTracker Data Management System (SWRCB, 2021a)
- State Water Resources Control Board's GAMA Groundwater Information System (SWRCB, 2021b)
- The California Department of Toxic Substances Control's EnviroStor data management system (DTSC, 2021)

5.4.2 Point Sources of Groundwater Contaminants

Clean-up and monitoring of point source pollutants may be under the responsibility of either the Central Coast Regional Water Quality Control Board (CCRWQCB) or the Department of Toxic Substances Control (DTSC). The locations of these clean-up sites are visible in SWRCB's GeoTracker database map, publicly available at: https://geotracker.waterboards.ca.gov/. The GeoTracker database is linked to the DTSC's EnviroStor data management system that is used to track clean-up, permitting, and investigation efforts. Table 5-5 and Figure 5-28 provide a summary of the active clean-up sites within the Subbasin. Table 5-5 does not include sites that have leaking underground storage tanks, which are not overseen by DTSC or the CCRWQCB.

Table 5-5. Active Cleanup Sites

Label	Site Name	Site Type	Status	Constituents of Concern (COCs)	Address	City
1	Dynegy Moss Landing	Corrective Action	Active	metals, petroleum, polychlorinated biphenyls (PCBs), volatile organic compounds (VOCs)	Highway 1 & Dolan Road	Moss Landing
2	Moss Landing Power Plant	Cleanup Program Site	Open - Verification Monitoring	metals/heavy metals, petroleum/fuels/oils, polynuclear aromatic hydrocarbons, volatile organic compounds (VOCs)	Highway 1 & Dolan Road	Moss Landing
3	National Refractories (Former)	Cleanup Program Site	Open - Remediation	chromium, trichloroethylene (TCE)	7697 California Highway 1	Moss Landing
4	Union Pacific Railroad - Salinas Yard	Cleanup Program Site	Open - Verification Monitoring	petroleum hydrocarbons, polycyclic aromatic hydrocarbons (PAHs), naphthalene, VOCs, metals	Rico and West Lakes Streets	Salinas
5	Toro Petroleum-Agt	Cleanup Program Site	Open - Verification Monitoring	benzene, petroleum hydrocarbons	308 West Market Street	Salinas
6	Pacific Gas & Electric (PG&E), Salinas Manufactured Gas Plant (MPG)	Voluntary Cleanup	Active	cyanide, metals, contaminated soil, hydrocarbon mixtures	2 Bridge Street	Salinas
7	Borina Foundation	Cleanup Program Site	Open - Remediation contaminated soil was excavated in 2013. Soil vapor extraction remedy is operating to treat soil gas	halogenated volatile organic compounds (VOCs) in soil and soil gas	110-124 Abbott Street	Salinas
8	Crop Production Services, Inc. - Salinas	Cleanup Program Site	Open - Remediation Pump and treat system in place	nitrate, pesticides in shallow aquifer	1143 Terven Avenue	Salinas
9	Pure-Etch Co	Corrective Action	Active - dual phase extraction remedy implemented	benzene, ethylbenzene, petroleum hydrocarbon-gas, toluene, xylenes	1031 Industrial Street	Salinas
10	NH3 Service Company	Cleanup Program Site	Open - Verification Monitoring Pump and treat system in place	nitrate	945 Johnson Avenue	Salinas
11	Firestone Tire (Salinas Plant)	National Priorities List	Delisted	1,2-dichloroethylene (DCE), tetrachloroethylene (PCE)	340 El Camino Real South	Salinas

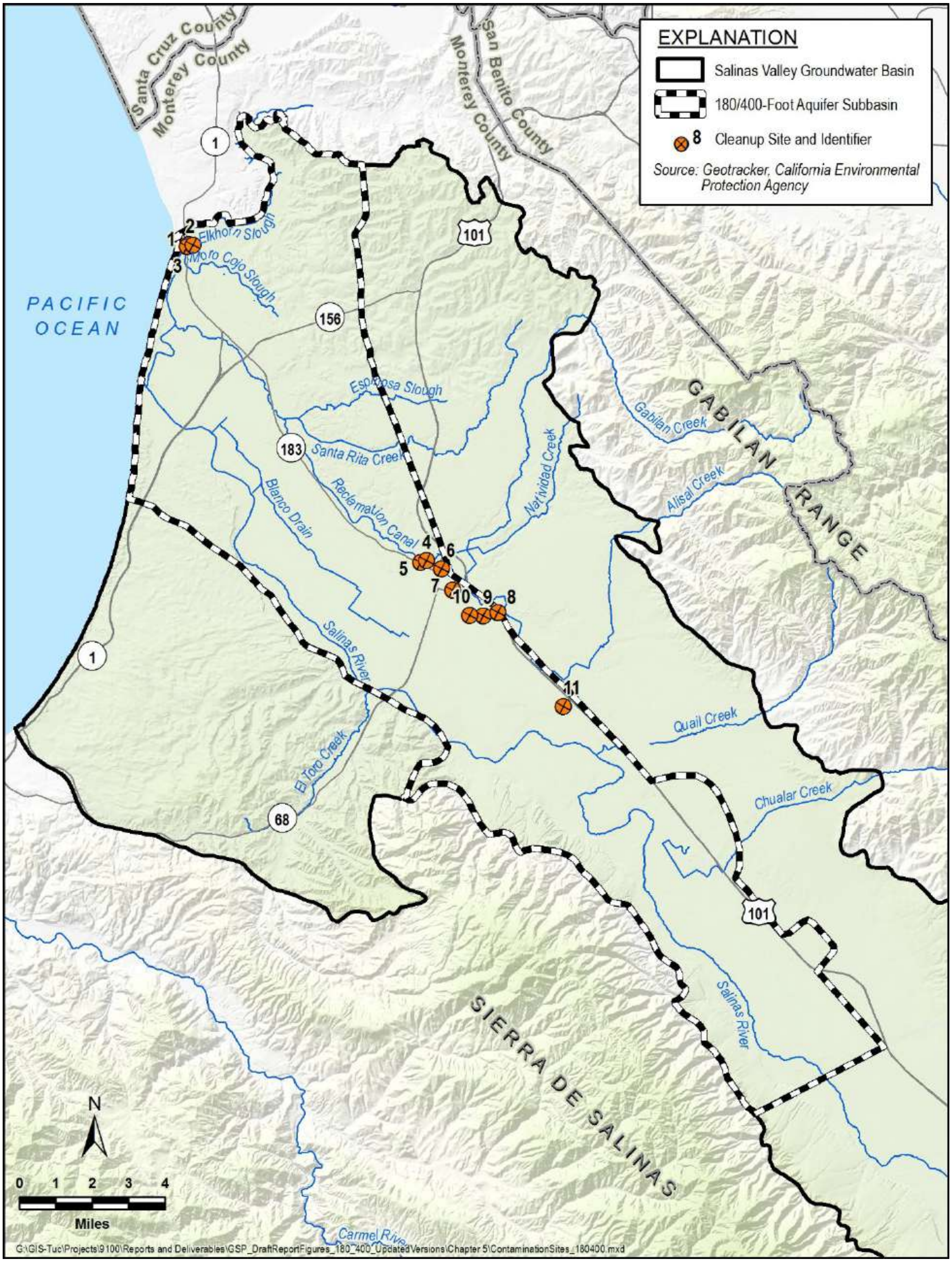


Figure 5-28. Active Cleanup Sites

5.4.3 Distribution and Concentrations of Diffuse or Natural Groundwater Constituents

In addition to the point sources described above, the CCRWQCB monitors and regulates activities and discharges that can contribute to non-point pollutants, which are constituents that are released to groundwater over large areas. In the Subbasin, the most prevalent non-point water quality concern is nitrate. The current distribution of nitrate was extensively monitored and evaluated by the CCGC and documented in a report submitted to the CCRWQCB (CCGC, 2015).

Figure 5-29 shows a map of nitrate distribution in the Subbasin prepared by CCGC. The orange and red areas illustrate the portions of the Subbasin where groundwater has nitrate concentrations above the drinking water MCL of 45 mg/L NO_3.

Figure 5-30 shows maps of measured nitrate concentration from six decades of monitoring for the entire Salinas Valley Groundwater Basin. These maps, prepared by MCWRA, indicate that elevated nitrate concentrations in groundwater were locally present in the 1960s, but significantly increased in 1970s and 1980s. Extensive distribution of nitrate concentrations above the drinking water MCL, as shown on Figure 5-29, has been present in the 180/400-Foot Aquifer Subbasin for 20 to 30 years.

A May 2018 staff report to the CCRWQCB included a summary of nitrate concentrations throughout the Central Coast Region, including the Salinas Valley Groundwater Basin. The staff report includes data from 2008 to 2018, collected at 2,235 wells in the Salinas Valley Groundwater Basin, during Agricultural Orders 2.0 and 3.0 sampling events. The report states that 26% of on-farm domestic wells in the 180/400-Foot Aquifer Subbasin exceeded the drinking water MCL, with a mean concentration of 52.7 mg/L NO_3. In addition, 21% of irrigation supply wells in the Subbasin exceeded this MCL with a mean concentration of 29.7 mg/L NO_3 (CCRWQCB, 2018).

Some constituents of concern can be concentrated at various aquifer depths. Nitrate is a surficial constituent derived from such sources as fertilizer, livestock, and septic systems. Because the sources are all near the surface, nitrate is usually highest near ground surface, and decreases with depth. Raising groundwater levels may mobilize additional nitrate. By contrast, arsenic concentrations usually increase with depth, and lowering groundwater levels may mobilize additional arsenic. The distribution and concentrations of constituents of concern can be further complicated by location and rate of groundwater pumping. The extent to which pumping affects groundwater quality depends on aquifer properties, distance to contamination, constituent characteristics and transport rate, and the time at which contaminants entered the subsurface.

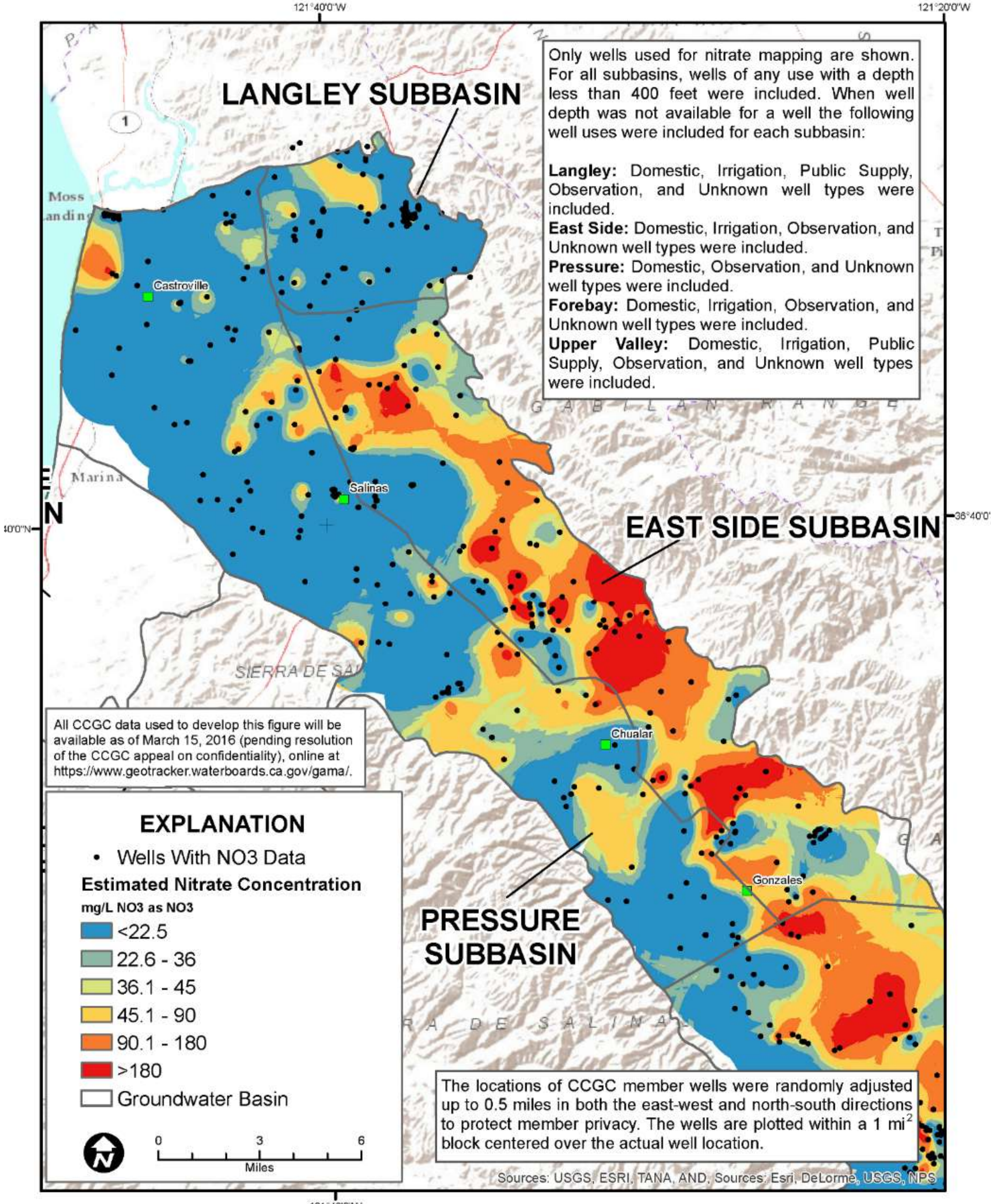


Figure 5-29. Estimated Nitrate Concentrations
(from CCGC, 2015)

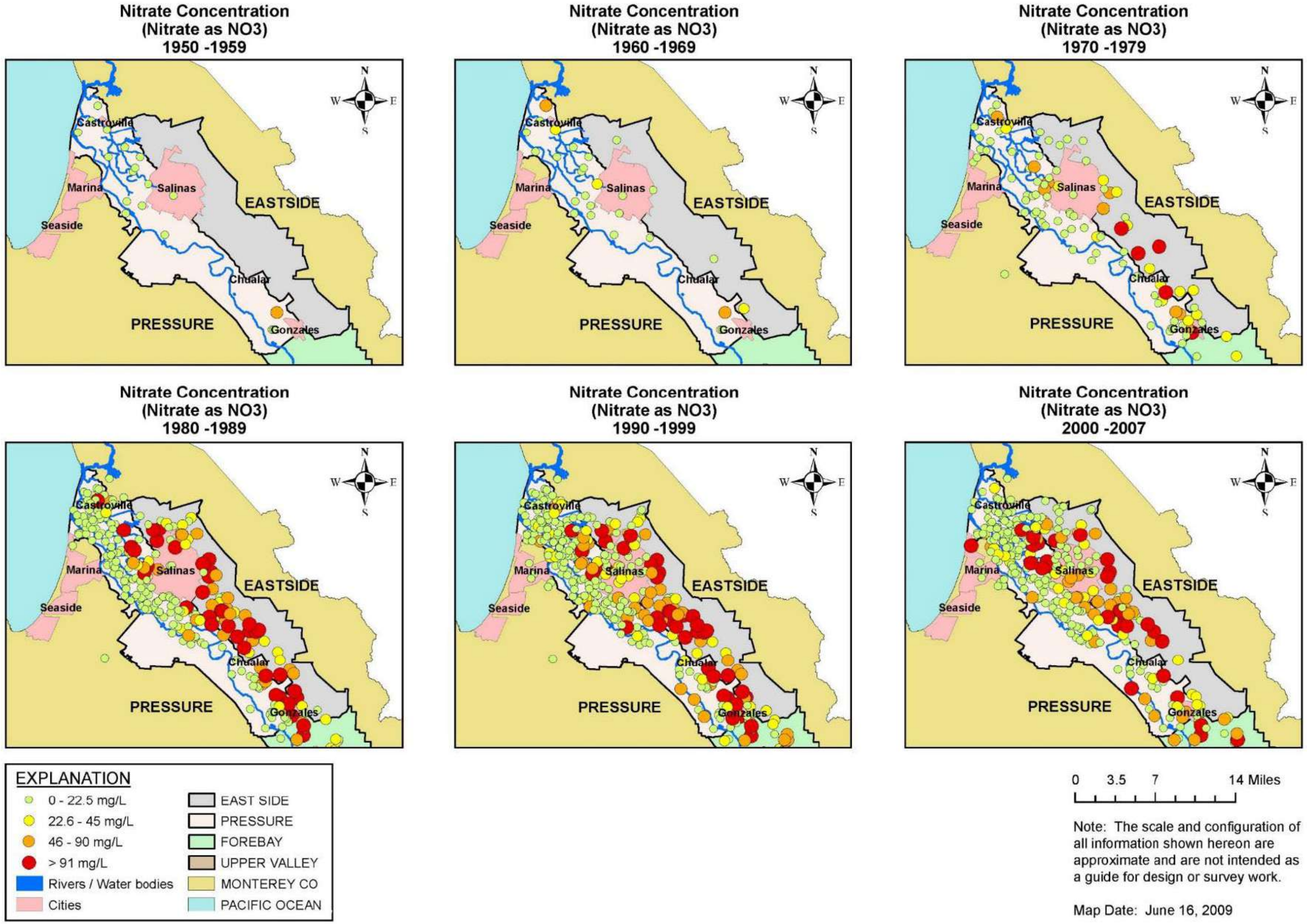


Figure 5-30. Nitrate Concentrations, 1950 to 2007
(modified from MCWRA data)

Additional groundwater quality conditions in the Basin are summarized in two USGS water quality studies in the Salinas Valley. The USGS 2005 GAMA study characterized deeper groundwater resources used for public water supply (Kulongoski and Belitz, 2005). The USGS 2018 GAMA study focused on domestic well water quality (Burton and Wright, 2018). The source data used in these two studies and additional publicly available water quality data can be accessed through the SWRCB GAMA groundwater information system at: https://gamagroundwater.waterboards.ca.gov/gama/datadownload.

The GAMA groundwater information system includes groundwater quality data for public water system supply wells from the SWRCB Division of Drinking Water (DDW), and on-farm domestic wells and irrigation supply wells from CCRWQCB's Irrigated Lands Regulatory Program (ILRP). This GSP relies on established thresholds for constituents of concern (COC): Maximum Contaminant Levels (MCLs) and Secondary Maximum Contaminant Levels (SMCLs) established by the State's Title 22 drinking water standards for public water system supply wells and on-farm domestic wells, and COC levels that may lead to reduced crop production for irrigation supply wells, as outlined in the CCRWQCB's Basin Plan (CCRWQCB, 2019).

Table 5-6 reports the constituents of concern in the 180/400-Foot Aquifer Subbasin based on GAMA groundwater information system data up to 2020. The number of wells that exceed the regulatory standard for any given COC is based on the latest sample for each well in the monitoring network. Not all wells have been sampled for all COC. Therefore, the percentage of wells with exceedances is the number of wells that exceed the regulatory standard divided by the total number of wells that have ever been sampled for that COC. Additionally, Table 5-6 does not report all of the constituents that are monitored under Title 22 or the Basin Plan; it only includes the constituents that exceed a regulatory standard. The total list of constituents sampled in the water quality monitoring network are listed in Table 8-4. Maps with the locations of wells that exceeded the regulatory standard for any of the COC listed in Table 5-6 from 2013 to 2019 are provided in Appendix 5C.

Table 5-6. Water Quality Constituents of Concern and Exccedances

Constituent of Concern	Regulatory Exceedance Standard	Standard Units	Number of Wells Sampled for COC	Number of Wells Exceeding Regulatory Standard from latest sample	Percentage of Wells with Exceedances
DDW Wells (Data from April 1974 to December 2020)					
Aluminum	**1000**	**UG/L**	**100**	**1**	**1%**
Arsenic	10	UG/L	102	2	2%
Di(2-ethylhexyl) phthalate	4	UG/L	86	2	2%
Benzo(a)Pyrene	0.2	MG/L	86	2	2%
Chloride	500	MG/L	97	3	3%
1,2 Dibromo-3-chloropropane	0.2	UG/L	81	9	11%
Dinoseb	7	UG/L	100	2	2%
Fluoride	2	MG/L	103	1	1%
Iron	300	UG/L	96	6	6%
Hexachlorobenzene	1	UG/L	67	2	3%
Heptachlor	0.01	UG/L	65	2	3%
Manganese	50	UG/L	95	5	5%
Methyl-tert-butyl ether (MTBE)	13	UG/L	101	3	3%
Nitrate (as nitrogen)	10	MG/L	139	12	9%
Tetrachloroethene	5	UG/L	150	1	1%
Specific Conductance	1600	UMHOS/CM	103	4	4%
Selenium	20	UG/L	101	2	2%
1,2,4-Trichlorobenzene	4	UG/L	102	1	1%
1,2,3-Trichloropropane	0.005	UG/L	107	13	12%
Total Dissolved Solids	1000	MG/L	98	7	7%
Vinyl Chloride	0.5	UG/L	150	34	23%
On-Farm Domestic ILRP Wells (Data from August 2012 to December 2020)					
Chloride	**500**	**MG/L**	**181**	**9**	**5%**
Iron	300	UG/L	41	11	27%
Manganese	50	UG/L	41	3	7%
Nitrite	1	MG/L	99	1	1%
Nitrate (as nitrogen)	10	MG/L	191	49	26%
Nitrate + Nitrite (sum as nitrogen)	10	MG/L	70	14	20%
Specific Conductance	1600	UMHOS/CM	207	44	21%
Sulfate	500	MG/L	181	3	2%
Total Dissolved Solids	1000	MG/L	154	44	30%
ILRP Irrigation Wells (Data from September 2012 to December 2020)					
Chloride	**350**	**MG/L**	**324**	**28**	**9%**
Iron	5000	UG/L	98	2	2%
Manganese	200	UG/L	98	1	1%

5.4.4 Groundwater Quality Summary

Based on the water quality information for the DDW and ILRP wells from GAMA groundwater information system, the following are the COC for drinking water supply wells in the Subbasin and that have exceedances in the Subbasin:

- 1,2 dibromo-3-chloropropane
- 1,2,3-trichloropropane
- 1,2,4-trichlorobenzene
- aluminum
- arsenic
- benzo(a)pyrene
- chloride
- di(2-ethylhexyl) phthalate
- dinoseb
- fluoride
- heptachlor
- hexachlorobenzene
- iron
- manganese
- methyl-tert-butyl ether (MTBE)
- nitrate (as nitrogen)
- nitrate + nitrite (sum as nitrogen)
- nitrite
- selenium
- specific conductance
- sulfate
- tetrachloroethene
- total dissolved solids
- vinyl chloride

The COC for agricultural supply wells that occur in the Subbasin and are known to cause reductions in crop production when irrigation water includes them in concentrations above agricultural water quality objectives include:

- chloride
- iron
- manganese

The COC for active cleanup sites listed in Table 5-5 are not part of the monitoring network described in Chapter 7. However, the status of these constituents at these sites will continue to be monitored by the DTSC or the CCRWQCB. Furthermore, the COC at these sites that have a regulatory standard under Title 22 for drinking water wells, or the Basin Plan for irrigation supply wells will be monitored in the DDW and ILRP wells that are part of the monitoring network.

This GSP relies on data from existing monitoring programs to measure changes in groundwater quality. Therefore, the GSA is dependent on the monitoring density and frequency of the DDW and ILRP. The monitoring system is further defined in Chapter 7.

5.5 Subsidence

Land subsidence is the lowering of the ground surface elevation. This is often caused by pumping below thick clay layers. Land subsidence can be elastic or inelastic. Elastic subsidence is called elastic because the small, lowering and rising of the ground surface is reversible. Inelastic subsidence is generally irreversible and is the focus of this GSP.

5.5.1 Data Sources

To estimate subsidence, DWR has made Interferometric Synthetic Aperture Radar (InSAR) satellite data available on their SGMA Data Viewer web map: https://sgma.water.ca.gov/webgis/?appid=SGMADataViewer#landsub. These are the only data used for estimating subsidence in this GSP.

5.5.2 Subsidence Mapping

Figure 5-31 presents a map showing the average annual InSAR subsidence data in the 180/400-Foot Aquifer Subbasin between June 2015 and June 2020 (DWR, 2020a). The yellow area on the map is the area with measured average annual changes in ground elevation of between -0.1 and 0.1 foot. As discussed in Section 8.9.2.1, because of measurement error in this methodology, any measured ground level changes between -0.1 and 0.1 foot are considered an area of no subsidence. The white areas on the map are areas with no available data. The map shows that no measurable subsidence has been recorded anywhere in the Subbasin.

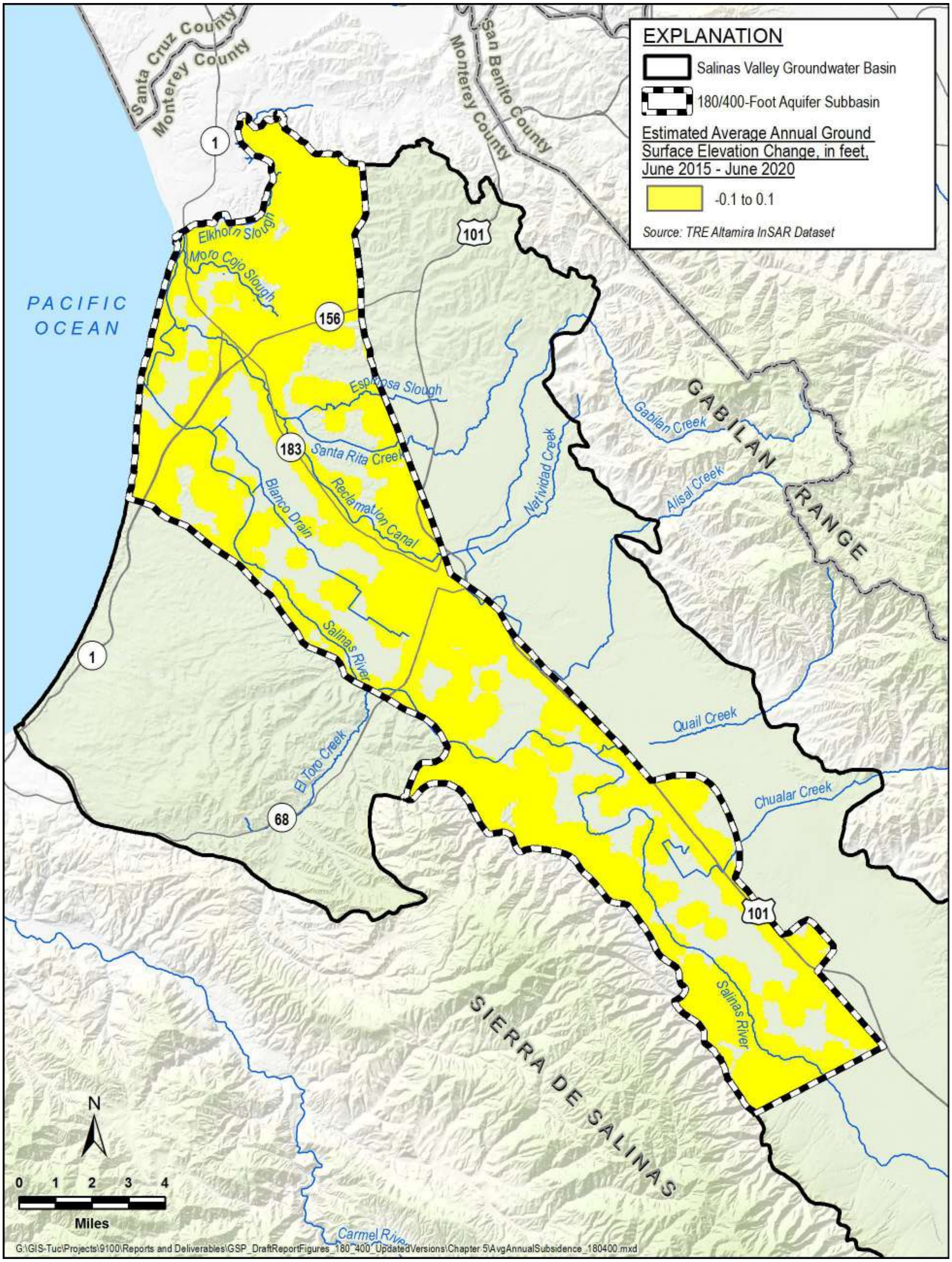


Figure 5-31. Estimated Average Annual InSAR Subsidence in Subbasin

5.6 Interconnected Surface Water

ISW is surface water that is hydraulically connected at any point by a continuous saturated zone to the underlying aquifer and the overlying surface water is not completed. If groundwater elevations are higher than the water level in the stream, the stream is said to be a gaining stream because it gains water from the surrounding groundwater. If the groundwater elevation is lower than the water level in the stream, it is termed a losing stream because it loses water to the surrounding groundwater. If the groundwater elevation is below the streambed elevation, the stream and groundwater are disconnected. SGMA does not require that disconnected stream reaches be analyzed or managed. These concepts are illustrated on Figure 5-32.

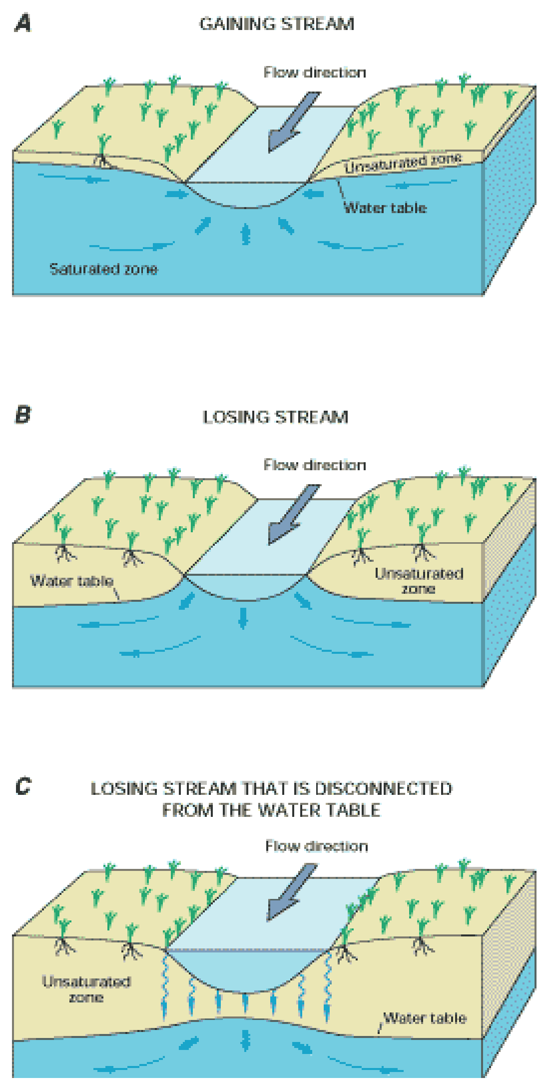


Figure 5-32. Conceptual Representation of Interconnected Surface Water (Winter, et al., 1999)

5.6.1 Data Sources

The preliminary SVIHM is used to map the potential locations of ISW, as described in Chapter 4 and shown on Figure 4-11. There is no data that verifies the location and extent of surface water connection to groundwater, nor the extent to which groundwater extraction depletes surface water. Therefore, this section describes the hydraulic principles that establish the relationship between surface water and groundwater, upon which the current conditions and monitoring network are based.

5.6.2 Evaluation of Surface Water and Groundwater Interconnection

Groundwater extraction can alter flows between surface water and groundwater. Flow changes related to interconnected surface and groundwater could be due to reductions in groundwater discharge to surface water, or increases in surface water recharge to groundwater. These two changes together constitute the change in the amount of surface water depletion.

Depletion of ISW is estimated by evaluating the change in the modeled stream leakage with and without pumping (i.e., water flowing from the stream into the groundwater system). A model simulation without any groundwater pumping in the model (i.e., SVIHM with no pumping) was compared to the model simulation with groundwater pumping (i.e., SVIHM with pumping). The difference in stream depletion between the 2 models is the depletion caused by the groundwater pumping. This comparison was undertaken for the entire area of the Salinas Valley included in the model and also for the Subbasin. The stream depletion differences are only estimated for the interconnected segments identified on Figure 4-11. The Salinas Valley Aquitard extends across much of the Subbasin and inhibits hydraulic connection between the stream and the underlying principal aquifers where groundwater pumping occurs. This analysis assumes that ISW in the Subbasin occurs along stream reaches located outside the mapped extent of the Aquitard shown on Figure 4-12. The methodology for quantifying stream depletion is described in detail by Barlow and Leake (2012).

This analysis uses the “peak” conservation release period from June to September that reflects when most conservation releases are made, not the full April to October MCWRA conservation release period when releases can be made. Depletion of interconnected sections of the surface water bodies is estimated separately for the peak conservation release period of June through September, and the non-peak conservation release period of October through May. Table 5-7 shows the estimated annual average depletion of ISW due to groundwater pumping along the stream segments in the Subbasin shown on Figure 4-11.

Table 5-7. Average SVIHM Simulated Depletion of Interconnected Surface Waters (AF/yr)

Peak Conservation Release Period	Non-Peak Conservation Release Period
2,600	5,800

Note: provisional data subject to change[1].

[1] These data (model and/or model results) are preliminary or provisional and are subject to revision. This model and model results are being provided to meet the need for timely best science. The model has not received final approval by the U.S. Geological Survey (USGS). No warranty, expressed or implied, is made by the USGS or the U.S. Government as to the functionality of the model and related material nor shall the fact of release constitute any such warranty. The model is provided on the condition that neither the USGS nor the U.S. Government shall be held liable for any damages resulting from the authorized or unauthorized use of the model.

5.7 Water Use

5.7.1 Data Sources

As mentioned in Chapter 3, water use in the 180/400-Foot Aquifer Subbasin consists of groundwater extraction, surface water, and recycled water. Agricultural and urban groundwater extraction data is collected by MCWRA through GEMS for wells with discharge pipes with an internal diameter greater than 3 inches within Zones 2, 2A, and 2B. Domestic pumping, including water systems small enough to not require reporting to the State, is estimated by multiplying the estimated number of domestic users by a water use factor. The initial water use factor used is 0.39 AF/yr/dwelling unit. Surface water diversions from the Salinas River collected by eWRIMS and SRDF make up the surface water supplies in the Subbasin. SVRP provides most of the recycled water in the Subbasin.

5.7.2 Water Use

5.7.2.1 Groundwater Use

Table 5-8 provides groundwater extraction by water use sector for the 180/400-Foot Aquifer Subbasin from 2017 to 2020. 2017 was considered current conditions in the GSP and this GSP Update uses 2020 to define current conditions. Agricultural pumping is reported by MCWRA for the period November 1 through October 31, whereas urban pumping is reported on a calendar-year basis. These reporting periods and submittal deadlines for the GEMS data is defined by Monterey County Ordinance No. 3717 and 3718. Rural domestic pumping is estimated on a calendar year basis.

Urban use data from MCWRA aggregates municipal wells, small public water systems, and industrial wells. On average, agricultural use accounted for 90% of groundwater extraction from 2017 to 2020; urban and industrial use accounted for 10%. MCWRA's Groundwater Reporting Program allows three different reporting methods: water flowmeter, electrical meter, or hour meter. From 2017 to 2020, 83% of extractions on average were calculated using a flowmeter, 16% electrical meter and <1%-hour meter. MCWRA ordinances 3717 and 3718 require annual flowmeter calibration, and that flowmeters be accurate to within +/- 5%. The same ordinance requires annual pump efficiency tests. SVBGSA assumes an electrical meter accuracy of +/- 5%. No groundwater was extracted for managed wetlands or managed recharge. Groundwater use by natural vegetation is assumed to be small and was not estimated for this report. This is a data gap that will be addressed with the Salinas Valley Integrated Hydrologic Model (SVIHM) in subsequent annual reports. Figure 5-33 illustrates the general location and volume of average groundwater extractions in the Subbasin from 2017 to 2020.

Table 5-8. 2017 to 2020 Groundwater Use (AF/yr)

	2017	2018	2019	2020
Rural Domestic	200	200	200	200
Urban (includes industrial)	11,000	12,600	12,100	12,300
Agricultural	101,600	103,200	105,100	106,500
Managed Wetlands	0	0	0	0
Managed Recharge	0	0	0	0
Natural Vegetation	0	0	0	0
Total	**112,800**	**116,000**	**117,400**	**119,000**

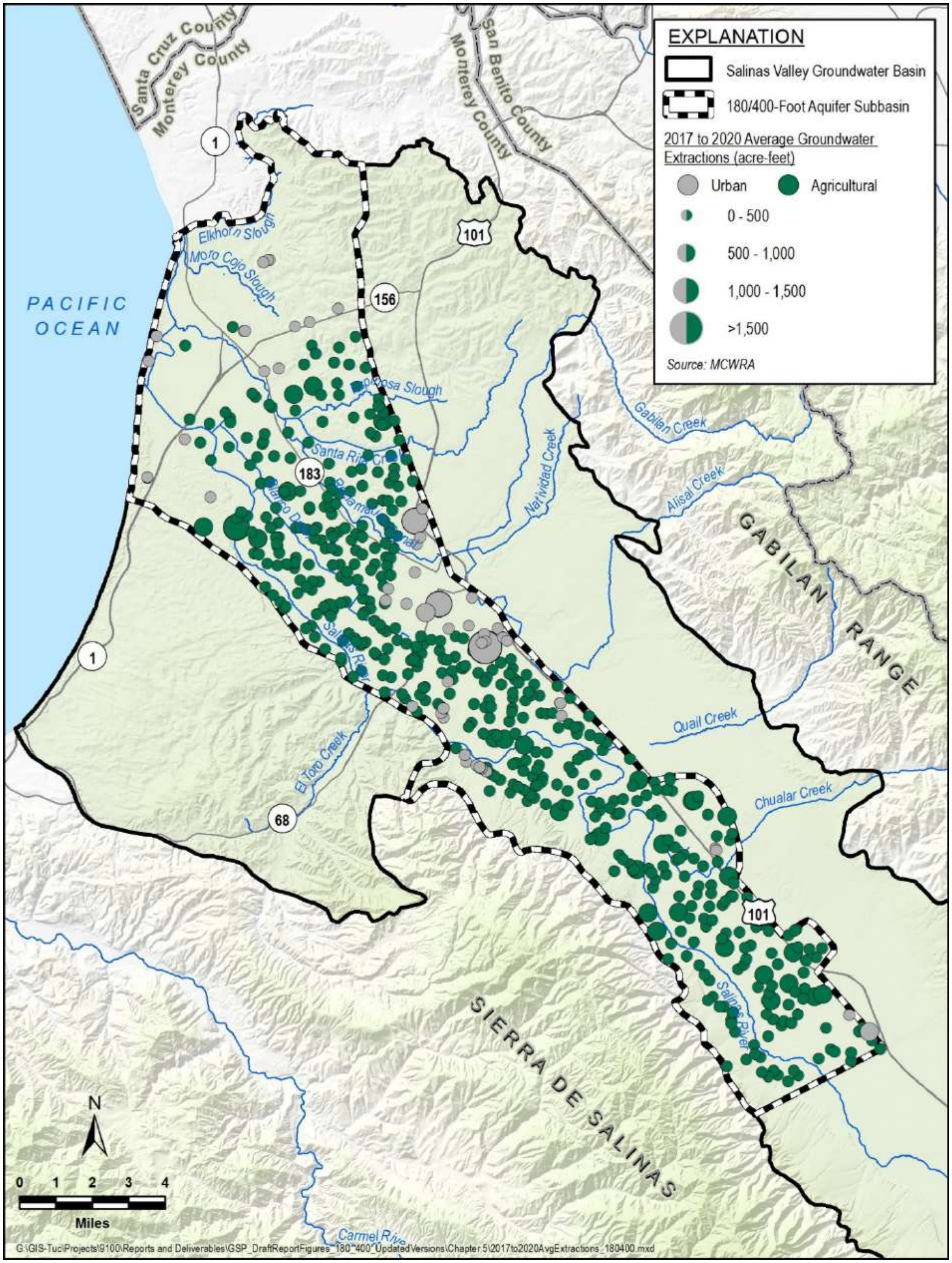


Figure 5-33. General Location and Volume of Groundwater Extractions in the 180/400-Foot Aquifer Subbasin

5.7.2.2 Surface Water Supply

Annual Salinas River diversion data are obtained from the SWRCB's eWRIMS website (SWRCB, 2021c). These data are combined with annual SRDF diversions to calculate the total surface water use in the 180/400-Foot Aquifer Subbasin. This accounting is done for convenience only and is not meant to imply that any or all of the reported diversions are classified as surface water. All surface water is used for irrigation.

Table 5-9. 2017 to 2020 Surface Water Use

Surface Water Diversions	2017	2018	2019	2020
SRDF	4,200	5,300	7,600	6,700
eWRIMS	7,800	7,800	7,100	7,800
Total	**11,900**	**13,100**	**14,700**	**14,500**

5.7.2.3 Recycled Water Supply

In addition to groundwater and surface water, a third water source type in the 180/400-Foot Aquifer Subbasin is recycled water. Monterey One Water treats and delivers this Salinas Valley Reclamation Plant (SVRP) recycled water to the coastal farmland surrounding Castroville through the CSIP system. Recycled water deliveries are summarized in Table 5-10.

Table 5-10. 2017 to 2020 Recycled Water Use

	2017	2018	2019	2020
SVRP-Recycled	10,300	13,600	8,500	12,500

5.7.2.4 Total Water Use

Total water use is the sum of groundwater extractions, surface water use, and recycled water use and is summarized in Table 5-11 and Figure 5-34.

Many growers and residents have noted that some irrigation water use is reported both to the SWRCB's eWRIMS as Salinas River diversions and to the MCWRA as groundwater pumping. Comparing surface water diversion data to groundwater pumping data is complicated by the fact that diversions and pumping are reported on different schedules. An initial analysis was undertaken by matching unique locations and monthly diversion amounts summed by the GEMS reporting year (November 1 to October 31) to reported annual pumping data from 2017 to 2020. The initial analysis suggests an average 2,200 AF/yr of water was reported to both MCWRA and the SWRCB. Further review indicated that the eWRIMS diversions do not include the Salinas River diversions at the SRDF. To avoid double counting, 2,200 AF of groundwater pumping are deducted from agricultural groundwater use to account for the potential double reporting.

Table 5-11. 2017 to 2020 Total Water Use by Water Source Type and Water Use Sector

Water Use Sector	2017			2018			2019			2020		
	Groundwater Extraction	Surface Water Use	Recycled Water	Groundwater Extraction	Surface Water Use	Recycled Water	Groundwater Extraction	Surface Water Use	Recycled Water	Groundwater Extraction	Surface Water Use	Recycled Water
Rural Domestic	200	0	0	200	0	0	200	0	0	200	0	0
Urban	11,000	0	0	12,600	0	0	12,100	0	0	12,300	0	0
Agricultural	99,400	11,900	10,300	101,000	13,100	13,600	102,900	14,700	8,500	104,300	14500	12500
SUBTOTALS	**110,600**	**11,900**	**10,300**	**113,800**	**13,100**	**13,600**	**115,200**	**14,700**	**8,500**	**116,800**	**14500**	**12500**
TOTAL	**132,800**			**140,500**			**138,400**			**143,800**		

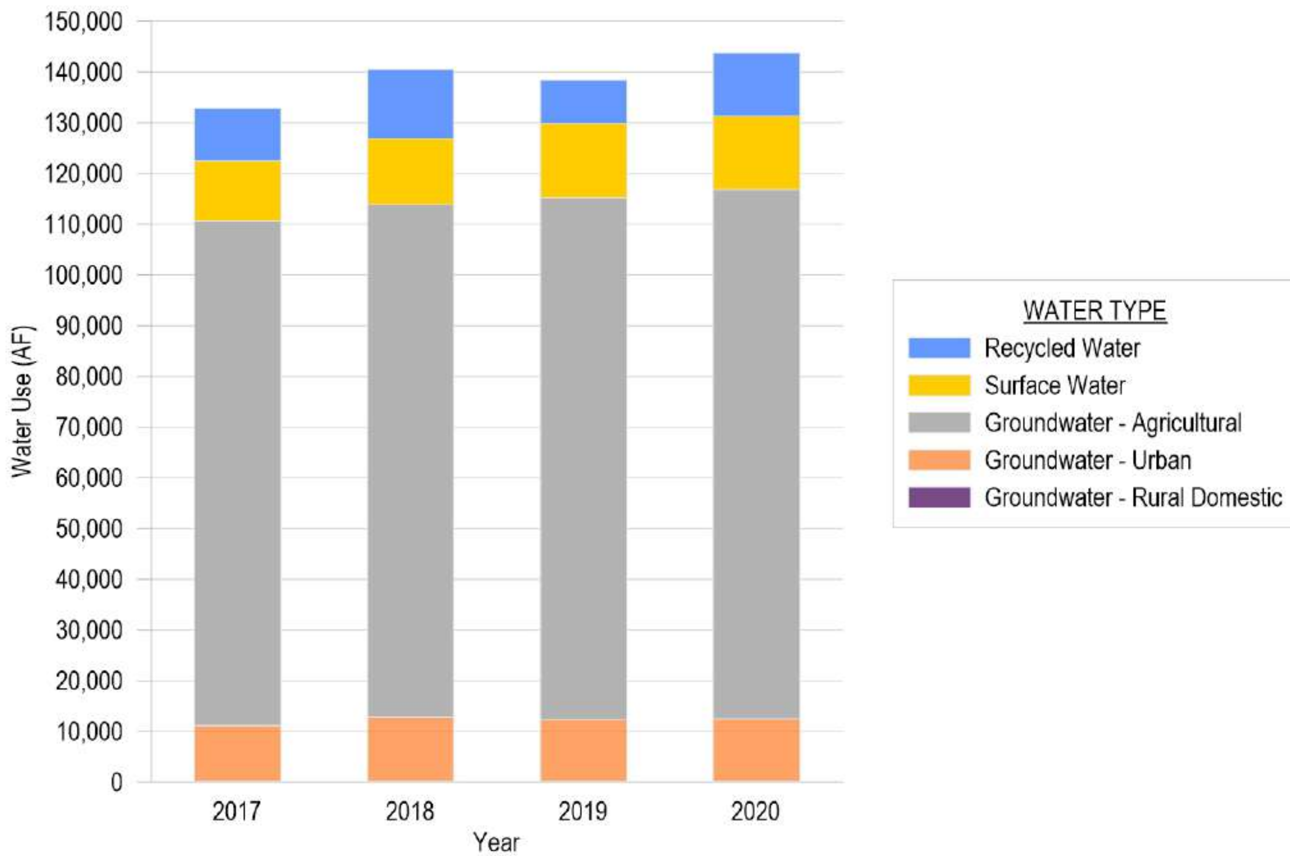


Figure 5-34. 2017 to 2020 Total Water Use by Water Source Type and Water Use Sector

6 WATER BUDGETS

This section summarizes the estimated water budgets for the 180/400-Foot Aquifer Subbasin, including information required by the GSP Regulations and information that is important for developing an effective plan to achieve sustainability. In accordance with the SGMA Regulations § 354.18, this water budget provides an accounting and assessment of the total annual volume of surface water and groundwater entering and leaving the basin, including historical, current, and projected water budget conditions, and the change in the volume of groundwater in storage. Water budgets are reported in graphical and tabular formats, where applicable.

The previous water budgets described in the approved GSP was developed using best tools and methods available at the time. Since the release and approval of that GSP, a provisional version of the Salinas Valley Integrated Hydrologic Model and an updated version of the Salinas Valley Operational Model were released by the USGS to the SVBGSA for use in developing GSPs. Updating the water budgets for this Subbasin using these new, best available tools is important for maintaining consistency with adjacent Subbasins managed by the SVBGSA. This section describes the water budgets for this Subbasin in a manner consistent with GSPs for other Subbasins in the Valley.

6.1 Overview of Water Budget Development

The water budgets are presented in two subsections: (1) historical and current water budgets, and (2) future water budgets. Within each subsection a surface water budget and groundwater budget are presented.

Historical and current water budgets are developed using a provisional version of the Salinas Valley Integrated Hydrologic Model (SVIHM)[2], developed by the United States Geological Survey (USGS). The SVIHM is a numerical groundwater-surface water model that is constructed using version 2 of the MODFLOW-OWHM code (Boyce *et al.*, 2020). This code is a version of the USGS groundwater flow code MODFLOW that estimates agricultural supply and demand through the Farm Process.

The model area covers the Salinas Valley Groundwater Basin from the Monterey-San Luis Obispo County Line in the south to the Pajaro Basin in the north, including the offshore extent of

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[2] These data (model and/or model results) are preliminary or provisional and are subject to revision. This model and model results are being provided to meet the need for timely best science. The model has not received final approval by the U.S. Geological Survey (USGS). No warranty, expressed or implied, is made by the USGS or the U.S. Government as to the functionality of the model and related material nor shall the fact of release constitute any such warranty. The model is provided on the condition that neither the USGS nor the U.S. Government shall be held liable for any damages resulting from the authorized or unauthorized use of the model.

the major aquifers. The model includes operations of the San Antonio and Nacimiento reservoirs. The SVIHM is supported by two sub models: a geologic model known as the Salinas Valley Geologic Model (SVGM) and a watershed model known as the Hydrologic Simulation Program – Fortran (HSPF). The SVIHM is not yet released by the USGS. Details regarding source data, model construction and calibration, and results for historical and current water budgets will be summarized in more detail once the model and associated documentation are available.

Future water budgets are being developed using an evaluation version of the Salinas Valley Operational Model (SVOM), developed by the USGS and Monterey County Water Resources Agency (MCWRA). The SVOM is a numerical groundwater-surface water model constructed with the same framework and processes as the SVIHM. However, the SVOM is designed for simulating future scenarios and includes complex surface water operations in the Surface Water Operations (SWO) module. The SVOM is not yet released by the USGS. Details regarding source data, model construction and calibration, and results for future budgets will be summarized in more detail once the model and associated documentation are available

In accordance with SGMA Regulations § 354.18, an integrated groundwater budget is developed for each principal aquifer for each water budget period. The 180/400-Foot Aquifer Subbasin comprises 3 principal aquifers.

6.1.1 Water Budget Components

The water budget is an inventory of the Subbasin's surface water and groundwater inflows and outflows. Some components of the water budget can be measured, such as groundwater pumping from metered wells, precipitation, and surface water diversions. Other components are not easily measured and can be estimated using groundwater models such as the SVIHM; these include unmetered agricultural pumping, recharge from precipitation and applied irrigation, and change in groundwater in storage. Figure 6-1 presents a general schematic diagram of the hydrogeologic conceptual model that is included in the water budget (DWR, 2020b). Figure 6-2 delineates the zones and boundary conditions of the SVIHM.

The water budgets for the Subbasin are calculated within the following boundaries:

- Lateral boundaries: The perimeter of the 180/400-Foot Aquifer Subbasin within the SVIHM is shown on Figure 6-2.
- Bottom: The base of the groundwater subbasin is described in the Hydrogeologic Conceptual Model and is defined as the base of the usable and productive unconsolidated sediments (Durbin *et al.* 1978). This ranges from less than 800 feet below ground surface in the far north of the Subbasin to almost 2,600 feet deep along the Subbasin's southwestern edge. The water budget is not sensitive to the exact definition of this base elevation because the base is defined as a depth below where there is not significant inflow, outflow, or change in storage.
- Top: The top of the water budget area is above the ground surface, so that surface water is included in the water budget.

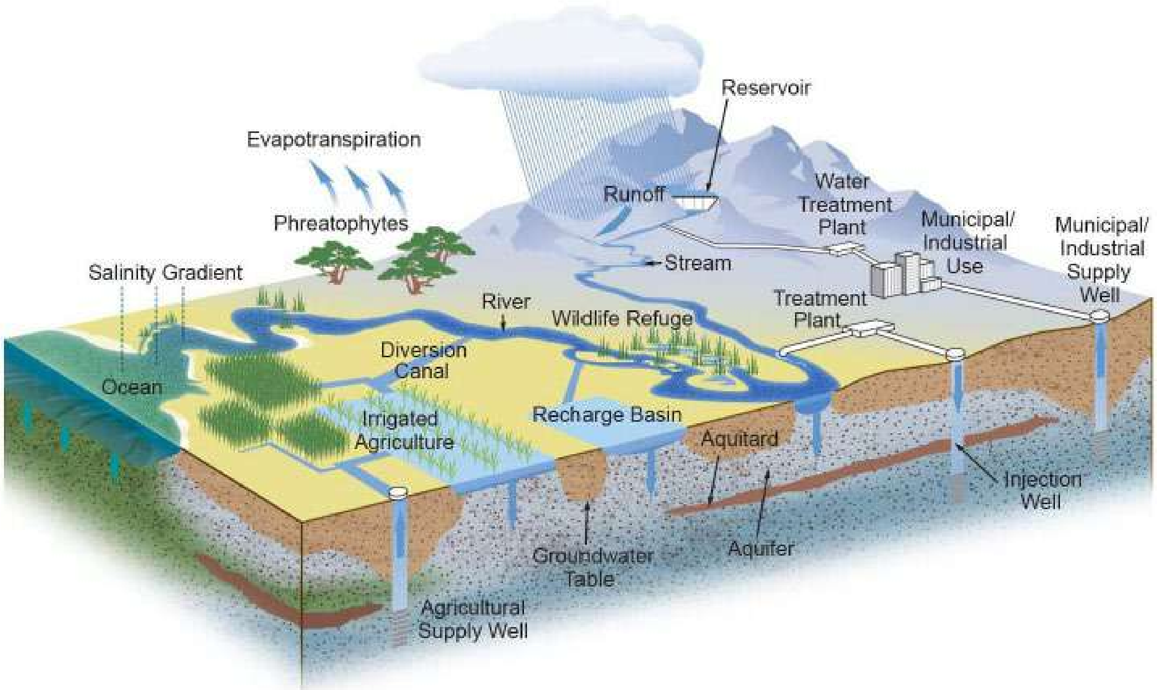

Figure 6-1. Schematic Hydrogeologic Conceptual Model (from DWR, 2020b)

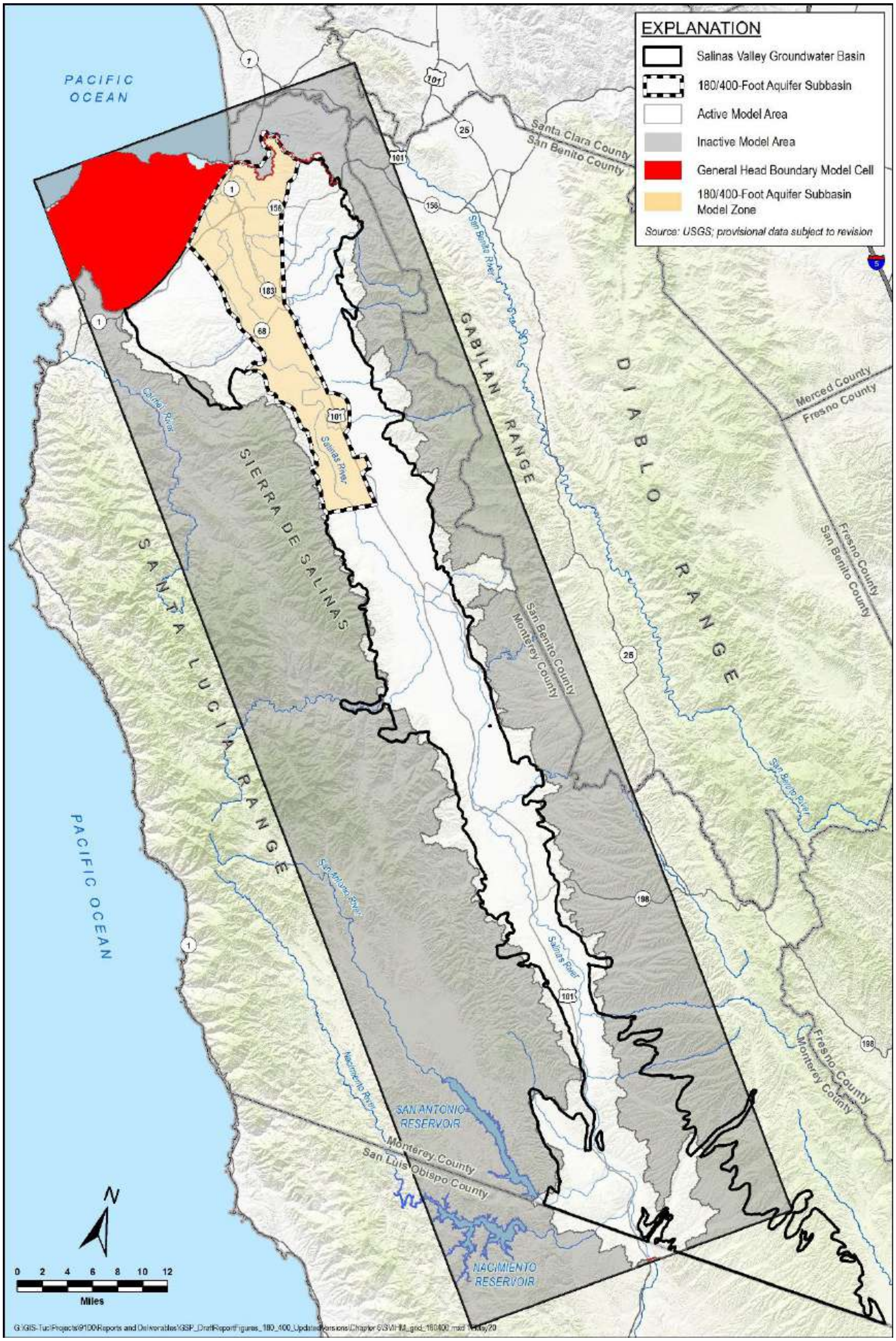

Figure 6-2. Subbasin Border and Boundary Conditions for the Salinas Valley Integrated Hydrologic Model

The 180/400-Foot Aquifer Subbasin water budget includes the following components:

Surface Water Budget:

- Inflows
  - Runoff of precipitation
  - Surface water inflows from streams and canals that enter the subbasin, including Salinas River, Chualar Creek, Quail Creek, Alisal Creek, Salinas Reclamation Canal, Santa Rita Creek, and several other smaller creeks
  - Groundwater discharge to streams
- Outflows
  - Stream discharge to groundwater
  - Stream diversions
  - Outflow to the ocean and neighboring subbasins from the Salinas River and other smaller streams

Groundwater Budget:

- Inflows
  - Deep percolation from precipitation and applied irrigation
  - Stream discharge to groundwater
  - Subsurface inflows, including:
    - Inflow from the Forebay Aquifer Subbasin
    - Inflow from the Langley Aquifer Subbasin
    - Inflow from the Eastside Aquifer Subbasin
    - Inflow from the Pajaro Valley Subbasin
    - Inflow from the Monterey Subbasin
    - Inflow from the Pacific Ocean (seawater intrusion)
    - Inflow from the surrounding watershed that are not in other DWR subbasins
- Outflows
  - Riparian evapotranspiration (ET)
  - Groundwater pumping, including municipal, industrial, and agricultural
  - Groundwater discharge to streams

- Groundwater discharge to drains
- Subsurface outflows, including:
  - Outflow to the Forebay Aquifer Subbasin
  - Outflow to the Langley Area Subbasin
  - Outflow to the Eastside Aquifer Subbasin
  - Outflow to the Pajaro Valley Subbasin
  - Outflow to the Monterey Subbasin
  - Outflows to the Pacific Ocean
  - Outflow to surrounding watershed that are not in other DWR subbasins

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

6.1.2 Water Budget Time Frames

Time periods must be specified for each of the 3 required water budgets. The SGMA Regulations require water budgets for historical conditions, current conditions, and projected conditions.

- The historical water budget is intended to evaluate how past land use and water supply availability has affected aquifer conditions and the ability of groundwater users to operate within the sustainable yield. GSP Regulations require that the historical water budget include at least the most recent 10 years of water budget information. DWR's Water Budget Best Management Practices (BMP) document further states that the historical water budget should help develop an understanding of how historical conditions concerning hydrology, water demand, and surface water supply availability or reliability have impacted the ability to operate the basin within the sustainable yield. Accordingly, historical conditions should include the most reliable historical data that are available for GSP development and water budgets calculations.
- The current water budget is intended to allow the GSA and DWR to understand the existing supply, demand, and change in storage under the most recent population, land use, and hydrologic conditions. Current conditions are generally the most recent conditions for which adequate data are available and that represent recent climatic and hydrologic conditions. Current conditions are not well defined by DWR but can include an average over a few recent years with various climatic and hydrologic conditions.
- The projected water budget is intended to quantify the estimated future baseline conditions. The projected water budget estimates the future baseline conditions concerning hydrology, water demand, and surface water supply over a 50-year

planning and implementation horizon. It is based on historical trends in hydrologic conditions which are used to project forward 50 years while considering projected climate change and sea level rise if applicable.

Although there is a significant variation between wet and dry seasons, the GSP does not consider separate seasonal water budgets for the groundwater budget. All water budgets are developed for complete water years. Selected time periods for the historical and current water budgets are summarized in Table 6-1 and on Figure 6-3. and described in Sections 6.1.2.1 and 6.1.2.2.

Table 6-1. Summary of Historical and Current Water Budget Time Periods

Time Period	Proposed Date Range	Water Year Types Represented in Time Period	Rationale
Historical	Water years 1980 through 2016	Dry: 11 Dry-Normal: 7 Normal: 5 Wet-Normal: 3 Wet: 11	Provides insights on water budget response to a wide range of variations in climate and groundwater use over an extensive period of record. Begins and ends in years with average precipitation.
Current	Water Year 2016	Dry-Normal: 1	Best reflection of current land use and water use conditions based on best available data.

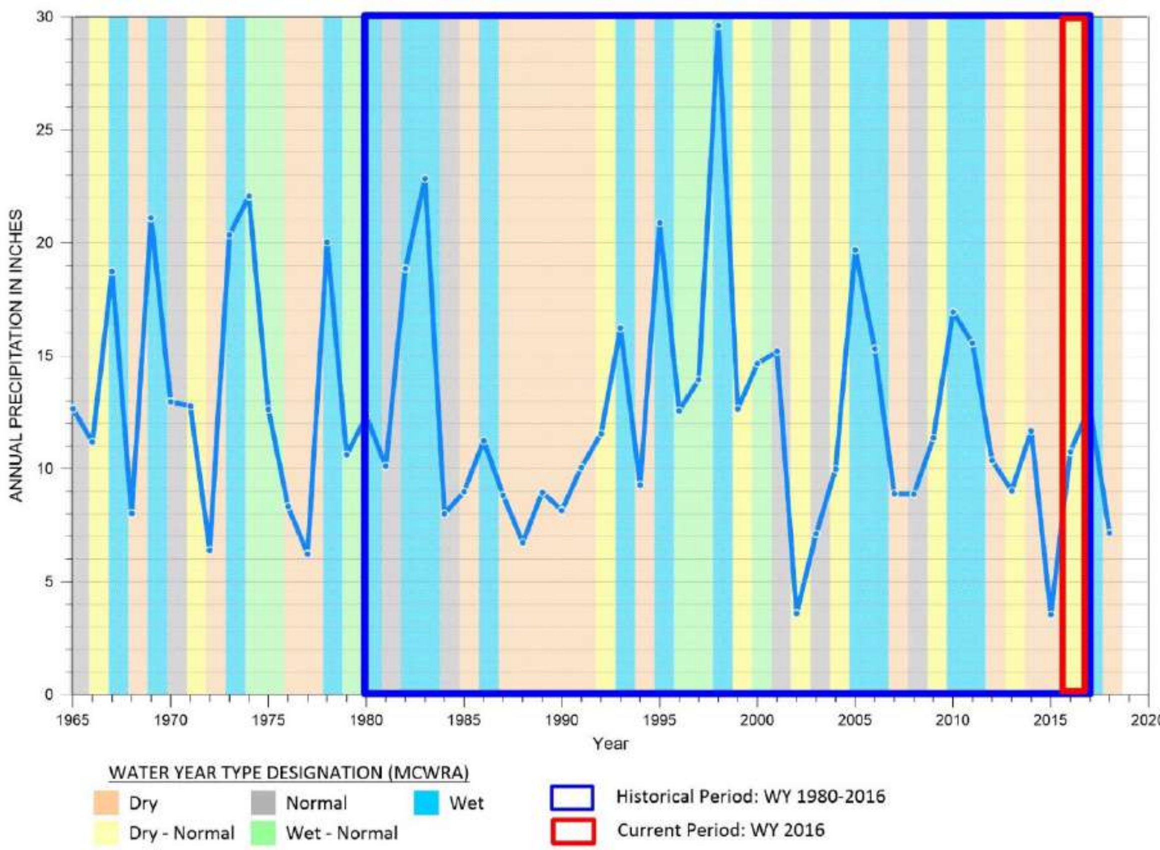

Figure 6-3. Climate and Precipitation for Historical and Current Water Budget Time Periods

6.1.2.1 Historical Water Budgets Time Period

GSP regulations require that the historical water budget be based on at least 10 years of data. The water budget is computed using results from the SVIHM numerical model for the period from October 1980 through September 2016. The SVIHM simulation covers water years 1967 through 2017; however, model results for years prior to 1980 and the year 2017 were not used for this water budget due to potential limitations and uncertainties in the provisional SVIHM. Water years 1980 through 2016 comprise a representative period with both wet and dry periods in the Subbasin (Table 6-1, Figure 6-3).

6.1.2.2 Current Water Budget Time Period

The current water budget is also computed using the SVIHM numerical model and is based on water year 2016. Water year 2016 is classified as dry-normal and is reflective of current and recent patterns of groundwater use and surface water use. Although Water Year 2016 appropriately meets the regulatory requirement for using the "…most recent hydrology, water supply, water demand, and land use information" (23 California Code of Regulations § 354.18 (c)(1)), water year 2016 may underestimate water availability because it was preceded by multiple dry or dry-normal years.

6.1.2.3 Future Projected Water Budgets Time Period

Future projected conditions are based on model simulations using the SVOM numerical flow model, using current reservoir operations rules, projected climate-change scenario, and estimated sea level rise. The projected water budget represents 47 years of future conditions. Following DWR guidance on implementing climate change factors, the future water budget simulations do not simulate a 47-year projected future, but rather simulate 47 likely hydrologic events that may occur in 2030, and 47 likely hydrologic events that may occur in 2070.

6.2 Overview of Data Sources for Water Budget Development

Table 6-2 provides the detailed water budget components and known model assumptions and limitations for each. A few water budget components are directly measured, but most water budget components are either estimated as input to the model or simulated by the model. Both estimated and simulated values in the water budgets are underpinned by certain assumptions. These assumptions can lead to uncertainty in the water budget. The USGS and cooperating agencies selected inputs to the preliminary SVIHM using best available data, reducing the level of uncertainty. However, uncertainty still exists in model inputs and results. Data sources subsequently used by the SVBGSA to adapt the SVIHM water budget results include reported groundwater extraction, measured change in groundwater elevations, and measured advancement of seawater intrusion. In addition to the model assumptions, additional uncertainty stems from any model's imperfect representation of natural condition and level of calibration. The water budgets for the 180/400-Foot Aquifer Subbasin are based on a preliminary version of the SVIHM, with limited documentation of model construction. The model is in internal review at the USGS, and a final version will likely not be released to the SVBGSA until after the GSP is submitted. Nonetheless, the SVIHM's calibration error is within reasonable bounds. Therefore, the model is the best available tool for estimating water budgets for the GSP.

As GSP implementation proceeds, the SVIHM will be updated and recalibrated with new data to better inform model simulations of historical, current, and projected water budgets. Model assumptions and uncertainty will be described in future updates to this chapter after model documentation is released by the USGS.

Table 6-2. Summary of Water Budget Component Data Source from the Salinas Valley Integrated Hydrologic Model and Other Sources

Water Budget Component	Source of Model Input Data	Limitations
Surface Water Inflows		
Inflow from Streams Entering Basin	Simulated from calibrated model for all creeks	Not all creeks are gauged
Groundwater Discharge to Streams	Simulated from calibrated model	Based on calibration of streamflow to available data from gauged creeks
Overland Runoff	Simulated from calibrated model	Based on land use, precipitation, and soils specified in model
Surface Water Outflows		
Streambed Recharge to Groundwater	Simulated from calibrated model	Based on calibration of streamflow to available data from gauged creeks and groundwater level data from nearby wells
Diversions	Simulated from calibrated model	Based on calibration of streamflow to available data from gauged creeks
Outflow to Streams Leaving Basin	Simulated from calibrated model for all creeks	Not all creeks are gauged
Groundwater Inflows		
Streambed Recharge to Groundwater	Simulated from calibrated model	Based on calibration of streamflow to available data from gauged creeks and groundwater level data from nearby wells
Deep Percolation of Precipitation and Irrigation Water	Simulated from demands based on crop, acreage, temperature, and soil zone processes	No measurements available; based on assumed parameters for crops and soils
Subsurface Inflow from Adjacent Basins and Surrounding Watershed Other than Neighboring Basins	Simulated from calibrated model	Limited groundwater calibration data at adjacent subbasin boundaries

Water Budget Component	Source of Model Input Data	Limitations
Subsurface Inflow from Ocean	Simulated from calibrated model	Seawater intrusion assumed equal to groundwater flow from the ocean across coastline
Groundwater Outflows		
Groundwater Pumping	Agricultural pumping is estimated by calibrated model, based on reported land use. Urban pumping is based on reported and estimated pumping. Model documentation not available at this time. Simulated pumping adjusted in water budget based on GEMS reported pumping..	Water budget pumping reported from the SVIHM contains errors. Domestic pumping not simulated in model. Pumping adjusted according to reported data.
Groundwater Discharge to Streams	Simulated from calibrated model	Based on calibration of streamflow to available data from gauged creeks and groundwater level data from nearby wells
Groundwater Discharge to Drains	Simulated from calibrated model	Based on calibration of the surface water network and groundwater level data from nearby wells
Subsurface Outflow to Adjacent Basins and Ocean	Simulated from calibrated model	Limited calibration data at adjacent subbasin boundaries
Riparian Evapotranspiration	Simulated from calibrated model	Based on representative plant group and uniform extinction depth

GROUNDWATER EXTRACTION

Groundwater extraction reported to MCWRA through the Groundwater Extraction Management System (GEMS) is used to adjust extraction in the water budget of the main Salinas Valley model zone. These data are available starting in 1995.

Groundwater Elevations

Groundwater elevation measurements that are part of the groundwater level monitoring networks in the SVBGSA subbasins are used to adjust change in groundwater storage due to groundwater elevations. These measurements are taken by MCWRA as part of their groundwater level monitoring efforts.

Seawater Intrusion

The seawater intrusion 500 mg/L chloride isocontour developed by MCWRA is used to calculate the decrease in usable groundwater in storage due to seawater intrusion. The isocontour is based on groundwater quality monitoring completed by MCWRA.

6.3 Historical and Current Water Budgets

Water budgets for the historical and current periods are presented below. The surface water budgets are presented first, followed by the groundwater budgets. These water budgets are based on the provisional SVIHM and are subject to change in the future. Water budgets will be updated in future GSP updates after the SVIHM is formally released by the USGS.

6.3.1 Historical and Current Surface Water Budget

The surface water budget accounts for the inflows and outflows for the streams within the Subbasin. This includes streamflows of rivers and tributaries entering and exiting the Subbasin, overland runoff to streams, and stream-aquifer interactions. Evapotranspiration by riparian vegetation along stream channels is estimated by the provisional SVIHM as part of the groundwater system and is accounted for in the groundwater budget.

Figure 6-4 shows the surface water network simulated in the provisional SVIHM. The model accounts for surface water flowing in and out across the subbasin boundary. For this water budget, boundary inflows and outflows are the sum of all locations that cross the Subbasin boundary. In some instances, a simulated stream might enter and exit the Subbasin boundary at multiple locations, such as Salinas River, Chualar Creek, and Natividad Creek/Reclamation Canal. The Salinas Valley Aquitard, which extends over much of the Subbasin, limits connectivity between surface water and principal aquifers where present. Figure 6-5 shows the surface water budget for the historical period, which also includes the current period. Table 6-3 shows the average values for components of the surface water budget for the historical and current periods. Positive values are inflows into the stream system, and negative values are outflows from the stream system. Boundary stream inflows and boundary stream outflows are an order of magnitude greater than any other component of the surface water budget. The flow between surface water and groundwater in the Subbasin is generally net negative, which indicates more deep percolation of streamflow to groundwater than groundwater discharge to streams.

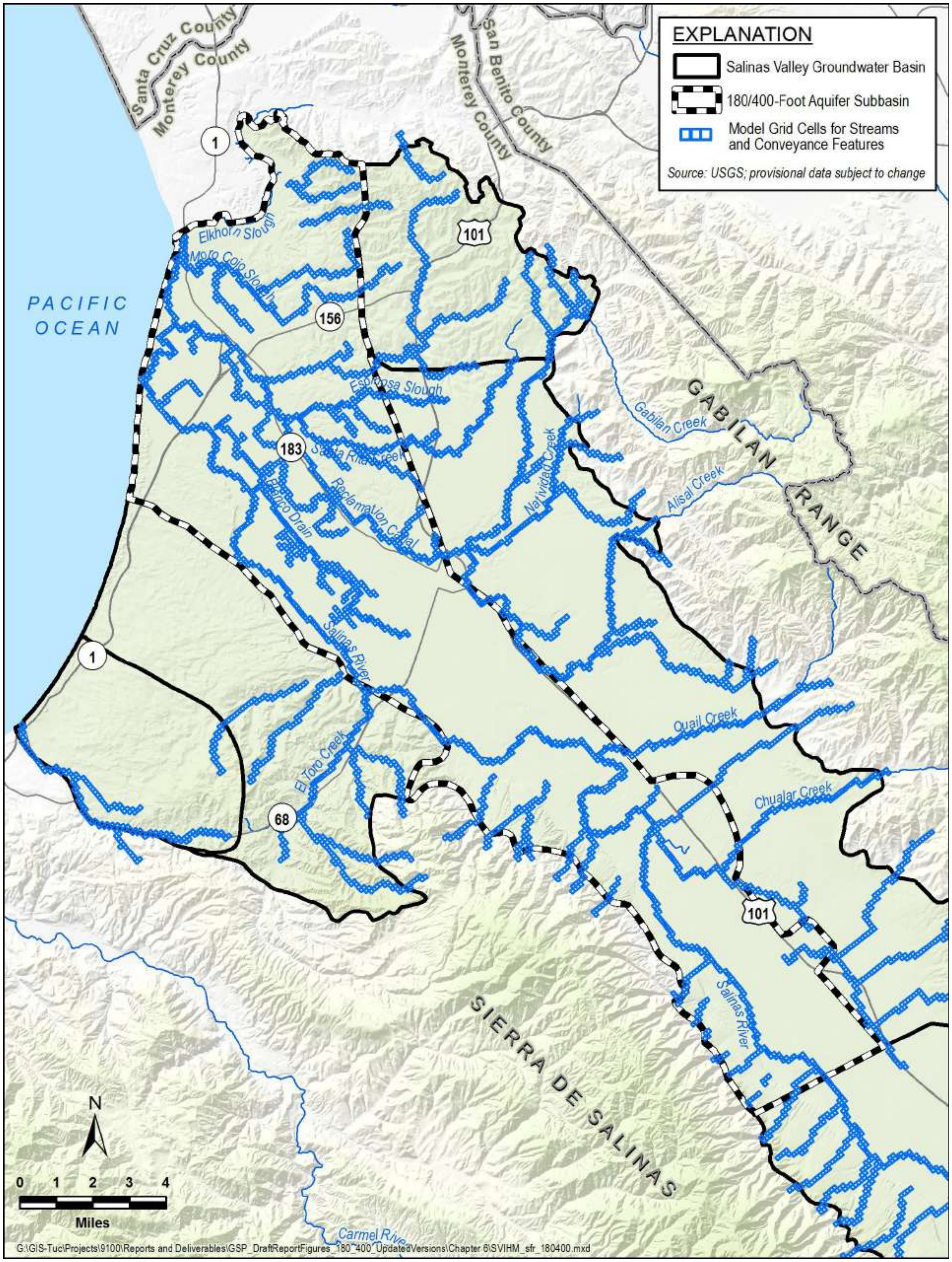

Figure 6-4. Surface Water Network in the 180/400-Foot Aquifer Subbasin from the Salinas Valley Integrated Hydrologic Model

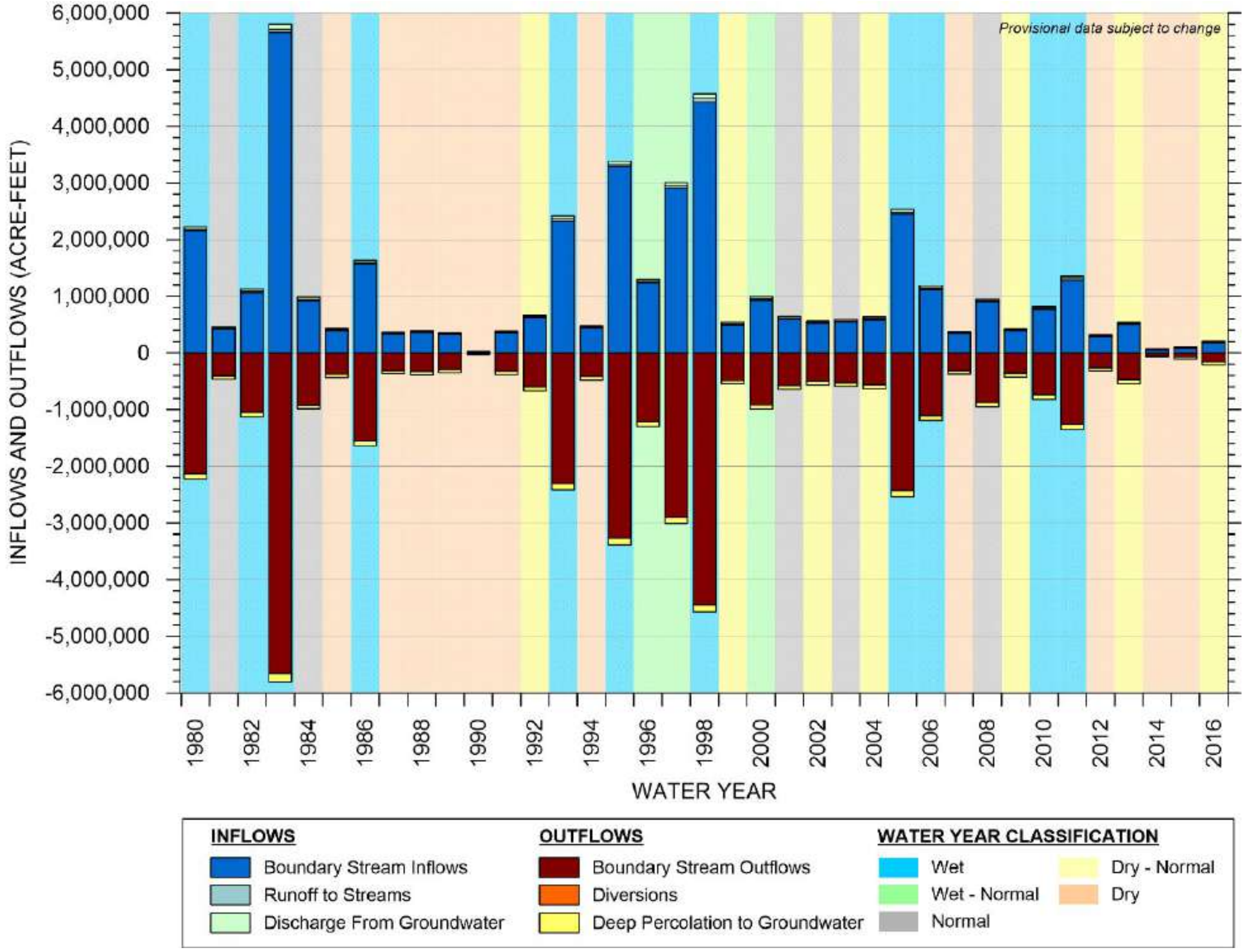

Figure 6-5. Historical and Current Surface Water Budget

Table 6-3. SVIHM Simulated Surface Water Budget Summary (AF/yr)

	Historical Average (WY 1980-2016)	Current (WY 2016)
Boundary Stream Inflows	1,105,700	174,500
Runoff to Streams	21,400	25,300
Net Flow between Surface Water and Groundwater	-40,700	-43,900
Boundary Stream Outflows	-1,086,100	-156,000
Diversions	-300	0

Note: provisional data subject to change.

6.3.2 Historical and Current Groundwater Budget

The groundwater budget accounts for the inflows and outflows to and from the Subbasin's aquifers, based on results from the SVIHM. This includes subsurface inflows and outflows of groundwater at the Subbasin boundaries, recharge, pumping, evapotranspiration, and net flow between surface water and groundwater.

Figure 6-6 shows SVIHM estimated annual groundwater inflows for the historical and current time periods. Inflows vary substantially from year to year. Table 6-4 provides average groundwater inflows for the historical and current period. The biggest inflow components are deep percolation of streamflow and deep percolation of precipitation and applied irrigation. Deep percolation of streamflow is slightly greater on average but also varies more. Values of 50,000 to 100,000 AF/yr are typical of each of these components. The most consistent groundwater flows into the Subbasin are from the subsurface, including inflow across the coastal boundary. For these water budgets, inflow from the ocean is counted as an inflow even though it is not usable. Freshwater subsurface inflows are between 18,000 and 24,000 AF/yr. Seawater inflows across the coastal boundary are between 2,000 and 4,000 AF/yr. These seawater inflows are less than the change in usable storage due to seawater intrusion, as calculated in Chapter 5, because the inflow represents full-strength seawater. However, the seawater mixes with fresh groundwater, and the unusable amount of groundwater is much greater than the full-strength seawater. Developing a variable density groundwater model will help understand this relationship. Total annual recharge is similar for the historical period and current period, with each equal to about 158,000 AF/yr.

Figure 6-7 shows the SVIHM estimated groundwater outflows for the historical and current time periods. Outflows vary from year to year; however, the annual variation is dampened compared to the inflows. Table 6-5 provides the SVIHM estimated average groundwater outflows of the historical and current periods. In all but the wettest years, the greatest groundwater outflow is pumping. Averaged over the historical period, groundwater pumping accounts for more than 50% of all groundwater outflows in the Subbasin. In the driest water years, like 1990 and 2014, it accounts for more than 70%. Total average annual groundwater outflow was about 172,000 AF for the historical period and 137,000 AF for the current period. All outflows are shown as negative values.

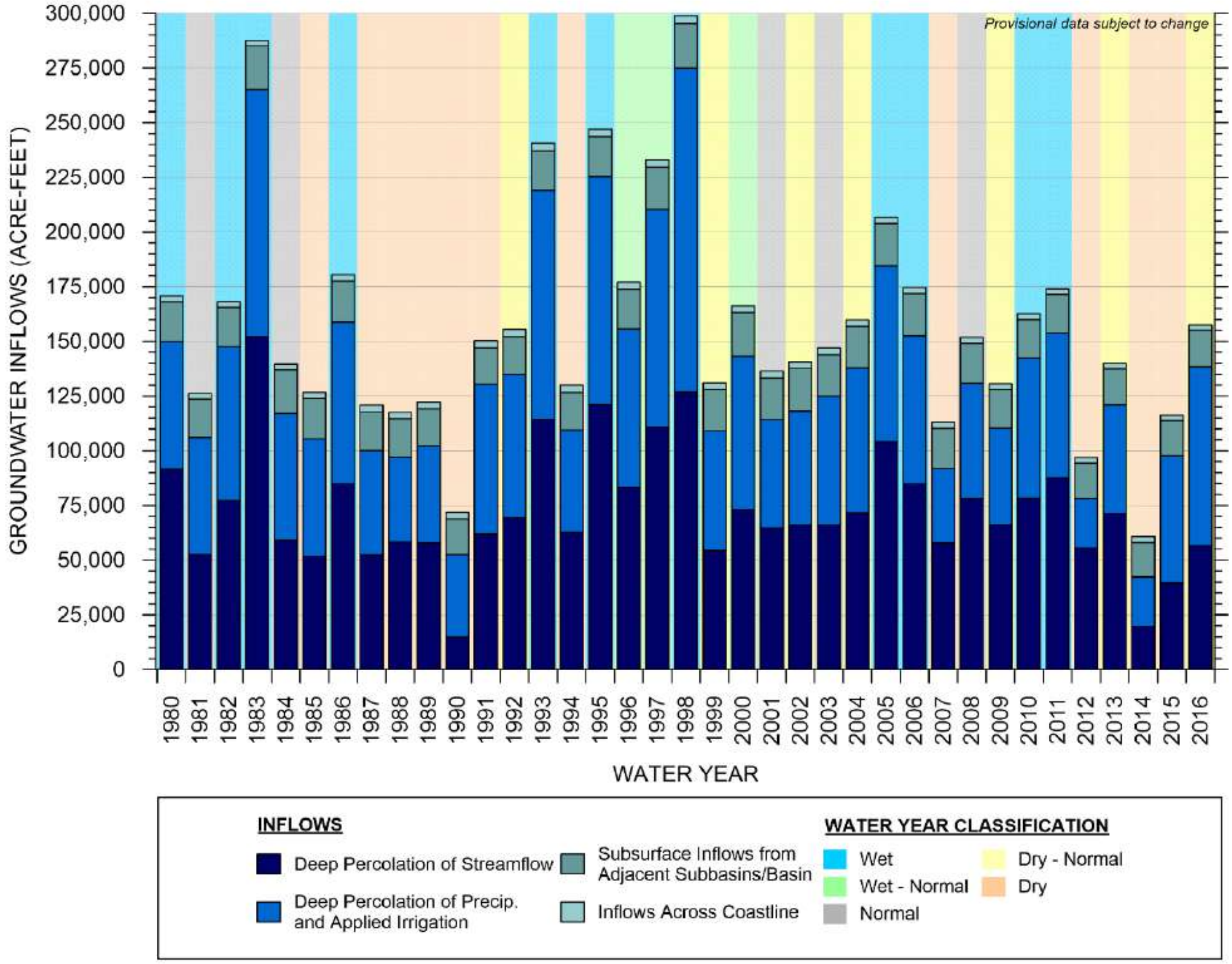

Figure 6-6. SVIHM Simulated Inflows to the Groundwater System

Table 6-4. SVIHM Simulated Groundwater Inflows Summary (AF/yr)

	Historical Average (WY 1980-2016)	Current (WY 2016)
Deep Percolation of Streamflow	73,000	56,700
Deep Percolation of Precipitation and Applied Irrigation	63,600	81,700
Subsurface Inflow from Adjacent Subbasins	18,100	16,700
Inflow Across Coastline	2,900	2,500
Total Inflows	157,600	157,600

Note: provisional data subject to change.

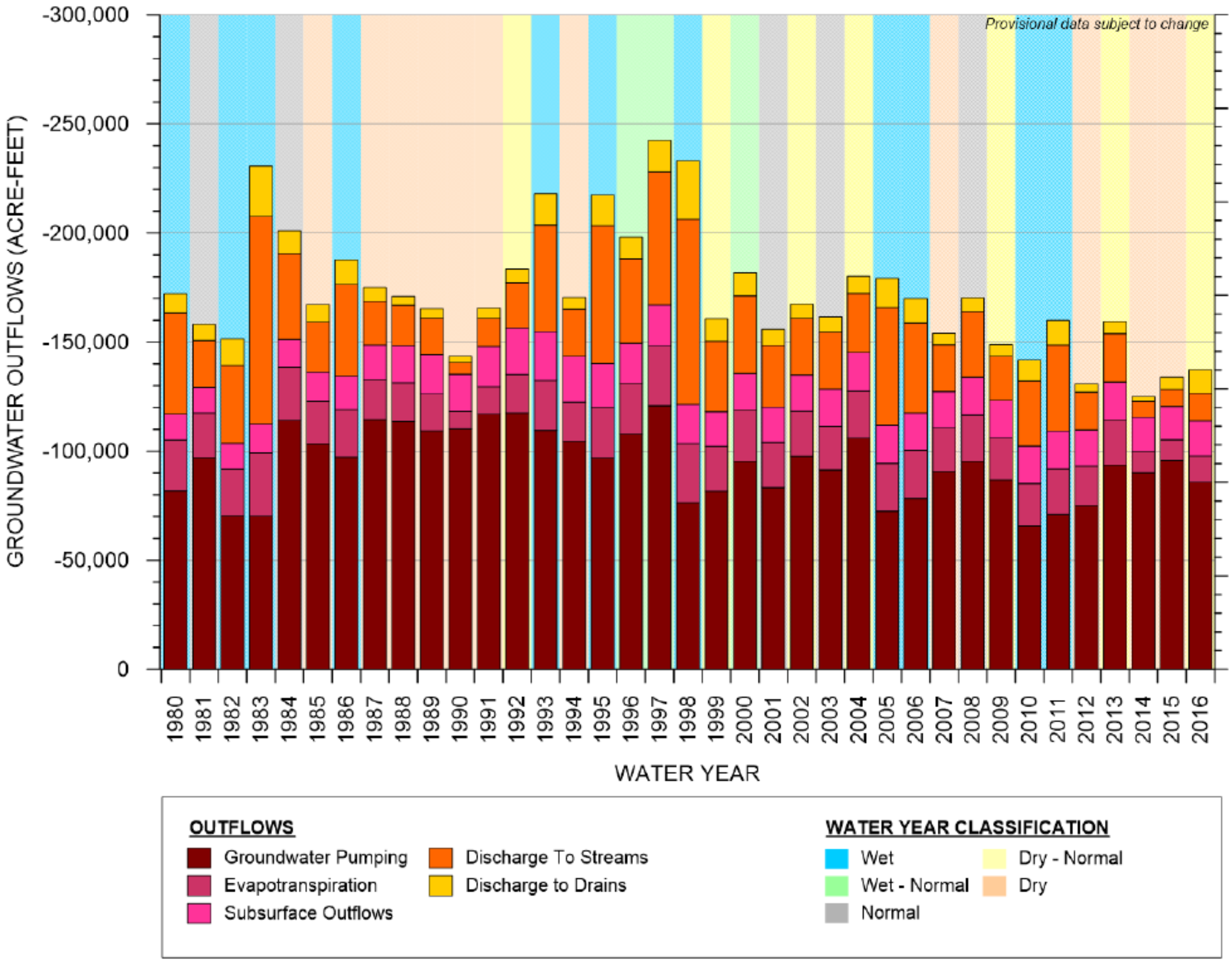

Figure 6-7. SVIHM Simulated Outflows from the Groundwater System

Table 6-5. SVIHM Simulated and Adjusted Groundwater Outflows Summary (AF/yr)

	Simulated		Adjusted	
	Historical Average (WY 1980-2016)	Current (WY 2016)	Historical Average (WY 1980-2016)	Current (WY 2016)
Groundwater Pumping	-94,300	-85,700	-132,800	-120,700
Groundwater Evapotranspiration	-19,900	-12,100	-19,900	-12,100
Subsurface Outflows to Adjacent Subbasins	-16,200	-15,500	-16,200	-15,500
Subsurface Outflows to Ocean	-500	-600	-500	-600
Discharge to Streams	-32,300	-12,800	-32,300	-12,800
Discharge to Drains	-9,000	-10,800	-9,000	-10,800
Total Outflows	-172,200	-137,400	-210,700	-172,400

Note: provisional data subject to change.
Adjusted pumping is described below.

Comparing SVIHM output to Groundwater Extraction Management System (GEMS) data reveals that, on average, the preliminary SVIHM estimates only approximately 71% of the pumping reported in the GEMS database for the Subbasin between 1995 and 2016. The historical average groundwater extraction reported to GEMS is 125,500 AF/yr, and the current (2016) extraction is 120,400 AF/yr. These GEMS data are likely more representative of historical conditions than the model generated pumping numbers; however, reliable GEMS data are only available since 1995. To accurately estimate groundwater extraction for the full historical period, this 71% ratio was applied to the SVIHM estimated historical pumping shown in Table 6-5 and Table 6-6, yielding an estimated (adjusted) historical average pumping rate of 132,800 AF/yr.

Figure 6-8 and Table 6-6 show SVIHM simulated groundwater pumping by water use sector. More than 85% of groundwater pumping in the Subbasin is used for agricultural purposes. Groundwater pumping varies from year to year; however, total pumping in the Subbasin has generally decreased since its peak in the 1980s and 1990s. Municipal and agricultural pumping are simulated in the SVIHM; however, domestic pumping, including *de minimis* pumping, is not included in the model, including pumping that occurs from a well with a discharge pipe of less than 3 inches. The SVIHM does not simulate domestic pumping because it is a relatively small portion of overall groundwater pumping in Salinas Valley Basin, and it is not included in the 180/400-Foot Subbasin water budget. The historical average in Table 6-6 is not strictly comparable to the GEMS historical average because the time periods used to calculate the averages are different; however, the ratio between these values is used to adjust simulated pumping to be more consistent with GEMS data.

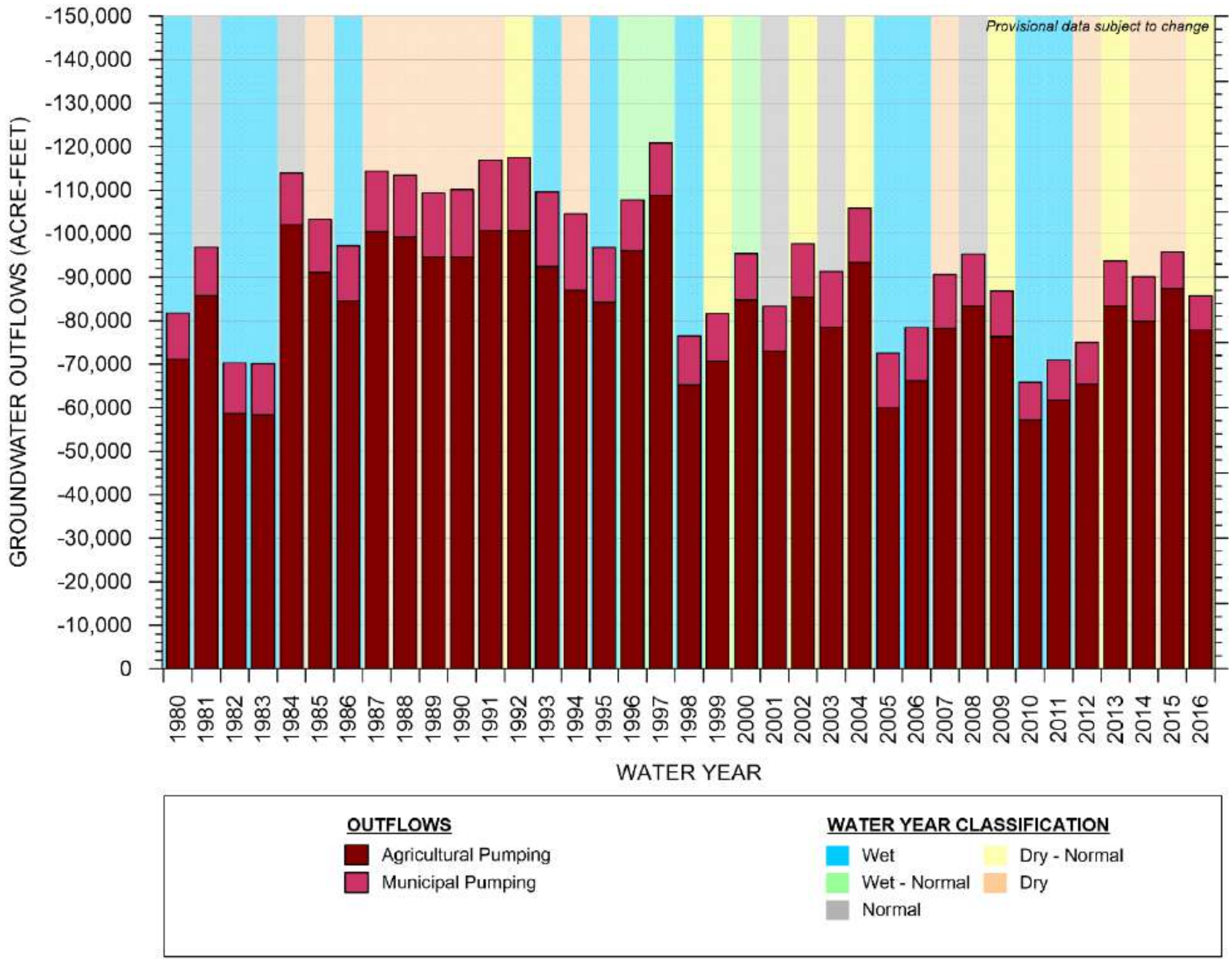

Figure 6-8. SVIHM Simulated Groundwater Pumping by Water Use Sector

Table 6-6. SVIHM Simulated and Adjusted Groundwater Pumping by Water Use Sector (AF/yr)

	Simulated		GEMS		Adjusted	
	Historical Average (WY 1980-2016)	Current (WY 2016)	Historical Average (WY 1995-2016)	Current (WY 2016)	Historical Average (WY 1980-2016)	Current (WY 2016)
Municipal & Industrial	-12,200	-7,900	-14,100	-11,000	-17,200	-11,100
Agricultural	-82,100	-77,800	-111,500	-109,400	-115,600	-109,600
Total Pumping	-94,300	-85,700	-125,600	-120,400	-132,800	-120,700

Note: provisional data subject to change.

[1] Adjusted agricultural pumping is based on the ratio between SVIHM and GEMS agricultural pumping, as described in text above.

Figure 6-9 shows SVIHM estimated net subsurface flows entering and exiting the Subbasin by watershed and neighboring subbasin. Historically, the Subbasin's subsurface inflows have been about 10% greater than its outflows for a net inflow of about 2,000 AF/yr. Table 6-7 shows SVIHM estimated historical mean and current year subsurface flows. These results are from the SVIHM; however, modeling completed for the Monterey Subbasin with the Monterey Basin Groundwater Flow Model, which is better calibrated and more reliable than the SVIHM in the Monterey Subbasin, shows a net flow from the Monterey Subbasin into the 180/400-Foot Aquifer Subbasin of 12,300 AF/yr from 2004 to 2018.

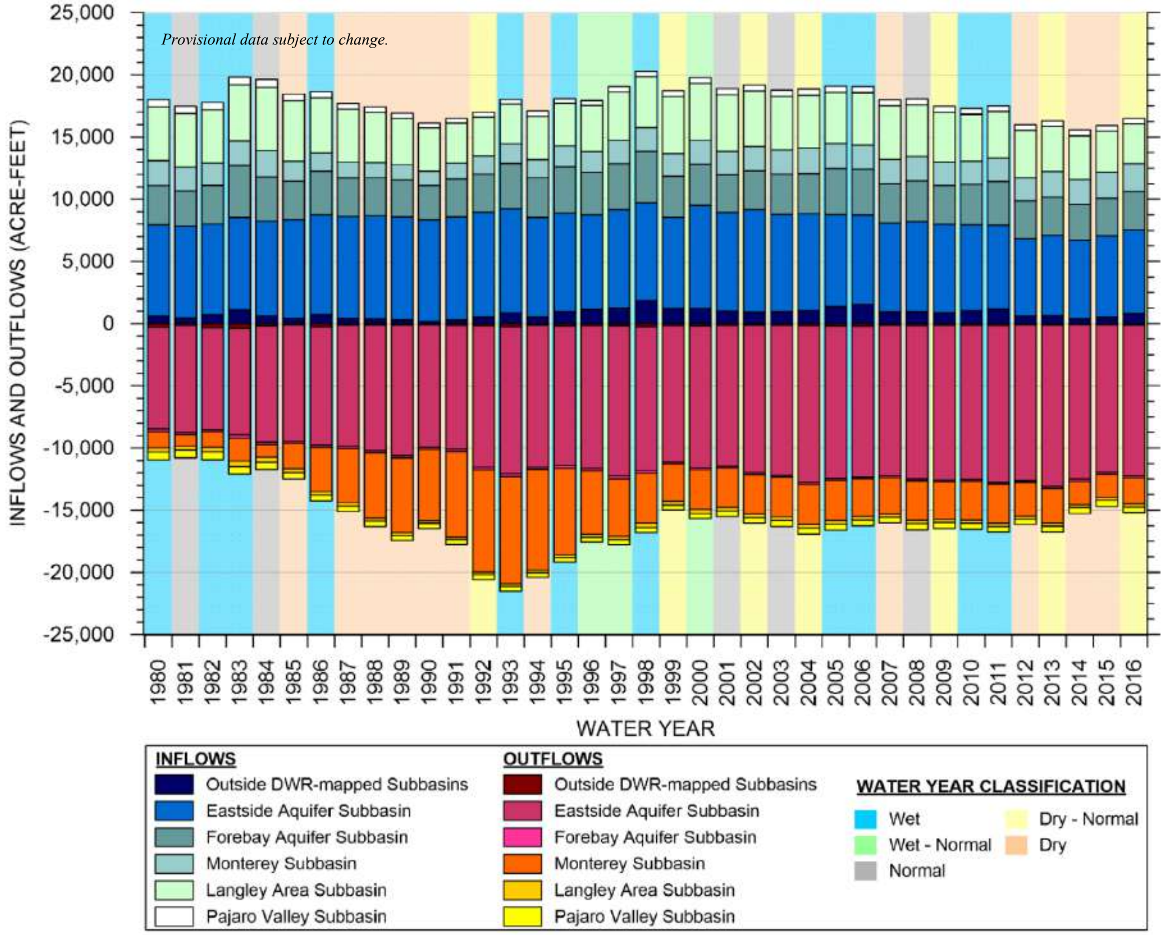

Figure 6-9. SVIHM Simulated Subsurface Inflows and Outflows from Watershed Areas and Neighboring Basins/Subbasins

Table 6-7. SVIHM Simulated Net Subbasin Boundary Flows (AF/yr)

	Historical Average (WY 1980-2016)	Current (WY 2016)
Eastside Aquifer Subbasin	-3,600	-5,400
Forebay Aquifer Subbasin	3,100	2,900
Monterey Subbasin	-1,900	100
Langley Area Subbasin	3,700	2,900
Pajaro Valley Subbasin	-100	0
Outside Areas	700	700

Note: provisional data subject to change.

Change in Salinas Valley groundwater storage has 2 components: change in storage due to groundwater level changes and change in storage due to seawater intrusion. The water budget inflows and outflows listed above only relate to the change in storage due to groundwater level changes. However, total change in usable groundwater storage is estimated with the sum of change in usable storage from seawater intrusion and the change in storage from groundwater level changes outside of the seawater intruded area. Each component is discussed separately, below.

A negative change in groundwater storage due to groundwater level changes indicates groundwater storage depletion associated with lower groundwater levels; while a positive value indicates groundwater storage accretion associated with higher groundwater levels. Averaged over the historical period, the preliminary SVIHM estimates that the 180/400-Foot Aquifer Subbasin is in overdraft by 14,800 AF/yr. Model results represent storage loss from all aquifer layers, including the Deep Aquifers. However, this simulated overdraft contains significant variability and uncertainty due to the preliminary calibration of the preliminary SVIHM version used for this GSP Update. Simulated groundwater levels in the preliminary SVIHM are generally lower than observed groundwater levels, indicating that simulated change in groundwater storage due to groundwater levels is overestimated. Figure 6-10 shows considerable variability in change in storage from one year to the next. In water year 1998, inflows exceeded outflows by more than 65,000 AF, while in 1988 outflows exceeded inflows by roughly 60,000 AF. The current period represents a snapshot in time showing variability within the model simulation and are not necessarily representative of actual current conditions.

Estimating storage loss from groundwater levels in the 180/400-Foot Subbasin is difficult because groundwater is pumped from a combination of confined and unconfined aquifers. Groundwater levels react differently to pumping depending on the type of aquifer. The decline in groundwater storage based on measured groundwater elevations from 1995 through 2019 is estimated to be about 800 AF/yr in the Subbasin, as described in Section 5.2.2. Based on measured groundwater levels from 1944 through 2013, a report by Brown and Caldwell (2015) estimates that groundwater storage decreased at an average rate of 200 AF/yr (assuming confined conditions) to 1,600 AF/yr (assuming unconfined conditions). During the drought years of 1984 through 1991, Brown and Caldwell estimates that groundwater storage in the 180/400-Foot Subbasin declined by 1,000 to 2,000 AF/yr (confined) and 10,000 to 20,000 AF/yr (unconfined) (Brown and Caldwell, 2015). The long-term average accounts for the short-term increase in storage loss during the drought period. The long-term historical average value reported in Section 5.2.2 is in the middle of the range of average values reported for confined and unconfined conditions by Brown and Caldwell, suggesting that the groundwater measurement dataset represents both confined and unconfined conditions. However, the storage loss estimate from Section 5.2.2 is likely underestimated because it does not account for conditions in the Deep Aquifers, due to lack of data. That estimate will be improved in the future after investigations of the Deep Aquifers.

Uncertainties exist in groundwater storage estimates from both the SVIHM and the analyses using groundwater level measurements. Therefore, based on the average of groundwater level measurements reported in Section 5.2.2, this GSP considers 800 AF as the historical average annual decline in storage due to change in groundwater elevations. This value is used for water budget adjustments described below.

Seawater intrusion degrades groundwater quality, making the groundwater unusable for most municipal or agricultural uses. Seawater that flows into the basin mixes with fresh water and renders it unusable, typically when the chloride concentration is above 500 mg/L. Therefore, the 500 mg/L chloride isocontour is used as the limit of usable groundwater in storage. Groundwater within the 500 mg/L isocontour is a mix of fresh groundwater and seawater, and it represents the extent of the non-useable groundwater interface at a given time.

Change in usable storage from seawater intrusion is calculated from MCWRA's annual seawater intrusion maps. Mapped contours indicate that the rate of loss of useable groundwater storage is greater than the simulated groundwater flow rate across the coastal boundary. This is because the simulated rate of groundwater flow across the coastal boundary represents the amount of full-strength seawater entering the Valley, but much more groundwater than the full-strength seawater is unusable as it mixes with fresh water. The loss of groundwater storage due to seawater intrusion in the 180/400-Foot Aquifer Subbasin is estimated to be 12,600 AF/yr.

Furthermore, the change in groundwater storage calculated by the SVIHM is not comparable to, and should not be equated with, the calculated change in usable groundwater in storage. The SVIHM water budget is an accounting of all flows across the subbasin boundaries, not an estimate of usable groundwater.

6.3.3 Historical and Current Groundwater Budget Summary

The main groundwater inflows into the subbasin are: (1) deep percolation of precipitation and irrigation water, (2) subsurface inflow from adjacent DWR groundwater basins and subbasins, and (3) stream recharge. Groundwater pumping is the predominant groundwater outflow. The smaller outflow terms are subsurface outflows to adjacent subbasins, evapotranspiration, discharge to streams, and flows to drains.

Figure 6-10 shows the entire groundwater water budget from the SVIHM and includes annual change in groundwater storage. Changes in groundwater storage are strongly correlated with changes in deep percolation of precipitation and stream flows. For example, 1983 and 1998 were comparatively very wet years and represent the greatest increases in deep percolation and, correspondingly, the greatest increases in groundwater storage over the historical period. Estimated cumulative change in groundwater storage has steadily declined over time with slight increases in response to wet periods.

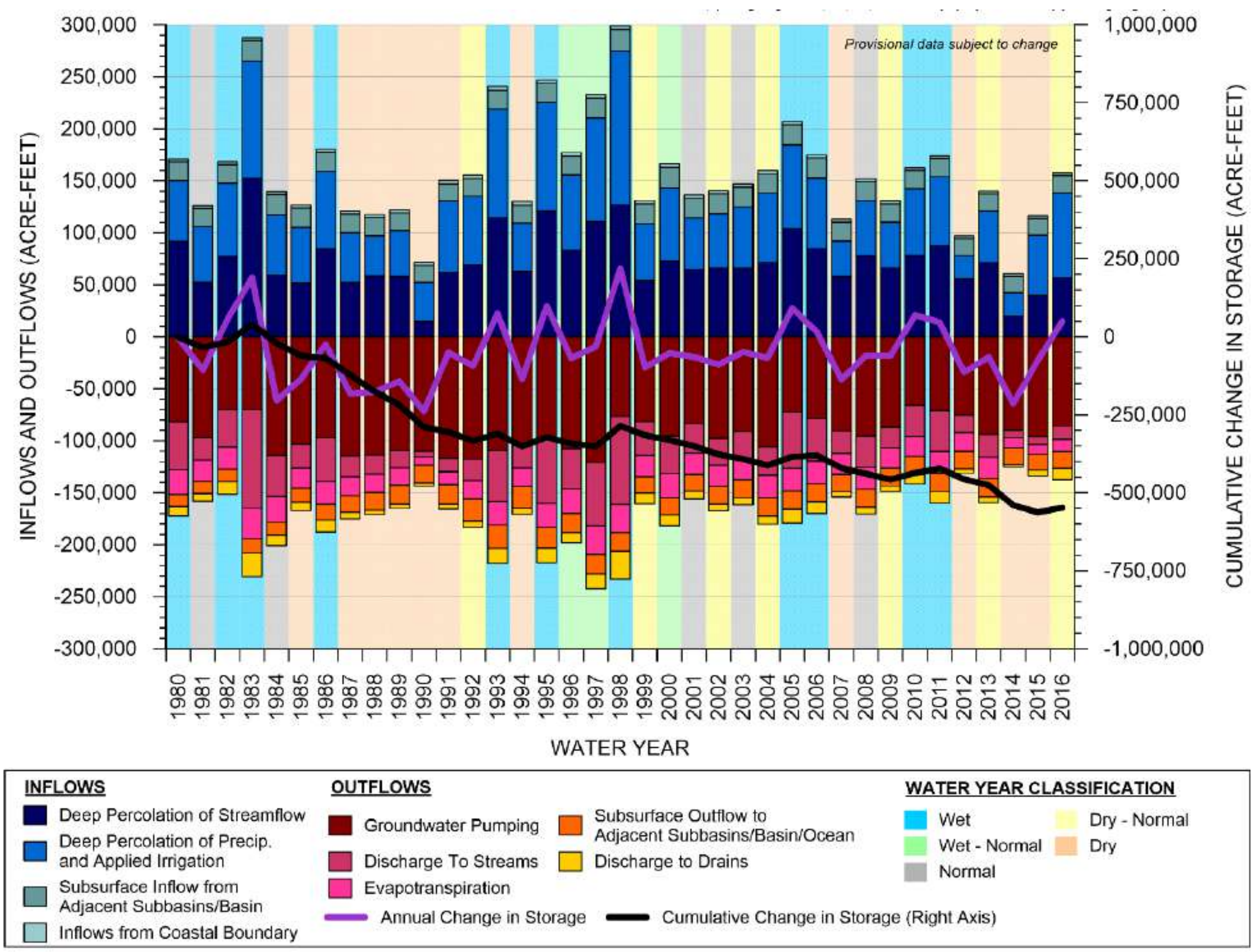

Figure 6-10. SVIHM Simulated Historical and Current Groundwater Budget

The SVIHM estimated the historical annual decline in storage due to change in groundwater levels to be 14,800 AF/yr. However, this decline is greater than estimated using groundwater level data, and this GSP considers the average annual historical decline in storage due to change in groundwater levels to be 800 AF/yr, as explained above. This combined with change in storage due to seawater intrusion equals the total change in usable storage.

A comparison of the historical and current groundwater budgets is shown in Table 6-8. The values in the table are based on the inflows and outflows presented in previous tables, as well as estimates of change in usable storage. Negative values indicate outflows or depletions. Historical average decline in usable storage (overdraft) is 13,400 AF/yr, which is the sum of seawater intrusion (12,600 AF/yr loss) and net storage loss due to groundwater level changes (800 AF/yr). Inflow across coastline is shown in Table 6-8 as an inflow because it is represented in the models as seawater flow into the Subbasin at the coastline; however, seawater intrusion into the Subbasin contributes to the loss in usable storage. This table is informative in showing the relative magnitude of various water budget components; however, these results are based on a provisional model and will be updated in future updates to this chapter after the SVIHM is completed and released by the USGS.

Table 6-8. Summary of Groundwater Budget (AF/yr)

	Historical Average (WY 1980-2016)	Current (WY 2016)
Net Inflows		
Net Stream Exchange	40,700	43,900
Deep Percolation of Precipitation and Applied Irrigation	63,600	81,700
Net Flow from Adjacent Subbasins/Basin	1,900	1,300
Net Coastal Inflow	2,400	1,900
Net Outflows		
Groundwater Pumping[1]	-132,800	-120,700
Flow to Drains	-9,000	-10,800
Groundwater Evapotranspiration	-19,900	-12,100
Change in Usable Storage (overdraft)		
Storage Loss (-) from Groundwater Levels[2]	-800	-15,000
Storage Loss (-) from Seawater Intrusion[3]	-12,600	-2,500

Note: provisional data subject to change. Water budget error, as reflected in change in storage, for the historical average period is greater than 30%, which is considered unreasonably large and will be addressed and improved in future updates to the GSP.
[1]Adjusted based on GEMS extraction data.
[2]Adjusted based on observed groundwater levels outside of the seawater intruded area.
[3]Adjusted based on observed 500 mg/L chloride isocontour.

6.3.4 Historical and Current Sustainable Yield

The historical and current sustainable yields reflect the amount of Subbasin-wide pumping reduction needed to balance the water budget, resulting in no net decrease in storage of useable groundwater. The sustainable yield can be estimated as:

$$\text{Sustainable yield} = \text{pumping} + \text{change in storage} + \text{seawater intrusion}$$

Table 6-9 provides a likely range of sustainable yields based on the GEMS derived historical pumping. This range represents the average GEMS reported pumping from 1995 to 2016, as shown in Table 6-6, plus and minus one standard deviation. The adjusted change in groundwater storage (loss) based on groundwater levels of 800 AF/yr, described in Sections 5.2.2 and 6.3.3, is used for this calculation, as well as the seawater intrusion estimate described in Sections 5.3.2

and 6.3.2, which is related to the change in volume of useable water rather than flows across the subbasin boundaries. These values are the likely range of the sustainable yield of the Subbasin. As previously described in Section 6.3.3, historical average overdraft is 13,400 AF/yr, which is the sum of seawater intrusion (12,600 AF/yr loss) and net storage loss due to groundwater level changes (800 AF/yr). This does not include overdraft in the Deep Aquifers due to insufficient data, which is a data gap that will be filled during GSP implementation. This GSP adopts this range of likely sustainable yields as the best estimate for the Subbasin.

Table 6-9. Historical Sustainable Yield for the 180/400 Subbasin Derived from GEMS, Observed Groundwater Levels, and Mapped Seawater Intrusion Areas (AF/y.)

	Low Historical Average	High Historical Average
Total Subbasin Pumping	114,800	136,600
Change in Storage due to Groundwater Levels	-800	-800
Change in Storage due to Seawater Intrusion	-12,600	-12,600
Estimated Sustainable Yield	101,400	123,200

Note: Pumping is shown as positive value for this computation. Change in storage value is based on observed groundwater measurements and seawater intrusion is based on mapped areas of intrusion, as previously described in the text.

6.4 Projected Water Budgets

Projected water budgets are extracted from the SVOM, which simulates future hydrologic conditions with assumed climate change. Two projected water budgets are presented, one incorporating estimated 2030 climate change projections and one incorporating estimated 2070 climate change projections.

The climate change projections are based on data provided by DWR (2018). Projected water budgets are useful for showing that sustainability will be achieved in the 20-year implementation period and maintained over the 50-year planning and implementation horizon. However, the projected water budgets are based on a provisional version of the SVOM and are subject to change. Model information and assumptions summarized in this section of the report are based on provisional documentation on the model. Additional information will be provided in future GSP updates after the model is released by the USGS.

6.4.1 Assumptions Used in Projected Water Budget Development

The assumptions incorporated into the SVOM for the projected water budget simulations include:

- Land Use: The land use is assumed to be static, aside from a semi-annual change to represent crop seasonality. The annual pattern is repeated every year in the model. Land use specified in the model by USGS reflects the 2014 land use.
- No urban growth is included in this simulation to remain consistent with USGS assumptions. If urban growth is infill, this assumption may result in an underestimate of net pumping increases and an underestimate of the Subbasin's future overdraft. If urban growth replaces agricultural irrigation, the impact may be minimal because the urban growth will replace existing agricultural water use.
- Reservoir Operations: The reservoir operations reflect MCWRA's current approach to reservoir management.
- Stream Diversions: The SVOM explicitly simulates only two stream diversions in the Salinas Valley Basin: Clark Colony and the Salinas River Diversion Facility (SRDF). The Clark Colony diversion is located along Arroyo Seco and diverts stream water to an agricultural area nearby. The SRDF came online in 2010 and diverts water from the Salinas River to the Castroville Seawater Intrusion Project (CSIP) area. Clark Colony diversions are repeated from the historical record to match the water year. SRDF diversions are made throughout the duration of the SVOM whenever reservoir storage and streamflow conditions allow during the period from April through October. For purposes of the projected water budgets, SRDF diversions are specified at a rate of 18 cubic feet per second.
- Recycled Water Deliveries: Recycled water has been delivered to the CSIP area since 1998 as irrigation supply. The SVOM includes recycled water deliveries throughout the duration of the model.

6.4.1.1 Future Projected Climate Assumptions

Several modifications were made to the SVOM in accordance with recommendations made by DWR in their *Guidance for Climate Change Data Use During Groundwater Sustainability Plan Development* (DWR, 2018). Three types of datasets were modified to account for 2030 and 2070 projected climate change: climate data including precipitation and potential evapotranspiration, streamflow, and sea level.

Climate Data

This GSP uses the climate change datasets provided by DWR for use by GSAs. The climate scenarios were derived by taking the historical interannual variability from 1915 through 2011 and increasing or decreasing the magnitude of events based on projected changes in precipitation and temperature from general circulation models. These datasets of climate projections for 2030 and 2070 conditions were derived from a selection of 20 global climate projections recommended by the Climate Change Technical Advisory Group as the most appropriate projections for California water resources evaluation and planning. Because the DWR climate datasets are only available through December 2011 and the SVOM uses a climate time series through December 2014, monthly change factors for January 2012 to December 2014 are assumed. DWR provided climate datasets for central tendency scenarios, as well as extreme wet and dry scenarios; the future water budgets described herein are based on the DWR central tendency scenarios for 2030 and 2070. Historical data were analyzed from the Salinas Airport precipitation gauge record to identify years from 1968 to 2011 that were most similar to conditions in 2012, 2013 and 2014. Based on this analysis, climate data from 1981, 2002, and 2004 are applied as the climate inputs for 2012, 2013, and 2014, respectively.

The modified monthly climate data for the entire model period are applied as inputs to the model, which reads precipitation and potential evapotranspiration data on a monthly basis.

Streamflow

DWR provided monthly change factors for unimpaired streamflow throughout California. For the Salinas Valley and other areas outside of the Central Valley, these change factors are provided as a single time series for each major watershed. Streamflows along the margins of the Basin are modified by the monthly change factors. As with the climate data, an assumption is required to extend the streamflow change factor time series through December 2014. It is assumed that the similarity in rainfall years at the Salinas Airport rainfall gauge could reasonably be expected to produce similar amounts of streamflow; therefore, the same years of 1981, 2002, and 2004 are repeated to represent the 2012, 2013, and 2014 streamflows.

Sea Level

DWR guidance recommends using a single static value of sea level rise for each of the climate change scenarios (DWR, 2018). For the 2030 climate change scenario, the DWR-recommended sea level rise value of 15 centimeters is used. For the 2070 climate change scenario, the DWR-recommended sea level rise value of 45 centimeters is used. The amount of sea level rise is assumed to be static throughout the duration of each of the climate change scenarios.

6.4.2 Projected Surface Water Budget

Average projected surface water budget inflows and outflows for the 47-year future simulation period with 2030 and 2070 climate change assumptions are quantified in Table 6-10. As with the current water budget, the boundary stream inflows and outflows are much greater than the other components.

Table 6-10: SVOM Simulated Average Surface Water Inflow and Outflow Components for Projected Climate Change Conditions (AF/yr)

Projected Climate Change Timeframe	2030	2070
Overland Runoff to Streams	20,500	21,800
Boundary Stream Inflows	1,184,000	1,327,200
Net Flow Between Surface Water and Groundwater	-53,600	-54,400
Boundary Stream Outflows	-1,144,300	-1,288,100
Diversions	-6,500	-6,600

Note: provisional data subject to change.

6.4.3 Projected Groundwater Budget

Average projected groundwater budget inflows for the 47-year future simulation period with 2030 and 2070 climate change assumptions are quantified in Table 6-11. In both the 2030 and 2070 simulations, the biggest contributors to groundwater inflows are deep percolation of stream flow and deep percolation of precipitation and irrigation.

Table 6-11: SVOM Simulated Average Groundwater Inflow Components for Projected Climate Change Conditions (AF/yr)

Projected Climate Change Timeframe	2030	2070
Deep Percolation of Stream Flow	56,500	57,800
Deep Percolation of Precipitation. and Irrigation	61,700	65,700
Inflow from Eastside Aquifer Subbasin	8,400	8,800
Inflow from Forebay Aquifer Subbasin	2,600	2,600
Inflow from Monterey Subbasin	1,900	2,000
Inflow from Langley Area Subbasin	4,400	4,600
Inflow from Pajaro Valley Subbasin	800	800

Projected Climate Change Timeframe	2030	2070
Inflow from Surrounding Watersheds	1,300	1,400
Inflow Across Coastline	2,900	3,100
Total Inflows	140,500	146,800

Note: provisional data subject to change.

Average SVOM projected groundwater budget outflows for the 47-year future simulation period with 2030 and 2070 climate change assumptions are quantified in Table 6-12. As in the historical and current water budgets, the greatest outflow is groundwater pumping. Negative values are shown in Table 6-12 to represent outflows.

Table 6-12: SVOM Simulated Average Groundwater Outflow Components for Projected Climate Change Conditions (AF/yr)

	Simulated		Adjusted	
Projected Climate Change Timeframe	**2030**	**2070**	**2030**	**2070**
Groundwater Pumping	-88,500	-92,500	-124,600	-130,300
Flows to Drains	-8,200	-8,800	-8,200	-8,800
Flow to Streams	-3,000	-3,400	-3,000	-3,400
Groundwater Evapotranspiration	-35,200	-37,000	-35,200	-37,000
Outflow to Eastside Aquifer Subbasin	-11,100	-11,300	-11,100	-11,300
Outflow to Forebay Aquifer Subbasin	-200	-200	-200	-200
Outflow to Monterey Subbasin	-2,600	-2,500	-2,600	-2,500
Outflow to Langley Area Subbasin	-300	-400	-300	-400
Outflow to Pajaro Valley Subbasin	-1,000	-1,000	-1,000	-1,000
Outflow to Surrounding Watersheds	-300	-300	-300	-300
Outflow Across Coastline	-300	-300	-300	-300
Total Outflows	-150,700	-157,700	-186,800	-205,500

Note: provisional data subject to change.

[1] Adjusted pumping is based on the ratio between historical average SVIHM and GEMS agricultural pumping, as described in Section 6.3.2.

As previously described for the historical water budget, the models used for this water budget analysis overestimate storage loss due to change in groundwater levels. Measured groundwater level data and seawater intrusion estimates based on change in intruded area indicate that the

Subbasin has historically been in overdraft (on the order of 13,400 AF/yr decline). Even though the SVOM projects overdraft to be 10,500 AF/yr for 2030 and 11,300 AF/yr for 2070, it does not account for loss of usable storage due to seawater intrusion. To estimate future decline in storage, the adjusted historical decline in storage from both groundwater elevations and seawater intrusion, and adjusted future pumping estimates provide a likely more reasonable estimate for projected sustainable yield calculations. The loss of groundwater storage due to changes in groundwater levels is slightly less in the projected simulations than in the historical simulations, even though there is no change in land use. This smaller decrease in groundwater storage is likely due to climate change, which is expected to be warmer and wetter according to DWR climate change factors. The model includes increased precipitation from climate change; however, it does not account for the frequency and magnitude of storm events. If storm events concentrate precipitation within short periods, more water may run off than infiltrate. More analysis needs to be done with regards to future recharge. This projected water budget adopts the historical average annual change in storage (due to groundwater level and seawater intrusion changes) as the most reasonable estimate for the future, assuming extraction continues. Since land use is assumed at 2014 conditions and does not change over time in the SVOM, groundwater storage declines are assumed to continue into the future at the historical average rate. This is reflected in the adjusted average change in storage due to change in groundwater levels in Table 6-13, which is set to a decline of 800 AF/yr. However, as described above, this storage loss estimate is likely underestimated because it does not account for conditions in the Deep Aquifers, due to lack of data. The estimate will be improved in the future after additional hydrogeologic investigations of the Deep Aquifers.

Combining Table 6-11 and Table 6-12 yields the SVOM simulated net groundwater inflow and outflow data for the 47-year future simulation with 2030 and 2070 climate change assumptions. These flows are shown in Table 6-13. Negative values indicate outflows or depletions. Projected future overdraft is 13,400 AF/yr, which is the sum of loss of usable storage from seawater intrusion and groundwater elevation decline . Inflow across the coastal boundary is shown as an inflow in the table because it represents seawater flow into the Subbasin in the model; this is different from change in usable storage calculated based on the 500 mg/L chloride isocontour. The SVOM is internally consistent in its water budget; however, adjustments to model results are necessary because the model is not well calibrated to estimated groundwater storage loss due to change in groundwater levels or seawater intrusion. Improved versions of the model is expected to be used in future GSP updates.

Table 6-13: Average SVOM Simulated and Adjusted Annual Groundwater Budget for Projected Climate Change Conditions (AF/yr)

	Simulated		Adjusted[1]	
Projected Climate Change Timeframe	**2030**	**2070**	**2030**	**2070**
Net Inflows				
Net Stream Exchange	53,600	54,400	53,600	54,400
Deep Percolation of Precipitation and Applied Irrigation	61,700	65,700	61,700	65,700
Net Flow from Adjacent Subbasins/Basin	3,800	4,400	3,800	4,400
Net Flow Across Coastal Boundary	2,600	2,900	2,600	2,900
Net Outflows				
Groundwater Pumping	-88,500	-92,500	-124,600	-130,300
Flow to Drains	-8,200	-8,800	-8,200	-8,800
Net Groundwater Evapotranspiration	-35,200	-37,000	-35,200	-37,000
Change in Usable Storage				
Net Storage Loss (-) from Groundwater Levels	-10,500	-11,300	-800	-800
Net Storage Loss (-) from Seawater Intrusion			-12,600	-12,600

Note: provisional data subject to change.

[1]Based on the adjusted change in storage, which is the historical average decline as described in the text, model error is greater than 30% for 2030 and 2070; these error values are unreasonably large and will be addressed and improved in future updates to the GSP. Adjusted pumping is based on the ratio between historical average SVIHM and GEMS agricultural pumping, as described in Section 6.3.2.

SVOM projected groundwater pumping by water use sector is summarized in Table 6-14. Because the model assumes no urban growth, future municipal pumping was assumed to be equal to current municipal pumping. Future agricultural pumping is then calculated as the total projected pumping minus the current municipal pumping. The 2030 and 2070 model simulations predict that agriculture will account for about 90% of pumping. Similar to the SVIHM, domestic pumping is not included in the SVOM future projections simulation.

Table 6-14: SVOM Simulated Projected Annual Groundwater Pumping by Water Use Sector (AF/yr)

	Simulated		Adjusted	
Water Use Sector	2030	2070	2030	2070
Urban Pumping	-7,900	-7,900	-11,000	-11,000
Agricultural Pumping	-80,600	-84,600	-113,600	-129,300
Total Pumping	-88,500	-92,500	-124,600	-130,300

Note: provisional data subject to change.

[1] Adjusted pumping is based on the ratio between historical average SVIHM and GEMS agricultural pumping, as described in Section 6.3.2.

6.4.4 Projected Sustainable Yield

Projected sustainable yield is the long-term pumping that can be sustained once all undesirable results have been addressed. However, it is not the amount of pumping needed to stop undesirable results before sustainability is reached. The SVBGSA recognizes that depending on the success of various proposed projects and management actions there may be some years when pumping must be held at a lower level to achieve necessary rises in groundwater elevation. The actual amount of allowable pumping from the Subbasin will be adjusted in the future based on the success of projects and management actions.

To retain consistency with the historical sustainable yield, projected sustainable yield can be estimated by summing all the average groundwater extractions, subtracting the average loss in storage from both groundwater levels and seawater intrusion. This represents the change in pumping that results in no change in storage of usable groundwater, assuming no other projects or management actions are implemented. For this sustainable yield discussion and associated computations, groundwater pumping outflows are reported as positive values, which is opposite of how the values are reported in the water budget tables. As discussed earlier, the current, preliminary version of the SVIHM, and by inference the SVOM, appears to overestimate the historical storage loss due to change in groundwater levels in the Subbasin and therefore underestimate the historical sustainable yield; and, it does not accurately account for seawater intrusion. The sustainable yield value will be updated in future GSP updates as more data are collected and additional analyses are conducted.

Although the sustainable yield values provide guidance for achieving sustainability, simply reducing pumping to within the sustainable yield is not proof of sustainability. Sustainability must be demonstrated through the Sustainable Management Criteria (SMC). Table 6-15 provides estimates of the future sustainable yield using estimated future pumping calculated in Table 6-14. As described for the historical sustainable yield, data indicate that the Subbasin has historically been in overdraft (on the order of 13,400 AF/yr decline, not including the Deep Aquifers). This historical decline in storage is used with the adjusted SVOM pumping estimates to provide a likely more reasonable estimate for projected sustainable yield. Therefore, although change in storage projected by the preliminary SVOM is on the order of -11,000 AF/yr, the historical average change in storage in Table 6-15 is set to a decline of 800 AF/yr. This does not include the Deep Aquifers, which is a data gap that will be filled during GSP implementation. Similarly, the historical average seawater intrusion rate of 12,600 AF/yr is also used for this calculation. These adjustments indicate that the SVIHM, and by inference the SVOM, is not well calibrated to storage loss to change in groundwater levels or seawater intrusion.

Table 6-15. Adjusted Projected Sustainable Yields for the 180/400 Subbasin Derived from GEMS, Observed Groundwater Levels, and Mapped Seawater Intrusion Areas (AF/yr)

	2030 Projected Sustainable Yield	2070 Projected Sustainable Yield	Historical Sustainable Yield Range
Groundwater Pumping	124,600	130,300	114,800 to 136,600
Change in Storage due to Seawater Intrusion	-12,600	-12,600	-12,600
Change in Storage due to Groundwater Levels	-800	-800	-800
Projected Sustainable Yield	111,200	116,900	101,400 to 123,200

Note: Pumping is shown as positive value for this computation. Change in storage value is based on observed groundwater measurements and seawater intrusion is based on mapped areas of intrusion, as previously described in the text for historical water budgets.

Table 6-15 includes the adjusted estimate of historical sustainable yield for comparison purposes. Although the sustainable yield values provide guidance for achieving sustainability, simply reducing pumping to within the sustainable yield is not proof of sustainability. Sustainability must be demonstrated through the SMC. The sustainable yield value will be modified and updated as more data are collected, and more analyses are performed.

6.4.5 Uncertainties in Projected Water Budget Simulations

Models are mathematical representations of physical systems. They have limitations in their ability to represent physical systems exactly and due to limitations in the data inputs used. There is also inherent uncertainty in groundwater flow modeling itself, since mathematical (or numerical) models can only approximate physical systems and have limitations in how they compute data. However, DWR (2018) recognizes that although models are not exact representations of physical systems because mathematical depictions are imperfect, they are powerful tools that can provide useful insights.

There is additional inherent uncertainty involved in projecting water budgets with projected climate change based on the available scenarios and methods. The recommended 2030 and 2070 central tendency scenarios that are used to develop the projected water budgets with the SVIHM provide a dataset that can be interpreted as what might be considered the most likely future conditions; there is an approximately equal likelihood that actual future conditions will be more stressful or less stressful than those described by the recommended scenarios (DWR, 2018).

As stated in DWR (2018):

> *"Although it is not possible to predict future hydrology and water use with certainty, the models, data, and tools provided [by DWR] are considered current best available science and, when used appropriately should provide GSAs with a reasonable point of reference for future planning."*

6.5 Subbasin Water Supply Availability and Reliability

Water is not imported into the 180/400-Foot Aquifer Subbasin. However, a significant portion of the Subbasin's recharge is derived from reservoir releases that regulate Salinas River streamflow. The historical water budget incorporates years when there was little availability of surface water flow and groundwater elevations declined as a result. Figure 6-5 shows that when Salinas River flows were low, deep percolation to groundwater was also low. Declines in groundwater levels during these years contributed to chronic groundwater storage loss and seawater intrusion during the historical period. The projected water budgets are developed with the SVOM, which is based on historical surface water flows and groundwater conditions, and therefore projected water budgets incorporate reasonable fluctuations in water supply availability. MCWRA plans to revise the Habitat Conservation Plan (HCP) for the Salinas River, which may change the current reservoir release schedule. A revised reservoir release schedule could influence the reliability of groundwater recharge.

6.6 Uncertainties in Water Budget Calculations

The level of accuracy and certainty is highly variable between water budget components, as previously described. A few water budget components are directly measured, but most water budget components are either estimated inputs to the model, simulated by the model, or adjusted to account for model errors and limited calibration to storage loss and seawater intrusion. Additional model uncertainty stems from an imperfect representation of natural condition and is reflected in model calibration error. However, inputs to the models are carefully selected by the USGS using best available data, the model's calculations represent established science for groundwater flow, and the model calibration error is within acceptable bounds. Therefore, the models are the best available tools for estimating water budgets. The model results are provisional and subject to change in future GSP updates after the models are released by the USGS.

The following list groups water budget components in increasing order of uncertainty.

- Measured: metered municipal, agricultural, and some small water system pumping

- Estimated: domestic pumping, including depth, rate, and location
- Simulated primarily based on climate data: precipitation, evapotranspiration, irrigation pumping
- Simulated based on calibrated model: all other water budget components

Simulated components based on calibrated model have the most uncertainty because those simulated results encompass uncertainty of other water budget components used in the model in addition to model calibration error.

7 MONITORING NETWORKS

This chapter describes the networks that will monitor the SMC discussed in Chapter 8. This description of the monitoring network has been prepared in accordance with the GSP Regulations § 354.32 *et seq.* to include monitoring objectives, monitoring protocols, and data reporting requirements.

7.1 Introduction

7.1.1 Monitoring Objectives

SGMA requires monitoring networks to collect data of sufficient quality, frequency, and distribution to characterize groundwater and related surface water conditions in the Subbasin, and to evaluate changing conditions that occur as the Plan is implemented. The monitoring networks are intended to:

- Monitor changes in groundwater conditions relative to measurable objectives and minimum thresholds.
- Demonstrate progress toward achieving measurable objectives.
- Monitor impacts to the beneficial uses or users of groundwater.
- Quantify annual changes in water budget components.

7.1.2 Approach to Monitoring Networks

Monitoring networks are developed for each of the 6 sustainability indicators that are relevant to the Subbasin:

- Chronic lowering of groundwater levels
- Reduction in groundwater storage
- Seawater intrusion
- Degraded water quality
- Land subsidence
- Depletion of ISW

Other monitoring networks, such as groundwater extraction, that are necessary to comply with GSP Regulations are also included in this chapter. Representative Monitoring Sites (RMS) are a subset of the monitoring network and are limited to sites with data that are publicly available and not confidential.

The SVBGSA estimated the density of monitoring sites and the frequency of measurements required to demonstrate short-term, seasonal, and long-term trends. If the required monitoring site density does not currently exist, the SVBGSA will expand monitoring networks for some sustainability indicators during GSP implementation. Filling data gaps and developing more extensive and complete monitoring networks will improve the SVBGSA's ability to demonstrate sustainability and refine the existing conceptual and numerical hydrogeologic models. Chapter 10 provides a plan and schedule for resolving data gaps. The SVBGSA will review the monitoring network in each 5-year assessment, including a determination of uncertainty and whether there are remaining data gaps that could affect the ability of the Plan to achieve the sustainability goal for the Subbasin.

7.1.3 Management Areas

No management areas have been defined for the 180/400-Foot Aquifer Subbasin.

7.2 Groundwater Level Monitoring Network

The sustainability indicator for chronic lowering of groundwater levels is evaluated by groundwater elevations monitored by MCWRA in designated monitoring wells. The Regulations require a network of monitoring wells sufficient to demonstrate groundwater occurrence, flow directions, and hydraulic gradients between principal aquifers and surface water features.

Figure 7-1 shows the 157 wells in the Subbasin monitored for groundwater elevations that are used to develop groundwater elevation contours. The groundwater elevation data for these wells are publicly available data and shown on the SVBGSA Web Map. The wells are shown by principal aquifer on Figure 7-1.

Of the wells shown on Figure 7-1, 91 are selected for inclusion in the groundwater level monitoring network as RMS wells. Out of the 91 RMS wells, 35 are in the 180-Foot Aquifer, 45 in the 400-Foot Aquifer, and 11 in the Deep Aquifers, as shown on Figure 7-2/

Figure 7-2, Figure 7-3, Figure 7-4, respectively. One of the Deep Aquifers RMS, 16S/04E-11D51, is likely also tapping into the 400-Foot Aquifer but due to lack of groundwater elevation data in the Deep Aquifers it will be used as proxy until more monitoring wells are drilled in the Deep Aquifers. Criteria for selecting wells as part of the RMS network include:

- RMS wells must have known depths and well completion data
- RMS wells should have a relatively long period of historical data
- Hydrographs of RMS wells should be visually representative of the hydrographs from surrounding wells. Appendix 5A includes the hydrograph comparisons used to establish that RMS wells are representative of surrounding wells

- RMS locations must cover the basin and provide data near basin boundaries
- RMS should be selected for each aquifer. There are 3 aquifers in the 180/400-Foot Aquifer Subbasin
- Data from RMS wells are public data and will be used for groundwater elevation maps and analysis. SVBGSA notified well owners of intent to include well in monitoring network.

The RMS wells in the groundwater level monitoring network are listed in Table 7-1. The need for any additional wells is discussed in Section 7.2.2. Appendix 5A presents well construction information and historical hydrographs for each RMS well.

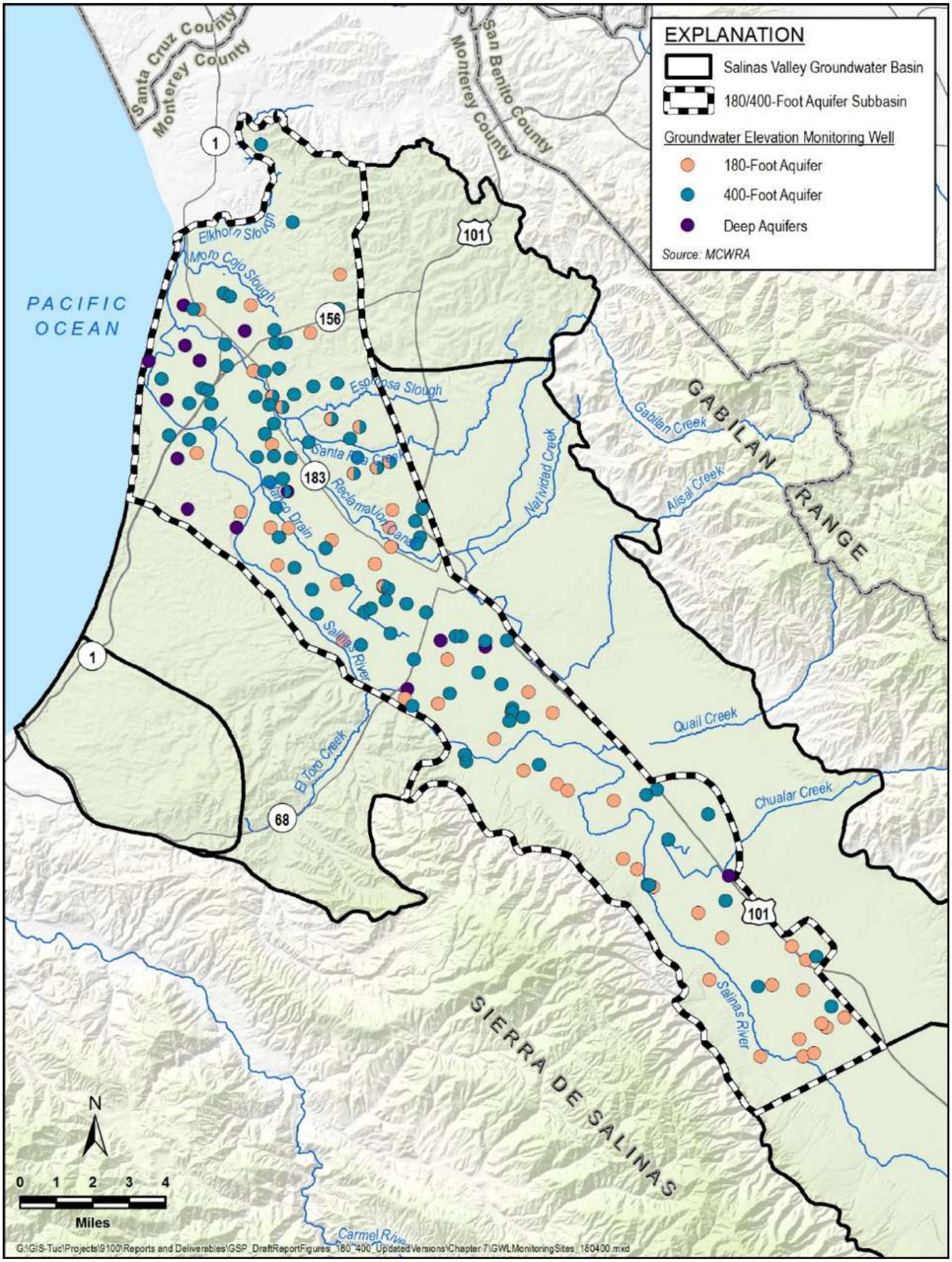

Figure 7-1. 180/400-Foot Aquifer Subbasin Monitoring Network for Groundwater Levels

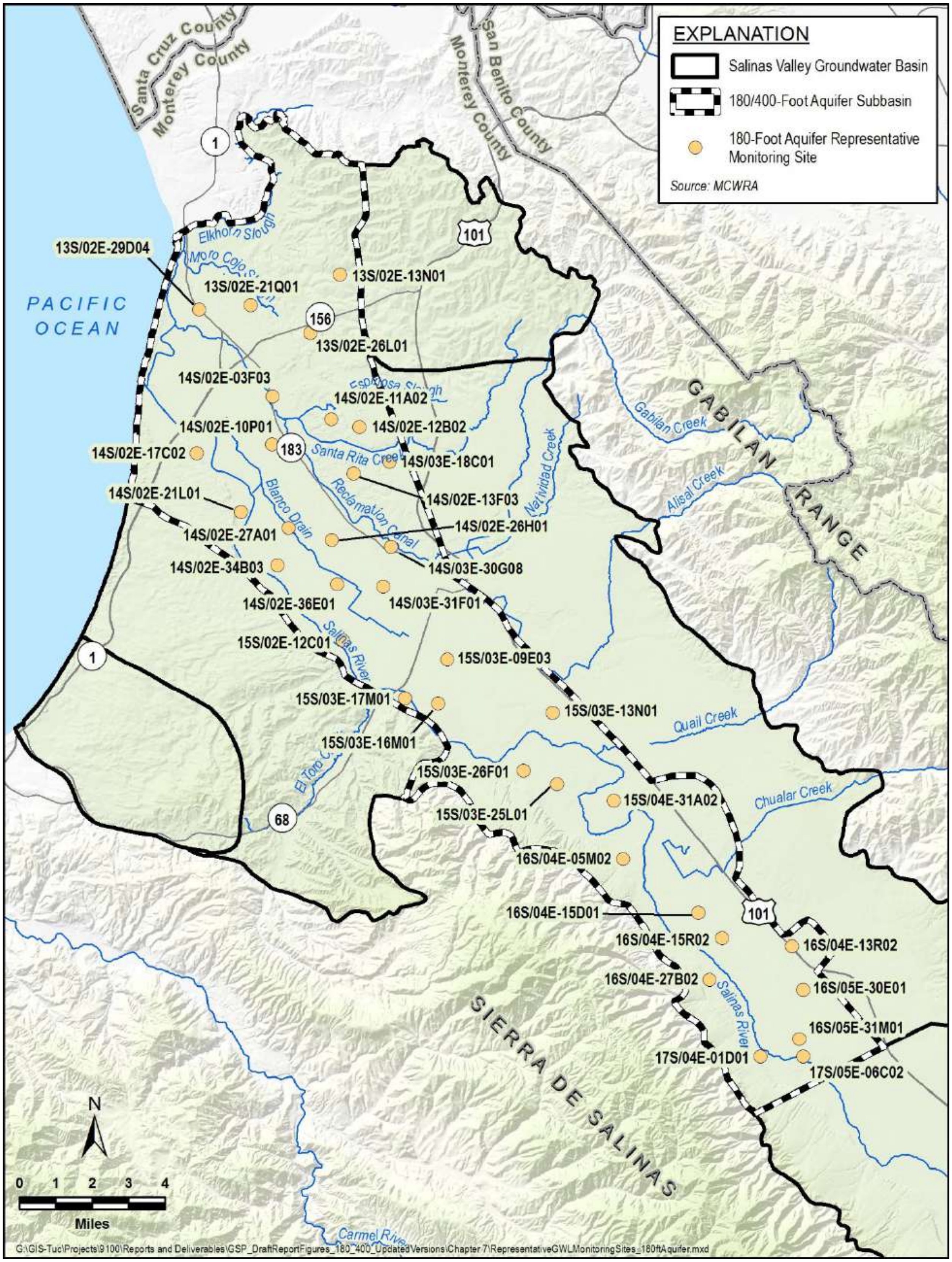

Figure 7-2. 180-Foot Aquifer Representative Monitoring Network for Groundwater Levels

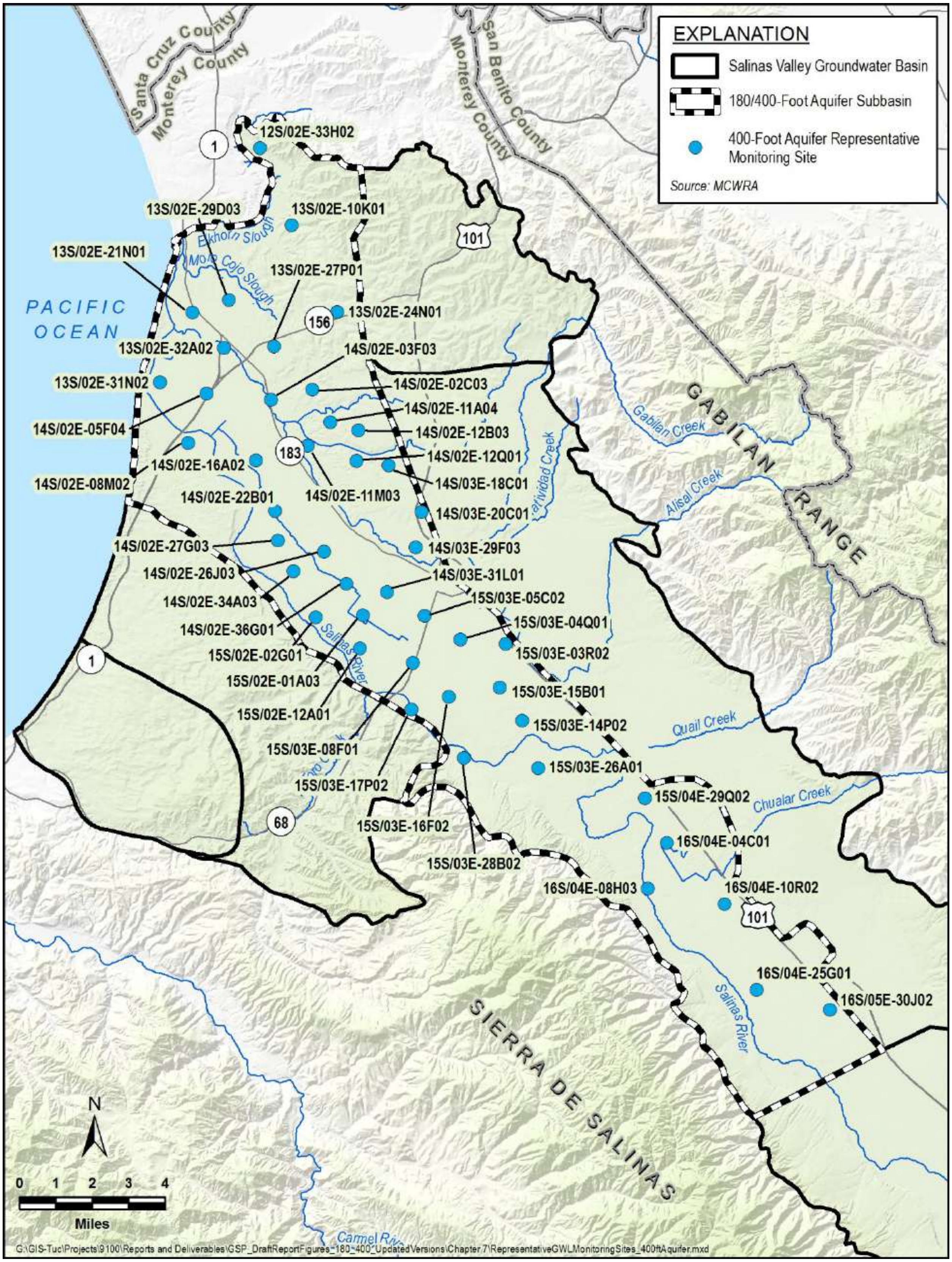

Figure 7-3. 400-Foot Aquifer Representative Monitoring Network for Groundater Levels

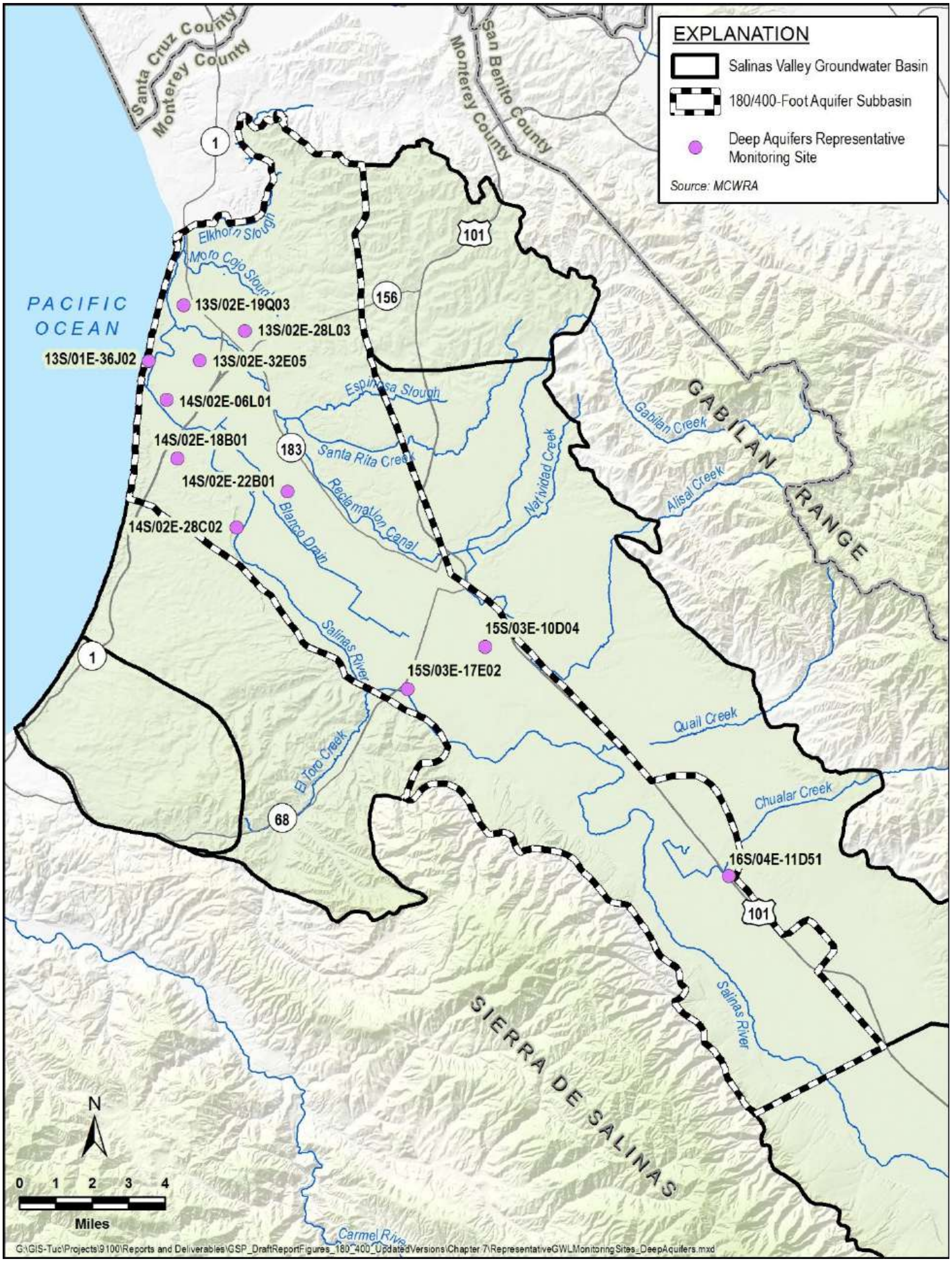

Figure 7-4. Deep Aquifers Representative Monitoring Network for Groundwater Levels

Table 7-1. 180/400-Foot Aquifer Subbasin Groundwater Level Representative Monitoring Site Network

State Well Number	CASGEM Well Number	Local Well Designation	Well Use	Total Well Depth (ft)	Reference Point (ft, NAVD88)	Latitude (NAD 83)	Longitude (NAD 83)	Period of Record (years)
				180-Foot Aquifer				
13S/02E-13N01	N/A	12672	Irrigation	200	78.0	36.7947	-121.7076	58
13S/02E-21Q01	367816N1217514W001	SELA22633	Observation	157	9.7	36.7816	-121.7514	16
13S/02E-26L01	N/A	11028	Unknown	250	109.1	36.7712	-121.7215	58
13S/02E-29D04	N/A	13020	Domestic	2190	11.0	36.7793	-121.7768	14
14S/02E-03F04	367454N1217393W001	ESPA22636	Observation	205	21.5	36.7454	-121.7393	16
14S/02E-10P01	N/A	2657	Irrigation	186	19.2	36.7263	-121.7390	37
14S/02E-11A02	N/A	14478	Observation	250	59.0	36.7371	-121.7098	26
14S/02E-12B02	367343N1216958W001	RODA14455	Observation	265	52.8	36.7343	-121.6958	26
14S/02E-13F03	N/A	14469	Observation	280	44.8	36.7156	-121.6980	26
14S/02E-17C02	N/A	21667	Domestic	140	55.5	36.7219	-121.7760	5
14S/02E-21L01	N/A	862	Irrigation	250	28.1	36.6991	-121.7533	58
14S/02E-26H01	366889N1217079W001	AMST22651	Observation	339	35.0	36.6889	-121.7079	16
14S/02E-27A01	366933N1217294W001	MCFD22632	Observation	293	22.0	36.6933	-121.7294	16
14S/02E-34B03	N/A	1212	Irrigation	346	30.7	36.6782	-121.7345	47
14S/02E-36E01	N/A	331	Irrigation	198	32.5	36.6714	-121.7046	74
14S/03E-18C01	367207N1216806W001	BORA15009	Observation	225	52.1	36.7207	-121.6806	26
14S/03E-30G08	366869N1216785W001	MKTC22650	Observation	293	41.6	36.6869	-121.6785	16
14S/03E-31F01	N/A	10280	Domestic	201	37.8	36.6709	-121.6818	88
15S/02E-12C01	N/A	1070	Irrigation	182	38.2	36.6490	-121.7010	74
15S/03E-09E03	N/A	183	Irrigation	249	54.0	36.6426	-121.6492	66
15S/03E-13N01	N/A	147	Irrigation	275	67.0	36.6226	-121.5964	65
15S/03E-16M01	366250N1216532W001	1359	Irrigation	N/A	59.5	36.6250	-121.6531	89
15S/03E-17M01	366265N1216692W001	1480	Irrigation	271	49.2	36.6268	-121.6695	23
15S/03E-25L01	N/A	656	Irrigation	392	71.6	36.5942	-121.5934	25
15S/03E-26F01	N/A	648	Irrigation	316	62.0	36.5993	-121.6100	63
15S/04E-31A02	N/A	1020	Irrigation	335	77.0	36.5882	-121.5651	57

State Well Number	CASGEM Well Number	Local Well Designation	Well Use	Total Well Depth (ft)	Reference Point (ft, NAVD88)	Latitude (NAD 83)	Longitude (NAD 83)	Period of Record (years)
16S/04E-05M02	N/A	38	Irrigation	261	83.0	36.5652	-121.5597	75
16S/04E-13R02	N/A	447	Irrigation	286	126.3	36.5320	-121.4752	64
16S/04E-15D01	365444N1215220W001	BRME10389	Irrigation	384	99.0	36.5444	-121.5220	67
16S/04E-15R02	N/A	576	Irrigation	300	100.0	36.5346	-121.5100	69
16S/04E-27B02	N/A	204	Irrigation	300	109.0	36.5180	-121.5155	63
16S/05E-30E01	N/A	394	Irrigation	263	118.0	36.5148	-121.4692	103
16S/05E-31M01	N/A	1788	Irrigation	172	121.0	36.4951	-121.4705	88
17S/04E-01D01	N/A	254	Irrigation	310	135.3	36.4878	-121.4894	67
17S/05E-06C02	364883N1214684W001	GZWA21202	Observation	115	116.7	36.4883	-121.4684	24
400-Foot Aquifer								
12S/02E-33H02	N/A	25861	Irrigation	580	55.5	36.8456	-121.7485	3
13S/02E-10K01	N/A	22934	Observation	660	100.0	36.8152	-121.7319	11
13S/02E-21N01	367847N1217618W001	2432	Irrigation	550	17.3	36.7848	-121.7618	67
13S/02E-24N01	N/A	1824	Domestic	600	162.0	36.7812	-121.7080	14
13S/02E-27P01	N/A	1720	Irrigation	606	50.5	36.7667	-121.7387	41
13S/02E-29D03	N/A	2683	Irrigation	632	8.9	36.7793	-121.7797	49
13S/02E-31N02	N/A	1682	Irrigation	576	10.9	36.7512	-121.7946	68
13S/02E-32A02	367653N1217636W001	10161	Irrigation	600	10.6	36.7655	-121.7636	61
14S/02E-02C03	N/A	1716	Irrigation	835	60.4	36.7500	-121.7193	26
14S/02E-03F03	367455N1217395W001	ESPB22635	Observation	455	25.5	36.7455	-121.7395	16
14S/02E-05F04	N/A	1169	Irrigation	582	13.6	36.7472	-121.7715	63
14S/02E-08M02	367275N1217803W001	239	Irrigation	500	14.6	36.7273	-121.7799	88
14S/02E-11A04	N/A	14480	Observation	490	58.9	36.7372	-121.7099	26
14S/02E-11M03	N/A	1705	Irrigation	660	41.5	36.7275	-121.7207	26
14S/02E-12B03	367343N1216959W001	RODB14456	Observation	390	53.2	36.7343	-121.6959	26
14S/02E-12Q01	367221N1216965W001	1707	Domestic/Irrigation	619	64.0	36.7221	-121.6964	88
14S/02E-16A02	N/A	353	Irrigation	669	21.2	36.7211	-121.7461	34
14S/02E-22L01	N/A	1965	Irrigation	700	21.9	36.7013	-121.7359	26
14S/02E-26J03	N/A	113	Irrigation	561	30.5	36.6855	-121.7111	40

State Well Number	CASGEM Well Number	Local Well Designation	Well Use	Total Well Depth (ft)	Reference Point (ft, NAVD88)	Latitude (NAD 83)	Longitude (NAD 83)	Period of Record (years)
14S/02E-27G03	N/A	1861	Irrigation	495	26.0	36.6895	-121.7342	34
14S/02E-34A03	N/A	1060	Irrigation	670	32.5	36.6775	-121.7260	25
14S/02E-36G01	N/A	370	Irrigation	416	35.0	36.6731	-121.6998	58
14S/03E-18C02	367207N1216805W001	BORB15010	Observation	395	52.2	36.7207	-121.6805	26
14S/03E-20C01	N/A	1814	Municipal	701	62.0	36.7026	-121.6635	29
14S/03E-29F03	N/A	1147	Municipal	650	52.0	36.6884	-121.6659	28
14S/03E-31L01	N/A	374	Municipal	640	44.0	36.6702	-121.6794	29
15S/02E-01A03	N/A	1357	Irrigation	480	36.0	36.6608	-121.6910	59
15S/02E-02G01	N/A	888	Irrigation	404	30.0	36.6594	-121.7144	64
15S/02E-12A01	N/A	197	Irrigation	549	43.0	36.6474	-121.6920	59
15S/03E-03R02	N/A	1808	Municipal	635	62.0	36.6508	-121.6201	29
15S/03E-04Q01	N/A	375	Municipal	540	62.0	36.6520	-121.6426	29
15S/03E-05C02	N/A	536	Municipal	614	45.0	36.6612	-121.6605	29
15S/03E-08F01	N/A	1821	Domestic/Irrigation	449	49.0	36.6422	-121.6657	74
15S/03E-14P02	N/A	388	Irrigation	606	62.6	36.6205	-121.6109	27
15S/03E-15B01	N/A	1007	Irrigation	452	63.0	36.6334	-121.6224	54
15S/03E-16F02	366292N1216474W001	1862	Irrigation	592	59.5	36.6291	-121.6474	16
15S/03E-17P02	N/A	1838	Domestic	760	52.0	36.6238	-121.6658	29
15S/03E-26A01	N/A	924	Irrigation	570	56.6	36.6017	-121.6025	28
15S/03E-28B02	N/A	1841	Domestic	490	70.0	36.6050	-121.6393	29
15S/04E-29Q02	N/A	1877	Irrigation	555	82.0	36.5910	-121.5492	26
16S/04E-04C01	N/A	441	Irrigation	466	87.0	36.5733	-121.5378	75
16S/04E-08H03	365550N1215465W001	CHEB21205	Observation	295	88.5	36.5550	-121.5465	24
16S/04E-10R02	N/A	546	Irrigation	484	109.4	36.5496	-121.5086	63
16S/04E-25G01	N/A	1882	Irrigation	560	108.3	36.5157	-121.4916	62
16S/05E-30J02	N/A	1790	Irrigation	443	127.0	36.5086	-121.4552	62
Deep Aquifer								
13S/01E-36J02	N/A	22681	Domestic	1364	23	36.7582	-121.8010	11
13S/02E-19Q03	367808N1217847W001	75	Irrigation	1562	18	36.7808	-121.7846	36

State Well Number	CASGEM Well Number	Local Well Designation	Well Use	Total Well Depth (ft)	Reference Point (ft, NAVD88)	Latitude (NAD 83)	Longitude (NAD 83)	Period of Record (years)
13S/02E-28L03	N/A	22928	Irrigation	1460	12.2	36.7713	-121.7540	2
13S/02E-32E05	N/A	10164	Observation	1650	18.8	36.7589	-121.7757	35
14S/02E-06L01	N/A	1672	Irrigation	1560	8	36.7429	-121.7917	36
14S/02E-18B01	N/A	26393	Irrigation	1700	86.6	36.7196	-121.7854	1
14S/02E-22A03	N/A	24033	Irrigation	1640	29	36.7077	-121.7304	3
14S/02E-28C02	N/A	23135	Irrigation	1160	45	36.6929	-121.7552	11
15S/03E-10D04	N/A	25553	Public	980	63.3	36.6481	-121.6307	1
15S/03E-17E02	N/A	26373	Domestic	700	48	36.6305	-121.6684	1
16S/04E-11D51*	N/A	2776	Irrigation	1000	115	36.5594	-121.5074	3

*Well is a proxy for the Deep Aquifers.

7.2.1 Groundwater Level Monitoring Protocols

Chapter 4 of the MCWRA CASGEM monitoring plan includes a description of existing groundwater elevation monitoring procedures (MCWRA, 2015). The CASGEM groundwater elevation monitoring protocols established by MCWRA are adopted by this GSP and are included in Appendix 7A. Groundwater elevation measurements will be collected at least 2 times per year to represent seasonal low and seasonal high groundwater conditions. The monitoring protocols described in Appendix 7A cover multiple monitoring methods for collecting data by hand and by automated pressure transducers. These protocols are consistent with data and reporting standards described in GSP Regulations § 352.4.

7.2.2 Groundwater Level Monitoring Network Data Gaps

Based on GSP Regulations and BMPs published by DWR on monitoring networks (DWR, 2016b), a visual analysis of the existing monitoring network was performed using professional judgment to evaluate whether there are data gaps in the groundwater level monitoring network.

While there is no definitive requirement on monitoring well density, the BMP cites several studies (Heath, 1976; Sophocleous, 1983; Hopkins and Anderson, 2016) that recommend 0.2 to 10 wells per 100 square miles. The BMP notes that professional judgment should be used to design the monitoring network to account for high-pumping areas, proposed projects, and other subbasin-specific factors.

The 180/400-Foot Aquifer Subbasin encompasses 132 square miles. If the BMP guidance recommendations are applied to the Subbasin, the well network should include between 1 and 13 wells in each of the 180-Foot, 400-Foot, and Deep Aquifers. The current network includes 35 wells in the 180-Foot Aquifer, 45 wells in the 400-Foot Aquifer, 11 wells in the Deep Aquifers. The number of groundwater level monitoring wells in each principal aquifer in the Subbasin either exceeds or is within the range of the BMP guidance. Visual inspection of Figure 7-2 and Figure 7-3 shows that wells in the RMS network are adequately distributed across the Subbasin, and there is no significant spatial data gap in the network for the 180-Foot and 400-Foot Aquifers.

However, visual inspection of the geographic distribution of the well network in the Deep Aquifers indicates that additional wells are necessary to adequately characterize the Subbasin. A higher density of monitoring wells is considered in areas of groundwater withdrawal to assess potential variation in groundwater elevations. Figure 7-5 shows the locations of existing groundwater elevation monitoring wells and the generalized locations where monitoring wells are needed in the Deep Aquifers. Although, the 180-Foot and 400-Foot Aquifers do not have any significant spatial data gaps, the data gaps in the northern part of the Subbasin and along the border with the Eastside Subbasin are locations of potential nested wells to help fill vertical data gaps on the connectivity between aquifers.

The generalized locations for new monitoring wells were based on addressing the criteria listed in the monitoring BMP including:

- Providing adequate data to produce seasonal potentiometric maps
- Providing adequate data to map groundwater depressions and recharge areas
- Providing adequate data to estimate change in groundwater storage
- Demonstrating conditions at Subbasin boundaries

Additionally, groundwater elevation measurements for most of the monitoring wells in the Subbasin occur only once a year. SVBGSA will work with MCWRA to ensure that wells within the groundwater level monitoring network are visited at least twice a year as outlined in Section 7.2.1. Furthermore, some of the wells in the monitoring network have unknown well construction information and that is a data gap that will be addressed during GSP implementation.

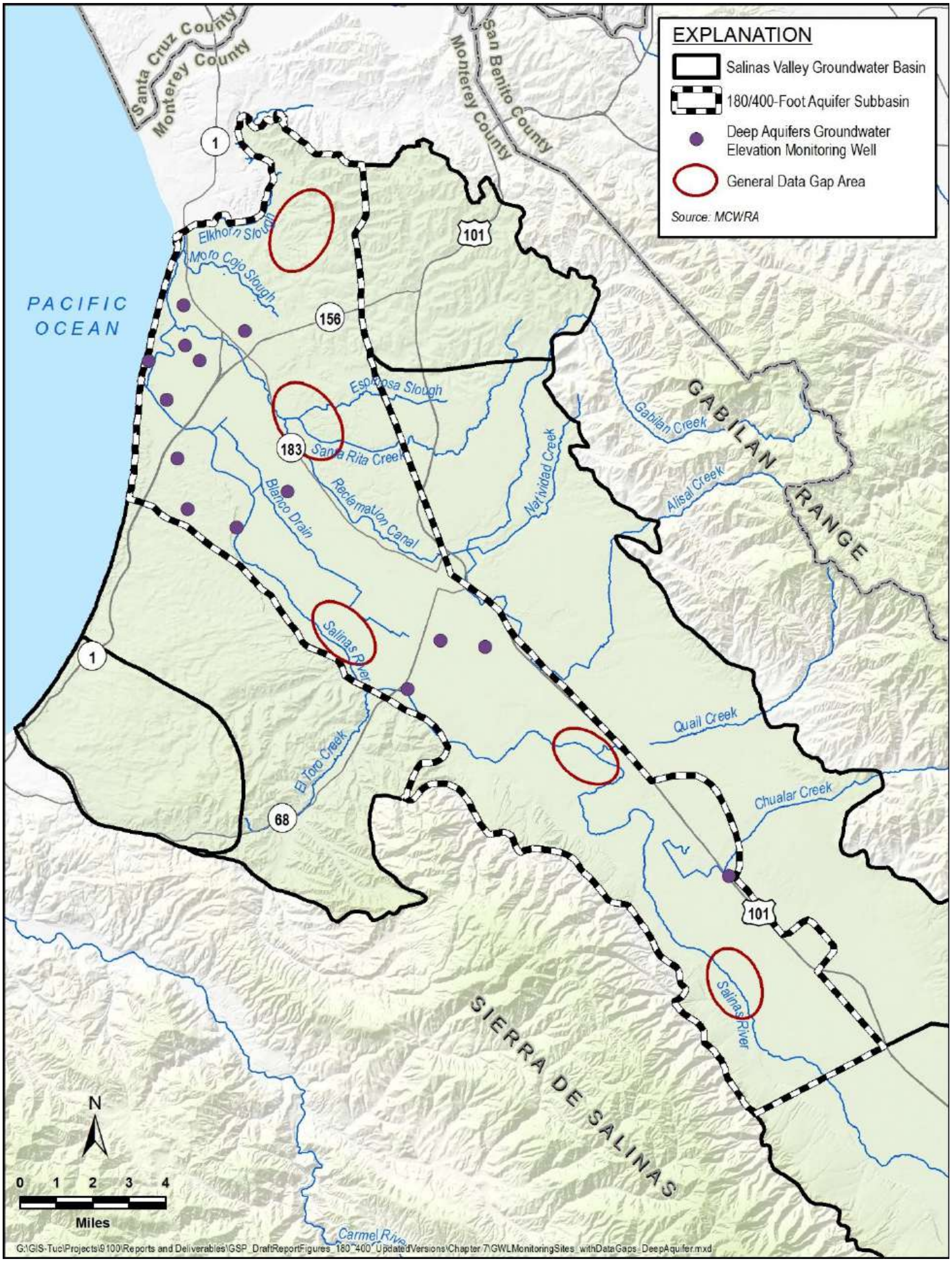

Figure 7-5. Data Gaps in the Groundwater Level Monitoring Network for the Deep Aquifers

7.3 Groundwater Storage Monitoring Network

As discussed in Chapter 8, the sustainability indicator for reduction of groundwater storage is measured using groundwater elevations and the advancement of the seawater intrusion front to calculate change in storage. Thus, the groundwater storage monitoring network is the same as the groundwater levels monitoring network and seawater intrusion monitoring network. Separate calculations of change in storage will be done for the area where seawater has intruded and the area where seawater has not intruded.

7.4 Seawater Intrusion Monitoring Network

The sustainability indicator for seawater intrusion is evaluated using the location of a chloride isocontour, based on chloride concentration measured at a network of monitoring wells. MCWRA currently develops annual maps of the 500 mg/L chloride isocontour (Figure 5-25 and Figure 5-26). The seawater intrusion monitoring network includes only wells where the data can be made publicly available. Should seawater intrusion advance beyond the current monitoring network, MCWRA will expand the existing seawater intrusion monitoring network.

Table 7-2 lists the wells currently used by MCWRA to monitor seawater intrusion in the 180/400-Foot Aquifer Subbasin. These wells are shown on Figure 7-6. Although there is seawater intrusion monitoring in the Deep Aquifers, there is currently no seawater intrusion mapping in the Deep Aquifers. This is a data gap that is addressed below. This table and figure also include wells that are not drilled in one of the 3 principal aquifers but are located in the Subbasin.

Table 7-2. 180/400-Foot Aquifer Seawater Intrusion Well Network

State Well Number	Total Well Depth (ft)	Latitude (NAD 83)	Longitude (NAD 83)
180-Foot Aquifer			
13S/02E-15R03	205	36.79763	-121.72885
13S/02E-21Q01	157	36.78164	-121.75139
14S/02E-03F04	205	36.74539	-121.73931
14S/02E-11A02	250	36.73713	-121.70981
14S/02E-12B02	265	36.73431	-121.69585
14S/02E-13F03	280	36.71562	-121.69801
14S/02E-15L02	200	36.71176	-121.74017
14S/02E-20B01	350	36.70568	-121.76872
14S/02E-21L01	250	36.69907	-121.75333
14S/02E-22P02	304	36.69326	-121.73829
14S/02E-24Q01	N/A	36.69382	-121.69398
14S/02E-26H01	339	36.68887	-121.70793
14S/02E-26N03	162	36.68155	-121.72537

State Well Number	Total Well Depth (ft)	Latitude (NAD 83)	Longitude (NAD 83)
14S/02E-26N50	336	36.67955	-121.72581
14S/02E-26P01	N/A	36.67908	-121.71880
14S/02E-27A01	293	36.69330	-121.72944
14S/02E-27F02	354	36.68704	-121.73509
14S/02E-34B03	346	36.67822	-121.73449
14S/02E-36E01	198	36.67135	-121.70460
14S/03E-07P02	296	36.72467	-121.68178
14S/03E-18C01	225	36.72072	-121.68056
14S/03E-18E03	260	36.71834	-121.68658
14S/03E-18P51	N/A	36.70528	-121.68057
14S/03E-30F01	1023	36.68833	-121.68128
14S/03E-30G08	293	36.68688	-121.67852
14S/03E-31B01	175	36.67564	-121.67844
15S/02E-02A01	242	36.66245	-121.71090
15S/02E-12C01	182	36.64898	-121.70095
16S/04E-08H01	130	36.55516	-121.54740
16S/04E-08H04	140	36.55502	-121.54656
16S/05E-31P02	115	36.48916	-121.46766
17S/05E-06C02	115	36.48832	-121.46840
400-Foot Aquifer			
13S/02E-15M01	1014	36.79880	-121.74569
13S/02E-15R02	585	36.79763	-121.72880
13S/02E-20J01	600	36.78619	-121.76501
13S/02E-28M02	767	36.77262	-121.75991
13S/02E-34G01	765	36.75682	-121.73652
13S/02E-34G02	N/A	N/A	N/A
13S/02E-34J50	N/A	36.75660	-121.72901
13S/02E-34M01	645	36.75547	-121.74375
13S/02E-35H01	440	36.75967	-121.70933
13S/02E-36F50	660	36.75920	-121.70179
14S/02E-01C01	591	36.75057	-121.69755
14S/02E-02A02	810	36.75136	-121.70754
14S/02E-02C03	835	36.74997	-121.71928
14S/02E-03F03	455	36.74548	-121.73949
14S/02E-03H01	800	36.74656	-121.72881
14S/02E-03M02	587	36.74212	-121.74085
14S/02E-03P01	614	36.74125	-121.73971
14S/02E-03R02	638	36.74009	-121.72778
14S/02E-04H01	512	36.74511	-121.74777
14S/02E-05C03	580	36.74792	-121.77457
14S/02E-05R03	653	36.73862	-121.76228
14S/02E-08C03	556	36.73402	-121.77011

State Well Number	Total Well Depth (ft)	Latitude (NAD 83)	Longitude (NAD 83)
14S/02E-09D04	785	36.73640	-121.76008
14S/02E-09N02	622	36.72483	-121.76008
14S/02E-10H01	640	36.73142	-121.73097
14S/02E-10M02	585	36.72736	-121.74325
14S/02E-10N51	580	36.72645	-121.74361
14S/02E-11A04	490	36.73717	-121.70989
14S/02E-11B01	822	36.73609	-121.71422
14S/02E-11M03	660	36.72754	-121.72074
14S/02E-12B03	390	36.73428	-121.69586
14S/02E-13E50	596	36.71645	-121.69917
14S/02E-13F02	480	36.71560	-121.69802
14S/02E-14R50	690	36.71195	-121.70974
14S/02E-15A01	623	36.72115	-121.72964
14S/02E-15N01	552	36.71076	-121.74379
14S/02E-15P01	595	36.71150	-121.73957
14S/02E-22L01	680	36.70133	-121.73594
14S/02E-22R01	672	36.69352	-121.72600
14S/02E-24E01	467	36.70348	-121.70666
14S/02E-24P02	454	36.69388	-121.70174
14S/02E-25D51	700	36.69234	-121.70484
14S/02E-26C50	594	36.69292	-121.72025
14S/02E-26J03	561	36.68549	-121.71108
14S/02E-34A03	670	36.67750	-121.72599
14S/02E-34A04	352	36.67886	-121.72921
14S/02E-36F03	602	36.67450	-121.70291
14S/02E-36G01	416	36.67315	-121.69976
14S/03E-07D50	600	36.73549	-121.68474
14S/03E-07K51	600	36.72946	-121.67609
14S/03E-07P50	1140	36.72324	-121.67989
14S/03E-18C02	395	36.72074	-121.68053
14S/03E-18E04	495	36.71833	-121.68655
14S/03E-30E03	430	36.68630	-121.68643
14S/03E-31F02	518	36.67133	-121.68199
15S/02E-01Q50	524	36.65195	-121.69825
15S/02E-03B05	N/A	36.66367	-121.73295
15S/03E-07K01	570	36.64222	-121.68044
15S/03E-08L01	656	36.63956	-121.66396
16S/04E-08H02	295	36.55514	-121.54741
16S/04E-08H03	295	36.55503	-121.54655
16S/04E-11D51	1000	36.55944	-121.50737
16S/05E-31P01	300	36.48916	-121.46768
17S/05E-06C01	N/A	36.48832	-121.46840

State Well Number	Total Well Depth (ft)	Latitude (NAD 83)	Longitude (NAD 83)
Deep Aquifers			
13S/01E-25R01	1393	36.76814	-121.79767
13S/01E-36J02	1364	36.75821	-121.80101
13S/02E-19Q03	1562	36.78080	-121.78457
13S/02E-28L03	1460	36.77132	-121.75396
13S/02E-31A02	1600	36.76468	-121.78329
14S/02E-07J03	1573	36.72741	-121.78209
14S/02E-14R02	1690	36.71190	-121.70989
14S/02E-18B01	1700	36.71959	-121.78541
14S/02E-19G01	1910	36.70157	-121.78617
14S/02E-20E01	2020	36.69959	-121.77964
14S/02E-21K04	1800	36.69771	-121.74999
14S/02E-21L02	1780	36.69665	-121.75524
14S/02E-22A03	1640	36.70771	-121.73043
14S/02E-22J02	1620	36.69352	-121.72966
14S/02E-23G02	1560	36.70217	-121.71199
14S/02E-23J02	N/A	36.69978	-121.70821
14S/02E-23P02	1620	36.69346	-121.71863
14S/02E-25A03	N/A	36.69004	-121.69111
14S/02E-26A10	N/A	36.69231	-121.70810
14S/02E-26D01	1645	36.69360	-121.72371
14S/02E-26G01	N/A	36.68950	-121.71647
14S/02E-26J04	N/A	36.68585	-121.70770
14S/02E-27J02	N/A	36.68761	-121.72609
14S/02E-27K02	1700	36.68466	-121.73528
14S/02E-28C02	1160	36.69290	-121.75521
14S/02E-28H04	1180	36.68865	-121.74453
14S/02E-29C01	1780	36.69275	-121.77143
14S/02E-34M01	1645	36.66970	-121.74113
14S/02E-35B01	1690	36.67893	-121.71497
14S/03E-19C01	1723	36.70575	-121.68395
15S/03E-03N58	682	36.65329	-121.63142
15S/03E-05R52	840	36.65007	-121.65285
15S/03E-10D04	980	36.64805	-121.63066
16S/04E-03K01	1060	36.56520	-121.51296
Not in a principal aquifer			
13S/02E-28L02	**529**	**36.77122**	**-121.75436**
14S/01E-13J01	N/A	36.71182	-121.80015
14S/02E-11A03	100	36.73712	-121.70972
14S/02E-13G01	676	36.71771	-121.69442
14S/02E-17C02	140	36.72192	-121.77596
14S/02E-27C02	488	36.68954	-121.73565

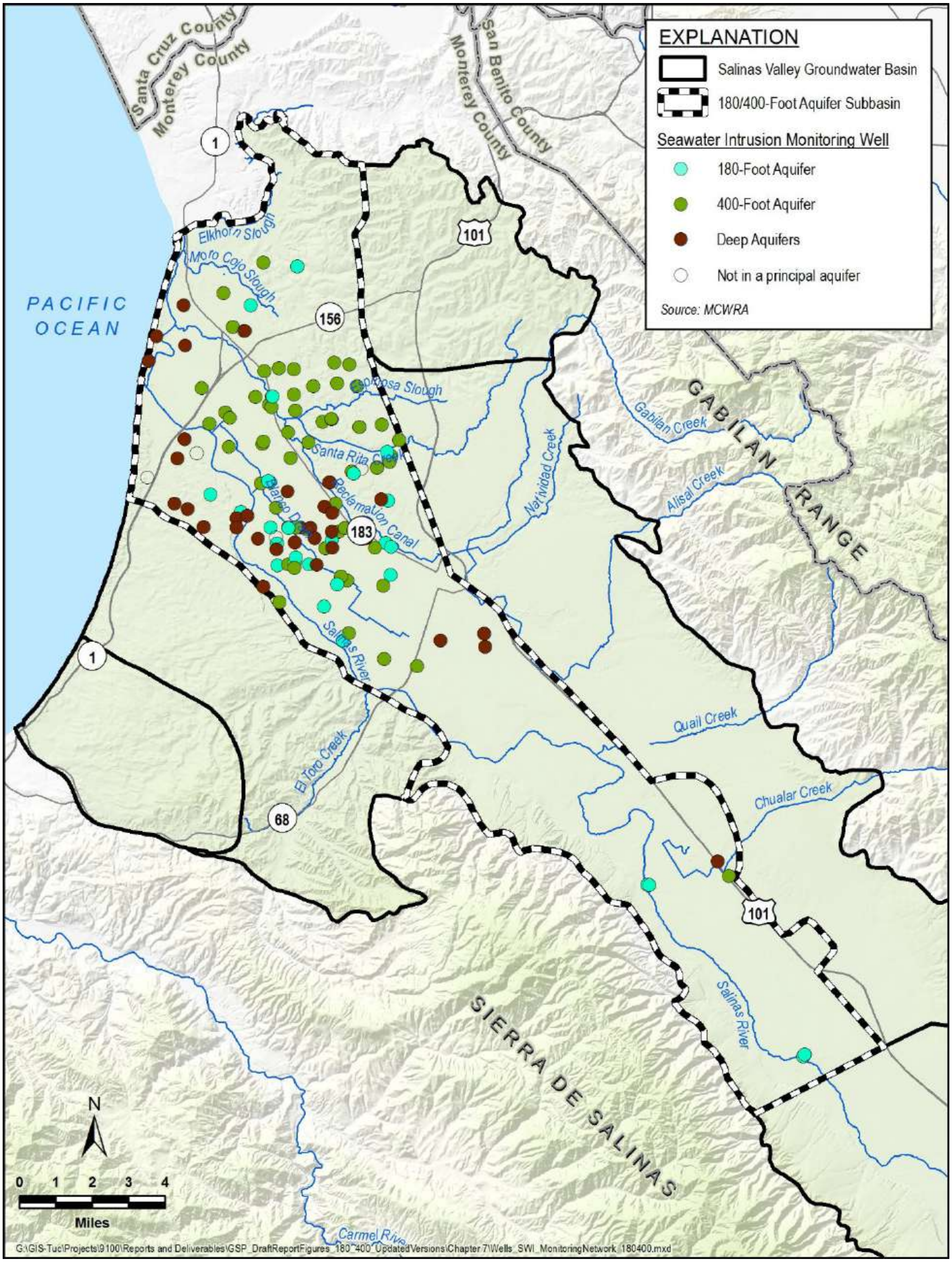

Figure 7-6. 180/400-Foot Aquifer Subbasin Seawater Intrusion Monitoring Network

7.4.1 Seawater Intrusion Monitoring Protocols

The protocols established by MCWRA for collecting groundwater quality data from monitoring wells and analyzing those data for seawater intrusion are adopted by this GSP. The groundwater quality data and seawater intrusion monitoring protocols are available in the Monterey County Quality Assurance Project Plan (QAPP) and included in Appendix 7B. MCWRA also established chloride data contouring protocols to establish the isocontour map, provided in Appendix 7C. These protocols are consistent with data and reporting standards described in GSP Regulations § 352.4.

7.4.2 Seawater Intrusion Monitoring Data Gaps

The network of wells with publicly available data for monitoring chloride concentrations includes an adequate number and distribution of wells in the 180-Foot and the 400-Foot Aquifers (Figure 7-6). However, the distribution of wells in the Deep Aquifer is inadequate and considered a data gap. As described in Section 7.2, additional wells will be identified in the Deep Aquifer for groundwater level monitoring. The data gap for seawater intrusion monitoring in the Deep Aquifer will be addressed by using the same set of new monitoring wells identified in the groundwater level monitoring network.

7.5 Groundwater Quality Monitoring Network

The sustainability indicator for degraded water quality is evaluated by adopting the SWRCB DDW and CCRWQCB ILRP groundwater quality networks. The water quality monitoring network for the Subbasin is composed of public water system supply wells monitored under DDW, and on-farm domestic wells and irrigation supply wells monitored under ILRP.

As described in Chapter 8, separate minimum thresholds are set for the COC for public water system supply wells, on-farm domestic wells, and irrigation supply wells. Therefore, although there is a single groundwater quality monitoring network, different wells in the network are reviewed for different constituents. COC for drinking water are assessed at public water supply wells and on-farm domestic wells, and COC for crop health are assessed at agricultural supply wells. The COC for the 3 sets of wells are listed in Chapter 5.

The public water system supply wells included in the monitoring network were identified by reviewing data from the SWRCB DDW. The SWRCB collects data for municipal systems; community water systems; non-transient, non-community water systems; and non-community water systems that provide drinking water to at least 15 service connections or serve an average of at least 25 people for at least 60 days a year. The RMS network consists of 98 wells monitored by DDW, as shown on Figure 7-7 and listed in Appendix 7D. The SWRCB is undertaking the SAFER Program to collect their groundwater quality data from small state water systems and make it readily available. Once that data is readily available, SVBGSA may add small system wells to its groundwater quality monitoring network.

All on-farm domestic wells and irrigation supply wells that have been sampled through the CCRWQCB's IRLP are included in the RMS network. Under the existing, Ag Order, the are 573 ILRP wells, consisting of 335 irrigation supply wells and 238 on-farm domestic wells that are all part of the RMS network. The locations of these wells are shown on Figure 7-8 and listed in Appendix 7D. The SVBGSA assumes that Ag Order 4.0 will have a similar representative geographic distribution of wells within the Subbasin. The agricultural groundwater quality monitoring network will be revisited and revised when the Ag Order 4.0 monitoring network is finalized.

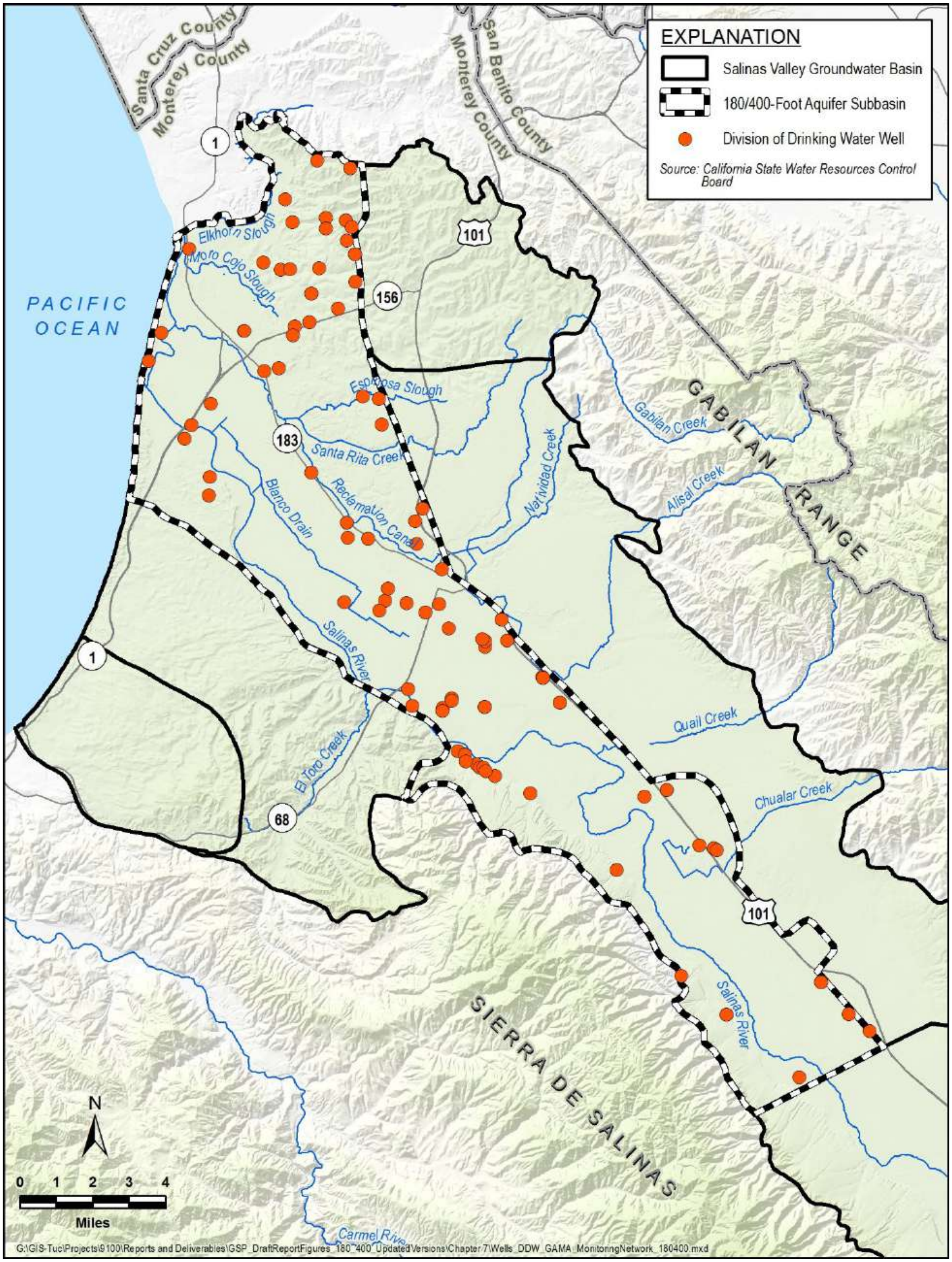

Figure 7-7. DDW Public Water System Supply Wells in the Groundwater Quality Monitoring Network

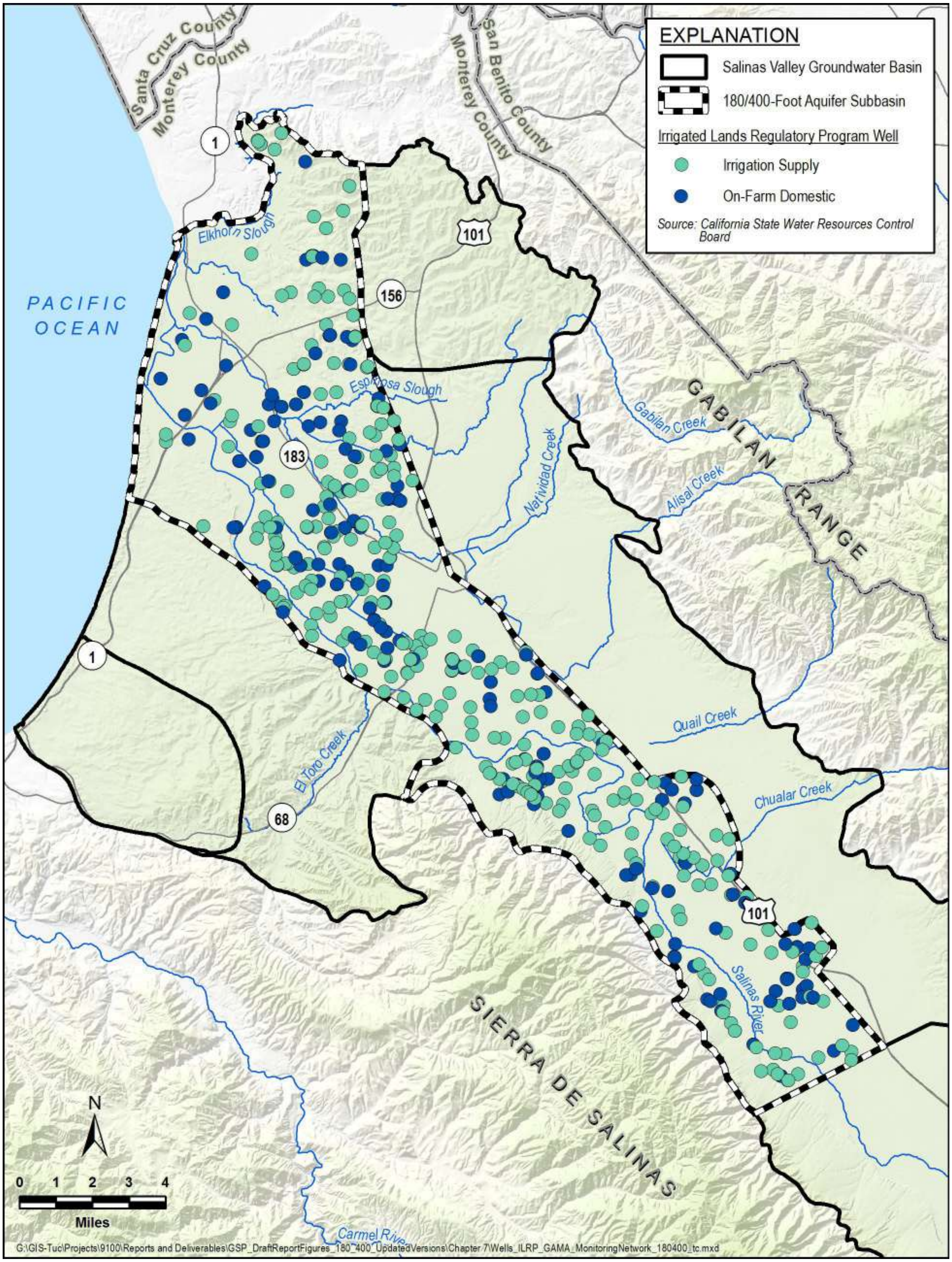

Figure 7-8. ILRP Wells Monitored under Ag Order 3.0 in the Groundwater Quality Monitoring Network

7.5.1 Groundwater Quality Monitoring Protocols

The SVBGSA does not independently sample wells for any COC. Instead, the GSA analyzes water quality data that are collected through the DDW and ILRP. Therefore, the GSA is dependent on the monitoring density and frequency of DDW and ILRP.

Water quality data from public water systems are collected, analyzed, and reported in accordance with protocols that are reviewed and approved by the SWRCB DDW, in accordance with the state and federal Safe Drinking Water Acts. Monitoring protocols may vary by agency.

ILRP data are currently collected under CCRWQCB Ag Order 3.0. ILRP samples are collected under the Tier 1, Tier 2, or Tier 3 monitoring and reporting programs. Under Ag Order 4.0, ILRP data will be collected in 3 phases and each groundwater basin within the Central Coast Region has been assigned to one or more of these phases. The designated phase for each ILRP well is provided in SWRCB's GeoTracker database and is publicly accessible at: https://geotracker.waterboards.ca.gov/. Ag Order 4.0 will take effect in the Subbasin beginning in 2025. Copies of the Ag Orders 3.0 and 4.0 monitoring and reporting programs are included in Appendix 7E and are incorporated into this GSP. These protocols are consistent with data and reporting standards described in GSP Regulations § 352.4.

7.5.2 Groundwater Quality Monitoring Data Gaps

The DDW and ILRP monitoring network provide sufficient spatial and temporal data to determine groundwater quality trends for water quality indicators to address known water quality issues. Additionally, there is adequate spatial coverage in the water quality monitoring network to assess impacts to beneficial uses and users.

7.6 Land Subsidence Monitoring Network

As described in Section 5.5, DWR collects land subsidence data using InSAR satellite data and makes these data available to GSAs. This subsidence dataset represents the best available science for the 180/400-Foot Subbasin and is therefore used as the subsidence monitoring network.

7.6.1 Land Subsidence Monitoring Protocols

Land Subsidence monitoring protocols are the ones used by DWR for InSAR measurements and interpretation. DWR adapted their methods to measure subsidence on hard surfaces only and interpolate between them to minimize the change in land surface elevation captures in soft surfaces that are likely not true subsidence. The cell size of this interpolated surface is 302 feet by 302 feet. If the annual monitoring indicates subsidence is occurring at a rate greater than the minimum thresholds, then additional investigation and monitoring may be warranted. In particular, the GSAs will implement a study to assess if the observed subsidence can be correlated to groundwater elevations, and whether a reasonable causality can be established. These protocols are consistent with data and reporting standards described in GSP Regulations § 352.4.

7.6.2 Land Subsidence Data Gaps

There are no data gaps associated with the subsidence monitoring network.

7.7 Interconnected Surface Water Monitoring Network

The primary tool for assessing depletion of ISW due to pumping will be shallow monitoring wells adjacent to the Salinas River in the Subbasin. Table 7-3 lists and Figure 7-9 shows the existing wells from MCWRA's groundwater monitoring programs that will be added to the ISW monitoring network. Figure 7-9 also shows the proposed locations of 2 new monitoring wells. Existing wells are chosen based on the locations of ISW determined by the preliminary SVIHM, well depth, and proximity to the Salinas River. Furthermore, the wells are also located in vicinity of a USGS stream gauge or MCWRA River Series measurement site shown on Figure 7-9. This allows for monitoring of groundwater elevations near the rivers in the Subbasin and may provide insight on the relationship between streamflow and groundwater elevations. Additionally, the combined use of groundwater elevation and streamflow data will allow SVBGSA to assess temporal changes in conditions due to variations in stream discharge and regional groundwater extraction, as well as other factors that may be necessary to identify adverse impacts on beneficial uses of the surface water as discussed in Chapter 8. All ISW monitoring wells are RMS. More information on the development of the ISW monitoring network is provided in Appendix 7F.

Table 7-3. Shallow Wells in the Interconnected Surface Water Monitoring Network

State Well Number	Total Well Depth (ft)	Latitude (NAD 83)	Longitude (NAD 83)
16S/04E-08H02	295	36.55514	-121.54741
16S/05E-31P02	115	36.48916	-121.46768

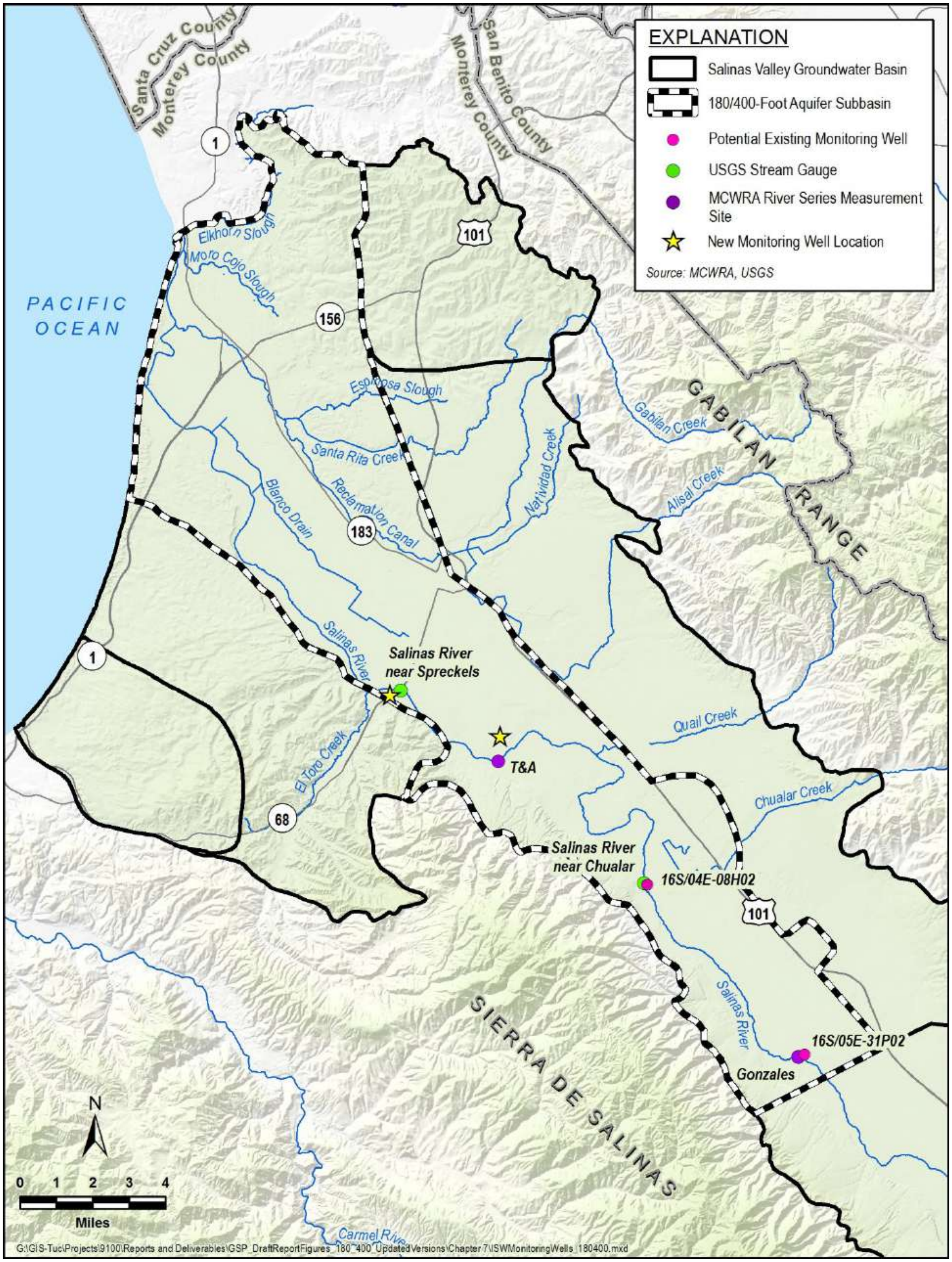

Figure 7-9. Interconnected Surface Water Monitoring Network

7.7.1 Interconnected Surface Water Monitoring Protocols

Monitoring protocols for shallow wells monitoring interconnected surface water will be identical to MCWRA's current groundwater elevation monitoring protocols, included in Appendix 7A. These protocols are consistent with data and reporting standards described in GSP Regulations § 352.4. Additionally, if possible, each well that is added to the monitoring network will be equipped with a data logger that will allow SVBGSA to assess if seasonal pumping is resulting in streamflow depletions.

7.7.2 Interconnected Surface Water Data Gaps

As shown in Figure 7-9, the data gaps in the ISW monitoring network will be filled with 2 new wells added along the Salinas River, as discussed in Chapter 10. The new shallow wells will be added to MCWRA's groundwater elevation monitoring program.

7.8 Other Monitoring Networks

7.8.1 Groundwater Extraction Monitoring Network

SGMA requires that annual reports include annual groundwater extraction for the Subbasin. MCWRA's Groundwater Extraction Monitoring System (GEMS) will be used to monitor urban and agricultural extraction in the Subbasin. Under Monterey County Ordinance No. 3717, public water systems and agricultural pumpers using wells with an internal discharge pipe greater than 3 inches within Zones 2, 2A, and 2B report extractions annually to GEMS. Extraction is self-reported by well owners or operators. Agricultural wells report their data based on MCWRA's reporting year that runs from November 1 through October 31. Urban and industrial wells report extraction on a calendar year basis. When extraction data is summarized annually, MCWRA combines industrial and urban extractions into a single urban water use. As depicted on Figure 3-3, these zones provide sufficient coverage of the 180/400-Foot Aquifer Subbasin.

SVBGSA will work with MCWRA to obtain the GEMS data through a coordinated reporting program such that wells owners can provide a single annual reporting to fulfill the requirements of both the GSP and the existing County Ordinance No. 3717.

7.8.1.1 Groundwater Extraction Monitoring Protocols

Groundwater extraction monitoring will be accomplished using the GEMS data provided by MCWRA. Existing GEMS protocols are consistent with data and reporting standards described in GSP Regulations § 352.4.

7.8.1.2 Groundwater Storage Monitoring Data Gaps

Accurate assessment of the amount of pumping requires an accurate count of the number of municipal, agricultural, and domestic wells in the GSP area. As proposed in Chapter 9, SVBGSA will undertake well registration during implementation to develop a database of existing and active groundwater wells. This database will draw from the existing MCWRA database, DWR's OSWCR database, and the Monterey County Health Department database of state small and local small water systems. As part of the assessment, the SVBGSA will verify well completion information and location, and whether the well is active, abandoned, or destroyed as is discussed further in Chapter 9.

A potential data gap is the accuracy and reliability of groundwater pumping reported through GEMS. SVBGSA will work with MCWRA to evaluate methods currently in place to assure data reliability. Based on the results of that evaluation, the protocols for monitoring may be revised and a protocol for well meter calibration may be developed. SVBGSA will work with MCWRA to consider the value of developing protocols for flowmeter calibration and other potential enhancements to the GEMS programs that are discussed in Chapter 9.

7.8.2 Salinas River Watershed Diversions

Salinas River watershed monthly diversion data are collected annually in the SWRCB's Electronic Water Rights Information Management System (eWRIMS). eWRIMS is used track information of water rights in the state and is publicly accessible at: https://ciwqs.waterboards.ca.gov/ciwqs/ewrims/reportingDiversionDownloadPublicSetup.do. These data include diversions from tributaries of the Salinas River.

7.8.2.1 Salinas River Watershed Diversions Monitoring Protocols

Salinas River watershed diversion monitoring protocols are those that the SWRCB has established for the collection of water right information. These protocols are consistent with data and reporting standards described in GSP Regulations § 352.4.

7.8.2.2 Salinas River Watershed Diversions Monitoring Data Gaps

These data are lagged by a year because the reporting period does not begin until February of the following year.

7.9 Data Management System and Data Reporting

The SVBGSA has developed a DMS in adherence to GSP Regulations § 352.6 and § 354.40 that is used to store, review, and upload data collected as part of the GSP development and implementation.

The SVBGSA DMS consists of 2 SQL databases. The HydroSQL database stores information about each well and water level and extraction time-series data. Fields in the HydroSQL database include:

- Subbasin
- Cadastral coordinates
- Planar coordinates
- Well owner
- Well name
- Well status
- Well depth
- Screened interval top and bottom
- Well type
- Water level elevation
- Annual pumping volume

Well owner and annual well-specific pumping information will be stored in HydroSQL; however, neither will be publicly accessible due to confidentiality requirements. Streamflow gauge data from the USGS will be stored in the HydroSQL similarly to the well water level information.

Water quality data are stored in the EnviroData SQL database, which is linked to the HydroSQL for data management purposes. EnviroData SQL contains fields such as:

- Station
- Parameter
- Sample Date
- Detection (detect or non-detect)
- Value
- Unit

The data used to populate the SVBGSA DMS are listed in Table 7-4. Categories marked with an X indicate datasets that were used in populating the DMS, including data that are publicly accessible or that are available to SVBGSA from MCWRA. Some data, such as groundwater extraction are confidential, and cannot be made publicly accessible by SVBGSA unless aggregated. Additional datasets will be added in the future as appropriate, such as recharge or diversion data.

Table 7-4. Datasets Available for Use in Populating the DMS

Data Sets	Data Category					
	Well and Site Information	Well Construction	Water Level	Groundwater Extraction[1]	Streamflow	Water Quality
DWR (CASGEM)	X	X				
MCWRA	X	X	X	X		
GAMA Groundwater Information System	X					X
USGS Gauge Station					X	

[1] Pumping data not publicly accessible

Data are compiled and reviewed to comply with quality objectives. The review included the following checks:

- Removing or flagging questionable data being uploaded in the DMS. This includes identifying outliers that may have been introduced during the original data entry process and plotting each well hydrograph to identify and remove anomalous data points.
- Loading into the database and checking for errors and missing data.

In the future, well log information will be entered for selected wells and other information will be added as needed to satisfy the requirements of the SGMA regulations.

The DMS also includes a publicly accessible web-map hosted on the SVBGSA website; accessible at https://svbgsa.org/gsp-web-map-and-data/. This web-map gives interested parties access to non-confidential technical information used in the development of the GSP and annual reports, and includes public well data and analysis such as water level contour maps and seawater intrusion, as well as various local administrative boundaries. In addition, the web-map has functionalities to graph time series of water levels and search for specific wells in the database. This web-map will be regularly updated as new information is made available to the SVBGSA.

8 SUSTAINABLE MANAGEMENT CRITERIA

This chapter defines the conditions that constitute sustainable groundwater management; and establishes minimum thresholds, measurable objectives, and undesirable results for each sustainability indicator. The minimum thresholds, measurable objectives, and undesirable results detailed in this chapter define the Subbasin's future conditions and commit the GSA to actions that will meet these criteria. This chapter includes adequate data to explain how SMC were developed and how they influence all beneficial uses and users.

The chapter is structured to address all the GSP Regulations § 354.22 *et. seq* regarding SMC. To retain an organized approach, the SMC are grouped by sustainability indicator. The discussion of each sustainability indicator follows a consistent format that contains all the information required by the GSP Regulations, and as further clarified in the SMC BMP (23 California Code of Regulations § 352.22 *et seq.*; DWR, 2017).

8.1 Definitions

The SGMA legislation and GSP Regulations contain terms relevant to the SMC. The definitions included in the GSP Regulations are repeated below. Where appropriate, additional explanatory text is added in italics. This explanatory text is not part of the official definitions of these terms.

- **Sustainability indicator** refers to any of the effects caused by groundwater conditions occurring throughout the basin that, when significant and unreasonable, cause undesirable results, as described in Water Code § 10721(x).

  The 6 sustainability indicators relevant to this subbasin include chronic lowering of groundwater levels; reduction of groundwater storage; degraded water quality; land subsidence; seawater intrusion; and depletion of ISW.

- Significant and unreasonable

  Significant and unreasonable is not defined in the Regulations. However, the definition of undesirable results states, "Undesirable results occur when significant and unreasonable effects … are caused by groundwater conditions…." This GSP adopts the phrase significant and unreasonable to be the qualitative description of undesirable conditions due to inadequate groundwater management. Minimum thresholds are the quantitative measurement of the significant and unreasonable conditions.

- **Minimum threshold** refers to a numeric value for each sustainability indicator used to define undesirable results.

  Minimum thresholds are indicators of an unreasonable condition.

- **Measurable objective** refers to a specific, quantifiable goals for the maintenance or improvement of specified groundwater conditions that have been included in an adopted Plan to achieve the sustainability goal for the basin.

  Measurable objectives are goals that the GSP is designed to achieve.

- **Interim milestone** refers to a target value representing measurable groundwater conditions, in increments of 5 years, set by an Agency as part of a Plan.

  Interim milestones are targets such as groundwater elevations that will be achieved every 5 years to demonstrate progress towards sustainability.

- Undesirable result

  Undesirable result is not defined in the Regulations. However, the description of undesirable result states that it should be a quantitative description of the combination of minimum threshold exceedances that cause significant and unreasonable effects in the subbasin. An example undesirable result is more than 10% of the measured groundwater elevations being lower than the minimum thresholds. Undesirable results should not be confused with significant and unreasonable conditions. Significant and unreasonable conditions are qualitative descriptions of conditions to be avoided; an undesirable result is a quantitative assessment based on minimum thresholds.

8.2 Sustainability Goal

The sustainability goal of the 180/400-Foot Aquifer Subbasin is to manage groundwater resources for long-term community, financial, and environmental benefits to the Subbasin's residents and businesses. The goal of this GSP is to ensure long-term viable water supplies while maintaining the unique cultural, community, and business aspects of the Subbasin. It is the express goal of this GSP to balance the needs of all water users in the Subbasin.

Several projects and management actions are included in this GSP and detailed in Chapter 9. It is not necessary to implement all projects and actions listed in this GSP to achieve sustainability. However, some combination of these will be implemented to ensure the Subbasin is operated within its sustainable yield and achieves sustainability. These management actions include demand management, promoting conservation and agricultural BMPs, land retirement, reservoir reoperation, and operationalization of management guidance from Deep Aquifers Study. Chapter 9 also includes direct and indirect recharge projects, water supply projects to replace groundwater use, and a seawater extraction barrier. Finally, Chapter 9 includes implementation actions that do not directly help meet the SMC, but contribute to GSP implementation through data collection, assistance to groundwater users, and collaboration with partner agencies. This suite of projects and management actions provide sufficient options to achieve sustainability in the 180/400-Foot Aquifer Subbasin throughout GSP implementation.

The management actions and projects are designed to achieve sustainability within 20 years by one or more of the following means:

- Educating stakeholders and prompting changes in behavior to improve chances of achieving sustainability.
- Increasing awareness of groundwater pumping impacts to promote voluntary reductions in groundwater use through improved water use practices or fallowing crop land.
- Increasing basin recharge.
- Developing new alternative water supplies for use in the Subbasin to offset groundwater pumping.

8.3 Achieving Long-Term Sustainability

The GSP addresses long-term groundwater sustainability. Correspondingly, the SVBGSA intends to develop SMC to avoid undesirable results under future hydrologic conditions. The understanding of future conditions is based on historical precipitation, evapotranspiration, streamflow, and reasonable anticipated climate change, which have been estimated on the basis of the best available climate science (DWR, 2018). These parameters underpin the estimated future water budget over the planning horizon (see Section 6.4). The average hydrologic conditions include reasonably anticipated wet and dry periods. Groundwater conditions that are the result of extreme climatic conditions and are worse than those anticipated do not constitute an undesirable result. However, SMC may be modified in the future to reflect observed future climate conditions.

The GSA will track hydrologic conditions during GSP implementation. These observed hydrologic conditions will be used to develop a value for average hydrologic conditions, which will be compared to predicted future hydrologic conditions. This information will be used to interpret the Subbasin's performance against SMC. Year-by-year micro-management is not the intent of this GSP; this GSP is developed to avoid undesirable results with long-term, deliberate groundwater management. For example, groundwater extractions may experience variations caused by reasonably anticipated hydrologic fluctuations. However, under average hydrologic conditions, there will be no chronic depletion of groundwater storage.

Further, since the GSP addresses long-term groundwater sustainability, exceedance of some SMC during an individual year does not constitute an undesirable result. Pursuant to SGMA regulations (California Water Code § 10721(w)(1)), "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." Therefore, groundwater levels may temporarily exceed minimum thresholds during prolonged droughts, which could be more extreme than those that have been anticipated based on historical data and anticipated climate change conditions. Such temporary exceedances do not constitute an undesirable result.

The SMC presented in this chapter are developed on the basis of historically observed hydrologic conditions and, in most cases, reasonably anticipated climate change. These SMC may be updated in future drafts to reflect changes in anticipated climate conditions and climate change based upon groundwater modeling results.

8.4 General Process for Establishing Sustainable Management Criteria

The SMC presented in this chapter were developed using publicly available information, feedback gathered during public meetings including subbasin committee meetings, hydrogeologic analysis, and meetings with SVBGSA staff and 180/400-Foot Aquifer Subbasin Committee members. The general process to develop the initial SMC included:

- Presentations to the Board of Directors on the SMC requirements and implications.
- Presentations to the Advisory Committee and Subbasin Specific working groups outlining the approach to developing SMC and discussing initial SMC ideas. The Advisory Committee and working groups provided feedback and suggestions for the development of initial SMC.
- Discussions with GSA staff and various Board Members.
- Modifying minimum thresholds and measurable objectives based on input from GSA staff and Board Members.

For the GSP Update, the process included:

- Presenting to the Subbasin Committee on the general SMC requirements and implications. These presentations outlined the original approach to developing SMC.
- Presenting to the Subbasin Committee on lessons learned on SMC since the original GSP, including DWR's review and assessment of the 180/400-Foot Aquifer Subbasin GSP, DWR's reviews of other GSPs, and legal consultation and Board direction during the development of 2022 Salinas Valley GSPs. This updated GSP incorporates DWR's suggested corrective actions into the SMC where appropriate.
- Presenting recommendations on whether to update the approach to SMC in the GSP Update, and receiving feedback from the Subbasin Committees and public.

- Modifying SMC approach for the storage and ISW SMC based on direction from the Subbasin Committee.

- Receiving public comment on the GSP Update SMC Chapter and discussing public comment with the Subbasin Committee.

8.5 Sustainable Management Criteria Summary

Table 8-1 provides a summary of the SMC for each of the 6 sustainability indicators. Measurable objectives are the goals that reflect the Subbasin's desired groundwater conditions for each sustainability indicator. These provide operational flexibility above the minimum thresholds. The minimum thresholds are quantitative indicators of the Subbasin's locally defined significant and unreasonable conditions. The undesirable result is a combination of minimum threshold exceedances that show a significant and unreasonable condition across the Subbasin as a whole. This GSP is designed to not only avoid undesirable results, but to achieve the sustainability goals within 20 years, along with interim milestones every 5 years that show progress. The management actions and projects provide sufficient options for reaching the measurable objectives within 20 years and maintaining those conditions for 30 years for all 6 sustainability indicators. The rationale and background for developing these criteria are described in detail in the following sections.

The SMC are individual criteria that will each be met simultaneously, rather than in an integrated manner. For example, the groundwater elevation and seawater intrusion SMC are 2 independent SMC that will be achieved simultaneously. The groundwater elevation SMC do not hinder the seawater intrusion SMC, but also, they do not ensure the halting of seawater intrusion by themselves. The SMC presented in Table 8-1 are part of the GSA's 50-year management plan: SGMA allows for 20 years to reach sustainability, and requires the Subbasin have no undesirable results for the subsequent 30 years.

Table 8-1. Sustainable Management Criteria Summary

Sustainability Indicator	Measurement	Minimum Threshold	Measurable Objective	Undesirable Result
Chronic lowering of groundwater levels	Measured through groundwater level representative monitoring well network.	Minimum thresholds are set to 1 foot above 2015 groundwater elevations. See Table 8-2.	Measurable objectives are set to 2003 groundwater elevations. See Table 8-2	More than 15% of groundwater elevation minimum thresholds are exceeded. Allows for 5 exceedances per year in the 180-Foot Aquifer; 7 in the 400-Foot Aquifer; and 2 in the Deep Aquifers.
Reduction in groundwater storage	Measured by proxy through groundwater level representative monitoring well network.	Minimum threshold is set to 626,000 AF below the measurable objective. This reduction is based on the groundwater level minimum thresholds. This number does not include the Deep Aquifers and will be refined as additional data are collected and other projects are implemented.	Measurable objective is set to zero when the groundwater elevations are held at the groundwater level measurable objectives. Since the goal is to manage to the measurable objective, additional water in storage is needed until groundwater elevations are at their measurable objectives.	There is an exceedance of the minimum threshold.
Seawater intrusion	Seawater intrusion maps developed by MCWRA.	Minimum threshold is the 2017 extent of the 500 mg/L chloride isocontour as developed by MCWRA for the 180-Foot and 400-Foot Aquifers. The minimum threshold is the line defined by Highway 1 for the Deep Aquifers.	Measurable objective is the line defined by Highway 1 for the 180-Foot, 400-Foot, and Deep Aquifers.	Any exceedance of the minimum threshold, resulting in mapped seawater intrusion beyond the 2017 extent of the 500 mg/L chloride isocontour.

Sustainability Indicator	Measurement	Minimum Threshold	Measurable Objective	Undesirable Result
Degraded groundwater quality	Groundwater quality data downloaded annually from GAMA groundwater information system.	Minimum threshold is zero additional exceedances of either the regulatory drinking water standards (potable supply wells) or the Basin Plan objectives (irrigation supply wells) for groundwater quality COC. Exceedances are only measured in public water system supply wells and ILRP on-farm domestic and irrigation supply wells. See Table 8-5. See Table 8-5	Measurable objective is identical to the minimum threshold.	Future or new minimum thresholds exceedances are caused by a direct result of GSA groundwater management action(s), including projects or management actions and regulation of groundwater extraction.
Land subsidence	Measured using DWR provided InSAR data.	Minimum threshold is zero net long-term subsidence, with no more than 0.1 foot per year of estimated land movement to account for InSAR errors.	Measurable objective is identical to the minimum threshold, resulting in zero net long-term subsidence.	There is an exceedance of the minimum threshold for subsidence due to lowered groundwater elevations.
Depletion of interconnected surface water	Groundwater elevations in shallow wells adjacent to locations of ISW identified using the SVIHM.	Minimum thresholds are established by proxy using shallow groundwater elevations 1 foot about those observed in 2015 near locations of ISW.	Measurable objectives are established by proxy using shallow groundwater elevations observed in 2003 near locations of ISW.	There is an exceedance of the minimum threshold in a shallow groundwater monitoring well used to monitor ISW.

8.6 Chronic Lowering of Groundwater Elevations SMC

8.6.1 Locally Defined Significant and Unreasonable Conditions

Locally defined significant and unreasonable groundwater elevations in the Subbasin are those that:

- Are at or below the observed groundwater elevations in 2015. Public and stakeholder input identified these historical groundwater elevations as significant and unreasonable.
- Cause significant financial burden to local agricultural interests.
- Interfere with other sustainability indicators

These significant and unreasonable conditions were determined based on input collected during Subbasin Committee meetings and discussions with GSA staff.

8.6.2 Minimum Thresholds

> *The minimum thresholds for chronic lowering groundwater levels are set to 1 foot above 2015 groundwater elevations in this Subbasin.*

The minimum threshold values for each well within the groundwater elevation representative monitoring network are provided in Table 8-2. The minimum threshold contour maps, along with the RMS well locations for the 180/400-Foot Aquifer Subbasin are shown on Figure 8-1 and Figure 8-2 for the 180-Foot and 400-Foot Aquifers, respectively. There were not enough 2015 groundwater elevation measurements of the Deep Aquifers to produce contours.

As of 2020, in the 180-Foot Aquifer, groundwater elevations in 4 of the 35 RMS wells (11%) were below the minimum threshold in the most recent Fall 2020 groundwater elevation measurements. In the 400-Foot Aquifer, groundwater elevations for 4 out of 45 RMS wells (9%) were below the minimum threshold, and in the Deep Aquifers 6 out of 11 RMS (55%) wells were below the minimum threshold in fall 2020.

Table 8-2. Chronic Lowering of Groundwater Levels Minimum Thresholds and Measurable Objectives

Monitoring Site	Current Groundwater Elevation (ft)	Minimum Threshold (ft)	Measurable Objective (ft)
180-Foot Aquifer			
13S/02E-13N01	6.6*	6.2	11.2*
13S/02E-21Q01	8.6	6.4*	8.5*
13S/02E-26L01	-4.2*	-6.2*	-3.0*
13S/02E-29D04	-3.3	-4.5*	-2.5*
14S/02E-03F04	-5.2	-7.9	-4.5
14S/02E-10P01	-19.4	-17.8	-6.4
14S/02E-11A02	-8.2	-10.6	-6.0*
14S/02E-12B02	-7.6	-10.8	-2.0*
14S/02E-13F03	-8.0	-11.2	-5.7
14S/02E-17C02	9.3	5.5	11.5*
14S/02E-21L01	-5.0	-6.0	-1.8
14S/02E-26H01	-9.5	-12.3	-6.2
14S/02E-27A01	-7.3	-9.9	-3.1*
14S/02E-34B03	-12.8	-21.8	-4.8
14S/02E-36E01	-12.5	-15.7	-3.3
14S/03E-18C01	11.8	7.6	12.4*
14S/03E-30G08	-13.1	-17.4	-8.5
14S/03E-31F01	-7.2	-11.4	-2.2
15S/02E-12C01	-13.7	-13.0*	-3.0*
15S/03E-09E03	-4.4	-15.1	2.9
15S/03E-13N01	-11.4	-10.0	12.8
15S/03E-16M01	3.6*	-6.0	11.5
15S/03E-17M01	4.7*	-4.6	11.9
15S/03E-25L01	13.6*	-2.7	24.6
15S/03E-26F01	0.3	-8.1	12.5
15S/04E-31A02	30.7	16.6	41.5
16S/04E-05M02	35.8	18.7	47.9
16S/04E-13R02	74.2	63.9	85.3
16S/04E-15D01	48.3	30.6	58.6
16S/04E-15R02	55.1	35.0	64.3
16S/04E-27B02	69.5*	69.5*	84.5*
16S/05E-30E01	77.1*	60.7	85.0
16S/05E-31M01	87.6	70.0	94.8
17S/04E-01D01	74.5	75.9	100.9
17S/05E-06C02	71.9	65.1	91.5
400-Foot Aquifer			
12S/02E-33H02	2.3	-3.0*	3.0*
13S/02E-10K01	-20.4	-19.3	-16.0*
13S/02E-21N01	-6.1	-6.3	-3.0*

Monitoring Site	Current Groundwater Elevation (ft)	Minimum Threshold (ft)	Measurable Objective (ft)
13S/02E-24N01	-2.0	-7.0	0.0*
13S/02E-27P01	-28.5	-44.5	-20.8
13S/02E-29D03	-4.3	-6.4	-2.4
13S/02E-31N02	-1.8	-5.0*	-0.4
13S/02E-32A02	-2.5	-4.6*	-1.0*
14S/02E-02C03	-29.0	-29.9	-20.0*
14S/02E-03F03	-11.8	-13.5	-5.2
14S/02E-05F04	-8.5	-15.2	-6.9
14S/02E-08M02	-3.2	-5.0*	-1.0*
14S/02E-11A04	-26.7	-25.1	-17.5
14S/02E-11M03	-24.0	-30.0*	-20.0*
14S/02E-12B03	-28.2	-27.8	-18.5
14S/02E-12Q01	-10.9	-13.6	-9.3
14S/02E-16A02	-14.5	-19.6	-7.9
14S/02E-22L01	-12.7	-22.9	-3.1
14S/02E-26J03	-18.7	-20.6*	-5.0
14S/02E-27G03	-13.9	-17.1	-8.3
14S/02E-34A03	-13.4	-12.4	-7.5
14S/02E-36G01	-9.8	-13.7	-0.1
14S/03E-18C02	-18.3	-19.7	-12.5
14S/03E-20C01	-41.0	-41.0	-35.0*
14S/03E-29F03	-23.0	-26.0	-15.0*
14S/03E-31L01	-9.0	-9.0	-3.0*
15S/02E-01A03	-12.7	-15.3	-0.7
15S/02E-02G01	-23.0	-28.0	-11.2
15S/02E-12A01	-13.8	-17.1	-4.7
15S/03E-03R02	-8.0	-17.0	-1.0*
15S/03E-04Q01	-6.0	-11.0	0.0*
15S/03E-05C02	-16.0	-16.0	-5.0*
15S/03E-08F01	-15.4	-17.8	-5.2
15S/03E-14P02	-7.6	-11.7	8.4
15S/03E-15B01	-5.5	-14.1	5.8
15S/03E-16F02	0.4	-6.5	5.0*
15S/03E-17P02	-8.0	-17.0	-2.0*
15S/03E-26A01	5.1	-4.5	15.0
15S/03E-28B02	4.0	-0.5	15.0*
15S/04E-29Q02	17.4	5.8	33.9
16S/04E-04C01	34.4	11.7	47.2
16S/04E-08H03	42.8	24.6	54.7
16S/04E-10R02	55.0	40.7	67.2
16S/04E-25G01	70.3	51.3	76.4

Monitoring Site	Current Groundwater Elevation (ft)	Minimum Threshold (ft)	Measurable Objective (ft)
16S/05E-30J02	83.0	67.2	90.7
Deep Aquifers			
13S/01E-36J02	-9.6	-4.2	2.0*
13S/02E-19Q03	-8.9	-2.4	6.3
13S/02E-28L03	-27.4	-40.0*	-29.0*
13S/02E-32E05	-14.7	-9.2	1.6
14S/02E-06L01	-14.7	-7.2	3.0
14S/02E-18B01	-27.6*	-35.0*	-25.0*
14S/02E-22A03	-103.2	-80.0*	-60.0*
14S/02E-28C02	-40.0	-41.2	-15.0*
15S/03E-10D04	-21.7	-20.0*	-10.0*
15S/03E-17E02	-14.0	-15.0*	-10.0*
16S/04E-11D51	48.5	43.0*	50.0*

*Groundwater elevation was estimated.

**Well is a proxy for the Deep Aquifers.

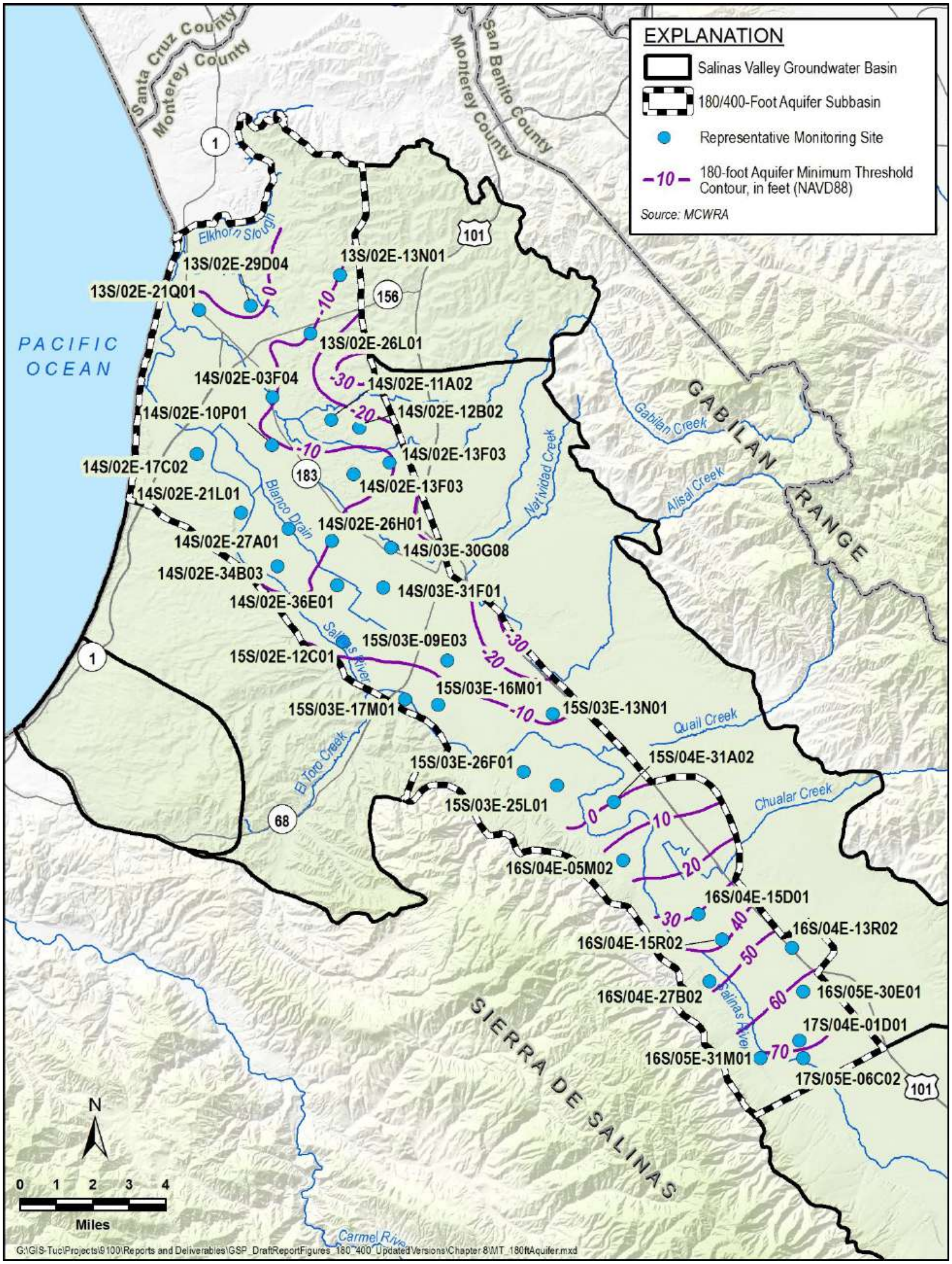

Figure 8-1. Groundwater Elevation Minimum Threshold Contour Map for the 180-Foot Aquifer

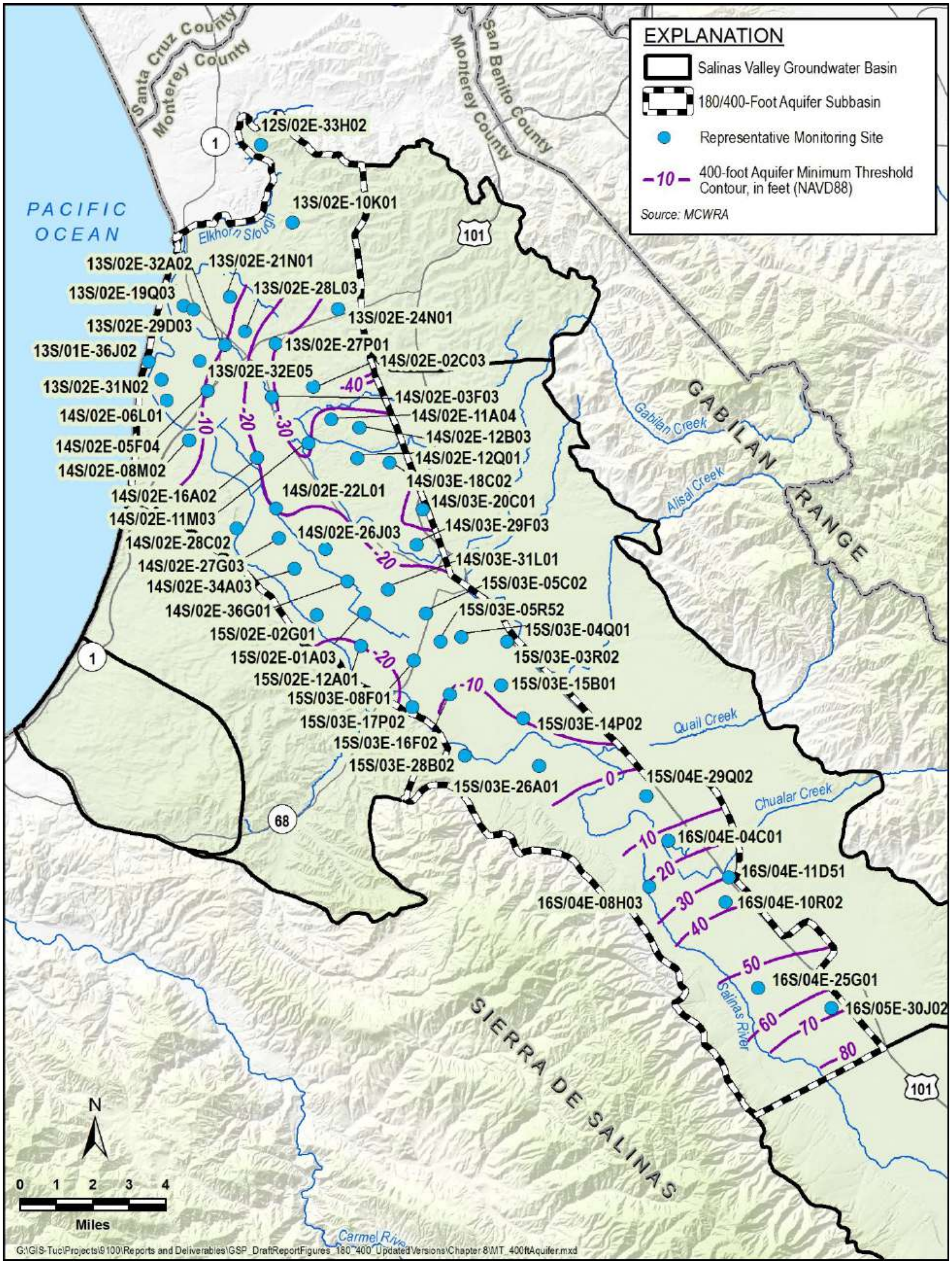

Figure 8-2. Groundwater Elevation Minimum Threshold Contour Map for the 400-Foot Aquifer

8.6.2.1 Information and Methodology Used to Establish Minimum Thresholds and Measurable Objectives

The development of both minimum thresholds and measurable objectives followed similar processes and are described in this section. The information used includes:

- Feedback from discussions with the Subbasin Committee on challenges and goals
- Historical groundwater elevation data and hydrographs from wells monitored by the MCWRA
- Maps of current and historical groundwater elevation data
- Analysis of the impact of groundwater elevations on domestic wells

The general steps for developing minimum thresholds and measurable objectives were:

1. The Subbasin Committee selected an approach and criteria for to setting the groundwater level minimum thresholds and measurable objectives.
2. SVBGSA used MCWRA's average groundwater elevation change hydrographs to select representative years that could define minimum thresholds and measurable objectives for the Subbasin. Groundwater elevations like those experienced during the representative climatic cycle between 1967 and 1998 were used to identify minimum thresholds and measurable objectives to ensure that they were achievable under reasonably expected climatic conditions. This representative period corresponds to important water management milestones for the Salinas Valley Groundwater Basin; water year 1967 marks the beginning of operations at San Antonio Reservoir, with first water releases in November 1966. The Castroville Seawater Intrusion Project (CSIP) began operating in 1998.

   The average groundwater elevation change hydrograph with preliminary minimum threshold and measurable objectives lines for the 180/400-Foot Aquifer Subbasin are shown on Figure 8-3. The average 2015 groundwater elevations in the 180/400-Foot Aquifer Subbasin are considered significant and unreasonable. When looking at the groundwater elevation changes within the representative climatic cycle, the historical lowest elevations occurred in 1991, at approximately 1 foot higher than 2015 elevations. The minimum thresholds were therefore set one foot above the 2015 groundwater elevations. The measurable objective is set to 2003 groundwater elevations, which is an achievable goal for the Subbasin under reasonably expected climatic conditions.

3. SVBGSA identified the appropriate minimum thresholds and measurable objectives on the respective monitoring well hydrographs. Each hydrograph was visually inspected to

check if the minimum threshold and measurable objective was reasonable. If an RMS did not have measurements from the minimum threshold or measurable objective years, the SMC were estimated using the hydrographs. Moreover, if the SMC seemed unreasonable for an RMS, they were adjusted based on historic water levels. The interpolated or adjusted minimum thresholds and measurable objectives are indicated by an asterisk in Table 8-2.

Hydrographs with well completion information showing minimum thresholds for each RMS are included in Appendix 8A.

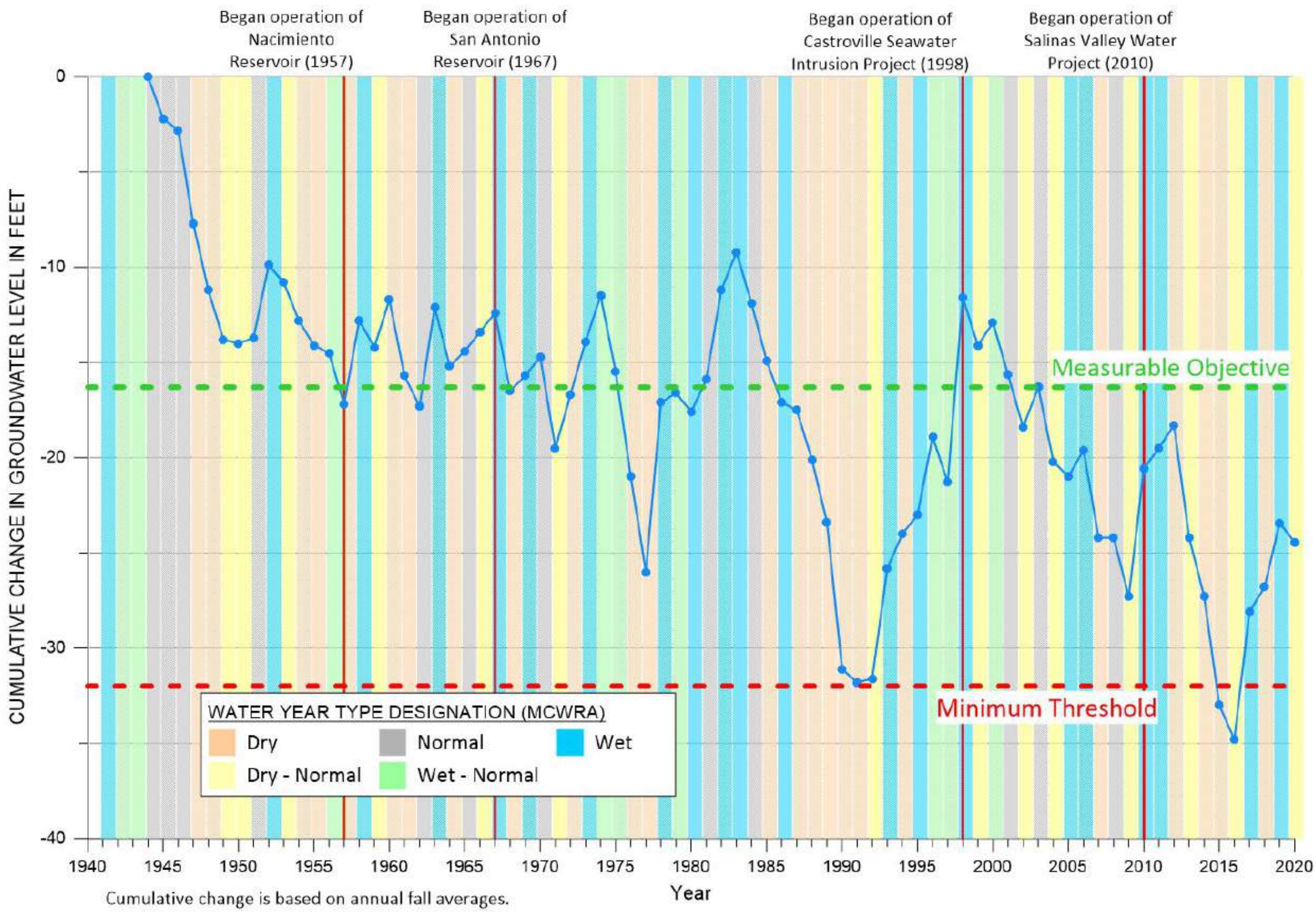

Figure 8-3. Cumulative Groundwater Elevation Change Hydrograph with Selected Measurable Objective and Minimum Threshold for the 180/400-Foot Aquifer Subbasin

8.6.2.2 Minimum Thresholds Impact on Domestic Wells

To address the human right to water, minimum thresholds for groundwater elevations are compared to the range of domestic well depths in the Subbasin using DWR's Online System for Well Completion Reports (OSWCR) database. This check was done to assure that the minimum thresholds maintain operability in a reasonable percentage of domestic wells. The proposed minimum thresholds for groundwater elevation do not necessarily protect all domestic wells because it is impractical to manage a groundwater basin in a manner that fully protects the shallowest wells. However, domestic wells are an important beneficial user.

The OSWCR database is used to check that most domestic wells are covered by the groundwater level monitoring network, since wells drilled in the shallow sediments above the Salinas Valley Aquitard may not be covered. The average computed depth of domestic wells in the Subbasin is 362 feet using the Public Land Survey System sections data in the OSWCR database. The sections were screened for those with domestic wells below 100 feet, since wells deeper than 100 feet are likely drilled in the 180-Foot Aquifer. Only 1.4% of the domestic wells in the Subbasin (10 out of the 691 wells) are likely drilled into the shallow sediments above the Aquitard. The remaining 98.6% of domestic wells are likely covered by the monitoring network because they are either drilled into a principal aquifer or drilled in an area where the Salinas Valley Aquitard likely is not present, such as the northern area of the Subbasin where most domestic wells are located.

Some adjustments to the analysis in the original GSP have been made to improve the accuracy of the analysis. These include:

- The OSWCR database may include wells that have been abandoned, destroyed, or replaced, such as if the user switched to a water system, and abandoned or destroyed wells would have no detrimental impacts from lowered groundwater levels.
- Only wells likely to be in the principal aquifers were considered, since some domestic wells may draw water from shallow, perched groundwater that is not managed under this GSP.
- Wells in the Deep Aquifers were not included because there was not enough 2015 or 2003 groundwater elevation data to contour the minimum thresholds or measurable objectives.
- Only wells that had accurate locations were included, since some wells in the OSWCR database are not accurately located, it could lead to inaccurate estimations of depth to water in the wells.
- The depth to water is derived from a smoothly interpolated groundwater elevation contour map. So only wells that fall within the contoured portion of the Subbasin were

used in the analysis. Additionally, errors in the map may result in errors in groundwater elevation at the selected domestic wells.

Given the limitations listed above, the analysis only included 14 wells with accurate locations out of the total 294 OSWCR domestic wells in the 180-Foot and 400-Foot Aquifers. The analysis showed that 83% of domestic wells in the 180-Foot Aquifer will have at least 25 feet of water in them as long as groundwater elevations remain above minimum thresholds; and all domestic wells in the 180-Foot Aquifer will have at least 25 feet of water in them when measurable objectives are achieved. In the 400-Foot Aquifer, 88% of domestic wells will have at least 25 feet of water in them if groundwater elevations remain above minimum thresholds and when measurable objectives are achieved. These percentages were considered reasonable given the limitations listed above.

8.6.2.3 Relationship between Individual Minimum Thresholds and Relationship to Other Sustainability Indicators

The SVBGSA compared minimum thresholds between RMSs to understand the relationship between RMSs (i.e., describe why or how a water level minimum threshold set at a particular RMS is similar to or different from water level thresholds in nearby RMS). The groundwater elevation minimum thresholds are derived from historical and/or smoothly interpolated groundwater elevations in the Subbasin. Therefore, the minimum thresholds are unique at every well, but when combined represent a reasonable and potentially realistic groundwater elevation map. Because the underlying groundwater elevation map is a reasonably achievable condition, the individual minimum thresholds at RMSs do not conflict with each other.

Groundwater elevation minimum thresholds can influence other sustainability indicators. SVBGSA reviewed the groundwater level minimum thresholds’ relationship with each of the other sustainability indicators’ minimum thresholds to ensure a groundwater level minimum threshold would not trigger an undesirable result for any of the other sustainability indicators. The groundwater elevation minimum thresholds are selected to avoid undesirable results for other sustainability indicators.

- **Reduction in groundwater storage.** The chronic lowering of groundwater levels minimum thresholds are identical to the groundwater storage minimum thresholds. Thus, the groundwater level minimum thresholds will not result in an undesirable loss of groundwater storage.

- **Seawater intrusion.** The chronic lowering of groundwater level minimum thresholds are set above historical lows. Therefore, the groundwater elevation minimum thresholds are intended to not exacerbate, and may help control, the rate of seawater intrusion. Seawater intrusion may be managed by either lowering groundwater elevations to capture seawater intrusion or raising groundwater elevations to drive seawater intrusion towards the coast.

Because it has not been determined if lower or higher groundwater elevations will be used to manage seawater intrusion; the groundwater elevation minimum threshold was not set solve seawater intrusion, but rather to not exacerbate seawater intrusion.

- **Degraded water quality.** The chronic lowering of groundwater levels minimum could affect groundwater quality through 2 processes:

  1. Changes in groundwater elevation could change groundwater gradients, which could cause poor quality groundwater to flow toward production and domestic wells that would not have otherwise been impacted. These groundwater gradients, however, are only dependent on differences between groundwater elevations, not on the groundwater elevations themselves. Therefore, the minimum threshold groundwater elevations do not directly lead to a significant and unreasonable degradation of groundwater quality in production and domestic wells.
  2. Decreasing groundwater elevations can mobilize COC that are concentrated at depth, such as arsenic. The groundwater level minimum thresholds are near or above historical lows. Therefore, any depth dependent constituents have previously been mobilized by historical groundwater levels. Maintaining groundwater elevations above the minimum thresholds assures that no new depth dependent COC are mobilized and are therefore protective of beneficial uses and users.

- **Land subsidence.** The chronic lowering of groundwater levels minimum thresholds are set at or above recent low groundwater elevations. Thus, they are set at levels that will not induce the dewatering and compaction of clay-rich sediments that causes subsidence in response to lowering groundwater elevations.

- **Depletion of ISW.** The chronic lowering of groundwater levels minimum thresholds are identical to the ISW minimum thresholds. Therefore, the groundwater level minimum thresholds will not result in a significant or unreasonable depletion of ISW, including groundwater-dependent ecosystems.

8.6.2.4 Effect of Minimum Thresholds on Neighboring Basins and Subbasins

The 180/400-Foot Aquifer Subbasin has 4 neighboring subbasins within the Salinas Valley Groundwater Basin:

- The Langley Subbasin to the north
- The Eastside Subbasin to the east
- The Forebay Subbasin to the south
- The Monterey Subbasin to the southwest

The SVBGSA is either the exclusive GSA or is one of the coordinating GSAs for the adjacent Subbasins. Because the SVBGSA covers all these subbasins, the SVBGSA is coordinating the development of the minimum thresholds and measurable objectives for all these subbasins. The Langley, Eastside, Forebay, and Monterey Subbasins have submitted GSPs in January 2022. Minimum thresholds for the 180/400-Foot Aquifer Subbasin have been reviewed relative to information developed for the neighboring subbasins' GSPs to ensure that these minimum thresholds will not prevent the neighboring subbasins from achieving sustainability. SVBGSA and MCWDGSA are close collaborators in developing and implementing their GSPs for the 180/400 and Monterey Subbasins. While SVBGSA and MCWDGSA have chosen slightly different groundwater level minimum thresholds for the same aquifers, the groundwater levels across the Subbasin boundary will continue to be closely monitored to ensure both subbasin minimum thresholds are met. Data development and management will be a part of a collaborative relationship during implementation to ensure both subbasins reach sustainability.

The Pajaro Valley Basin lies directly to the north of the Subbasin. Because the minimum thresholds in the 180/400-Foot Aquifer Subbasin are above historical low groundwater elevations, it is likely that the minimum thresholds will not prevent the Pajaro Basin from achieving and maintaining sustainability. The SVBGSA will coordinate closely with the Pajaro Valley Water Agency to ensure that the basins do not prevent each other from achieving sustainability.

8.6.2.5 Effects on Beneficial Users and Land Uses

The groundwater level minimum thresholds may have several effects on beneficial users and land uses in the Subbasin.

Agricultural land uses and users. The groundwater elevation minimum thresholds prevent continued lowering of groundwater elevations in the Subbasin. Unless sufficient projects and management actions are undertaken, this may have the effect of limiting the amount of groundwater pumping in the Subbasin. Limiting the amount of groundwater pumping may limit the amount and type of crops that can be grown in the Subbasin. The groundwater elevation minimum thresholds could therefore limit expansion of the Subbasin's agricultural economy. This could have various effects on beneficial users and land uses:

- Agricultural land currently under irrigation may become more valuable as bringing new lands into irrigation becomes more difficult and expensive.
- Agricultural land not currently under irrigation may become less valuable because it may be too difficult and expensive to irrigate.

Urban land uses and users. The groundwater level minimum thresholds may reduce the amount of groundwater pumping in the Subbasin. This may limit urban growth, or result in urban areas obtaining alternative sources of water. This may result in higher water costs for public drinking water systems.

Domestic land uses and users. The groundwater level minimum thresholds are intended to protect most domestic wells, including small state and small local system wells. Therefore, the minimum thresholds will likely have an overall beneficial effect on existing domestic land uses by protecting the ability to pump from domestic wells. However, extremely shallow domestic wells may become dry, requiring owners to drill deeper wells. Additionally, the groundwater elevation minimum thresholds may limit the number of new domestic wells or small state and small local system wells that can be drilled to limit future declines in groundwater elevations.

Ecological land uses and users. The groundwater level minimum thresholds may limit the amount of groundwater pumping in the Subbasin and may limit both urban and agricultural growth. This outcome may benefit ecological land uses and users by curtailing the conversion of native vegetation to agricultural or domestic uses, and by reducing pressure on existing ecological land caused by declining groundwater elevations.

8.6.2.6 Relevant Federal, State, or Local Standards

No federal, state, or local standards exist for chronic lowering of groundwater levels.

8.6.2.7 Method for Quantitative Measurement of Minimum Thresholds

Groundwater level minimum thresholds will be directly measured from the representative monitoring well network. The groundwater elevation monitoring will be conducted in accordance with the monitoring plan outlined in Chapter 7. Furthermore, the groundwater elevation monitoring will meet the requirements of the technical and reporting standards included in the GSP Regulations.

As noted in Chapter 7, the current groundwater elevation representative monitoring network in the Subbasin includes 91 wells. Data gaps were identified in Chapter 7 and will be resolved during implementation of this GSP.

8.6.3 Measurable Objectives

The measurable objectives for chronic lowering of groundwater levels represent target groundwater elevations that are higher than the minimum thresholds. These measurable objectives provide operational flexibility to ensure that the Subbasin can be managed sustainably over a reasonable range of hydrologic variability.

> *The measurable objectives for the chronic lowering of groundwater levels are set to 2003 groundwater elevations.*

The measurable objectives are summarized in Table 8-2 and are also shown on the hydrographs for each RMS in Appendix 8A.

8.6.3.1 Methodology for Setting Measurable Objectives

The methodology for establishing measurable objectives is described in detail in Section 8.6.2.1. A year from the relatively recent past was selected for setting measurable objectives to ensure that objectives are achievable. Figure 8-3 shows that there was a slow downward trend in average groundwater elevations through 2003. Since 2003, water elevations have consistently decreased at a more rapid rate. Groundwater elevations from 2003 were selected as representative of the measurable objectives for the 180/400-Foot Aquifer Subbasin. The measurable objective contour maps for the 180/400-Foot Aquifer Subbasin along with the representative monitoring network wells are shown on Figure 8-4 and Figure 8-5 for the 180-Foot and 400-Foot Aquifers, respectively.

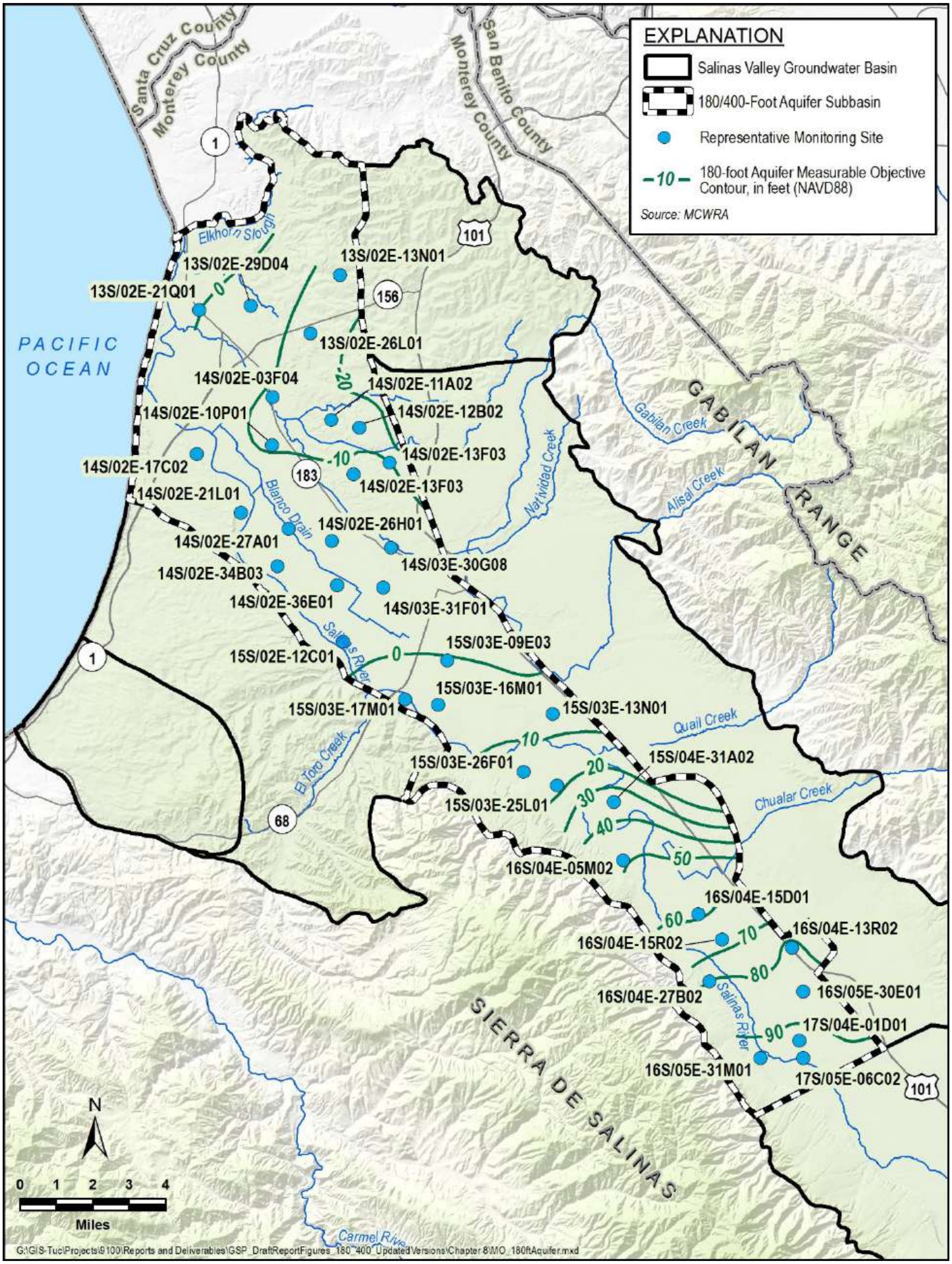

Figure 8-4. Groundwater Elevation Measurable Objective Contour Map for the 180-Foot Aquifer

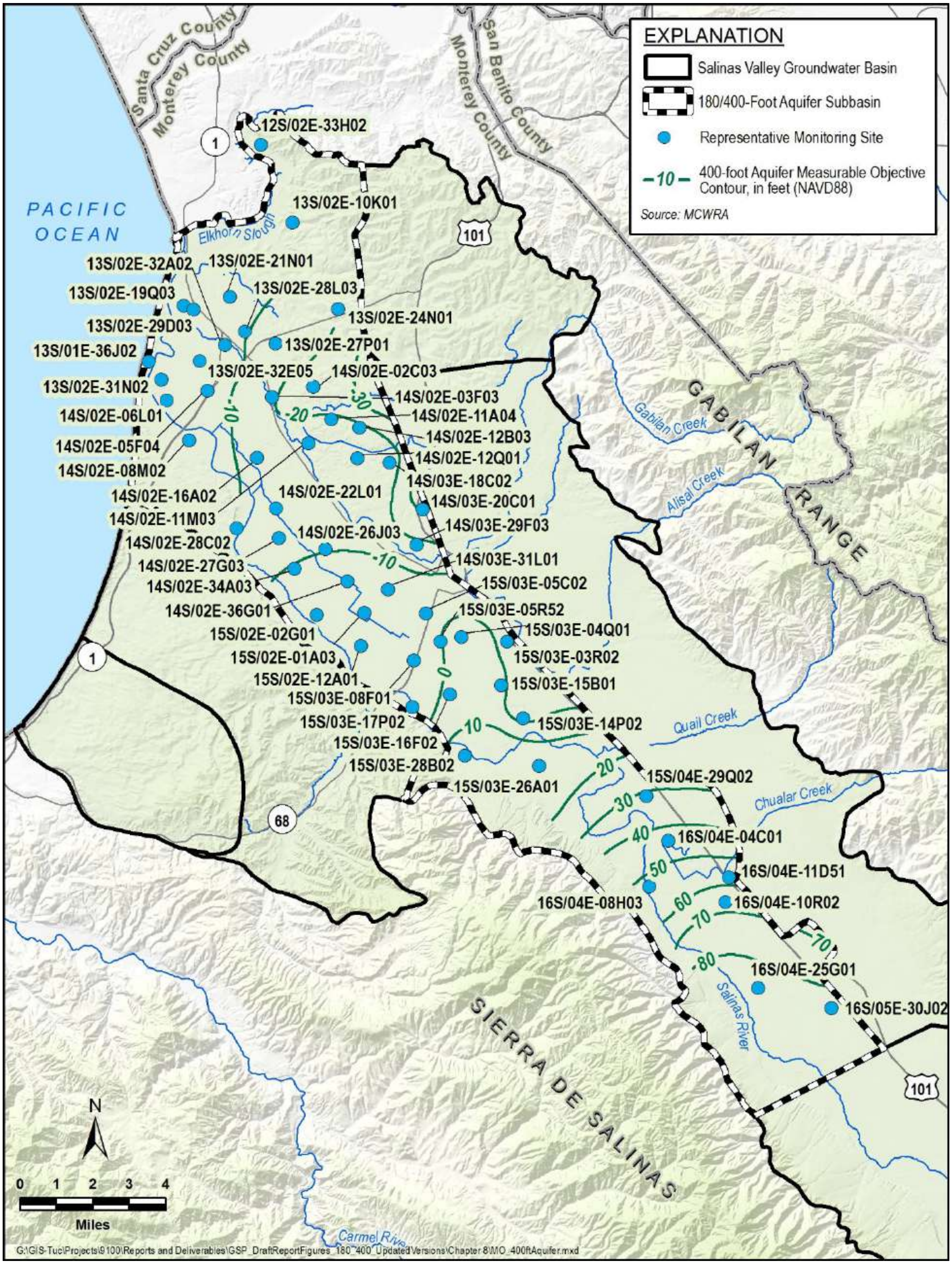

Figure 8-5. Groundwater Elevation Measurable Objective Contour Map for the 400-Foot Aquifer

8.6.3.2 Interim Milestones

Interim milestones for groundwater elevations are shown in Table 8-3. These are only initial estimates of interim milestones. Interim milestones for groundwater levels will be modified as better data, analyses, and project designs become available.

Table 8-3. Chronic Lowering of Groundwater Levels Interim Milestones

Monitoring Site	Current Groundwater Elevation (ft)	Interim Milestone at Year 2025 (ft)	Interim Milestone at Year 2030 (ft)	Interim Milestone at Year 2035 (ft)	Measurable Objective (ft) (goal to reach at 2040)
	180-Foot Aquifer				
13S/02E-13N01	6.6*	7.8	8.9	10.1	11.2*
13S/02E-21Q01	8.6	8.6	8.6	8.5	8.5*
13S/02E-26L01	-4.2*	-3.9	-3.6	-3.3	-3.0*
13S/02E-29D04	-3.3	-3.1	-2.9	-2.7	-2.5*
14S/02E-03F04	-5.2	-5.0	-4.9	-4.7	-4.5
14S/02E-10P01	-19.4	-16.2	-12.9	-9.7	-6.4
14S/02E-11A02	-8.2	-7.7	-7.1	-6.6	-6.0*
14S/02E-12B02	-7.6	-6.2	-4.8	-3.4	-2.0*
14S/02E-13F03	-8.0	-7.4	-6.9	-6.3	-5.7
14S/02E-17C02	9.3	9.9	10.4	11.0	11.5*
14S/02E-21L01	-5.0	-4.2	-3.4	-2.6	-1.8
14S/02E-26H01	-9.5	-8.7	-7.9	-7.0	-6.2
14S/02E-27A01	-7.3	-6.3	-5.2	-4.2	-3.1*
14S/02E-34B03	-12.8	-10.8	-8.8	-6.8	-4.8
14S/02E-36E01	-12.5	-10.2	-7.9	-5.6	-3.3
14S/03E-18C01	11.8	12.0	12.1	12.3	12.4*
14S/03E-30G08	-13.1	-12.0	-10.8	-9.7	-8.5
14S/03E-31F01	-7.2	-6.0	-4.7	-3.5	-2.2
15S/02E-12C01	-13.7	-11.0	-8.4	-5.7	-3.0*
15S/03E-09E03	-4.4	-2.6	-0.8	1.1	2.9
15S/03E-13N01	-11.4	-5.4	0.7	6.8	12.8
15S/03E-16M01	3.6*	5.6	7.6	9.5	11.5
15S/03E-17M01	4.7*	6.5	8.3	10.1	11.9
15S/03E-25L01	13.6*	16.4	19.1	21.9	24.6
15S/03E-26F01	0.3	3.4	6.4	9.5	12.5
15S/04E-31A02	30.7	33.4	36.1	38.8	41.5
16S/04E-05M02	35.8	38.8	41.9	44.9	47.9
16S/04E-13R02	74.2	77.0	79.8	82.5	85.3
16S/04E-15D01	48.3	50.9	53.4	56.0	58.6
16S/04E-15R02	55.1	57.4	59.7	62.0	64.3
16S/04E-27B02	69.5*	73.3	77.0	80.8	84.5*
16S/05E-30E01	77.1*	79.1	81.1	83.0	85.0

Monitoring Site	Current Groundwater Elevation (ft)	Interim Milestone at Year 2025 (ft)	Interim Milestone at Year 2030 (ft)	Interim Milestone at Year 2035 (ft)	Measurable Objective (ft) (goal to reach at 2040)
16S/05E-31M01	87.6	89.4	91.2	93.0	94.8
17S/04E-01D01	74.5	81.1	87.7	94.3	100.9
17S/05E-06C02	71.9	76.8	81.7	86.6	91.5
	400-Foot Aquifer				
12S/02E-33H02	2.3	2.5	2.7	2.8	3.0*
13S/02E-10K01	-20.4	-19.3	-18.2	-17.1	-16.0*
13S/02E-21N01	-6.1	-5.3	-4.6	-3.8	-3.0*
13S/02E-24N01	-2.0	-1.5	-1.0	-0.5	0.0*
13S/02E-27P01	-28.5	-26.6	-24.7	-22.7	-20.8
13S/02E-29D03	-4.3	-3.8	-3.4	-2.9	-2.4
13S/02E-31N02	-1.8	-1.5	-1.1	-0.8	-0.4
13S/02E-32A02	-2.5	-2.1	-1.8	-1.4	-1.0*
14S/02E-02C03	-29.0	-26.8	-24.5	-22.3	-20.0*
14S/02E-03F03	-11.8	-10.2	-8.5	-6.9	-5.2
14S/02E-05F04	-8.5	-8.1	-7.7	-7.3	-6.9
14S/02E-08M02	-3.2	-2.7	-2.1	-1.6	-1.0*
14S/02E-11A04	-26.7	-24.4	-22.1	-19.8	-17.5
14S/02E-11M03	-24.0	-23.0	-22.0	-21.0	-20.0*
14S/02E-12B03	-28.2	-25.8	-23.4	-20.9	-18.5
14S/02E-12Q01	-10.9	-10.5	-10.1	-9.7	-9.3
14S/02E-16A02	-14.5	-12.9	-11.2	-9.6	-7.9
14S/02E-22L01	-12.7	-10.3	-7.9	-5.5	-3.1
14S/02E-26J03	-18.7	-15.3	-11.9	-8.4	-5.0
14S/02E-27G03	-13.9	-12.5	-11.1	-9.7	-8.3
14S/02E-34A03	-13.4	-11.9	-10.5	-9.0	-7.5
14S/02E-36G01	-9.8	-7.4	-5.0	-2.5	-0.1
14S/03E-18C02	-18.3	-16.9	-15.4	-14.0	-12.5
14S/03E-20C01	-41.0	-39.5	-38.0	-36.5	-35.0*
14S/03E-29F03	-23.0	-21.0	-19.0	-17.0	-15.0*
14S/03E-31L01	-9.0	-7.5	-6.0	-4.5	-3.0*
15S/02E-01A03	-12.7	-9.7	-6.7	-3.7	-0.7
15S/02E-02G01	-23.0	-20.1	-17.1	-14.2	-11.2
15S/02E-12A01	-13.8	-11.5	-9.3	-7.0	-4.7
15S/03E-03R02	-8.0	-6.3	-4.5	-2.8	-1.0*
15S/03E-04Q01	-6.0	-4.5	-3.0	-1.5	0.0*
15S/03E-05C02	-16.0	-13.3	-10.5	-7.8	-5.0*
15S/03E-08F01	-15.4	-12.9	-10.3	-7.8	-5.2
15S/03E-14P02	-7.6	-3.6	0.4	4.4	8.4
15S/03E-15B01	-5.5	-2.7	0.2	3.0	5.8
15S/03E-16F02	0.4	1.6	2.7	3.9	5.0*

Monitoring Site	Current Groundwater Elevation (ft)	Interim Milestone at Year 2025 (ft)	Interim Milestone at Year 2030 (ft)	Interim Milestone at Year 2035 (ft)	Measurable Objective (ft) (goal to reach at 2040)
15S/03E-17P02	-8.0	-6.5	-5.0	-3.5	-2.0*
15S/03E-26A01	5.1	7.6	10.1	12.5	15.0
15S/03E-28B02	4.0	6.8	9.5	12.3	15.0*
15S/04E-29Q02	17.4	21.5	25.7	29.8	33.9
16S/04E-04C01	34.4	37.6	40.8	44.0	47.2
16S/04E-08H03	42.8	45.8	48.7	51.7	54.7
16S/04E-10R02	55.0	58.1	61.1	64.2	67.2
16S/04E-25G01	70.3	71.8	73.4	74.9	76.4
16S/05E-30J02	83.0	84.9	86.9	88.8	90.7
	Deep Aquifers				
13S/01E-36J02	-9.6	-6.7	-3.8	-0.9	2.0*
13S/02E-19Q03	-8.9	-5.1	-1.3	2.5	6.3
13S/02E-28L03	-27.4	-27.8	-28.2	-28.6	-29.0*
13S/02E-32E05	-14.7	-10.6	-6.6	-2.5	1.6
14S/02E-06L01	-14.7	-10.3	-5.9	-1.4	3.0
14S/02E-18B01	-27.6*	-27.0	-26.3	-25.7	-25.0*
14S/02E-22A03	-103.2	-92.4	-81.6	-70.8	-60.0*
14S/02E-28C02	-40.0	-33.8	-27.5	-21.3	-15.0*
15S/03E-10D04	-21.7	-18.8	-15.9	-12.9	-10.0*
15S/03E-17E02	-14.0	-13.0	-12.0	-11.0	-10.0*
16S/04E-11D51**	48.5	48.9	49.3	49.6	50.0

*Groundwater elevation estimated.

**Well is a proxy for the Deep Aquifers.

8.6.4 Undesirable Results

8.6.4.1 Criteria for Defining Chronic Lowering of Groundwater Levels Undesirable Results

The chronic lowering of groundwater levels undesirable result is a quantitative combination of groundwater level minimum threshold exceedances. The undesirable result is:

> *More than 15% of the groundwater elevation minimum thresholds are exceeded in any single aquifer.*

Since the GSP addresses long-term groundwater sustainability, exceedances of groundwater levels minimum thresholds during a drought do not constitute an undesirable result. Pursuant to SGMA Regulations (California Water Code § 10721(w)(1)), “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." Therefore, groundwater levels may temporarily exceed minimum thresholds during droughts, and do not constitute an undesirable result, as long as groundwater levels rebound.

Undesirable results provide flexibility in defining sustainability. Increasing the percentage of allowed minimum threshold exceedances provides more flexibility but may lead to significant and unreasonable conditions for some beneficial users. Reducing the percentage of allowed minimum threshold exceedances ensures strict adherence to minimum thresholds but reduces flexibility due to unanticipated hydrogeologic conditions. The undesirable result was set at 15% to balance the interests of beneficial users with the practical aspects of groundwater management under uncertainty.

The 15% limit on minimum threshold exceedances in the undesirable result allows for 5 exceedances in the 180-Foot Aquifer, 7 exceedances in the 400-Foot Aquifer, and 2 in the Deep Aquifers. This was considered a reasonable number of exceedances given the hydrogeologic uncertainty of the Subbasin. As the monitoring system grows, additional exceedances will be allowed. One additional exceedance will be allowed for approximately every 7 new monitoring wells.

8.6.4.2 Potential Causes of Undesirable Results

Conditions that may lead to an undesirable result include the following:

- **Localized pumping clusters.** Even if regional pumping is maintained within the sustainable yield, clusters of high-capacity wells may cause excessive localized drawdowns that lead to undesirable results.

- **Expansion of *de minimis* pumping.** Individual *de minimis* pumpers do not have a significant impact on groundwater elevations. However, many *de minimis* pumpers are often clustered in specific residential areas. Pumping by these *de minimis* users is not regulated under this GSP. Adding additional domestic *de minimis* pumpers in these areas may result in excessive localized drawdowns and undesirable results.

- **Departure from the GSP's climatic assumptions, including extensive, unanticipated drought.** Minimum thresholds were established based on historical groundwater elevations and reasonable estimates of future climatic conditions and groundwater elevations. Departure from the GSP's climatic assumptions or extensive, unanticipated droughts may lead to excessively low groundwater elevations and undesirable results.

8.6.4.3 Effects on Beneficial Users and Land Uses

The primary detrimental effect on beneficial users from allowing multiple exceedances occurs if more than 1 exceedance take place in a small geographic area. Allowing 15% exceedances is reasonable if the exceedances are spread out across the Subbasin, and as long as any 1 well does not regularly exceed its minimum threshold. If the exceedances are clustered in a small area, it will indicate that significant and unreasonable effects are being born by a localized group of landowners.

8.7 Reduction in Groundwater Storage SMC

8.7.1 Locally Defined Significant and Unreasonable Conditions

Locally defined significant and unreasonable conditions in groundwater storage in the Subbasin are those that:

- Lead to chronic, long-term reduction in groundwater storage, or
- Interfere with other sustainability indicators

These significant and unreasonable conditions were determined based on input collected during Subbasin Committee meetings and discussions with GSA staff.

8.7.2 Minimum Thresholds

The minimum threshold for reduction in groundwater storage is 626,000 acre-feet below the measurable objective in the 180/400-Foot Aquifer Subbasin. This reduction is based on the groundwater level and seawater intrusion minimum thresholds. This number does not include any storage changes in the Deep Aquifers and will be refined as additional data are collected and other projects are implemented.

Although not the metric for establishing change in groundwater storage, the GSAs are committed to pumping at or less than the Subbasin's long-term sustainable yield. SGMA allows 20 years to reach sustainability. Under current conditions, groundwater storage is 15,500 AF above the minimum threshold.

8.7.2.1 Information and Methodology Used to Establish Minimum Thresholds and Measurable Objectives

The groundwater storage minimum threshold and measurable objective rely on the groundwater elevation and seawater intrusion minimum thresholds. The methodologies used to the establish those two minimum thresholds are detailed in Section 8.6.2.1 and Section 8.8.2.1. The GSP Regulations § 354.36 (b) states that: "Groundwater elevations may be used as a proxy for monitoring other sustainability indicators if the Agency demonstrates the following: (1) Significant correlation exists between groundwater elevations and the sustainability indicators for which groundwater elevation measurements serve as a proxy." The general relationship between groundwater storage and groundwater elevations is discussed in greater detail in Chapter 4, Section 4.4.2.

Figure 8-6 compares the Subbasin's cumulative change in storage, plotted on the black line, with the average annual change in groundwater elevation, plotted on the blue line. The groundwater elevation change data are derived from the groundwater level monitoring network; the cumulative change in groundwater storage is derived from the SVIHM. Although the data come from 2 sources, the data generally show similar patterns between 1980 and 2016. The decrease in storage modeled by the SVIHM from 1983 to 1998 is not exactly reflected in the change in groundwater elevations, because the modeled storage is dependent on the simulated groundwater elevations in the SVIHM. However, from 1998 to 2016, the cumulative change in storage and annual change in groundwater elevations seem to be more closely related as verified on Figure 8-7.

Figure 8-7 shows a scatter plot of cumulative change in storage and annual average change in groundwater elevation. The blue data points show data for the entire model period from 1980 to 2016 and the orange data points show data from 1998 to 2016. Although, the data for the entire model period demonstrate a weak correlation (R^2=0.3748), a more significant positive correlation exists between groundwater elevations and the amount of groundwater in storage between 1998 and 2016 (R^2=0.8334). The correlation for the 1998 to 2016 period is sufficient to show that groundwater elevations are an adequate proxy for groundwater storage. The data presented on Figure 8-6 and Figure 8-7 are used to establish groundwater elevation as proxies for groundwater in storage for the portion of the Subbasin that is not seawater intruded.

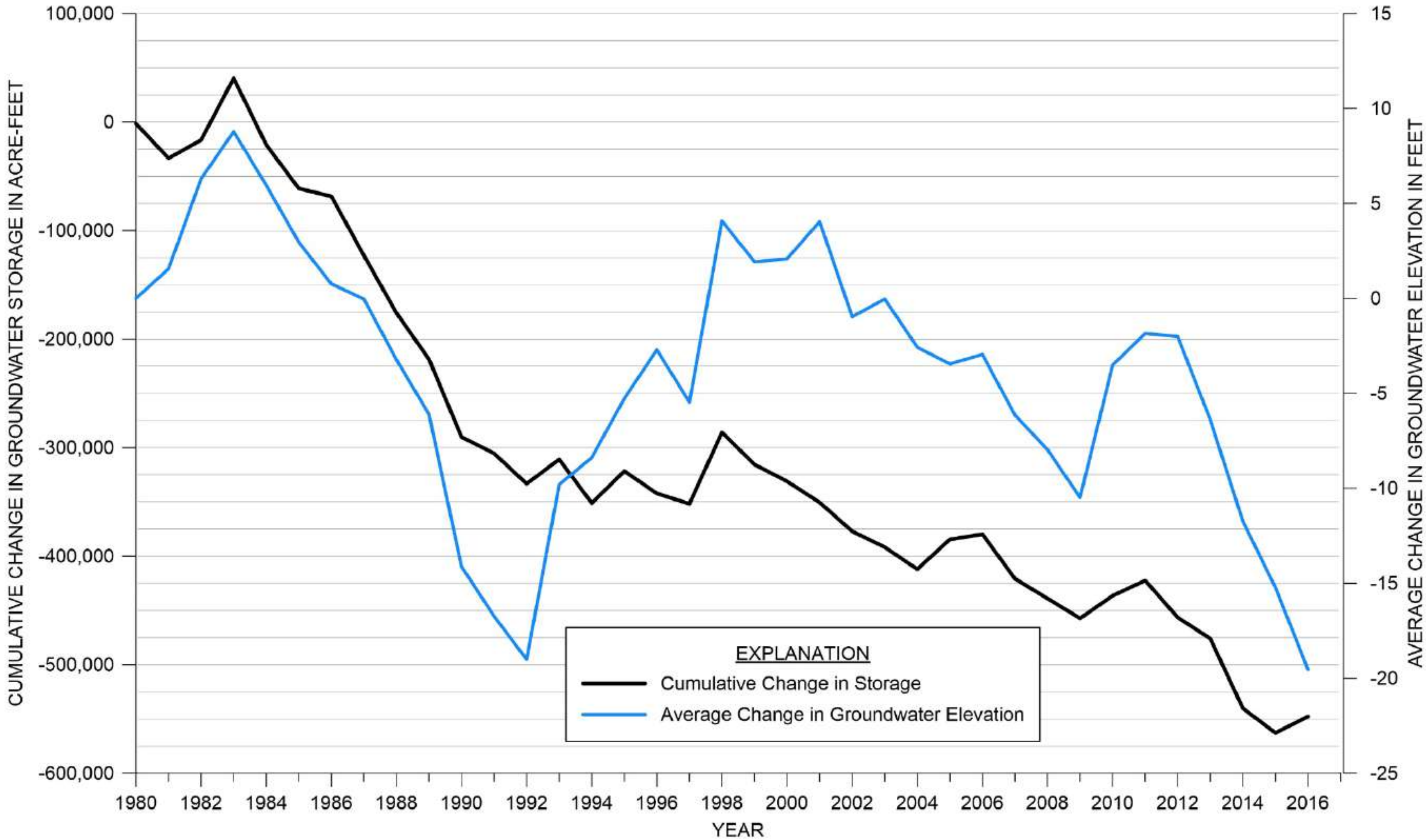

Figure 8-6. Cumulative Change in Storage and Average Change in Groundwater Elevation in the 180/400-Foot Aquifer Subbasin

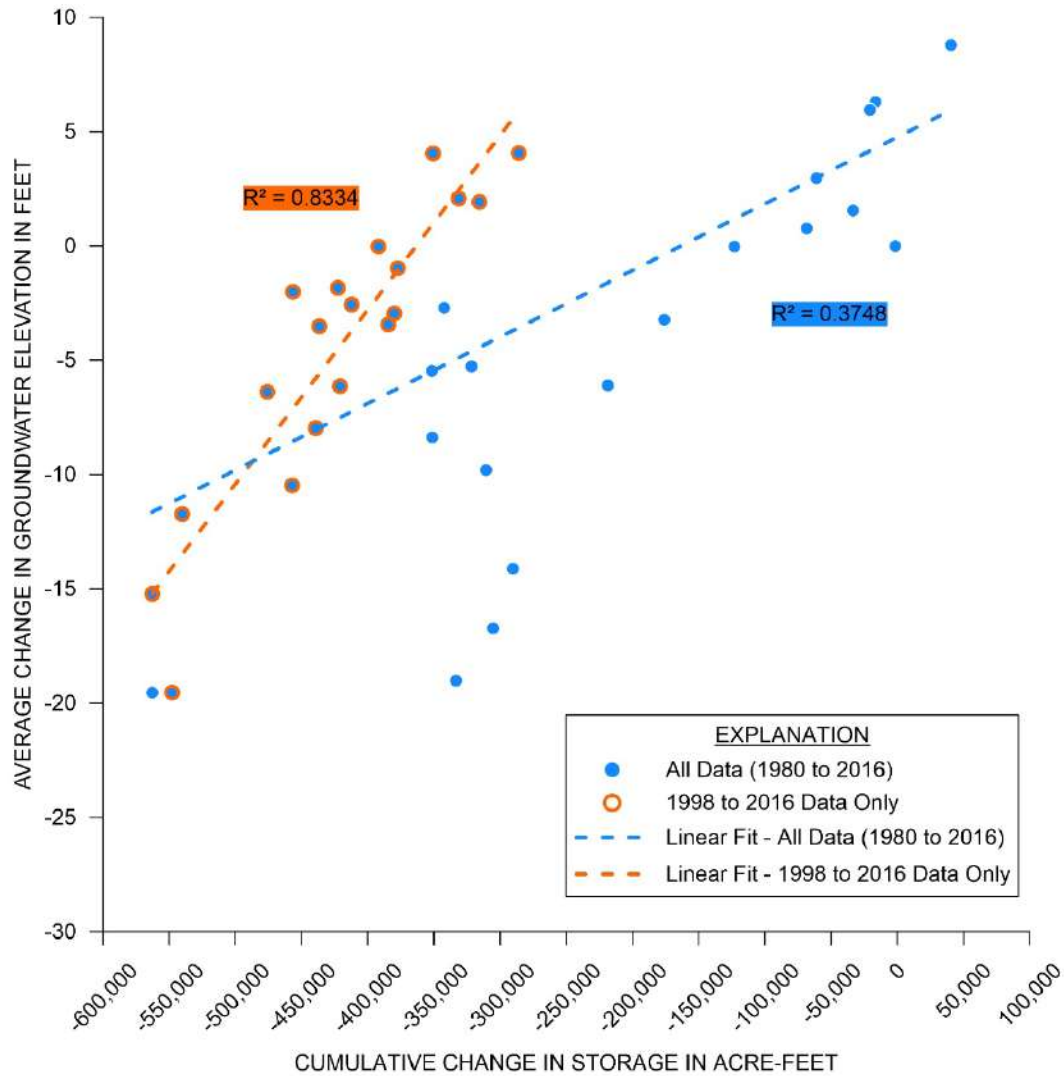

Figure 8-7. Correlation Between Cumulative Change in Storage and Average Change in Groundwater Elevation

The groundwater storage change due to changes in groundwater elevations is calculated based on the average groundwater elevation difference between the minimum threshold and measurable objectives multiplied by the area of the Subbasin that is not seawater intruded and a storage coefficient. The non-seawater intruded area in the Subbasin at the measurable objective is 84,200 acres. As described in Appendix 5B, the storage coefficient of 0.078 is used, based on an average of previous estimates of storage coefficients. Calculations based on the previous storage coefficient estimates result in a range from 41,000 AF to 138,000 AF. An average of the estimates is used here, resulting in a difference between the storage minimum threshold and measurable objective of 90,000 AF for the non-seawater intruded area.

The storage change due to seawater intrusion was estimated by calculating the volume of water in the 180-Foot and 400-Foot Aquifers that would transition from saline to fresh based on the location of the minimum threshold and measurable objective 500-mg/L chloride isocontour locations. Approximately 334,000 acre-feet of usable water would be added to storage in the 180-Foot Aquifer if the 500-mg/L isocontour is moved to the measurable objective location. Approximately 202,000 acre-feet of usable water would be added to storage in the 400-Foot Aquifer if the 500-mg/L isocontour is moved to the measurable objective location. The total increase in usable stored water due to reduced seawater intrusion is therefore 536,000 AF.

Total change in groundwater storage between minimum threshold conditions and measurable objective conditions is the sum of the storage change due to groundwater elevations and the storage change due to seawater intrusion. The previous storage coefficient estimates result in a range from 577,000 to 674,000 AF for the amount of water in storage between minimum threshold and measurable objective groundwater conditions. The average of this range, 626,000 AF, is used to set the minimum threshold for reduction of groundwater storage. A storage coefficient of 0.078 will be used to adequately compare current conditions to the minimum threshold. The groundwater storage change due to a reduction in seawater intrusion accounts for about 86% of the total average storage change between minimum thresholds and measurable objective conditions; change in water levels account for only 14% of the change in storage. Therefore, the choice of storage coefficient only has a small influence on the SMC.

The Deep Aquifers were not included in this calculation, which is a data gap that will continued to be addressed during GSP implementation. This estimate will be refined as more data are gathered and other projects are implemented.

8.7.2.2 Relationship between Individual Minimum Thresholds and Relationship to Other Sustainability Indicators

The minimum threshold for reduction in groundwater storage is a single value for the entire Subbasin. Therefore, the concept of potential conflict between minimum thresholds at different locations is not applicable.

The reduction in groundwater storage minimum threshold could influence other sustainability indicators. The reduction in groundwater storage minimum threshold is selected to avoid undesirable results for other sustainability indicators, as outlined below.

- **Chronic lowering of groundwater levels.** The reduction in storage minimum threshold is calculated from the groundwater level minimum thresholds. Therefore, the minimum threshold for reduction in groundwater storage is consistent with, and will not result in, a significant or unreasonable impact on groundwater elevations.
- **Seawater intrusion.** The reduction in storage minimum threshold is based on the groundwater level minimum thresholds, which is meant to keep groundwater elevation above historical lows and does not promote additional pumping. Therefore, the minimum threshold for reduction in groundwater storage will not result in a significant increase in seawater intrusion. However, keeping reduction of groundwater storage at the minimum threshold may not, by itself, stop all seawater intrusion.
- **Degraded water quality.** The reduction in storage minimum threshold is established to maintain groundwater elevations above historical lows. The change in storage minimum threshold will not directly lead to any additional degradation of groundwater quality.
- **Land subsidence.** The reduction in storage minimum threshold is established to maintain groundwater elevations above historical lows. Therefore, the change in storage minimum threshold will not induce any additional dewatering of clay-rich sediments; and will not induce additional subsidence.
- **Depletion of ISW.** The reduction in storage minimum threshold is established to maintain groundwater elevations above historical lows. Therefore, the change in storage minimum threshold will not induce additional depletion of ISW.

8.7.2.3 Effect of Minimum Thresholds on Neighboring Basins and Subbasins

The 180/400-Foot Aquifer Subbasin has 4 neighboring subbasins within the Salinas Valley Groundwater Basin:

- The Langley Subbasin to the north
- The Eastside Subbasin to the east

- The Forebay Subbasin to the south
- The Monterey Subbasin to the southwest

The SVBGSA is either the exclusive GSA or is one of the coordinating GSAs for the adjacent Subbasins. Because the SVBGSA covers all these subbasins, the SVBGSA is coordinating the development of the minimum thresholds and measurable objectives for all these subbasins. The Langley, Eastside, Forebay, and Monterey Subbasins have submitted GSPs in January 2022. Minimum thresholds for the 180/400-Foot Aquifer Subbasin have been reviewed relative to information developed for the neighboring subbasins' GSPs to ensure that these minimum thresholds will not prevent the neighboring subbasins from achieving sustainability.

The Pajaro Valley Basin occurs directly to the north. Because the minimum thresholds in the 180/400-Foot Aquifer Subbasin are set at the long-term future sustainable yield, it is likely that the minimum thresholds will not prevent the Pajaro Basin from achieving and maintaining sustainability. The SVBGSA will coordinate closely with the Pajaro Valley Water Agency as it sets minimum thresholds to ensure that the basins do not prevent each other from achieving sustainability.

8.7.2.4 Effect on Beneficial Uses and Users

The reduction in groundwater storage minimum threshold might limit the amount of groundwater pumping in the Subbasin. Limiting pumping may impact the beneficial uses and users of the Subbasin.

Agricultural land uses and users. Limiting the amount of groundwater pumping may limit agricultural production or restrict options for crops that can be grown in the Subbasin by reducing the amount of available water. Agricultural lands that are currently not irrigated may be particularly impacted because the additional groundwater pumping needed to irrigate these lands could remove groundwater from storage until it is below the minimum threshold.

Urban land uses and users. Limiting the amount of groundwater pumping may increase the cost of water for municipal users in the Subbasin because municipalities may need to find other, more expensive water sources.

Domestic land uses and users. The change in storage minimum threshold is based on groundwater level minimum thresholds that protect most domestic wells. Therefore, the minimum threshold will likely have an overall beneficial effect on existing domestic land uses by protecting the ability to pump from domestic wells.

Ecological land uses and users. Limiting the amount of pumping may generally benefit the environmental groundwater uses. Maintaining historical amounts of groundwater in the Subbasin maintains groundwater supplies for environmental purposes at levels similar to historical levels.

8.7.2.5 Relation to State, Federal, or Local Standards

No federal, state, or local standards exist for reductions in groundwater storage.

8.7.2.6 Method for Quantitative Measurement of Minimum Threshold

The amount of groundwater in storage will be calculated by calculating the change between groundwater elevation contour maps. The change in storage estimates will also be checked every 5 years when the SVIHM model is updated.

8.7.3 Measurable Objectives

> *The measurable objective for reduction in groundwater storage measurable objective is 0 when groundwater levels and seawater intrusion are at their measurable objectives.*

Since the goal is to manage to the measurable objective, additional water in storage is needed until groundwater elevations are at their measurable objectives.

8.7.3.1 Methodology for Setting Measurable Objectives

The measurable objective for reduction in groundwater storage was calculated as described in Section 8.6.2.1.

8.7.3.2 Interim Milestones

The reduction in storage interim milestones are shown in Table 8-4 for each of the 5-year intervals, consistent with the minimum thresholds and the measurable objectives. At 2017 groundwater elevations, the groundwater in storage is about 20,000 AF above the minimum threshold, yet to reach the measurable objective a gain of 151,400 AF in groundwater storage needs to occur every 5 years until 2040. At current, 2020, groundwater elevations the groundwater in storage is approximately 15,500 AF above the minimum threshold.

Table 8-4. Reduction in Groundwater Storage Interim Milestones

Gain in Storage needed to Reach Measurable Objective (AF)	At Current Conditions (2020)	At Interim Milestone Year 2025	At Interim Milestone Year 2030	At Interim Milestone Year 2035	At Measurable Objective Year 2040
5-year incremental change	-610,200	151,400	151,400	151,400	0
Cumulative change	-610,200	-454,200	-302,800	-151,400	0

8.7.4 Undesirable Results

8.7.4.1 Criteria for Defining Reduction in Groundwater Storage Undesirable Results

The reduction in groundwater storage undesirable result is:

There is an exceedance of the minimum threshold.

Since the GSP addresses long-term groundwater sustainability, exceedances of groundwater storage minimum thresholds during a drought do not constitute an undesirable result. Pursuant to SGMA Regulations (California Water Code § 10721(w)(1)), "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." Therefore, groundwater storage may temporarily exceed minimum thresholds during droughts, and do not constitute an undesirable result, as long as groundwater levels rebound.

8.7.4.2 Potential Causes of Undesirable Results

Conditions that may lead to an undesirable result for the reduction in groundwater storage sustainability indicator include the following:

- **Expansion of agricultural or municipal pumping.** Additional agricultural or municipal pumping may result in lowered groundwater elevations that reduce groundwater storage to an undesirable result.
- **Expansion of *de minimis* pumping.** Pumping by *de minimis* users is not regulated under this GSP. Adding domestic *de minimis* pumpers in the Subbasin may result in low groundwater levels that reduce the groundwater storage below to an undesirable result.
- **Departure from the GSP's climatic assumptions, including extensive, unanticipated drought.** The undesirable result is established based on reasonable anticipated future climatic conditions and groundwater elevations. Departure from the GSP's climatic assumptions or extensive, unanticipated droughts may lead to excessively low groundwater recharge and unanticipated high pumping rates that could reduce groundwater in storage to an undesirable result.

8.7.4.3 Effects on Beneficial Users and Land Use

The practical effect of the reduction in groundwater storage undesirable result is no chronic, long-term net change in groundwater storage. Therefore, beneficial uses and users will have access to a similar amount of water in storage that currently exists, and the undesirable result will not have an additional negative effect on the beneficial users and uses of groundwater.

8.8 Seawater Intrusion SMC

8.8.1 Locally Defined Significant and Unreasonable Conditions

Locally defined significant and unreasonable seawater intrusion in the Subbasin is defined as follows:

- Any seawater intrusion in the Subbasin is significant and unreasonable.

This significant and unreasonable condition was determined based on input collected during Subbasin Committee meetings and discussions with GSA staff.

8.8.2 Minimum Thresholds

> *The minimum threshold for seawater intrusion is defined as the 2017 extent of the 500 mg/L chloride concentration isocontour for the 180-Foot and 400-Foot Aquifers, and as the line defined by Highway 1 for the Deep Aquifers.*

Figure 8-8 and Figure 8-9 present the minimum threshold, shown in red, for seawater intrusion in the 180-Foot and 400-Foot Aquifers, respectively, as represented by the 2017 extent of the 500 mg/L chloride concentration isocontour. The purple lines on the two figures show the current 2020 extent of seawater intrusion in the 180-Foot and 400-Foot Aquifers. Under current conditions, 180-Foot and 400-Foot Aquifers seawater intrusion extents exceed the minimum thresholds.

Figure 8-10 shows the minimum threshold for the Deep Aquifers in red that is defined by Highway 1. There is no reported seawater intrusion in the Deep Aquifers.

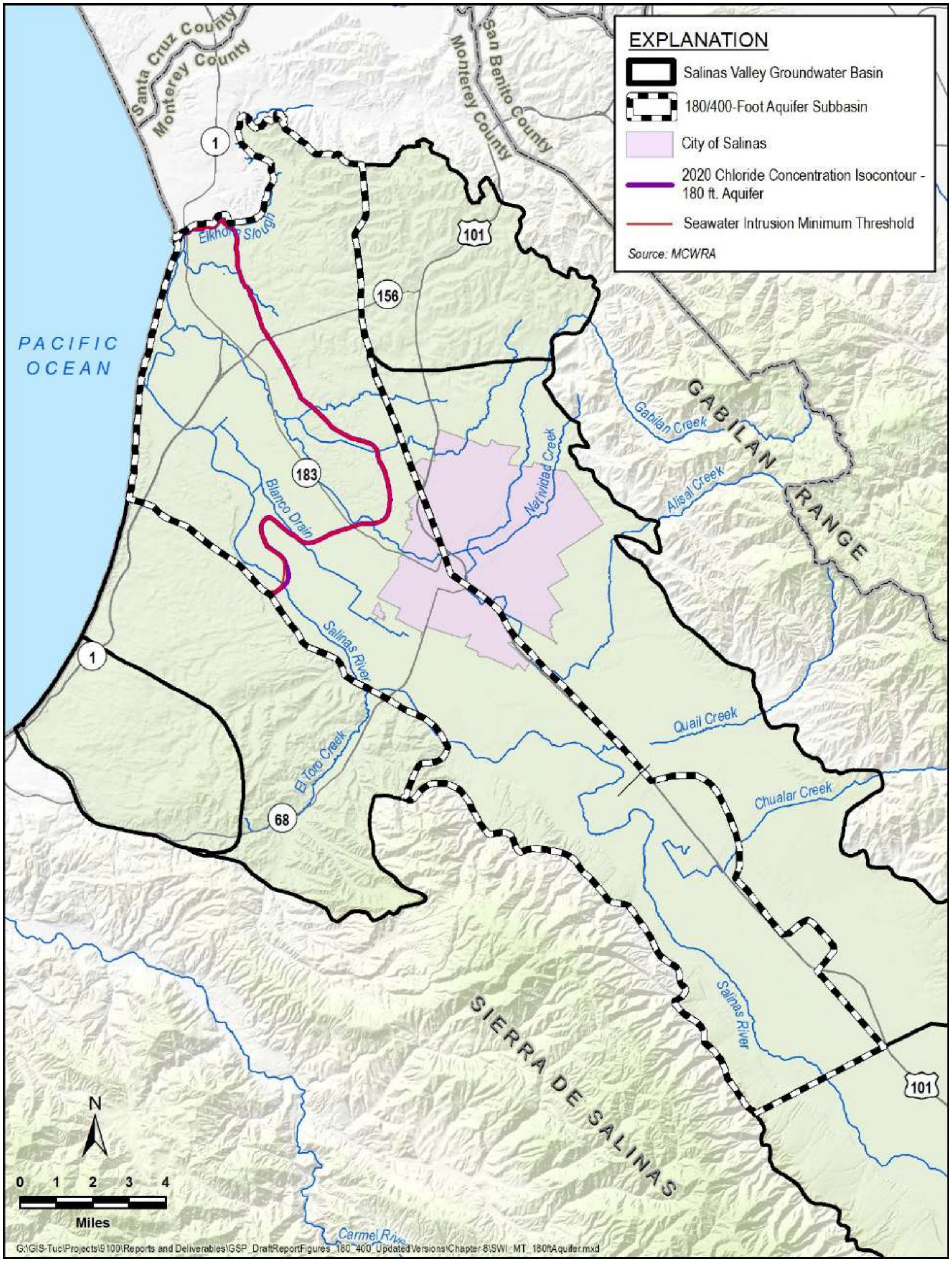

Figure 8-8. Minimum Threshold for Seawater Intrusion in the 180-Foot Aquifer

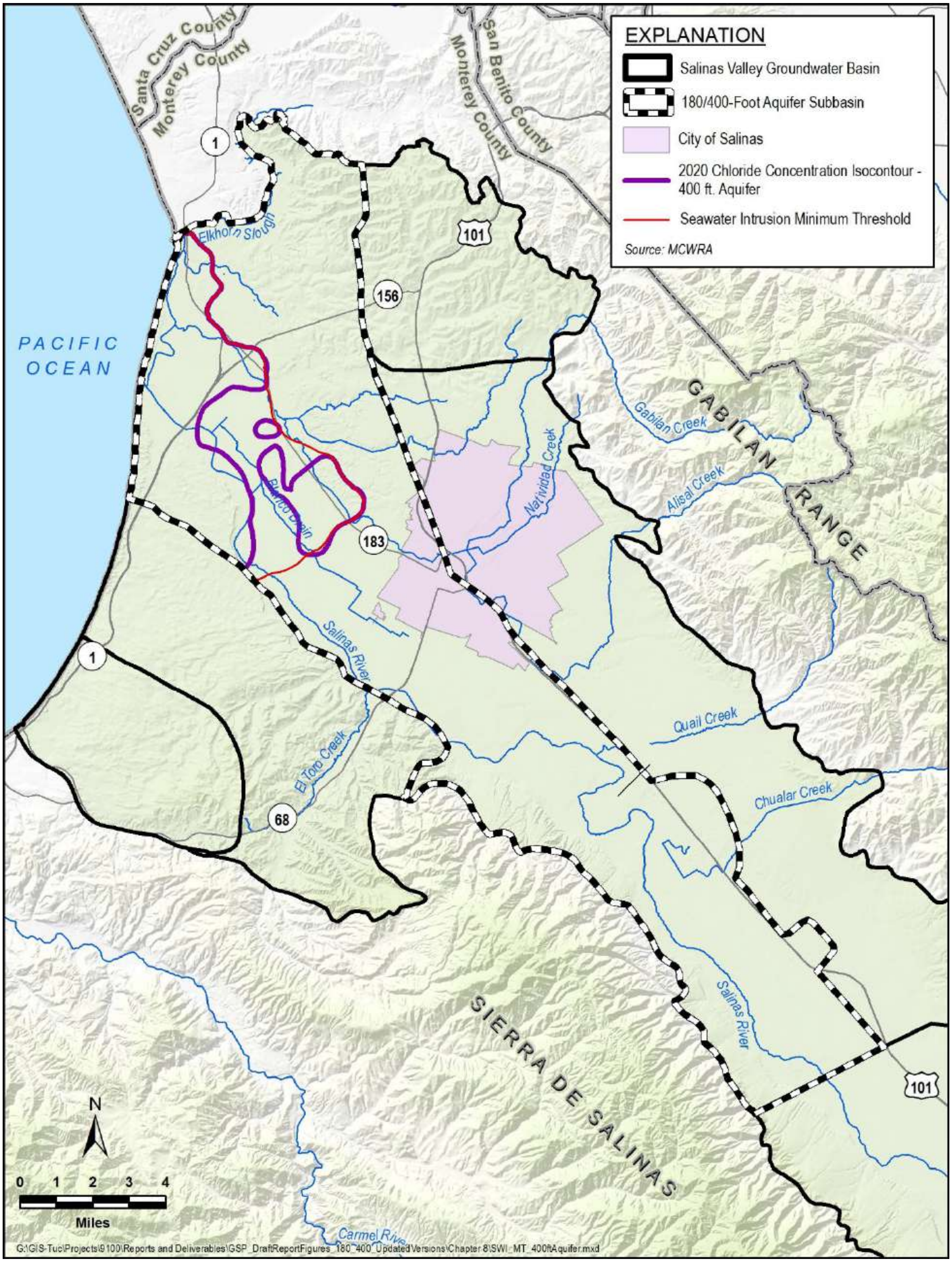

Figure 8-9. Minimum Threshold for Seawater Intrusion in the 400-Foot Aquifer

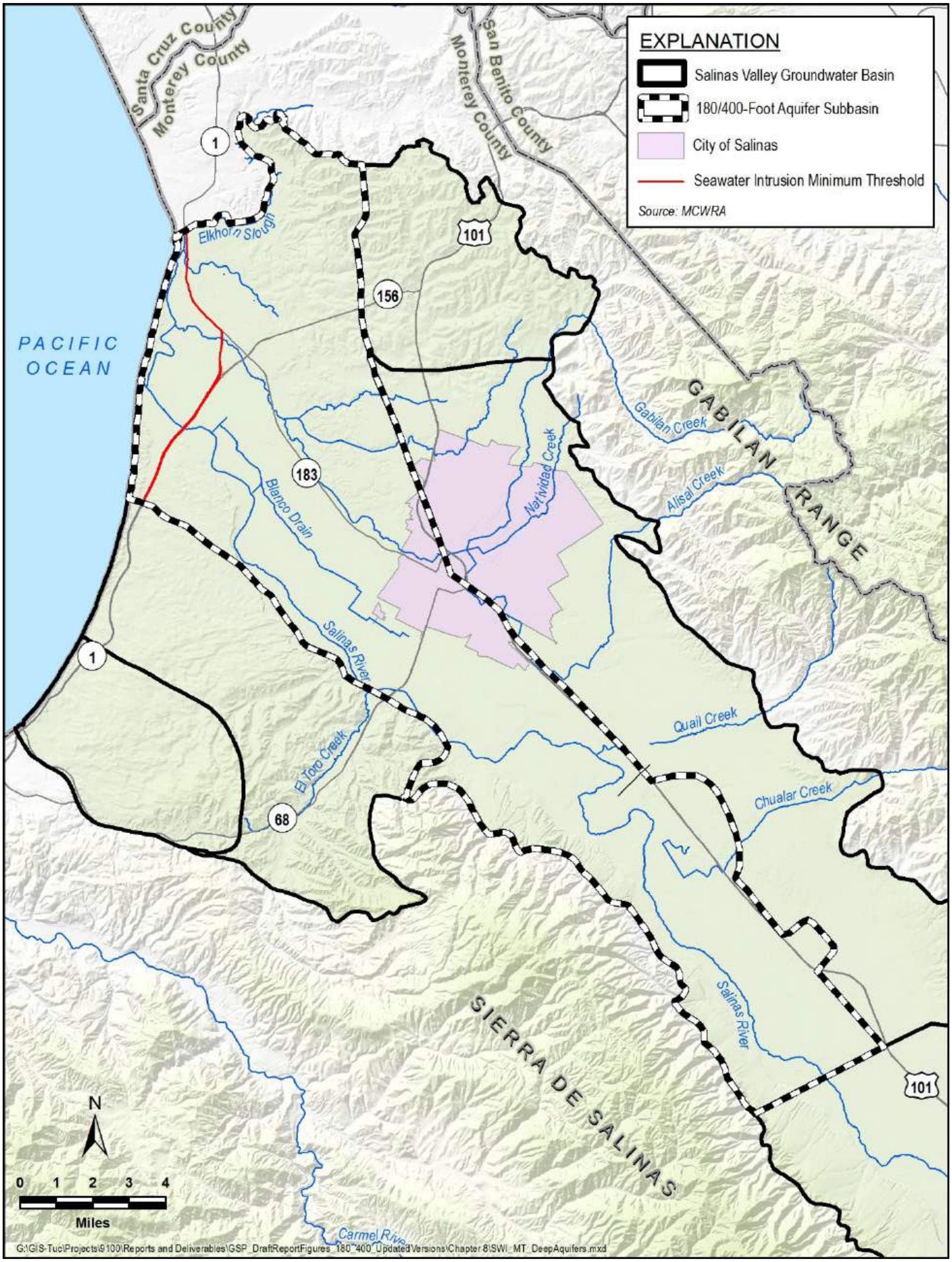

Figure 8-10. Minimum Threshold for Seawater Intrusion in the Deep Aquifers

8.8.2.1 Information and Methodology Used to Establish Minimum Thresholds and Measurable Objectives

The seawater intrusion minimum threshold is based on seawater intrusion maps developed by MCWRA. MCWRA publishes estimates of the extent of seawater intrusion every year. The MCWRA maps define the extent of seawater intrusion as the inferred location of the 500 mg/L chloride isocontour. These maps are developed through analysis and contouring of groundwater quality measured at privately-owned wells and dedicated monitoring wells near the coast. The maps of current and historical seawater intrusion is included in Chapter 5.

The groundwater model that will be used to assess the effectiveness of projects and management actions on seawater intrusion specifically incorporates assumptions for future sea level rise. Therefore, the actions to avoid undesirable results will address sea level rise.

8.8.2.2 Relationship between Individual Minimum Thresholds and Relationship to Other Sustainability Indicators

The relationship between the seawater intrusion minimum threshold and other sustainability indicators are as follows:

- **Chronic lowering of groundwater levels.** The seawater intrusion minimum threshold does not promote additional pumping that could cause groundwater elevations to decrease in the Subbasin. Therefore, the seawater intrusion minimum threshold will not result in significant or undesirable groundwater elevations.

- **Reduction in groundwater storage.** The seawater intrusion minimum threshold does not promote additional pumping or lowering of groundwater elevations that will lead to a reduction in storage. Therefore, the seawater intrusion minimum threshold will not result in an exceedance of the groundwater storage minimum threshold.

- **Degraded water quality.** The seawater intrusion minimum threshold does not promote decreasing groundwater elevations that could lead to exceedances of groundwater quality minimum thresholds. In fact, the seawater intrusion minimum threshold may have a beneficial impact on groundwater quality by preventing increases in chloride concentrations in supply wells.

- **Land subsidence.** The seawater intrusion minimum threshold does not promote additional pumping that could cause subsidence. Therefore, the seawater intrusion minimum threshold will not result in an exceedance of the subsidence minimum threshold.

- **Depletion of ISW.** The seawater intrusion minimum threshold does not promote additional pumping or lower groundwater elevations adjacent to ISW. Therefore, the seawater intrusion minimum threshold will not result in a significant or unreasonable depletion of ISW.

8.8.2.3 Effect of Minimum Threshold on Neighboring Basins and Subbasin

The 180/400-Foot Aquifer Subbasin has 4 neighboring subbasins within the Salinas Valley Groundwater Basin:

- The Langley Subbasin to the north
- The Eastside Subbasin to the east
- The Forebay Subbasin to the south
- The Monterey Subbasin to the southwest

The SVBGSA is either the exclusive GSA or is one of the coordinating GSAs for the adjacent Subbasins. Because the SVBGSA covers all these subbasins, the SVBGSA is coordinating the development of the minimum thresholds and measurable objectives for all these subbasins. The Langley, Eastside, Forebay, and Monterey Subbasins have submitted GSPs in January 2022. Minimum thresholds for the 180/400-Foot Aquifer Subbasin have been reviewed relative to information developed for the neighboring subbasins' GSPs to ensure that these minimum thresholds will not prevent the neighboring subbasins from achieving sustainability. SVBGSA and MCWDGSA are close collaborators in developing and implementing their GSPs for the 180/400 and Monterey Subbasins. Although SVBGSA uses the seawater intrusion isocontour developed by MCWRA, and MCWDGSA uses an isocontour derived based on a combination of TDS and chloride measurements and geophysical data, the seawater across the Subbasin boundary will continue to be closely monitored to ensure both subbasin minimum thresholds are met. The MCWRA seawater intrusion isocontour for the Monterey Subbasin has notable data gaps, which is why MCWDGSA chose other data for more accuracy in the Monterey Subbasin. These data will be aligned during implementation with enhanced data-sharing and collaboration per conversations among SVBGSA, MCWDGSA, and MCWRA staff.

The Pajaro Valley Basin has submitted an alternative submittal. Because the minimum thresholds in the 180/400-Foot Aquifer Subbasin is no further intrusion, it is likely that the minimum threshold will not prevent the Pajaro Basin from achieving and maintaining sustainability. The SVBGSA will coordinate closely with the Pajaro Valley Water Agency as it sets minimum thresholds to ensure that the basins do not prevent each other from achieving sustainability.

8.8.2.4 Effects on Beneficial Users and Land Uses

Agricultural land uses and users. The seawater intrusion minimum threshold generally provides positive benefits to the Subbasin's agricultural water users. Preventing seawater intrusion into the Subbasin ensures that a supply of usable groundwater will exist for agricultural use.

Urban land uses and users. The seawater intrusion minimum threshold generally provides positive benefits to the Subbasin's urban water users. Preventing seawater intrusion into the Subbasin will help ensure an adequate supply of groundwater for municipal supplies.

Domestic land uses and users. The seawater intrusion minimum threshold generally provides positive benefits to the Subbasin's domestic water users. Preventing seawater intrusion into the Subbasin will help ensure an adequate supply of groundwater for domestic supplies.

Ecological land uses and users. Although the seawater intrusion minimum threshold does not directly benefit ecological uses, it can be inferred that the seawater intrusion minimum thresholds provide generally positive benefits to the Subbasin's ecological water uses. Preventing seawater intrusion into the Subbasin will help prevent unwanted high salinity levels from impacting ecological groundwater uses.

8.8.2.5 Relevant Federal, State, or Local Standards

No federal, state, or local standards exist for seawater intrusion.

8.8.2.6 Method for Quantitative Measurement of Minimum Threshold

Chloride concentrations are measured in groundwater samples collected from the MCWRA's seawater intrusion monitoring network. These samples are used to develop the inferred location of the 500 mg/L chloride isocontour. The methodology and protocols for collecting samples and developing the 500 mg/L chloride isocontour are detailed in Appendix 7B and Appendix 7C.

8.8.3 Measurable Objectives

The measurable objective for seawater intrusion is defined as the 500 mg/L chloride concentration isocontour as the line defined by Highway 1.

8.8.3.1 Methodology for Setting Measurable Objectives

In the 180/400-Foot Subbasin, the measurable objective for the seawater intrusion SMC is the same as the line that defines Highway 1. This will improve the Subbasin's groundwater quality and provide access to usable groundwater to additional beneficial users. This measurable objective may be modified as the projects and actions to address seawater intrusion are refined. The methodology used to set measurable objectives is discussed in Section 8.8.2.1.

8.8.3.2 Interim Milestones

The interim milestones for seawater intrusion are:

6. 2025: identical to current conditions
7. 2030: one-third of the way to the measurable objective
8. 2035: two-thirds of the way to the measurable objective

These are only our initial estimates of interim milestones for seawater intrusion. The interim milestones will be refined using the Seawater Intrusion Model, in conjunction with the SVOM based on specific projects and management actions as project scoping progresses.

8.8.4 Undesirable Results

8.8.4.1 Criteria for Defining Seawater Intrusion Undesirable Results

The seawater intrusion undesirable result is a quantitative combination of chloride concentrations minimum threshold exceedances. There is only one minimum threshold for each of the three aquifers. Because even localized seawater intrusion is not acceptable, the basin-wide undesirable result is zero exceedances of minimum thresholds. For the Subbasin, the seawater intrusion undesirable result is:

> *Any exceedance of the minimum threshold, resulting in mapped seawater intrusion beyond the 2017 extent of the 500 mg/L chloride.*

8.8.4.2 Potential Causes of Undesirable Results

Conditions that may lead to an undesirable result include the following:

- Increased coastal pumping that could draw seawater more inland
- Unanticipated high sea level rise

8.8.4.3 Effects on Beneficial Users and Land Use

The primary detrimental effect on beneficial users and land uses from allowing seawater intrusion to increase in the Subbasin is that the pumped groundwater may become saltier. Thus, preventing further seawater intrusion into the Subbasin prevents greater impacts to domestic, municipal, and agricultural wells and associated land uses.

8.9 Degraded Water Quality SMC

8.9.1 Locally Defined Significant and Unreasonable Conditions

Locally defined significant and unreasonable changes in groundwater quality in the Subbasin are increases in a COC caused by a direct result of a GSA groundwater management action that either:

- Results in groundwater concentrations in a potable water supply well above an established MCL or SMCL, or
- Lead to significantly reduced crop production.

These significant and unreasonable conditions were determined based on input from the Subbasin Committee and discussions with GSA staff. These conditions were determined to be significant and unreasonable because groundwater quality in exceedance of these will cause a financial burden on groundwater users. Public water systems with COC concentrations above the MCL or SMCL are required to add treatment to the drinking water supplies or drill new wells. Agricultural wells with COCs that significantly reduce crop production will reduce grower's yields and profits.

8.9.2 Minimum Thresholds

> *The minimum thresholds for degraded water quality are zero additional exceedances of the regulatory drinking water standards (potable supply wells) or Basin Plan objectives (irrigation supply wells) beyond those observed in 2017 for groundwater quality constituents of concern.*

The minimum thresholds for DDW public water system supply wells and ILRP on-farm domestic wells reflect California's Title 22 drinking water standards. The minimum thresholds for irrigation supply wells are based on the water quality objectives listed in the Basin Plan (CCRWQCB, 2019). The minimum threshold values for the COC for all 3 sets of wells are provided in Table 8-5 and are based on data up to 2017. Full discussion of these current conditions is included in Chapter 5, but the running total of regulatory standard exceedances from Table 5-6 is used to measure against the minimum thresholds and is included in Table 8-5.The last column Table 8-5 includes the number of exceedances above the minimum thresholds. Because the minimum thresholds reflect no additional exceedances, the minimum thresholds are set to the number of existing exceedances. Surpassing the number of existing exceedances for any of the listed constituents will lead to an undesirable result. Not all wells in the monitoring network are sampled for every COC.

Minimum thresholds are established based on existing groundwater quality in 2017. Since 2017, there has only been one new additional COC in the Subbasin. Manganese has been added to the list of COC for ILRP irrigation supply wells. Because there was no exceedance of manganese in 2017 the minimum threshold for this new COC is set to 0. DDW wells and ILRP on-farm domestic wells do not have any new COC.

Table 8-5. Degradation of Groundwater Quality Minimum Thresholds

Constituent of Concern (COC)	Minimum Threshold/Measurable Objective – Number of Wells Exceeding Regulatory Standard from latest sample (April 1974 to December 2017)	Current Conditions: Exceedances of Regulatory Standard up to 2020	Number of Exceedances above Minimum Threshold
DDW Wells			
1,2 Dibromo-3-chloropropane	9	9	0
1,2,3-Trichloropropane	11	13	2
1,2,4-Trichlorobenzene	1	1	0
Aluminum	1	1	0
Arsenic	1	2	1
Benzo(a)Pyrene	2	2	0
Chloride	2	3	1
Di(2-ethylhexyl)phthalate	2	2	0
Dinoseb	2	2	0
Fluoride	1	1	0
Heptachlor	2	6	4
Hexachlorobenzene	2	2	0
Iron	2	2	0
Manganese	1	5	4
Methyl-tert-butyl ether (MTBE)	3	3	0
Nitrate (as nitrogen)	4	12	8
Selenium	2	2	0
Specific Conductance	2	4	2
Tetrachloroethene	1	1	0
Total Dissolved Solids	4	7	3
Vinyl Chloride	34	34	0
ILRP On-Farm Domestic Wells			
Chloride	9	9	0
Iron	7	11	4
Manganese	1	3	2
Nitrite	1	1	0
Nitrate (as nitrogen)	36	49	13
Nitrate + Nitrite (sum as nitrogen)	4	14	10
Specific Conductance	35	44	9
Sulfate	2	3	1
Total Dissolved Solids	33	44	11
ILRP Irrigation Supply Wells			
Chloride	19	28	9
Iron	2	2	0
Manganese	0	1	1

8.9.2.1 Information and Methodology Used to Establish Water Quality Minimum Thresholds and Measurable Objectives

As noted in the GSP Regulations, minimum thresholds are based on a degradation of groundwater quality, not an improvement of groundwater quality (23 California Code of Regulations § 354.28 (c)(4)). Therefore, this GSP is designed to avoid taking any action that may inadvertently move groundwater constituents already in the Subbasin in such a way that the constituents have a significant and unreasonable impact that would not otherwise occur. COC must meet 2 criteria:

1. They must have an established level of concern such as an MCL or SMCL for drinking water, or a level known to affect crop production.
2. They must have been found in the Subbasin at levels above the level of concern.

Based on the review of groundwater quality in Chapter 5, the COC that may affect drinking water supply wells include those for DDW and ILRP on-farm domestic wells listed in Table 8-5

The COC that are known to cause reductions in crop production are those for ILRP irrigation supply wells listed in Table 8-5.

As discussed in Chapter 7, wells for 3 separate water quality monitoring networks were reviewed and used for developing SMC:

- Public water system supply wells regulated by the SWRCB DDW.
- On-farm domestic wells monitored as part of CCRWQCB ILRP. This dataset was obtained from the SWRCB through the GAMA groundwater information system. The ILRP data were separated into 2 data sets, 1 for on-farm domestic wells and the other for irrigation supply wells (discussed below) for purposes of developing initial draft minimum thresholds and measurable objectives for each type of well. The monitoring well network for the ILRP will change when the monitoring network for Ag Order 4.0 is finalized. At that time, the new ILRP domestic monitoring network will be incorporated into this GSP, replacing the current network, for water quality monitoring.
- Irrigation supply wells monitored as part of ILRP. As mentioned above, this dataset was obtained from the SWRCB through the GAMA groundwater information system. Like the on-farm domestic well dataset, the IRLP irrigation supply monitoring network will change when Ag Order 4.0 is finalized.

Each of these well networks are monitored for a different set of water quality parameters. Furthermore, some groundwater quality impacts are detrimental to only certain networks. For example, high nitrates are detrimental to public water system supply wells and on-farm domestic wells but are not detrimental to irrigation supply wells. The constituents monitored in each well network are indicated by an X in Table 8-6. An X does not necessarily indicate that the constituents have been found above the regulatory standard in that monitoring network.

Table 8-6. Summary of Constituents Monitored in Each Well Network

Constituent	Public Water System Supply	On-Farm Domestic[1]	Irrigation Supply
Silver	X		
Aluminum	X		
Alachlor	X		
Arsenic	X		
Atrazine	X		
Boron	X	X	X
Barium	X		
Beryllium	X		
Lindane	X		
Di(2-ethylhexyl) phthalate	X		
Bentazon	X		
Benzene	X		
Benzo(a)Pyrene	X		
Toluene	X		
Cadmium	X		
Chlordane	X		
Chloride	X	X	X
Chlorobenzene	X		
Cyanide	X		
Chromium	X		
Carbofuran	X		
Carbon Tetrachloride	X		
Copper	X		
Dalapon	X		
1,2 Dibromo-3-chloropropane	X		
1,1-Dichloroethane	X		
1,2-Dichloroethane	X		
1,2-Dichlorobenzene	X		
1,4-Dichlorobenzene	X		
1,1-Dichloroethylene	X		
cis-1,2-Dichloroethylene	X		
trans-1,2-Dichloroethylene	X		
Dichloromethane (a.k.a. methylene chloride)	X		
1,2-Dichloropropane	X		
Dinoseb	X		
Diquat	X		
Di(2-ethylhexyl)adipate	X		
Ethylbenzene	X		
Endrin	X		
Fluoride	X		
Trichlorofluoromethane	X		
1,1,2-Trichloro-1,2,2-Trifluoroethane	X		
Iron	X	X	X
Foaming Agents (MBAS)	X		
Glyphosate	X		
Hexachlorocyclopentadiene	X		

Constituent	Public Water System Supply	On-Farm Domestic[1]	Irrigation Supply
Hexachlorobenzene	X		
Heptachlor	X		
Mercury	X		
Manganese	X	X	X
Molinate	X		
Methyl-tert-butyl ether (MTBE)	X		
Methoxychlor	X		
Nickel	X		
Nitrite	X	X	
Nitrate (as nitrogen)	X	X	
Nitrate + Nitrite (sum as nitrogen)		X	
Oxamyl	X		
1,1,2,2-Tetrachloroethane	X		
Perchlorate	X		
Polychlorinated Biphenyls	X		
Tetrachloroethene	X		
Pentachlorophenol	X		
Picloram	X		
Antimony	X		
Specific Conductance	X	X	
Selenium	X		
2,4,5-TP (Silvex)	X		
Simazine	X		
Sulfate	X	X	
Styrene	X		
1,1,1-Trichloroethane	X		
1,1,2-Trichloroethane	X		
1,2,4-Trichlorobenzene	X		
Trichloroethene	X		
1,2,3-Trichloropropane	X		
Total Dissolved Solids	X	X	
Thiobencarb	X		
Thallium	X		
Toxaphene	X		
Vinyl Chloride	X		
Xylenes	X		
Zinc	X		

[1]Basin plan states domestic wells are monitored for Title 22 constituents; however, GAMA groundwater information system only provides data for the constituents listed above.

8.9.2.2 Relationship between Individual Minimum Thresholds and Relationship to Other Sustainability Indicators

Preventing degradation of groundwater quality may affect other sustainability indicators or may limit activities needed to achieve minimum thresholds for other sustainability indicators as described below:

- **Chronic lowering of groundwater levels.** The degradation of groundwater quality minimum thresholds could influence groundwater level minimum thresholds by limiting the types of water that can be used for recharge to maintain or raise groundwater elevations. Water used for recharge cannot exceed any groundwater quality standards. In addition, a change in groundwater elevations may cause a change in groundwater flow direction which in turn could cause poor water quality to migrate into areas of good water quality.

- **Reduction in groundwater storage.** The degradation of groundwater quality minimum thresholds do not promote lower groundwater elevations. Therefore, the groundwater quality minimum thresholds will not result in an exceedance of the groundwater storage minimum threshold.

- **Seawater intrusion.** The degradation of groundwater quality minimum thresholds do not promote additional pumping that could exacerbate seawater intrusion. Therefore, the groundwater quality minimum thresholds will not result in an exceedance of the seawater intrusion minimum threshold.

- **Land subsidence.** The degradation of groundwater quality minimum thresholds do not promote additional pumping that could cause subsidence. Therefore, the groundwater quality minimum thresholds will not result in an exceedance of the subsidence minimum threshold.

- **Depletion of ISW.** The degradation of groundwater quality minimum thresholds do not promote additional pumping or lower groundwater elevations adjacent to ISW. Therefore, the groundwater quality minimum thresholds will not result in a significant or unreasonable depletion of ISW.

8.9.2.3 Effect of Minimum Thresholds on Neighboring Basins and Subbasins

The 180/400-Foot Aquifer Subbasin has 4 neighboring subbasins within the Salinas Valley Groundwater Basin:

- The Langley Subbasin to the north
- The Eastside Subbasin to the east
- The Forebay Subbasin to the south
- The Monterey Subbasin to the southwest

The SVBGSA is either the exclusive GSA or is one of the coordinating GSAs for the adjacent Subbasins. Because the SVBGSA covers all these subbasins, the SVBGSA is coordinating the development of the minimum thresholds and measurable objectives for all these subbasins. The Langley, Eastside, Forebay, and Monterey Subbasins have submitted GSPs in January 2022. Minimum thresholds for the 180/400-Foot Aquifer Subbasin have been reviewed relative to information developed for the neighboring subbasins' GSPs to ensure that these minimum thresholds will not prevent the neighboring subbasins from achieving sustainability.

The Pajaro Valley Basin lies directly to the north of the Subbasin. Because the minimum thresholds in the 180/400-Foot Aquifer Subbasin are to prevent degradation of water quality, it is likely that the minimum thresholds will not prevent the Pajaro Basin from achieving and maintaining sustainability. The SVBGSA will coordinate closely with the Pajaro Valley Water Agency as it sets minimum thresholds to ensure that the basins do not prevent each other from achieving sustainability.

8.9.2.4 Effect on Beneficial Uses and Users

Agricultural land uses and users. The groundwater quality minimum thresholds generally provide positive benefits to the Subbasin's agricultural water users. Preventing any GSA actions that would result in additional agricultural supply wells exceeding levels that could reduce crop production ensures that a supply of usable groundwater will exist for beneficial agricultural use.

Urban land uses and users. The groundwater quality minimum thresholds generally provide positive benefits to the Subbasin's urban water users. Preventing any GSA actions that would result in COC in additional drinking water supply wells exceeding MCLs or SMCLs ensures adequate groundwater quality for public water system supplies.

Domestic land uses and users. The groundwater quality minimum thresholds generally provide positive benefits to the Subbasin's domestic water users. Preventing any GSA actions that would result in COC in additional drinking water supply wells exceeding MCLs or SMCLs ensures adequate groundwater quality for domestic supplies.

Ecological land uses and users. Although the groundwater quality minimum thresholds do not directly benefit ecological uses, it can be inferred that the degradation of groundwater quality minimum thresholds provide generally positive benefits to the Subbasin's ecological water uses. Preventing any GSA actions that would result in COC migrating will prevent unwanted contaminants from impacting ecological groundwater uses.

8.9.2.5 Relation to State, Federal, or Local Standards

The groundwater quality minimum thresholds specifically incorporate state and federal standards for drinking water and basin plan objectives.

8.9.2.6 Method for Quantitative Measurement of Minimum Thresholds

Degradation of groundwater quality minimum thresholds will be directly measured from existing public water system supply wells, on-farm domestic wells, and irrigation supply wells. Groundwater quality will be measured with SWRCB GAMA groundwater information system data submitted through existing monitoring programs—DDW and ILRP—as discussed in Chapter 7.

- Exceedances of MCLs and SMCLs in public water system supply wells will be monitored with annual water quality data submitted to the DDW.
- Exceedances of MCLs and SMCLs in on-farm domestic wells will be monitored with ILRP data.
- Exceedances of water quality objectives for crop production will be monitored with ILRP data.

Initially, the review of drinking water MCLs, SMCLs, and water quality objectives that maintain adequate crop production will be centered around the COC identified above. If during review of the water quality data additional constituents appear to exceed any of the regulatory standards, these additional constituents will be added to the list of COC for the Subbasin.

8.9.3 Measurable Objectives

The measurable objectives for degradation of groundwater quality represent target groundwater quality distributions in the Subbasin. SGMA does not mandate the improvement of groundwater quality. Therefore, the measurable objectives are based on no groundwater quality degradation and are identical to the minimum thresholds, as defined in 8.9.2.1.

> *The measurable objectives for degraded water quality are zero additional exceedances of the regulatory drinking water standards (potable supply wells) or Basin Plan objectives (irrigation supply wells) beyond those observed in 2017 for groundwater quality constituents of concern.*

8.9.3.1 Methodology for Setting Measurable Objectives

As described above, measurable objectives are set to be identical to the minimum thresholds and therefore follow the same method as detailed in Section 8.9.2.1.

8.9.3.2 Interim Milestones

There is no anticipated degradation of groundwater quality during GSP implementation that results from the implementation of projects and actions as described in Chapter 9. Therefore, the expected interim milestones are identical to current conditions.

8.9.4 Undesirable Results

8.9.4.1 Criteria for Defining Undesirable Results

The degradation of groundwater quality becomes an undesirable result when a quantitative combination of groundwater quality minimum thresholds is exceeded. For the Subbasin, the exceedance of minimum thresholds is unacceptable as a direct result of GSP implementation. Some groundwater quality changes are expected to occur independent of SGMA activities; because these changes are not related to SGMA activities, nor GSA management, they do not constitute an undesirable result. Additionally, SGMA states that GSAs are not responsible for addressing water quality degradation that was present before January 1, 2015 (California Water Code § 10727.2(b)(4)). Therefore, the degradation of groundwater quality reaches an undesirable result when:

> *Future or new minimum thresholds exceedances are caused by a direct result of GSA groundwater management action(s), including projects or management actions and regulation of groundwater extraction.*

The groundwater level SMC is designed and intended to help protect groundwater quality. Setting the groundwater level minimum thresholds at or above historical lows assures that no new depth dependent constituents of water quality concern are mobilized. The GSA may pursue projects or management actions to ensure that groundwater levels do not fall below groundwater level minimum thresholds.

This undesirable result recognizes there is an existing regulatory framework in the form of the California Porter Cologne Act and the federal Clean Water Act that addresses water quality management; and considers existing federal, state, and local groundwater quality standards, which were used in the development of minimum thresholds in the GSP. SVBGSA is not responsible for enforcing drinking water requirements or for remediating violations of those requirements that were caused by others (Moran and Belin, 2019). The existing regulatory regime does not require nor obligate the SVBGSA to take any affirmative actions to manage or control existing groundwater quality. However, SVBGSA is committed to monitoring and disclosing changes in groundwater quality and ensuring its groundwater management actions do not cause drinking water or irrigation water to be unusable.

SVBGSA will work closely with the Central Coast Regional Water Quality Control Board and other entities that have regulatory authority over water quality. SVBGSA will lead the Water Quality Coordination Group, as described in Chapter 9, which includes meeting annually with these partner agencies to review the status of water quality data and discuss any action needed to address water quality degradation.

If the GSA has not implemented any groundwater management actions in the Subbasin, including projects, management actions, or pumping management, no such management actions constitute an undesirable result. If minimum thresholds are exceeded after the GSA has implemented actions in the Subbasin, the GSA will review groundwater quality and groundwater gradients in and around the project areas to assess if the exceedance resulted from GSA actions to address sustainability indicators, or was independent of GSA activities. Both the implementation of actions and assessment of exceedances will occur throughout the GSP timeframe of 50 years as required by SGMA. The general approach to assess if a minimum threshold exceedance is due to GSA action will include:

- If no projects, management actions, or other GSP implementation actions have been initiated in a subbasin, or near the groundwater quality impact, then the impact was not caused by any GSA action.

- Many projects will likely include a new monitoring network. If data from the project-specific monitoring network do not show groundwater quality impacts, this will suggest that the impact was not caused by any GSA actions.

- If a GSA undertakes a project that changes groundwater gradients, moves existing constituents, or results in the exceedance of minimum thresholds, SVBGSA will undertake a more rigorous technical study to assess local, historical groundwater quality distributions, and the impact of the GSA activity on that distribution.

- For SGMA compliance, undesirable results for groundwater quality are not caused by (1) lack of action; (2) GSA required reductions in pumping; (3) exceedances in groundwater quality minimum thresholds that occur, if there are fewer exceedances than if there had been a lack of management; (4) exceedances in groundwater quality minimum thresholds that would have occurred independent of projects or management actions implemented by the GSA; (5) past harm.

8.9.4.2 Potential Causes of Undesirable Results

Conditions that may lead to an undesirable result include the following:

- **Required Changes to Subbasin Pumping**. If the location and rates of groundwater pumping change as a result of projects implemented under the GSP, these changes could alter hydraulic gradients and associated flow directions, and cause movement of one of the COC towards a supply well at concentrations that exceed relevant standards.

- **Groundwater Recharge**. Active recharge of imported water or captured runoff could modify groundwater gradients and move one of the COC towards a supply well in concentrations that exceed relevant limits.

- **Recharge of Poor-Quality Water**. Recharging the Subbasin with water that exceeds an MCL, SMCL, or level that reduces crop production could lead to an undesirable result.

8.9.4.3 Effects on Beneficial Users and Land Use

The undesirable result for degradation of groundwater quality is avoiding groundwater degradation caused by a direct result of a GSA groundwater management action. Therefore, the undesirable result will not impact the use of groundwater and will not have a negative effect on the beneficial users and uses of groundwater. This undesirable result does not apply to groundwater quality changes that occur due to other causes.

8.10 Land Subsidence SMC

8.10.1 Locally Defined Significant and Unreasonable Conditions

Locally defined significant and unreasonable subsidence in the Subbasin is defined as follows:

- Any inelastic land subsidence that is caused by lowering of groundwater elevations in the Subbasin or

- Any inelastic subsidence that causes an increase of flood risk.

These significant and unreasonable conditions were determined based on input collected during Subbasin Committee meetings and discussions with GSA staff.

Subsidence can be elastic or inelastic. Elastic subsidence is the small, reversible lowering and rising of the ground surface. Inelastic subsidence is generally irreversible. This SMC only concerns inelastic subsidence.

8.10.2 Minimum Thresholds

> *The minimum threshold for subsidence is zero net long-term subsidence, with no more than 0.1 foot per year of estimated land movement measured subsidence between June of one year and June of the subsequent year to account for InSAR measurement errors.*

The most current 2020 subsidence data, described in Chapter 5, does not exceed the subsidence minimum threshold.

8.10.2.1 Information Used and Methodology for Establishing Subsidence Minimum Thresholds

The minimum threshold was established using InSAR data available from DWR. The general minimum threshold is for no long-term irreversible subsidence in the Subbasin. The InSAR data provided by DWR, however, is subject to measurement error. DWR stated that, on a statewide level, for the total vertical displacement measurements between June 2015 and June 2019, the errors are as follows (DWR, 2019, personal communication):

1. The error between InSAR data and continuous GPS data is 16 mm (0.052 feet) with a 95% confidence level.
2. The measurement accuracy when converting from the raw InSAR data to the maps provided by DWR is 0.048 feet with 95% confidence level.

By adding errors 1 and 2, the combined error is 0.1 foot. While this is not a robust statistical analysis, it does provide an estimate of the potential error in the InSAR maps provided by DWR.

Additionally, the InSAR data provided by DWR reflects both elastic and inelastic subsidence. While it is difficult to compensate for elastic subsidence, visual inspection of monthly changes in ground elevations suggest that elastic subsidence is largely seasonal. To minimize the influence of elastic subsidence on the assessment of long-term, permanent subsidence, changes in ground level will only be measured annually from June of one year to June of the following year.

8.10.2.2 Relationship between Individual Minimum Thresholds and Relationship to Other Sustainability Indicators

The subsidence minimum threshold has little or no impact on other minimum thresholds, as described below:

- **Chronic lowering of groundwater levels.** The land subsidence minimum threshold will not decrease groundwater elevations and therefore will not result in significant or unreasonable groundwater elevations.

- **Reduction in groundwater storage.** The land subsidence minimum threshold will not change the amount of pumping and therefore will not result in a significant or unreasonable change in groundwater storage.

- **Seawater intrusion.** The land subsidence minimum threshold does not promote additional pumping that could exacerbate seawater intrusion. Therefore, the subsidence minimum threshold will not induce additional advancement of seawater intrusion along the coast.

- **Degraded water quality.** The land subsidence minimum threshold does not promote decreasing groundwater elevations that lead to exceedance of water quality minimum thresholds and therefore will not result in significant of unreasonable degradation of water quality.

- **Depletion of ISW.** The land subsidence minimum threshold does not promote additional pumping or lower groundwater elevations adjacent to ISW. Therefore, the subsidence minimum threshold will not result in a significant or unreasonable depletion of ISW.

8.10.2.3 Effect of Minimum Thresholds on Neighboring Basins and Subbasins

The 180/400-Foot Aquifer Subbasin has 4 neighboring subbasins within the Salinas Valley Groundwater Basin:

- The Langley Subbasin to the north

- The Eastside Subbasin to the east

- The Forebay Subbasin to the south

- The Monterey Subbasin to the southwest

The SVBGSA is either the exclusive GSA or is one of the coordinating GSAs for the adjacent Subbasins. Because the SVBGSA covers all these subbasins, the SVBGSA is coordinating the development of the minimum thresholds and measurable objectives for all these subbasins. The Langley, Eastside, Forebay, and Monterey Subbasins have submitted GSPs in January 2022. Minimum thresholds for the 180/400-Foot Aquifer Subbasin have been reviewed relative to information developed for the neighboring subbasins' GSPs to ensure that these minimum thresholds will not prevent the neighboring subbasins from achieving sustainability.

The Pajaro Valley Basin lies directly to the north of the Subbasin. Because the minimum thresholds in the 180/400-Foot Aquifer Subbasin is zero subsidence, it is likely that the minimum thresholds will not prevent the Pajaro Basin from achieving and maintaining sustainability. The SVBGSA will coordinate closely with the Pajaro Valley Water Agency as it sets minimum thresholds to ensure that the basins do not prevent each other from achieving sustainability.

8.10.2.4 Effects on Beneficial Uses and Users

The subsidence minimum threshold is set to prevent any long-term inelastic subsidence. Available data indicate that there is currently no long-term subsidence occurring in the Subbasin, and pumping limits are already required by minimum thresholds for other sustainability indicators. The subsidence minimum threshold does not impact infrastructure and does not require any additional reductions in pumping, and there is no negative impact on any beneficial user.

8.10.2.5 Relation to State, Federal, or Local Standards

There are no federal, state, or local regulations related to subsidence.

8.10.2.6 Method for Quantitative Measurement of Minimum Threshold

The minimum thresholds will be assessed using DWR-supplied InSAR data.

8.10.3 Measurable Objectives

The measurable objective for subsidence represents a target subsidence rates in the Subbasin. Because the minimum threshold of zero net long-term subsidence is the best achievable outcome, the measurable objective is identical to the minimum threshold.

> *The measurable objective for land subsidence is zero net long-term subsidence, with no more than 0.1 foot per year of estimated land movement measured subsidence to account for InSAR measurement errors.*

8.10.3.1 Methodology for Setting Measurable Objectives

The measurable objective will be assessed using DWR-supplied InSAR data.

8.10.3.2 Interim Milestones

The subsidence measurable objective is set at current conditions of no long-term subsidence. There is no change between current conditions and sustainable conditions. Therefore, the interim milestones are identical to current conditions of zero long-term subsidence, and annual measurements of no more than 0.1 foot of subsidence per year.

8.10.4 Undesirable Results

8.10.4.1 Criteria for Defining Undesirable Results

By regulation, the land subsidence undesirable result is a quantitative combination of subsidence minimum threshold exceedances. For the Subbasin, no long-term subsidence is acceptable. Therefore, the land subsidence undesirable result is:

> *There is an exceedance of the minimum threshold for land subsidence due to lowered groundwater elevations.*

Should potential subsidence be observed, the SVBGSA will first assess whether the subsidence may be due to elastic subsidence. If the subsidence is not elastic, the SVBGSA will undertake a program to assess whether the subsidence is caused by lowered groundwater elevations. The first step in the assessment will be to check if groundwater elevations have dropped below historical lows. If groundwater elevations remain above historical lows, the GSA shall assume that any observed subsidence was not caused by lowered groundwater levels. If groundwater levels have dropped below historical lows, the GSA will attempt to correlate the observed subsidence with measured groundwater elevations. Additionally, if the Subbasin experiences subsidence in multiple consecutive years that are due to InSAR measurement error, the GSAs will confirm if the error is not actually net long-term subsidence.

8.10.4.2 Potential Causes of Undesirable Results

Conditions that may lead to an undesirable result include a shift in pumping locations. Shifting a significant amount of pumping to an area that is susceptible to subsidence could trigger subsidence that has not been observed before.

8.10.4.3 Effects on Beneficial Users and Land Use

The undesirable result for subsidence does not allow any subsidence to occur in the Subbasin. Therefore, there is no negative effect on any beneficial uses and users.

8.11 Depletion of Interconnected Surface Water SMC

Areas with ISW occur where shallow groundwater may be connected to the surface water system. This SMC applies only to locations of ISW, as shown on Figure 4-11.

The SVIHM is used to identify the locations of ISW and to develop an estimate of the quantity and timing of stream depletions due to pumping during current and historical groundwater conditions. Shallow groundwater and surface water levels simulated by the SVIHM are used to identify the location of interconnection and evaluate the frequency with which different stream reaches are connected with groundwater in the underlying aquifer. The magnitude of stream depletions in relation to shallow groundwater elevations in interconnected reaches are evaluated in Chapter 5.

8.11.1 Locally Defined Significant and Unreasonable Conditions

Locally defined significant and unreasonable depletion of ISW in the Subbasin is defined as:

- Depletion from groundwater extraction that would result in a significant and unreasonable impact on other beneficial uses and users such as riparian water rights holders, appropriative surface water rights holders, ecological surface water users, and recreational surface water uses.

- Depletion from groundwater extraction more than observed in 2015, as measured by shallow groundwater elevations near locations of ISW. While a documented determination of whether past depletions was significant is not available, staying above 2016 depletions was determined to be a reasonable balance for all the beneficial uses and users.

These significant and unreasonable conditions were determined based on input collected during the development of 2022 GSPs, the 180/400 Subbasin Committee, and discussions with GSA staff. There is currently no data that determines what level of depletion from groundwater extraction has a significant adverse effect on steelhead trout or other beneficial use or user of. Should there be a determination regarding what level of depletion from groundwater extraction is significant, SVBGSA will take that into consideration as it reviews how it locally defines significant and unreasonable conditions for the SMC in the 5-Year Update.

8.11.2 Minimum Thresholds

> *The minimum threshold for depletion of interconnected surface water are established by proxy using shallow groundwater elevations 1 foot higher than those observed in 2015 near locations of interconnected surface water.*

No minimum thresholds are established for times when flow in a river is due to conservation releases from a reservoir. One purpose for these conservation releases is to recharge the Salinas Valley Groundwater Basin. Therefore, depletion of conservation releases is a desired outcome, and the minimum thresholds and measurable objectives do not apply to these flows.

The locations of ISW identified with the SVIHM are based on best available data but contain uncertainty, which is discussed in Chapters 4, 5, and 6. Additional stream and groundwater level data are needed to reduce uncertainty, verify with observed conditions, and track changes over time. The shallow groundwater monitoring wells, USGS stream gauges, and MCWRA River Series measurement sites will be used to supplement the analysis of locations of connectivity provided by the SVIHM. These monitoring points will also become part of the ISW monitoring network that is discussed in Chapter 7. Data from the ISW monitoring network will be used to monitor and evaluate the interconnection through time. Current conditions will be assessed according to the SMC when the ISW monitoring network is established.

As discussed in Chapter 7, a monitoring network for ISW composed of shallow groundwater monitoring wells is in the process of development. Two existing shallow wells are part of the monitoring network and they will be supplemented with 2 new shallow wells if needed. The monitoring network is dependent on the location and magnitude of stream reaches determined by the SVIHM. Table 8-7 includes the minimum thresholds and measurable objectives for the existing wells in the network. Neither well had an exceedance of the minimum threshold in 2020. Once the new monitoring wells are drilled, SMC will be determined using the wells' groundwater elevations during the minimum threshold and measurable objective years, or interpolated values from the groundwater elevation contour maps for wells that do not have shallow groundwater elevation measurements for those years.

Table 8-7. Depletion of Interconnected Surface Water Minimum Thresholds and Measurable Objectives

Monitoring Site	Current Groundwater Elevation (ft)	Minimum Threshold (ft)	Measurable Objective (ft)
16S/04E-08H02	39.3	30.0*	47.2
16S/05E-31P02	89.3	80.0*	94.7

*Groundwater elevation estimated.

8.11.2.1 Information Used and Methodology for Establishing Depletion of Interconnected Surface Water Minimum Thresholds

8.11.2.1.1 Establishing Groundwater Elevations as Proxies

The GSP Regulations § 354.28(d) states that: "an Agency may establish a representative minimum threshold 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 minimum thresholds as supported by adequate evidence."

The evaluation of ISW in the Salinas Valley Groundwater Basin is based on an approach recommended by the Environmental Defense Fund (EDF, 2018) that uses groundwater elevations as surrogates for streamflow depletion rates caused by groundwater use. Basic hydraulic principles state that groundwater flow is proportional to the difference between groundwater elevations at different locations along a flow path. Using this basic principle, groundwater flow to a stream, or conversely seepage from a stream to the underlying aquifer, is proportional to the difference between water elevation in the stream and groundwater elevations at locations away from the stream. Assuming the elevation in the stream is relatively stable, changes in interconnectivity between the stream and the underlying aquifer is determined by changes in groundwater levels in the aquifer. Thus, the change in hydraulic gradient between stream elevation and surrounding groundwater elevations is representative of change in interconnection between surface water and groundwater. Monitoring the hydraulic gradient in the aquifer adjacent to the stream monitors the interconnectivity between stream and aquifer. Therefore, the gradient can be monitored by measuring and evaluating groundwater elevations at selected shallow monitoring wells near streams. No existing estimations of the quantity and timing of depletions of ISW exist, nor data available to make estimations, so the hydraulic principles provide the best available information.

8.11.2.1.2 Review of Beneficial Uses and Users of Surface Water

The various beneficial uses and users of surface waters were addressed when setting the ISW depletion minimum thresholds. The classes of beneficial uses and users that were reviewed include riparian rights holders, appropriative rights holders, ecological surface water users, and recreational surface water users. This is not a formal analysis of public trust doctrine, but it is a reasonable review all uses and users in an attempt to balance all interests. This was not an assessment about what constitutes a reasonable beneficial use under Article X, Section 2 of the California Constitution. The minimum thresholds for depletion of ISW are developed using the definition of significant and unreasonable conditions described above, public information about critical habitat, locations of ISW derived from the SVIHM, and public information about water rights described below.

Riparian water rights holders. Table 8-8 provides a summary of water diversions reported to the SWRCB by water rights holders on the Salinas River and its tributaries within the 180/400-Foot Aquifer Subbasin. The diversion data were obtained from queries of the SWRCB eWRIMS water rights management system. The diversion data are self-reported by water-rights holders with points of diversion located within the Subbasin. Some of the diversions shown in Table 8-8 are also reported to MCWRA as groundwater pumping.

The SVBGSA is not aware of any current water rights litigation or water rights enforcement complaints by any riparian water rights holders in the Subbasin. Therefore, SVBGSA assumes that the current level of depletion has not injured any riparian water rights holders in the Subbasin.

Table 8-8. Reported Annual Surface Water Diversions in the 180/400-Foot Aquifer Subbasin

Diversions (Acre-Feet)	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Statement of Diversion and Reported Riparian Diversions	6,524	7,205	9,172	8,912	8,251	7,628	7,786	7,842	7,118	7,756

Appropriative water rights holders. There are no appropriative water right holders in the 180/400-Foot Aquifer Subbasin. The SVBGSA is not aware of any current water rights litigation or water rights enforcement complaints by any appropriative rights holders in the Subbasin. Therefore, SVBGSA assumes that the current level of depletion has not injured any appropriative water rights holders in the Subbasin.

Ecological surface water users. Review of MCWRA's Nacimiento Dam Operation Policy (MCWRA, 2018b) and MCWRA's water rights indicates MCWRA operates the Dam in a manner that meets downstream demands and considers ecological surface water users. Since the reservoir operations consider ecological surface water users and reflect reasonable existing surface water depletion rates, this GSP infers that stream depletion from existing groundwater pumping is not unreasonable. If further river management guidelines are developed to protect ecological surface water users, the SMC in this GSP will be revisited.

Recreational surface water users. No recreational activities such as boating regularly occur on surface water bodies in the Subbasin.

As shown by the analysis above, the current rate of surface water depletion is not having an unreasonable impact on the various surface water uses and users in the Subbasin. Therefore, the minimum thresholds are based on 2015 groundwater elevations, when surface water depletions were not unreasonable.

8.11.2.2 Relationship between Individual Minimum Thresholds and Relationship to Other Sustainability Indicators

The minimum thresholds for depletion of ISW are set to 1 foot above 2015 groundwater elevations in the shallow monitoring wells within the Subbasin. The minimum thresholds all reference the same historical year and have existed simultaneously in the past. Therefore, no conflict exists between minimum thresholds measured at various locations within the Subbasin.

The depletion of ISW minimum threshold could influence other sustainability indicators as follows:

- **Chronic lowering of groundwater levels.** The depletion of ISW minimum thresholds are set at the groundwater level minimum thresholds. Therefore, the ISW minimum thresholds will not result in chronic lowering of groundwater elevations.

- **Reduction in groundwater storage.** The depletion of ISW minimum thresholds are set at the change in storage minimum thresholds, which are the same as the groundwater level minimum thresholds. Therefore, the ISW minimum thresholds will not result in an undesirable loss of groundwater storage.

- **Seawater intrusion.** The depletion of ISW minimum thresholds do not promote additional pumping that could exacerbate seawater intrusion. Therefore, seawater intrusion will not be affected by the depletion of ISW minimum thresholds.

- **Degraded water quality.** The depletion of ISW minimum thresholds do not promote decreasing groundwater elevations that lead to exceedance of groundwater quality minimum thresholds. Therefore, groundwater quality will not be affected by the ISW minimum thresholds.

- **Land subsidence**. The depletion of ISW minimum thresholds do not promote additional pumping that could cause subsidence. Therefore, subsidence will not be affected by the ISW minimum thresholds.

8.11.2.3 Effect of Minimum Thresholds on Neighboring Basins and Subbasins

The 180/400-Foot Aquifer Subbasin has 4 neighboring subbasins within the Salinas Valley Groundwater Basin:

- The Langley Subbasin to the north
- The Eastside Subbasin to the east
- The Forebay Subbasin to the south
- The Monterey Subbasin to the southwest

The SVBGSA is either the exclusive GSA or is one of the coordinating GSAs for the adjacent Subbasins. Because the SVBGSA covers all these subbasins, the SVBGSA is coordinating the development of the minimum thresholds and measurable objectives for all these subbasins. The Langley, Eastside, Forebay, and Monterey Subbasins have submitted GSPs in January 2022. Minimum thresholds for the 180/400-Foot Aquifer Subbasin have been reviewed relative to information developed for the neighboring subbasins' GSPs to ensure that these minimum thresholds will not prevent the neighboring subbasins from achieving sustainability.

The Pajaro Valley Basin lies directly to the north of the Subbasin. Although a small portion of the 180/400-Foot Aquifer Subbasin does drain into Elkhorn Slough to the north, there is no interconnected surface water and groundwater between the Pajaro Valley and the 180/400-Foot Aquifer Subbasin due to the clay in the Elkhorn Slough. Therefore, the minimum thresholds for depletion of interconnected surface waters does not influence the ability of Pajaro Valley to achieve sustainability.

8.11.2.4 Effect on Beneficial Uses and Users

Table 3-9 of the *Salinas River Long-Term Management Plan* (MCWRA, 2019a) includes a list of 18 different designated beneficial uses on certain reaches of the river. In general, the major beneficial uses on the Salinas River are:

- Surface water diversions for agricultural, urban/industrial, and domestic supply
- Groundwater pumping from recharged surface water
- Freshwater habitat

- Rare, threatened, or endangered species, such as the Steelhead Trout
- CSIP diversions

The depletion of ISW minimum thresholds may have varied effects on beneficial users and land uses in the Subbasin.

Agricultural land uses and users. The depletion of ISW minimum thresholds prevent lowering of groundwater elevations adjacent to certain parts of streams and rivers beyond historical lows. The measurable objectives are higher than the minimum thresholds, providing flexibility for needed groundwater extraction during droughts or periods of low reservoir releases. Minimum thresholds higher than historical levels might affect the quantity and type of crops that can be grown in land adjacent to streams, and the ability of crops to withstand droughts. Therefore, these minimum thresholds are considered the least restrictive for agricultural land users. However, because the Subbasin is in overdraft, pumping limitations may needed to reach sustainability if there are insufficient projects and management actions available.

Urban land uses and users. The depletion of ISW minimum thresholds prevent lowering of groundwater elevations adjacent to certain parts of streams and rivers beyond historical lows. The measurable objective is higher than the minimum thresholds, providing flexibility for needed groundwater extraction during droughts or periods of low reservoir releases. Minimum thresholds higher than historical levels may limit the amount of urban pumping near rivers and streams, which could limit urban growth. Therefore, these minimum thresholds are considered the least restrictive for urban land uses and users. However, because the Subbasin is in overdraft, pumping limitations may needed to reach sustainability if there are insufficient projects and management actions available. If pumping is limited beyond historical levels, municipalities may have to obtain alternative sources of water to achieve urban growth goals. If this occurs, this may result in higher water costs for municipal water users.

Domestic land uses and users. The depletion of ISW minimum thresholds protect existing domestic land users and uses near locations of ISW from groundwater elevation declines below historical lows by maintaining shallow groundwater elevations near streams and protecting the operability of relatively shallow domestic wells.

Ecological land uses and users. The depletion of ISW minimum thresholds address ecological uses and users by preventing depletion of ISW from groundwater pumping beyond what was historically experienced. Additionally, by setting future groundwater levels at or above recent lows, there should be less impact to ecological users than has been seen to date.

8.11.2.5 Relation to State, Federal, or Local Standards

There are no explicit federal, state, or local standards for depletion of ISW. However, both state and federal provisions call for the protection and restoration of conditions necessary for endangered and threatened species.

8.11.2.6 Method for Quantitative Measurement of Minimum Threshold

The SVIHM is used to preliminarily identify areas of ISW and will help determine when any flow in a river is primarily due to conservation releases from Nacimiento and San Antonio reservoirs. Groundwater elevations measured in shallow wells adjacent to these areas of ISW will serve as the primary approach for monitoring depletion of ISW. As discussed in Chapter 7, existing shallow wells will be added, or new shallow wells will be installed to monitor groundwater elevations adjacent to surface water bodies during GSP implementation. There may be areas in the 180/400-Foot Aquifer Subbasin that this approach may not be applicable and additional analysis may need to be conducted from these areas.

New shallow monitoring wells installed pursuant to the GSP will not have data from 2015. Minimum thresholds for those wells will be estimated by either correlation with nearby deeper wells with water-level records that include 2015, or from groundwater model results.

8.11.3 Measurable Objectives

The measurable objectives for depletion of ISW target groundwater elevations that are higher than the minimum thresholds. The measurable objectives are consistent with the chronic lowering of groundwater elevation and reduction in groundwater storage measurable objectives.

> *The measurable objectives for depletion of interconnected surface water are established by proxy using shallow groundwater elevations observed in 2003 near locations of interconnected surface water.*

8.11.3.1 Methodology for Setting Measurable Objectives

The depletion of ISW measurable objectives are set to be identical to the groundwater level measurable objectives. The methodology for establishing measurable objectives is outlined in Section 8.6.2.1. Groundwater elevations from 2003 were selected as representative of the measurable objectives for the 180/400-Foot Aquifer Subbasin.

8.11.3.2 Interim Milestones

The interim milestones leading to the depletion of ISW measurable objectives are included in Table 8-9 for the existing wells in the ISW monitoring network.

Table 8-9. Depletion of Interconnected Surface Water Interim Milestones

Monitoring Site	Current Groundwater Elevation (ft)	Interim Milestone at Year 2025 (ft)	Interim Milestone at Year 2030 (ft)	Interim Milestone at Year 2035 (ft)	Measurable Objective (ft) (goal to reach at 2040)
16S/04E-08H02	39.3	41.3	43.3	45.2	47.2
16S/05E-31P02	89.3	90.6	92.0	93.3	94.7

8.11.4 Undesirable Results

8.11.4.1 Criteria for Defining Undesirable Results

By regulation, the depletion of ISW undesirable result is a quantitative combination of minimum threshold exceedances. The undesirable result for depletion of ISW is:

> *There is an exceedance of the minimum threshold in a shallow groundwater monitoring well used to monitor interconnected surface water.*

Streamflow depletion in the Subbasin is complicated by many factors, such as reservoir releases, recharge of the aquifer from streamflow, losses to vegetation, and ET. The ISW SMC applies to depletion of ISW from groundwater use. For SGMA compliance purposes, the default assumption is that any depletions of surface water beyond the level of depletion that occurred prior to 2015, as evidenced by reduction in groundwater levels, represent depletions that are not significant and unreasonable. Any additional depletions of surface water flows caused by groundwater conditions in excess of conditions as they were in 2015 would likely be an undesirable result that must be addressed under SGMA. There is currently no biological opinion or habitat conservation plan that indicates additional protection is needed for species protected under the Endangered Species Act; however, if it is determined that additional protection is needed and streamflow loss is due to groundwater extraction, not surface water flows, SVBGSA will adapt as necessary to adhere to environmental laws.

8.11.4.2 Potential Causes of Undesirable Results

Conditions that may lead to an undesirable result for the depletion of ISW include the following:

- **Localized pumping increases.** Even if the Subbasin is adequately managed at the Subbasin scale, increases in localized pumping near interconnected surface water bodies could reduce shallow groundwater elevations.

- **Expansion of riparian water rights.** Riparian water rights holders often pump from wells adjacent to streams. Pumping by these riparian water rights holder users is not regulated under this GSP. Additional riparian pumpers near interconnected reaches of rivers and streams may result in excessive localized surface water depletion.

- **Changes in Nacimiento and San Antonio Reservoir Releases.** Since the Salinas River is dependent on reservoir releases for sustained flows, releases at low levels could cause undesirable results. The ability to avoid undesirable results for ISW is partially dependent on reservoir releases.

- **Departure from the GSP's climatic assumptions, including extensive, unanticipated drought.** Minimum thresholds were established based on anticipated future climatic conditions. Departure from the GSP's climatic assumptions or extensive, unanticipated droughts may lead to excessively low groundwater elevations that increase surface water depletion rates.

8.11.4.3 Effects on Beneficial Users and Land Use

The depletion of ISW undesirable result is to have no net increase in surface water depletion due to groundwater use beyond 2015 levels, as determined by shallow groundwater elevations. The effects of undesirable results on beneficial users and land use are the same as the effects of minimum thresholds on beneficial uses and users, as described in Section 8.11.2.4.

SVBGSA will work with National Marine Fisheries Service (NMFS) and MCWRA to further evaluate the effects of the ISW measurable objectives, minimum thresholds, and undesirable results on surface water flows and beneficial users.

9 PROJECTS AND MANAGEMENT ACTIONS

9.1 Introduction

This chapter describes the projects and management actions that will allow the Subbasin to attain sustainability in accordance with GSP Regulations §354.42 and §354.44. This chapter includes a description of proposed projects and proposed groundwater management actions. The set of projects and management actions included provide sufficient options for reaching sustainability; however, not all projects need to be implemented. In this GSP, projects are activities supporting groundwater sustainability that require infrastructure or physical change to the environment. Projects include green infrastructure projects that achieve benefits through alteration of vegetation or soils, such as removal of invasive species and floodplain restoration. The term management actions generally refers to activities that support groundwater sustainability without infrastructure.

The projects and management actions adopted in this GSP are designed to achieve a number of outcomes including:

- Achieving groundwater sustainability by meeting Subbasin-specific SMC by 2040
- Providing equity between those who benefit from projects and those who pay for projects
- Providing incentives to constrain groundwater pumping within the sustainable yield

The projects and management actions included in this chapter outline a framework for achieving sustainability, however, many details must be developed before any of the projects and management actions can be implemented. Costs will be additional to the agreed-upon funding to sustain the operational costs of the SVBGSA and funding needed for monitoring and reporting.

This GSP is developed as part of an integrated effort by the SVBGSA to achieve groundwater sustainability in all 6 subbasins of the Salinas Valley under its authority. Therefore, the projects and actions included in this GSP are part of a larger set of integrated projects and actions for the entire Valley. Projects implemented in other subbasins may have indirect benefits for the 180/400-Foot Aquifer Subbasin, and projects implemented within this Subbasin may have indirect benefits for other subbasins.

The projects and management actions that are planned to reach sustainability were the most reliable, implementable, cost-effective, and acceptable to stakeholders. Descriptions of these projects and management actions are included below and are not in order of priority. Generalized costs are also included for planning purposes. Components of these projects and actions may change in future analyses, including facility locations, recharge mechanisms, and other details.

Therefore, each of the projects and management actions described in this GSP should be treated as a generalized project representative of a range of potential project configurations.

The projects and management actions are based on existing infrastructure, including the reservoirs and their spillways. They assume continued operation of that infrastructure at current capacity. If current infrastructure is operated differently or other projects are implemented within the Valley that affect groundwater conditions, SVBGSA will consider the effect of any such changes in meeting sustainability goals and will act in furtherance of reaching such goals.

Discussions and decisions regarding specific projects will continue throughout GSP implementation and will be part of the adaptive management of the Subbasin. Members of the GSA and stakeholders in the Subbasin should view these projects and management actions as a starting point for more detailed discussions. Where appropriate, details that must be agreed upon are identified for each project or management action.

As a means to compare projects, this chapter estimates the cost per AF of water. The cost per AF is the amortized cost of the project divided by the annual yield. It is not the cost of water for irrigation or the domestic cost of drinking water for households on water systems. The cost is included to help compare projects; however, more refined cost analyses and future benefit analyses will be completed during GSP implementation.

The specific design for implementing management actions and projects will provide landowners and public entities flexibility in how they manage water and how the Subbasin achieves groundwater sustainability. Not all projects and management actions need to be implemented. 180/400 stakeholders will work collaboratively to determine which projects and management actions to implement in order to maintain sustainability of the 180/400-Foot Aquifer Subbasin and will pursue adaptive management if conditions change.

9.2 General Process for Developing Projects and Management Actions

9.2.1 Process for Developing Projects and Management Actions

9.2.1.1 Original GSP

The general process for developing the projects and management actions in the original GSP included a combination of reviewing publicly available information, gathering feedback during public meetings, conducting hydrogeologic analysis, consulting with SVBGSA staff, and meeting with Advisory Committee and Board members.

The initial list of projects in the 180/400-Foot Aquifer Subbasin GSP was developed with stakeholder input, including a brainstorming workshop for stakeholders to propose and discuss their ideas. The list of projects and management actions developed in this workshop were then narrowed down based on feasibility, likelihood of stakeholder acceptance, and ability to address groundwater conditions.

The projects listed in the original GSP constitute an integrated management program for the entire Valley, including all 6 subbasins of the Salinas Valley Groundwater Basin. The SVBGSA selected these projects from a larger set of potential projects. Appendix 9B of the original GSP lists the potential projects that were considered for the Valley-wide integrated management program in the original GSP.

The SVBGSA assessed potential projects listed in Appendix 9B of the original GSP for cost effectiveness in achieving sustainability throughout the Basin. It selected 13 projects for further consideration based on the projects being the most reliable, implementable, cost-effective, and acceptable to stakeholders. These 13 projects were separated into priority projects and alternative projects. The priority projects are generally the most cost effective. Alternative projects may be implemented in the Basin based on further analysis of the effectiveness of the priority projects, water availability, and refined cost estimates. Not all projects and management actions need to be implemented.

9.2.1.2 GSP Update

Developing projects and management actions for this GSP Update involved building on, updating, and adding to the projects and management actions developed for the entire Salinas Valley as part of the 180/400-Foot Aquifer Subbasin GSP. The process for developing projects for this GSP Update included receiving stakeholder input through the Subbasin Implementation Committee at 3 points: based on discussion of the main changes prior to revising the chapter, upon receiving the chapter, and after public comment on the chapter was received. The iterative process enabled the Committee to consider the public comments before finalizing the chapter. In addition, the Advisory Committee and Board received and commented on the chapter.

This GSP Update makes the following main updates: accounting for actions taken since GSP submittal, updating descriptions based on further refinement and needed clarifications, separating demand planning from funding, and including Implementation Actions. In addition, projects that occur and primarily benefit areas outside the Subbasin are separated into Section 9.6. This includes projects included in the original 180/400-Foot Aquifer Subbasin GSP and new projects added through the development of GSPs in adjacent subbasins. Updated scoping that occurred during the development of 2022 GSPs is incorporated into this GSP Update. These changes were brought to Subbasin Implementation Committee for review and input.

9.2.2 Estimation of Project Benefits

GSP regulations require an explanation of the benefits that are expected to be realized from the project or management action. The SVOM was not available during the development of the original GSP but was for the GSP Update. This has resulted in a mix of methods used to estimate project benefits:

- Direct project benefits. For projects that provide an alternative water supply to be used in lieu of groundwater extraction, it is a direct project benefit of reduced extraction based on the amount of water supplied.
- North Salinas Valley (NSV) Groundwater Model. Since the SVOM was not available during the development of the original GSP, a more simplified numerical groundwater flow model was developed for project estimation of benefits. The NSV used MODFLOW 2000 model code (Harbaugh et al, 2000), a public domain finite-difference model code developed by the USGS. See Appendix 9D of the original GSP for details on this modeling.
- SVOM. Draft versions of the SVOM were available for use by SVBGSA to develop the 2022 GSPs. Some project benefits have been updated using the SVOM, particularly for projects where project scoping progressed. See Appendix 6A for a description of the SVOM.
- Monterey Subbasin Groundwater Flow Model (MBGWFM). MCWD GSA developed the MBGWFM to model projects and management actions in the Monterey Subbasin. Results from modeling done for the Monterey Subbasin are included here. See Monterey Subbasin GSP for a description of the modeling.
- Modeling was not used to estimate project benefits when the benefits are not able to be quantified, such as the extraction barrier that has the purpose of preventing advancement of seawater intrusion, or the project or management action has variable results based on the level of effort, such as fallowing and agricultural land retirement.

9.2.3 Cost Assumptions Used in Developing Projects

Assumptions and issues for each project need to be carefully reviewed and revised during the pre-design phase of each project. Project designs, and therefore costs, could change considerably as more information is gathered.

The cost estimates included for each SVBGSA project are order-of-magnitude estimates. These estimates were made with little to no detailed engineering data. The expected accuracy range for such an estimate is within plus 50% or minus 30%. The cost estimates are based on perceptions of current conditions at the project location and reflect professional opinions of costs at this time and are subject to change as project designs mature.

For infrastructure projects, capital costs include major infrastructure components such as pipelines, pump stations, customer connections, turnouts, injection wells, recharge basins, and storage tanks. Capital costs also include 30% contingency for plumbing appurtenances, 15%

increase for general conditions, 15% for contractor overhead and profit, and 9.25% for sales tax. Engineering, legal, administrative, and project contingencies were assumed as 30% of the total construction cost and included within the capital cost. For capital projects, land acquisition at $45,000/acre was also included within capital costs.

Annual operations and maintenance (O&M) fees include the costs to operate and maintain new project infrastructure. O&M costs also include any pumping costs associated with new infrastructure. O&M costs do not include O&M or pumping costs associated with existing infrastructure, such as existing Salinas Valley Reclamation Plant (SVRP, or Reclamation Plant) costs, because these are assumed to be part of water purchase costs. Water purchase costs are assumed to include repayment of loans for existing infrastructure; however, these purchase costs will need to be negotiated. The terms of such a negotiation could vary widely.

Capital costs were annualized over 25 years and added with annual O&M costs and water purchase costs to determine an annualized dollar per acre-foot ($/AF) cost for each project.

Costs that were estimated for the original GSP and were not otherwise updated in this GSP Update are escalated by 20% to account for inflation since 2019. Cost estimates for projects within this GSP Update are included in Appendix 9A.

9.3 Overview of Projects and Management Actions

This GSP is part of an integrated plan for managing groundwater in all 6 subbasins of the Salinas Valley that are managed by the SVBGSA. This GSP focuses on the projects that directly help the 180/400-Foot Aquifer Subbasin reach its sustainability goals, but also includes multi-subbasin projects outside the Subbasin that may benefit the Subbasin and reduce the need for additional projects and management actions.

Following are the major types of projects that can be developed to supplement the 180/400-Foot Aquifer Subbasin's groundwater supplies:

- Demand planning
- In-lieu recharge through direct delivery of water to replace groundwater pumping
- Direct recharge through recharge basins or injection/dry wells
- Indirect recharge through decreased ET
- Seawater intrusion pumping barrier

The projects and management actions for this GSP are listed in Table 9-1.

Table 9-1. Projects and Management Actions

Project/ Management Action #	Name	Description	Project Benefits	Quantification of Project Benefits	Cost
A – MANAGEMENT ACTIONS					
MA1	Demand Planning	Proactively determines how extraction should be controlled and planned for	Decreases extraction if needed	Range of potential project benefits	Approximately $400,000 for establishment of pumping allocations and pumping controls
MA2	Fallowing, Fallow Bank, and Agricultural Land Retirement	Includes voluntary fallowing, a fallow bank whereby anybody fallowing land could draw against the bank to offset lost profit from fallowing, and retirement of agricultural land	Decreased groundwater extraction for irrigated agriculture	Dependent on program participation	$650-$1,900/AF if land is fallowed $1,250-$3,100/AF if land is retired
MA3	Conservation and Agricultural BMPs	Promote agricultural best management practices and support use of ET data as an irrigation management tool for growers	Better tools assist growers to use water more efficiently; decreased groundwater extraction	Dependent on specific BMPs implemented	Approximately $100,000 for 4 workshops, grant writing, and demonstration trials. Cost could be reduced if shared between subbasins.
MA4	Reservoir Reoperation	Collaborate with MCWRA to evaluate potential reoperation scenarios, which could be paired with projects such as the Interlake Tunnel, seasonal reservoir releases with aquifer storage and recovery (ASR), or other potential projects	More regular annual reservoir releases, including dry years, which could provide water for seasonal storage through ASR in the northern Salinas Valley	Unable to quantify benefits until feasibility study is completed	Multi-subbasin: Approximately $400,000 - $500,000
MA5	Undertake and Operationalize Guidance from Deep Aquifers Study	Complete study of the Deep Aquifers to enable better management of groundwater and seawater intrusion and operationalize guidance	Increase understanding of Deep Aquifers; protect Deep Aquifers from seawater intrusion and groundwater level decline	Unable to quantify until Deep Aquifers Study completed	Multi-subbasin: $850,000 for Study; cost for operationalizing depends on outcomes of Study

Project/ Management Action #	Name	Description	Project Benefits	Quantification of Project Benefits	Cost
MA6	MCWRA Drought Reoperation	Support the existing Drought Technical Advisory Committee (D-TAC) when it develops plans for how to manage reservoir releases during drought	Multi-subbasin benefits: more regular seasonal reservoir releases; drought resilience	Unable to quantify benefits since drought operations have yet to be triggered	Minimal SVBGSA staffing costs for participation. No additional MCWRA costs since already formed
P – PROJECTS					
P1	Multi-benefit Stream Channel improvements	Prune native vegetation and remove non-native vegetation, manage sediment, and enhance floodplains for recharge. Includes 3 components: Stream Maintenance Program Invasive Species Eradication Floodplain Enhancement and Recharge	Groundwater recharge, flood risk reduction, returns streams to a natural state of dynamic equilibrium	Component 1: Multi-subbasin benefits not quantified Component 2: Multi-subbasin benefit of 2,790 to 20,880 AF/yr of increased recharge Component 3: Multi-subbasin benefit of 1,000 AF/yr from 10 recharge basins	Component 1 Multi-subbasin Cost: $150,000 for annual administration and $95,000 for occasional certification; $780,000 for the first year of treatment on 650 acres, and $455,000 for annual retreatment of all acres Component 2 Multi-subbasin Average Cost: $16,500,000 Unit Cost: $60 to $600/AF Component 3 Multi-subbasin Cost: $11,160,000 Unit Cost: $930/AF
P2	CSIP System Optimization	Infrastructure and program implementation improvements to better accommodate diurnal and seasonal fluctuation in irrigation demand in the CSIP system, maximize use of recycled and Salinas River water, and further reduce groundwater extraction	Decreased groundwater extraction	Benefit of up to 5,000 AF/yr of recycled and river water provided for irrigation in-lieu of groundwater extraction.	Capital cost $24,300,000. Unit cost: $430/AF/yr
P3	Modify M1W Recycled Water Plant	Infrastructure upgrades to prevent the winter maintenance shutdown and allow delivery of tertiary treated wastewater to CSIP instead of groundwater when water demand is low	Decreased groundwater extraction	Up to 800 AF/yr of recycled water provided for irrigation in-lieu of groundwater extraction.	Capital Cost: $8,967,000, and Unit Cost: $890/AF.

Project/ Management Action #	Name	Description	Project Benefits	Quantification of Project Benefits	Cost
P – PROJECTS					
P4	CSIP Expansion	Expand service area of CSIP to provide a combination of Salinas River water, recycled water, and, when needed, groundwater in lieu of groundwater extraction	Decreased groundwater extraction	Multi-subbasin benefit for 3,500-acre expansion: up to 7,000 AF/yr of recycled and river water provided for irrigation in-lieu of groundwater extraction	Multi-subbasin Capital Cost for 3,500-acre expansion: $88,039,000 Unit Cost: $1,070/AF.
P5	Seawater Intrusion Extraction Barrier	Install a series of wells in the 180-Foot and 400-Foot Aquifers to extract groundwater and form a hydraulic barrier that prevents seawater intrusion from advancing inland of the wells	Prevention of seawater intrusion inland of wells, provision of brackish water that could be desalted for an additional water supply	Prevention of seawater intrusion unable to be quantified; an estimated 30,000 AF/yr extracted for potential desalting	Capital Cost: $122,866,000; Unit Cost for 30,000 AF/yr extracted: $710/AF
P6	Regional Municipal Supply Project	Build a regional brackish treatment plant that will treat water extracted from seawater intrusion barrier and supply drinking water to municipalities in the Eastside Subbasin and other subbasins	Less groundwater pumping, reduced risk of seawater intrusion	Multi-subbasin benefit: 15,000 AF/yr of imported desalinated water reduces groundwater extraction. Portion of this benefiting the 180/400 Subbasin has yet to be determined.	Multi-subbasin Capital Cost: $375-$394 million Unit Cost: $2,830-$2,950/AF
P7	Seasonal Release with ASR	Release flows from reservoirs during the winter/spring, for groundwater recharge and then diversion at the SRDF. Diverted water will be treated and then injected into the 180-Foot and 400-Foot Aquifers for seasonal storage, and then extracted for delivery to CSIP during the peak irrigation season and/or delivered for direct municipal use.	Seasonal storage of winter/spring flows in the northern Salinas Valley; reduced coastal pumping during peak irrigation season	14,600 AF/yr injected; 6,800 AF/yr of additional groundwater storage in the 180/400-Foot Aquifer Subbasin	Multi-subbasin Capital Cost: $166,954,000 Unit Cost for 14,600 AF/yr injected: $2,560/AF
P8	Irrigation Water Supply Project (or Somavia Road Project)	Extract groundwater during the peak irrigation season to induce greater groundwater recharge and storage during the winter/spring	Less groundwater pumping in area where extracted water is delivered	3,000 AF/yr of extracted water for in lieu use or recharge	Capital Cost: $5,925,000 Unit Cost: $440/AF for extraction wells (not including distribution costs)

Project/ Management Action #	Name	Description	Project Benefits	Quantification of Project Benefits	Cost
CROSS-BOUNDARY PROJECTS *(projects outside the Subbasin that will likely have indirect benefits for the 180/400 Subbasin that may reduce the need for other projects and management actions)*					
R1	Eastside Floodplain Enhancement and Recharge	Restore creeks and floodplains to slow the flow of water	More infiltration, less erosion, less flooding	2,300 AF/yr of water available for recharge in Eastside Subbasin. 1,000 AF/yr increase in storage in Eastside Subbasin. 200 AF/yr increase in storage in the 180/400-Foot Aquifer Subbasin	Capital Cost: $12,596,000 Unit Cost: $1,050/AF
R2	11043 Diversion at Chualar	Build a new facility near Chualar that would be allowed to divert water from the Salinas River when streamflow is high	Less groundwater pumping, moderately less seawater intrusion in other subbasins	Multi-subbasin: Annual average of 6,000 AF/yr of excess streamflow for in lieu use or recharge, resulting in approximately 4,600 AF/yr increase in storage, mainly in the Eastside.	Capital Cost: $55,684,000 Unit Cost: $1,280/AF
R3	11043 Diversion at Soledad	Build a new facility near Soledad that would be allowed to divert water from the Salinas River when streamflow is high	Less groundwater pumping, slightly less seawater intrusion in other subbasins	Multi-subbasin: Annual average of 6,000 AF/yr of excess streamflow is diverted for in lieu use or recharge, resulting in approximately 4,600 AF/yr increase in storage, mainly in the Eastside.	Capital Cost: $104,688,000 Unit Cost: $2,110/AF
M1	MCWD Demand Management Measures	Provides in-lieu recharge through reducing groundwater demands.	Reduced pumping in the principal aquifers resulting in an in-lieu recharge benefit; slightly less seawater intrusion.	Equivalent to a 2,500 AF/yr in-lieu recharge benefit at the current population for MCWD service area.	$350,000 to $450,000 annually

Project/ Management Action #	Name	Description	Project Benefits	Quantification of Project Benefits	Cost
CROSS-BOUNDARY PROJECTS *(projects outside the Subbasin that will likely have indirect benefits for the 180/400 Subbasin that may reduce the need for other projects and management actions)*					
M2	Stormwater Recharge Management	Existing policies will facilitate and result in additional stormwater catchment and infiltration over time as redevelopment occurs	Groundwater recharge, urban flood risk reduction	Under the existing urban development footprint approximately 550 AF/yr of stormwater is generated and infiltrated west of Highway 1 in Marina. Groundwater modeling indicates that stormwater recharge catchment and recharge will increase to 1,100 AF/yr on average as further projected development occurs which will increase net subbasin infiltration rates by 200 AF/yr to 500 AF/yr in the Monterey Subbasin.	No additional cost to implement
M3	Indirect Potable Reuse	Direct non-potable irrigation use and/or injection of advanced treated water from Monterey One Water (M1W) and extraction using existing MCWD wells or new production wells.	Reduced pumping in the principal aquifers resulting in an in-lieu recharge benefit; slightly less seawater intrusion.	Approximately 2,200 AF/yr to 5,500 AF/yr advance treated recycled water available to MCWD based on current and projected wastewater flows.	Investments have already been made to deliver 1,427 AF/yr for landscape irrigation. Unit cost: $2,400/AF Approximately 2,400 AF/yr recharge through IPR: Capital cost: $65 million Unit cost: $3,300/AF Costs per AF would likely decrease at higher production capacities due to economies of scale.

Project/ Management Action #	Name	Description	Project Benefits	Quantification of Project Benefits	Cost
CROSS-BOUNDARY PROJECTS *(projects outside the Subbasin that will likely have indirect benefits for the 180/400 Subbasin that may reduce the need for other projects and management actions)*					
C1	Corral de Tierra Pumping Allocation and Control	Proactively determine how extraction should be fairly divided and controlled in the Corral de Tierra Management Area	Decreased extraction; range of potential benefits, which may include increased flows to the 180/400-Foot Subbasin	Variable based on pumping controls	$500,000 for establishment of pumping allocations and controls
G - IMPLEMENTATION ACTIONS					
I1	Well Registration	Register all production wells, including domestic wells	Better informed decisions, more management options	N/A – Implementation Action	Not estimated at this time
I2	Groundwater Extraction Management System (GEMS) Expansion and Enhancement	Update current GEMS program by collecting groundwater extraction data from wells in areas not currently covered by GEMS and improving data collection	Better informed decisions	N/A – Implementation Action	Not estimated at this time
I3	Dry Well Notification System	Develop a system for well owners to notify the GSA if their wells go dry. Refer those owners to resources to assess and improve their water supplies. Form a working group if concerning patterns emerge.	Support affected well owners with analysis of groundwater elevation decline	N/A – Implementation Action	Not estimated at this time
I4	Water Quality Coordination Group	Form a working group for agencies and organizations to collaborate on addressing water quality concerns	Improve water quality	N/A – Implementation Action	Not estimated at this time
I5	Land Use Jurisdiction Coordination Program	Review land use plans and efforts to coordinate with land use planning agencies to assess activities that potentially create risks to groundwater quality or quantity.	Better aligned land use and water use planning	N/A – Implementation Action	Not estimated at this time

9.4 Management Actions

Management actions are new or revised non-structural programs or policies that are intended to reduce or optimize local groundwater use. Management actions are not listed in priority order. Prioritization will occur during GSP implementation as an ongoing, adaptive process.

9.4.1. MA 1: Demand Planning

Demand planning is one approach to managing and controlling pumping. It provides a management action to proactively determine how extraction should be regulated and controlled, if needed. The original GSP proposed a Water Charges Framework for the Salinas Valley, as a structure to manage groundwater extraction through promoting voluntary pumping reductions and charging fees for various levels of pumping. As with the GSPs for the other Salinas Valley subbasins, this GSP Update focuses on the appropriate projects and management actions for this specific subbasin. Further, a Water Charges Framework is not the only type of demand planning. Demand Planning widens the management action to other types of demand planning and separates demand planning from the funding mechanism, so as to not preclude options. Demand planning includes, but is not limited to, pumping allocations, pumping controls, and pumping reductions.

For example, pumping allocations divide up the sustainable yield among beneficial users. Pumping allocations are not water rights and cannot determine water rights. Instead, they are a way to determine each extractor's pro-rata share of groundwater extraction and regulate groundwater extraction. They can be used to:

- Underpin management actions that manage pumping
- Generate funding for projects and management actions
- Incentivize water conservation and/or recharge projects

Pumping allocations can take many forms if it is needed now or in the future. Allocations can be developed based on various criteria, such as acreage, land use, historical pumping, or number of connections. Often allocation structures are based on a hybrid of multiple criteria.

Once the allocation structure is established, pumping controls could be put in place immediately or there could be a trigger after which they will be put in place, such as pumping beyond the sustainable yield. Designing a feasible and effective allocation structure requires good groundwater extraction data. Two implementation actions that can help provide data are Well Registration (Implementation Action G1) and GEMS Expansion and Enhancement (Implementation Action G2).

Pumping controls or reductions can be implemented based on an allocation structure; however, there are other options for managing pumping. For example, pumping reductions could be implemented as a percentage reduction from prior years. Demand planning also encompasses planning for future demand that may occur from change in land use, such as bringing land into irrigated production or new housing developments.

Including demand planning in the GSP shows that there are options that can be developed, but it will not establish pumping allocations nor pumping controls. A full stakeholder engagement process and in-depth analysis needs to be undertaken to assess demand planning options and implement actions. Stakeholder engagement will include outreach to water systems, homeowners, and landowners so that those interested can participate in the development of demand planning.

Demand planning can be used as the basis for pumping fees, which can raise funds for projects and management actions. For example, a fee structure could be defined such that each extractor has a pumping allowance that is based on their allocation, and a penalty or disincentive fee is charged for extraction over that amount. If the sustainable yield is lower than current extraction, a transitional pumping allowance could be developed to transition from a groundwater user's actual historical pumping amounts (estimated or measured) to their allowance based on the sustainable yield. The purpose of this transitional allowance is to ensure that no pumper is required to immediately reduce their pumping, but rather pumpers have an opportunity to reduce their pumping over a set period. Transitional pumping allowances could then be phased out until total pumping allowances in each subbasin are less than or equal to the calculated sustainable yield.

Demand planning may be concentrated on specific geographic areas. For example, a number of the projects included in Section 9.5 are designed to ensure a reliable, year-round supply of water to growers in the CSIP area. These projects will remove any need for groundwater pumping in the CSIP area. To promote use of CSIP water, an ordinance could be adopted preventing any pumping for irrigating agricultural lands served by CSIP. To ensure adequate water supplies for CSIP, the CSIP supplemental wells could be exempt from the restrictions in this ordinance.

9.4.1.1 Relevant Measurable Objectives

The measurable objectives benefiting from demand planning include:

- **Groundwater elevation measurable objective.** This measurable objective will benefit from pumping allocations and controls that promote less pumping that will result in higher groundwater levels.
- **Groundwater storage measurable objective.** This measurable objective is based on the amount of groundwater in storage when groundwater elevations are held at their measurable objective. Therefore, pumping allocations and controls that reduce pumping

contribute to increasing groundwater elevations. In turn, groundwater in storage will also increase and will help achieve long-term sustainable yield.

- **Land subsidence measurable objective.** This measurable objective will benefit from pumping allocations and controls that reduce the pumping stress on the local aquifer and thereby reduce any potential for subsidence.
- **Seawater intrusion measurable objective.** Conserving groundwater will support the natural hydraulic gradient that pushes back against the intruding seawater.

9.4.1.2 Expected Benefits and Evaluation of Benefits

The primary benefits expected for this management action is that it is another demand-side management tool and will help bring extraction in line with the sustainable yield and raise groundwater elevations. Working within a groundwater budget will help the Subbasin to meet its sustainable yield volume.

Benefits will be measured using the monitoring networks described in Chapter 7. Groundwater elevations will be measured with a network of wells that is monitored by MCWRA. Groundwater storage will be monitored using groundwater extraction measurements and estimates. Land subsidence will be measured using InSAR data provided by DWR. Seawater intrusion will be measured using select RMS wells.

9.4.1.3 Circumstances for Implementation

SVBGSA will work with the Subbasin stakeholders to collect data needed to establish demand planning and undertake stakeholder outreach during the development of actions. As part of this, SVBGSA will determine whether to implement pumping controls immediately or to establish a trigger based on groundwater conditions, after which controls are implemented.

9.4.1.4 Permitting and Regulatory Process

The GSA Board of Directors will need to authorize the establishment of demand planning. The development and implementation of pumping controls is a regulatory activity and would be embodied in a GSA regulation. The regulation could be established to provide for automatic implementation upon existence of specific criteria or to require the vote of the Board of Directors to implement.

9.4.1.5 Implementation Schedule

If selected, the proposed implementation schedule is shown in Figure 9-1. After demand planning is initiated for the 180/400-Foot Aquifer Subbasin, pumping controls will be implemented only when needed.

Task Description	Year 1	Year 2	Year 3	Year 4	Years 5+
Phase I – Data collection and stakeholder outreach					
Phase II – Establishment of allocation structure					
Phase III – Pumping controls, when needed					

Figure 9-1. Implementation Schedule for Pumping Management

9.4.1.6 Legal Authority

California Water Code §10726.4 (a) (2) provides GSAs the authority to control groundwater extractions by regulating, limiting, or suspending extractions from individual groundwater wells or extractions from groundwater wells in the aggregate. Imposition of pumping allocations and controls will require a supermajority plus vote of the SVBGSA Board of Directors.

9.4.1.7 Estimated Cost

Development of a structure and plan for demand planning is approximately $400,000. This includes outreach meetings to engage stakeholders, analysis of potential options, facilitation of stakeholder dialogues, refinement according to specific situations, and legal analysis. If pumping controls are enacted, there will be additional administrative costs associated with implementation.

9.4.1.8 Public Noticing

As part of the approval of demand planning in the 180/400-Foot Aquifer Subbasin, it will go through a public notice process to ensure that all groundwater users and other stakeholders have ample opportunity to comment on it. The general steps in the public notice process will include the following:

- GSA staff will bring an assessment of the need for allocations to the SVBGSA Board in a publicly noticed meeting. This assessment will include:
    - A description of the undesirable result(s) that may occur if action is not taken
    - A description of the proposed management action
    - An estimated cost and schedule for the proposed management action
    - Any alternatives to the proposed management action
- The SVBGSA Board will notify stakeholders in the area of the proposed project/management action and allow at least 30 days for public response.
- After the 30-day public response period, the SVBGSA Board will vote whether or not to approve the implementation of the management action and notify the public if approved via an announcement on the SVBGSA website and mailing lists.

Imposition of pumping allocations and controls may also require a CEQA review process and may require an EIR or a Mitigated Negative Declaration (the review could also result in a Negative Declaration or Notice of Exemption). All projects will follow the public noticing requirements per CEQA or NEPA.

9.4.2 MA 2: Fallowing, Fallow Bank, and Agricultural Land Retirement

This management action is a revised version of the Agricultural Land and Pumping Allowance Retirement Management Action in the original GSP, and is revised such that it could be undertaken with or without pumping allocations.

To reduce groundwater extraction temporarily or permanently, this management action includes 3 actions that could be implemented on an as-needed basis to reduce irrigated land. These actions provide options for voluntary fallowing and land retirement that can be targeted to specific locations that have declining groundwater elevations or recharge potential, such as floodplains. Water quality and access to drinking water wells will also be considered when deciding where to incentivize fallowing or land retirement. The following could be included under an overarching program, even if implemented independently:

- **Rotational fallowing.** Participating growers fallow some percentage of land or fallow on a rotating basis. This could be modified to include partial fallowing, such as growing fewer crops per year instead of completely fallowing land.
- **Fallow bank.** Growers could contribute to a fallow bank whereby anybody fallowing land could draw against the bank to offset the lost income from fallowing. This could be combined with other fallowing plans. The specific design of a fallow bank will be developed during GSP implementation, including options such as exempting growers from rotational fallowing if they contribute a certain amount of money to the fallow bank.
- **Agricultural land retirement.** SVBGSA could develop a system for voluntary agricultural land retirement or pay to retire agricultural land, effectively reducing the amount of groundwater used in the Subbasin. Payment would likely be limited without pumping allocations. The benefit from this program depends on identifying willing participants.

This management action could work together with pumping allocations. If stakeholders develop pumping allocations into a water market, payments could be developed as a part of the market.

9.4.2.1 Relevant Measurable Objectives

The measurable objectives benefiting from fallowing or land retirement include:

- **Groundwater levels measurable objective.** Depending on the location of fallowing or land retirement, this measurable objective will benefit from decreased pumping that will result in higher groundwater levels.
- **Groundwater storage measurable objective.** Depending on the location of fallowing or land retirement, reducing pumping from the principal aquifers will ultimately have the effect of increasing groundwater in storage.
- **Land subsidence measurable objective.** Depending on the location of fallowing or land retirement, this measurable objective will benefit from fallowing or land retirement that reduce the pumping stress on the local aquifers and thereby reduce any potential for subsidence.
- **Seawater intrusion measurable objective.** Conserving groundwater will support the natural hydraulic gradient that pushes back against the intruding seawater.

9.4.2.2 Expected Benefits and Evaluation of Benefits

The primary benefits expected for this management action is reduced Subbasin pumping. This management action is costed for saving 1,000 AF/yr; however, it could be scaled to any size. The less water that is extracted from the principal aquifer, the more water is in storage. Depending on the location of fallowing and land retirement, benefits may include halting the decline of or raising groundwater elevations, combatting seawater intrusion, and avoiding subsidence in specific areas. Because it is unknown how many landowners will willingly enter the land retirement program, it is difficult to quantify the expected benefits at this time.

Benefits will be measured using the monitoring networks described in Chapter 7. Groundwater elevations will be measured with a network of wells that is monitored by MCWRA. A direct correlation between agricultural land retirement and changes in groundwater elevations is likely not possible because this is only one among many management actions and projects that may be implemented in the Subbasin. Groundwater storage will be monitored using groundwater pumping measurements and estimates. Land subsidence will be measured using InSAR data provided by DWR. Seawater intrusion will be measured using select RMS wells.

9.4.2.3 Circumstances for Implementation

Agricultural land retirement relies on willing participants, be it for participation or land sale. No other triggers are necessary or required. The circumstance for implementation is for SVBGSA to identify the need for the management action and identify willing participants and secure their participation.

9.4.2.4 Permitting and Regulatory Process

While no permitting or regulatory processes are necessary for buying land or securing agreements with landowners for fallowing or land retirement, the SVBGSA will secure and record as appropriate, the necessary agreements or deed restrictions to implement the management action.

9.4.2.5 Implementation Schedule

If selected, the process and GSA incentives for fallowing and/or land retirement will be developed over 2 years. The development of a fallow bank may take additional time. Although the program will be ongoing, it is reliant on willing participants and may be implemented intermittently or on an as-needed basis.

9.4.2.6 Legal Authority

California Water Code §10726.2 provides GSAs the authority to purchase, among other things, land, water rights, and privileges.

9.4.2.7 Estimated Cost

The cost for voluntary fallowing and land retirement depends on extent of fallowing and land retirement. These cost estimates are based on average rent and land value, and they do not capture the additional economic benefits associated with agriculture. The average cost of land and rent was derived from a source that had county-specific estimates. It is understandable that even within a county the cost of land acquisition is highly variable; however, this was the best available information on the average cost of land.

The costs of fallowing land sufficient to reach 1,000 AF/yr water conserved are shown in Table 9-2, which could be scaled to the amount desired. Fallowed land would be planted with cover crops to maintain soil quality. Vegetables are the most common crop type in the 180/400 Subbasin (MCWRA, 2021). Since vegetables in the 180/400 use 2.3 AF/acre/yr (MCWRA, 2021) and cover crops use only 0.3 AF/acre/yr. (RCDSCC, 2018), each acre of vegetables fallowed would save 2.0 AF/yr. Therefore, conserving 1,000 AF/yr would require fallowing about 500 acres of vegetables. The average rent between the low and high estimates is $2,250/acre/yr. (ASFMRA, 2020) and the cost to plant and maintain cover crops is $300/acre/yr. (Highland Economics, 2017), which would result in a unit cost of $1,275/AF water conserved when fallowing.

Table 9-2. Estimated Cost of Fallowing and Agricultural Land Retirement[1]

Annual Fallowing	Low Estimate	High Estimate	Description
Annual rent (cost/acre)	$1,000	$3,500	Rent for row crops in Monterey County (ASFMRA, 2020)
Annual cover crop cost per acre	$300	$300	Cost for cover crops in nearby Pajaro Valley (Highland Economics, 2017)
Annual rent plus annual cover crop cost per acre	$1,300	$3,800	
Acres fallowed annually to conserve 1,000 AF/yr	500 acres	500 acres	Based on vegetable water use in the 180/400 (MCWRA, 2021) and cover crop water usage (RCDSCC, 2018)
Annual cost to conserve 1,000 AF/yr through fallowing	$650,000	$1,900,000	
Unit cost/AF water conserved	$650	$1,900	
Agricultural Land Retirement	**Low Estimate**	**High Estimate**	**Description**
Land value per acre	$27,500	$75,000	Cost per acre row crops in Monterey County (ASFMRA, 2020)
Unit cost/AF water conserved	$1,250	$3,100	Using cover crop value as annual O&M, 6% interest, and annualized over 25 years

9.4.2.8 Public Noticing

All appropriate documentation for any agricultural land retirement achieved through a land sale, agreement or deed restriction will be recorded with the County of Monterey Assessor – Clerk – Recorder's Office. All agricultural land retirement by any means through the GSA will be recorded and publicly accessible.

9.4.3 MA 3: Conservation and Agricultural BMPs

This would be a program to incentivize and/or assist with conservation and agricultural BMPs to reduce groundwater pumping. It may also improve groundwater quality. SVBGSA acknowledges that BMPs are being developed as part of Ag Order 4.0 and will work to complement and not replicate those efforts. Potential practices that will be part of a program include:

- **ET Data.** ET data indicate crops' theoretical water needs as determined by crop type and weather conditions. Some ET data sets are 100% automated, relying on satellite imagery and weather stations to provide affordable data for large areas of land. Other ET data sets are generated automatically, but then subjected to expert verification, resulting in higher quality data at higher cost. The incorporation of ET data with soil moisture sensors, soil nutrient data, and flow meter data can help inform more efficient irrigation practices. The GSA could support the development and utilization of these tools through securing funding or coordinating with existing local agricultural extension specialists who conduct research and provide technical assistance to growers.

- **Education and Outreach.** SVBGSA will support existing local agricultural extension specialists with their education and outreach on BMPs that would increase water conservation and decrease pumping. Efforts will promote irrigation practices to reduce water use. Efforts could also include supporting practices to increase water retention such as compost application and use of cover crops. These BMPs could also support compliance with Ag Order regulations applicable to groundwater. Effective implementation of BMPs will require buy-in from growers. SVBGSA will work with local agricultural extension specialists and growers to understand preferred BMPs and those that could yield the greatest water savings. SVBGSA could partner with existing organizations or technical assistance providers to help growers identify which BMPs they could pursue and analyze the potential savings from their implementation. Technical workshops and professional referrals can be utilized with partners to accomplish outreach effectively and efficiently with growers.

9.4.3.1 Relevant Measurable Objectives

The measurable objectives benefiting from outreach and education include:

- **Groundwater levels measurable objective**. This measurable objective will benefit from BMPs that promote less pumping or greater recharge that result in higher groundwater levels.
- **Groundwater storage measurable objective**. Reducing pumping or adding water to the principal aquifer will ultimately have the effect of increasing groundwater in storage.
- **Land subsidence measurable objective.** This measurable objective will benefit from BMPs that reduce the pumping stress on the local aquifer and thereby reduce any potential for subsidence.
- **Seawater intrusion measurable objective.** depending on the location. Decreased water use near the coast will reduce the pumping stress that causes groundwater elevations to drop below the level that causes seawater intrusion.

9.4.3.2 Expected Benefits and Evaluation of Benefits

The primary benefit of implementing this management action is to provide the latest technologies and opportunities to modify agricultural practices that would allow farmers to reduce pumping needs but realize the same crop yields. This program could also be a mechanism for grant opportunities, funded through the SVBGSA to identify pilot programs and other innovative technological advancements that could provide an overall groundwater basin benefit.

Improving ET data allows for improved modeling and sets more accurate expectations for climate change impacts on crops. This in turn is translated into expected water demand for the crops. With more accurate data and information, pumpers can work with the SVBGSA to improve water extractions and potentially keep more water in the ground. This would result in protected groundwater elevations and storage. Furthermore, education and outreach activities can help inform farmers about cutting-edge technology that would help maximize irrigation efficiency. This would also improve groundwater elevations and storage. Benefits cannot be quantified until specific BMPs are identified and promoted.

Benefits will be measured using the monitoring networks described in Chapter 7. Groundwater elevations will be measured with a network of wells that is monitored by MCWRA. Land subsidence will be measured using InSAR data provided by the DWR.

9.4.3.3 Circumstances for Implementation

The circumstance for implementation is for willing farmers to participate in an education and outreach program and to work with the SVBGSA to identify opportunities. No other triggers are necessary or required.

9.4.3.4 Permitting and Regulatory Process

No permitting or regulatory processes are necessary for an education and outreach program.

9.4.3.5 Implementation Schedule

If selected, the option for an outreach and education program could begin immediately. This program will be ongoing.

9.4.3.6 Legal Authority

No legal authority is needed to promote outreach and education.

9.4.3.7 Estimated Cost

The Conservation and Agricultural BMP activities would be conducted as an ongoing program funded annually. This would cost approximately $100,000 to promote opportunities for education seminars, grant writing tasks, demonstration projects, and other activities focused on BMPs in the agricultural industry.

9.4.3.8 Public Noticing

The SVBGSA will endeavor to have the broadest possible public noticing of educational and outreach activities to inform stakeholders, interested parties, landowners, and agricultural interests of conservation and agricultural BMPs.

9.4.4 MA 4: Reservoir Reoperation

This management action is an updated version of the Reservoir Reoperation management action that was in the original GSP. It has been updated based on further stakeholder discussion during the development of SVBGSA 2022 GSPs.

This management action consists of SVBGSA collaborating with MCWRA and other interested parties to evaluate potential reoperation scenarios that promote the sustainability of the 180/400-Foot Aquifer Subbasin while also operating within the committed purposes of existing infrastructure, such as the Salinas Valley Water Project. Additionally, analysis of reservoir reoperation would take under consideration the other beneficial users dependent on reservoir flows, such as steelhead trout and users in other subbasins. This management action is reliant on a new source of dedicated funding. This management action is focused on reoperation of the Nacimiento and San Antonio Reservoirs that would prevent or reduce the curtailment of reservoir releases in consecutive years.

This management action includes a feasibility study by working with MCWRA on existing models or developing new ones to simulate reservoir operations and groundwater-surface water interactions along the Salinas River.

Details of this management action are dependent on the outcome and progress other activities, including the Habitat Conservation Plan (HCP) that is under development by MCWRA. It could be paired with potential capital projects that are within the sustainability horizon of the GSP. Both projects referenced below rely on infrastructure owned and operated by MCWRA and any analysis of the potential benefits from reservoir reoperation or implementation would require a cooperative effort between SVBGSA and MCWRA. These projects include:

- **ILT and Spillway Modification.** The proposed Interlake Tunnel project consists of design, permitting, construction, and maintenance of a tunnel that would divert water from Nacimiento Reservoir to San Antonio Reservoir. San Antonio and Nacimiento Reservoirs have storage capacities of 335,000 and 377,900 AF, respectively; however, the Nacimiento River watershed produces nearly 3 times the average annual flow of the San Antonio River watershed. Consequently, more available storage capacity must be maintained in Nacimiento Reservoir to prevent downstream flooding during storm events than must be maintained in San Antonio Reservoir. Initial modeling shows the proposed Interlake Tunnel project would divert 49,400 AF/yr of flood control water on average from Nacimiento Reservoir to San Antonio Reservoir, or 47,800 AF/yr with the spillway modification (MCWRA, 2020a). This would increase the total volume of water in storage by 39,000 AF/yr, or 54,300 AF/yr with the spillway modification. The reservoir operating rules for this modeling reflect the current Nacimiento Dam Operations Policy (MCWRA, 2018a), and therefore reflect changes due to the project as compared to current reservoir operations, not considering any potential reductions in reservoir capacity that may be required if deferred maintenance does not occur. This project is intended to primarily increase water available for conservation releases to the Salinas River between April and October. Any additional conservation releases would be diverted at the SRDF for irrigation within the CSIP area. Without the spillway modification, model results show the additional conservation releases would result in approximately 30,500 AF/yr of additional groundwater recharge from the Salinas River in the basin over the entire modeled hydrologic period. With the spillway modification, there would be approximately 32,000 AF/yr of additional groundwater recharge (MCWRA, 2020a).

- **Seasonal Release with ASR or Direct Delivery.** This project entails modifying reservoir releases for the MCWRA's Conservation Program and SRDF diversions to store at least a portion of these releases during alternate seasons in the 180-Foot and 400-Foot Aquifers. This seasonal storage would reduce or eliminate the need for Conservation Program dry season releases and initial modeling shows it would increase annual carryover in the reservoirs, allowing for more consistent alternate seasonal releases. This alternate season release water would be diverted at the SRDF, treated, and recharged through ASR injection wells into an unimpaired part of the aquifer in the winter/spring and later extracted during peak irrigation season demands for use through the CSIP system. ASR is a critical component of this project because it enables summer releases for CSIP to be shifted to winter/spring releases; however, a benefits assessment will be done to assess differing levels of special benefits. As an alternative to direct injection for groundwater recharge, seasonal reservoir releases could be used for direct delivery for municipal supply within the Basin. Under direct delivery use, this water would act as in-lieu recharge by reducing the need for pumping from municipal wells, resulting in less groundwater demand when water is directly delivered. This project would require additional infrastructure.

This GSP is primarily concerned with project benefits that maintain groundwater sustainability in the 180/400-Foot Aquifer Subbasin. However, ancillary benefits and relative costs must also be addressed and carefully evaluated. These projects will affect the entire Salinas Valley, and the analyses of these projects must consider the impact on all subbasins. This GSP includes reservoir reoperation as a management action to help maintain groundwater sustainability along the Salinas River, including some portion that augments groundwater in the 180/400-Foot Aquifer Subbasin. This management action will likely be subject to a new flow regime and reservoir operations resulting from the planned HCP, and subject to any biological opinion or incidental take permit issued by NMFS, or other regulations issued by applicable regulatory agencies. MCWRA is currently negotiating with NMFS to develop an HCP for the Salinas River. The HCP will establish flow prescriptions, and influence reservoir operations.

9.4.4.1 Relevant Measurable Objectives

Should reservoir reoperation move forward, the intended 180/400-Foot Aquifer Subbasin GSP measurable objectives benefiting include:

- **Groundwater levels measurable objective.** Releasing additional water from the reservoirs even during droughts should help allow for more surface water to percolate to groundwater, primarily in the Upper Valley and the Forebay Subbasins, and would recharge groundwater subbasins and raise groundwater elevations. Because reservoir reoperation focuses on preventing the curtailment of reservoir releases curing in consecutive years, the dry year supply of river water to the Subbasin will help alleviate lowering of groundwater levels
- **Groundwater storage measurable objective.** Increased groundwater recharge near the Salinas River will help improve groundwater storage. Increased dry year river supplies will help alleviate dry year overdraft.
- **Seawater intrusion measurable objective.** By allowing additional surface flows to reach the SRDF, more surface water may be used in the CSIP area, either directly or through ASR, which would result in reduced pumping and lower seawater intrusion potential.
- **Land subsidence measurable objective.** Increasing both groundwater elevations and groundwater storage will have the added benefit of preventing any potential land subsidence. Adding water in the subsurface will keep pore spaces saturated with positive pressure and inhibit land surface collapse associated with groundwater depletion.
- **ISW measurable objective.** Continuing to release some water from the reservoirs even during droughts should benefit ISW where the Salinas Valley Aquitard is not present by maintaining groundwater elevations at or above historical lows.

9.4.4.2 Expected Benefits and Evaluation of Benefits

Benefits that may arise from this management action would be the development of additional reservoir reoperation analysis. Wells in the vicinity of the Salinas River where there is no aquitard present may be projected to experience improved groundwater elevations. The effort may produce additional management alternatives to be applied during drought conditions.

Should reservoir reoperation move forward, intended expected benefits for the 180/400-Foot Aquifer include more consistent annual releases, including during dry years, which could provide water for seasonal storage through ASR in the northern Salinas Valley.

Benefits will be measured using the monitoring networks described in Chapter 7. Groundwater elevations and groundwater storage will be measured with a network of wells that is monitored by MCWRA. Land subsidence will be measured using InSAR data provided by the Department of Water Resources. When data gaps are filled, ISW will be measured through shallow groundwater wells and river flow.

9.4.4.3 Circumstances for Implementation

In order for this management action to move ahead MCWRA and SVBGSA would need to agree to coordinate on such an analysis and SVBGSA would lead the effort to source associated funding. Ultimately MCWRA would determine whether such an effort would be pursued under their role as owner and operator of the reservoirs.

9.4.4.4 Permitting and Regulatory Process

The initial phases of this management action include a feasibility study, which does not require permitting or meeting regulatory requirements. This will include an evaluation of the permitting and regulatory steps needed for potential reoperation.

Implementing the ultimate reoperation scenario will require coordination with permits from NMFS, the SWRCB, or other agencies that have authority over Salinas River flows.

9.4.4.5 Implementation Schedule

If selected, the feasibility study associated with this management action will be conducted within the first 5 years of the Forebay GSP implementation.

9.4.4.6 Legal Authority

No legal authority is required to undertake the feasibility study. MCWRA, SVBGSA, NMFS, and other project partners will participate in the study. Implementing the ultimate reoperation scenario will be under the authority of MCWRA. The SVBGSA does not have any authority over surface water management or reservoir operations.

9.4.4.7 Estimated Cost

This management action is estimated to cost approximately $400,000 - $500,000.

9.4.4.8 Public Noticing

The work associated with this effort would be under the purview of MCWRA. SVBGSA would utilize publicly noticed meetings of the SVBGSA Board of Directors, Advisory Committee, Integrated Implementation Committee, and Subbasin Committees to update the public on such analysis and outcomes from model efforts.

9.4.5 MA 5: Undertake and Operationalize Guidance from Deep Aquifers Study

The Deep Aquifers underlying portions of the Salinas Valley Basin are a critical groundwater resource that is highly valued but minimally understood. Over the decades, as seawater intrusion has advanced into the 180-Foot and 400-Foot Aquifers, agricultural landowners and drinking water providers have drilled wells deeper to access fresh water. The need for additional studies about the Deep Aquifers has been identified in the context of stopping seawater intrusion and effectively managing groundwater sustainability.

The 180/400-Foot Aquifer Subbasin GSP Section 9.3.6 Priority Management Action 5: Support and Strengthen Monterey County Restrictions on Additional Wells in the Deep Aquifers, calls for the SVBGSA to support the County reimposing a prohibition on drilling any new wells into the Deep Aquifers until more information is known about the Deep Aquifers' sustainable yield. The plan was to complete the study of the Deep Aquifers over the subsequent years when funding became available. While the prior prohibition is no longer in effect, the plan for the study of the Deep Aquifers has developed.

To address seawater intrusion, the SVBGSA created the Seawater Intrusion Working Group (SWIG). The SWIG membership comprises 9 agencies and municipalities and multiple stakeholders to develop consensus on the current understanding of seawater intrusion in the Subbasin and adjacent subbasins subject to seawater intrusion, identify data gaps, and develop a broad-based plan for controlling seawater intrusion. Working together with a Technical Advisory Committee (TAC), the SWIG identified key tasks that could be included in the Deep Aquifers Study. GSA staff began to meet with stakeholders and partner agencies to determine if there was a reasonable and equitable path forward for securing funding to initiate this study.

SVBGSA developed a Cooperative Funding Proposal for the Deep Aquifers Study. The Study focuses on describing the geology, hydrogeology, and extents of the Deep Aquifers; the Deep Aquifers water budgets; and addressing the economic and administrative Constraints on extracting from the Deep Aquifers. The Study will include guidance on management issues and also propose and initiate a Deep Aquifers Monitoring Program. The Study began in January 2022 and will take 2 years to complete. The GSAs will incorporate findings of the Deep Aquifers Study into future GSP updates to ensure that the study and the development of future regulations will promote groundwater sustainability of the Deep Aquifers as defined in this GSP.

This management action operationalizes guidance from the Deep Aquifers Study. The Study will provide interim and final guidance for management based on how recent and new data informs the Deep Aquifers' HCM and water budget, particularly with regards to recharge, risk of seawater intrusion, and ultimately sustainable management according to SGMA.

9.4.5.1 Relevant Measurable Objectives

The measurable objectives benefiting from the Deep Aquifers Study include:

- **Groundwater level measurable objectives**. The Study and its guidance for management will address declining groundwater levels, and if needed, will recommend actions be implemented that prevent significant and unreasonable groundwater elevations.
- **Groundwater storage measurable objective.** The Study and its guidance for management will address groundwater storage, and if needed, will recommend actions be implemented that prevent significant and unreasonable decline in storage.
- **Seawater intrusion measurable objective.** The Study and its guidance for management will address the potential for seawater intrusion in the Deep Aquifers, and if needed, will recommend actions be implemented to prevent seawater intrusion.
- **Land subsidence measurable objectives.** The Study and its guidance for management will address the potential for subsidence due to groundwater elevation declines in the Deep Aquifers, and if needed, will recommend actions be implemented to prevent subsidence.

9.4.5.2 Expected Benefits and Evaluation of Benefits

The primary benefit from undertaking the Deep Aquifers Study and the operationalization of the guidance for management is to achieve sustainability according to SGMA. This includes ensuring that there is not an undesirable result for groundwater levels, groundwater storage, seawater intrusion, and subsidence based on conditions in the Deep Aquifers. An ancillary benefit from shallower aquifers may include avoiding subsidence and reducing seawater intrusion.

Benefits will be measured using the monitoring networks described in Chapter 7. Groundwater elevations will be measured with a network of wells that is monitored by MCWRA. Groundwater storage will be monitored using groundwater elevations and seawater intrusion as proxies. Land subsidence will be measured using InSAR data provided by DWR. Seawater intrusion will be measured using select RMS wells.

9.4.5.3 Circumstances for Implementation

SVBGSA began the Deep Aquifers Study in January 2022, and it will take 2 years to complete.

9.4.5.4 Permitting and Regulatory Process

No permits are necessary to undertake Deep Aquifers Study. Any actions undertaken to implement guidance resulting from the Study will be developed in accordance with all applicable groundwater laws and respect all groundwater rights.

9.4.5.5 Implementation Schedule

SVBGSA began the Deep Aquifers Study in January 2022, and it will take 2 years to complete. SVBGSA will operationalize guidance from the Study immediately upon completion of the Study.

9.4.5.6 Legal Authority

California Water Code §10726.4 (a)(2) provides GSAs the authority to control groundwater extractions by regulating, limiting, or suspending extractions from individual groundwater wells or extractions from groundwater wells in the aggregate. No legal authority is needed to undertake the Study itself.

9.4.5.7 Estimated Cost

SVBGSA developed a funding agreement for the Deep Aquifers with various parties and stakeholders in the total amount of for $850,000. Additional funding to operationalize guidance from the Study will be estimated once the Study is complete.

9.4.5.8 Public Noticing

Public meetings have been and will continue to be held to inform groundwater pumpers and other stakeholders that the Deep Aquifers Study is being developed, and that it will provide guidance for management. Operationalization of management guidance will be developed in an open and transparent process. Groundwater pumpers and other stakeholders will have the opportunity at these meetings to provide input and comments on the process and the program elements.

9.4.6 MA 6: MCWRA Drought Reoperation

MCWRA formed a Drought Operations Technical Advisory Committee (D-TAC) to provide, when drought triggers occur, technical input and advice regarding the operations of Nacimiento and San Antonio Reservoirs. The D-TAC developed Standards and Guiding Principles to be used in the development of a proposed reservoir release schedule triggered under specific, seasonally defined conditions. This management action would result in decisions on reservoir operation and flow releases during a drought.

The proposed reservoir release operations schedule triggered under specific, seasonally defined conditions of drought will be developed based on the best available scientific knowledge, data, and understanding of the environmental biology, hydrology, and hydrogeology of the Salinas Valley; under the technical expertise of the members of the D-TAC. If adopted, the proposed reservoir release schedule will be implemented based on specific tools and templates made available to the D-TAC. These are discussed further in the Implementation Procedures. The proposed reservoir release schedule will acknowledge, address, and balance the water needs of various stakeholders for limited resources during a drought.

The D-TAC will use a MCWRA provided template when developing the release schedule. The specific actions will also be described in a narrative form to expound upon the actions taken for each month shown in the release schedule. Reservoir releases will be made under direction of the MCWRA Board of Directors or Board of Supervisors through the adoption of a reservoir release schedule or dry winter release priorities, to be executed by MCWRA staff. Appendix 9B outlines the D-TAC Standards, Guiding Principles, and Implementation Procedures. The recommendations of the D-TAC may change with the development and adoption of a Habitat Conservation Plan (HCP), but the D-TAC Standards, Guiding Principles, and Implementation procedures will remain in place unless modified by an HCP.

Summary Actions

The Standards and Guiding Principles Document and any recommended release schedule prepared by the D-TAC will first be received by the Reservoir Operations Advisory Committee. The Reservoir Operations Advisory Committee will meet to discuss recommended release schedules and will solicit information, data, and public comment regarding appropriate MCWRA operations during droughts. Following receipt of public input regarding any subsequent release schedule, the Reservoir Operations Advisory Committee will then prepare a written recommendation regarding reservoir operations which will be transmitted to the MCWRA Board of Directors for consideration and action. Any interested party that dissents from the Reservoir Operations Committee’s recommendation may submit separate written comments to the MCWRA Board of Directors. The MCWRA Board of Directors will determine, in accordance with applicable law, whether MCWRA will adopt a release schedule, provided the MCWRA General Manager may, in his sole discretion, refer the question of whether MCWRA should implement a recommended release schedule to the MCWRA Board of Supervisors for final determination. In the event the MCWRA General Manager elects not to refer the question of implementation of a recommended release schedule to the MCWRA Board of Supervisors, the decision of the MCWRA Board of Directors regarding such questions shall constitute final agency action for all purposes. The MCWRA Board of Directors (or MCWRA Board of Supervisors, if applicable) will retain full discretion and authority to accept or reject, in whole or in part, the written recommendations of the Reservoir Operations Advisory Committee.

9.4.6.1 Relevant Measurable Objectives

Relevant multi-subbasin measurable objectives benefiting from this project include:

- **Groundwater levels measurable objective.** Releasing additional water from the reservoirs even during droughts should help ensure annual groundwater recharge during multi-year droughts in the Salinas Valley Basin, which will help prevent lowering of groundwater elevations during droughts. This will translate to the 180/400-Foot Aquifer Subbasin groundwater levels over time both directly from river recharge and indirectly from subsurface inflow from upgradient groundwater.
- **Groundwater storage measurable objective.** Releasing additional water from the reservoirs even during droughts should help ensure annual groundwater recharge during multi-year droughts in the Salinas Valley Basin, which will increase the amount of groundwater in storage during droughts. An increase in groundwater storage for the whole Salinas Basin will translate down gradient to the 180/400-Foot Aquifer Subbasin, which is at the lowest point in the Valley.
- **Land subsidence measurable objective.** Increasing both groundwater elevations and groundwater storage will have the added benefit of helping prevent any potential land subsidence. Maintaining and adding water in the subsurface will keep pore spaces saturated with positive pressure and inhibit land surface collapse associated with groundwater depletion.
- **Seawater intrusion measurable objective.** Releasing more water from the reservoirs will enhance the groundwater elevations and storage necessary to support the natural hydraulic gradient that halts and pushes back against the intruding seawater. However, the trade-off may be that as conservation flows are held back, CSIP has to rely on groundwater extraction to a greater extent.

It is expected that there is some groundwater benefit to the 180/400-Foot Aquifer Subbasin. Further investigation is needed to determine the extent to which this project benefits the 180/400 measurable objectives.

9.4.6.2 Expected Benefits and Evaluation of Benefits

The D-TAC will help develop a release schedule aimed at mitigating negative effects from droughts, including from surface water flows and groundwater recharge. The proposed reservoir release schedule will be based on scientific data and will acknowledge, address, and balance the water needs of various stakeholders for limited resources during a drought. The proposed reservoir release schedule will maintain geographic equity, avoid adverse impacts to Valley-wide agricultural operations, and avoid, to the extent possible, consecutive years where only minimum releases are made from the reservoirs. Annual reservoir releases will help recharge the aquifers in the Salinas Basin, which will help prevent declines in groundwater elevations and storage during drought periods overall. Subsequently, although subsidence is not likely in this Subbasin, this will help reduce the risk of subsidence and prevent water quality degradation.

This GSP is unable to quantify the benefits at this time because the D-TAC decisions will be different each time it convenes. Drought conditions have not been triggered to cause the D-TAC to convene.

If and when D-TAC does convene, benefits will be measured using the monitoring networks described in Chapter 7. Groundwater elevations will be measured with a network of wells that is monitored by MCWRA. Groundwater storage will be monitored using groundwater elevations as proxies. Land subsidence will be measured using InSAR data provided by DWR. Seawater intrusion will be measured using select RMS wells.

9.4.6.3 Circumstances for Implementation

The D-TAC is already established. Its convening will occur when conditions trigger it on an annual basis.

9.4.6.4 Permitting and Regulatory Process

This management action follows the ongoing permitting and regulatory process used by MCWRA for reservoir operations.

9.4.6.5 Implementation Schedule

The D-TAC is already established. Its convening will occur when conditions trigger it on an annual basis.

Annually, the D-TAC will meet any time a “drought trigger” occurs to develop a recommended release schedule for Nacimiento and San Antonio Reservoirs. MCWRA presents the annual reservoir release schedule at the October meeting of the MCWRA Reservoir Operations Advisory Committee. If the December 1 forecasted combined reservoir storage volume is below 220,000 AF and the San Antonio Reservoir forecasted storage is below 82,000 AF, the D-TAC release schedule process will begin. MCWRA will schedule a D-TAC meeting to occur no earlier than February 15 and the D-TAC will meet as needed through March 31. The release schedule will be developed for April through December of the current year. If significant inflow occurs during this period, then modifications to the release schedule will be made through existing MCWRA protocols. The D-TAC will develop a recommended release schedule consistent with its Standards and Guiding Principles. The D-TAC’s Standards and Guiding Principles and any subsequent release schedule will be presented to the MCWRA Board of Directors and/or Board of Supervisors for consideration and decision.

9.4.6.6 Legal Authority

MCWRA, which owns and operates the reservoirs, is implementing the D-TAC. Since MCWRA is a member of the SVBGSA, it benefits 1 of the SVBGSA members. The SVBGSA will participate in and work in cooperation with MCWRA on the D-TAC. No additional legal authority is needed.

9.4.6.7 Estimated Cost

This management action is already underway. MCWRA is already funding costs associated with facilitation of the D-TAC. SVBGSA costs include staff participation in the D-TAC.

9.4.6.8 Public Noticing

As this management action is already underway, MCWRA has already completed initial public noticing. Public noticing will occur for the October Reservation Operations meeting that activates the D-TAC, and when the reservoir release schedule developed by the D-TAC goes to Reservation Operations and/or the Board of Directors for consideration.

9.5 Projects

9.5.1 P1: Multi-benefit Stream Channel Improvements

This project has been widened from the Invasive Species Eradication project in the original GSP to combine complementary and overlapping programs into one project. This project includes the invasive species eradication work that was in the original GSP, plus adds the Stream Maintenance Program and floodplain restoration for a more holistic project. Over the past half century, the Salinas River has been impacted by the construction of the San Antonio and Nacimiento Dams and flood control levees intended to move water away from agricultural fields. These activities have changed natural river geomorphology, resulting in sediment build up and vegetation encroachment on the historically dynamic channels of the Salinas River. This alteration of natural floodplains and geomorphology has increased flood risk, decreased direct groundwater recharge, and contributed to increased ET through vegetation build-up. Targeted, geomorphically informed stream maintenance and floodplain enhancement can improve stream function both morphologically and biologically.

This program takes a 3-pronged approach to stream channel improvements. First, it addresses vegetation growth and geomorphic conditions in the river channel by removing perennial native and non-native vegetation in designated maintenance channels (and removing *Arundo donax* (arundo) and *Tamarix sp.* (tamarisk) throughout the river corridor). Second, the program reduces the height of sediment bars that have been identified to meet criteria for impeding flow. Third, it enhances floodplains to increase groundwater recharge.

This 3-pronged approach increases flow by removing dense native and non-native vegetation, provides vegetation free channel bottom areas for infiltration, stabilizes stream banks and earthen levees by reducing downstream velocities, and reduces flood risk. This program's activities also benefit native species throughout the river ecosystem. By improving geomorphological function through vegetation and sediment removal activities, the coordinated efforts allow native species to reestablish in areas where invasive species have become dominant. River maintenance activities enhance groundwater recharge efforts through the streambed by providing additional open channel bed for infiltration, and floodplain enhancement can further recharge potential of high flows. Infiltration through the streambed accounts for a significant portion of the groundwater budget, and invasive species such as arundo, which can take up to 4 times as much water as native riparian species, thereby negatively impacting both river flows as well as infiltration in to the subsurface through the streambed (Cal-IPC, 2011).

Surface water flows, and notably flood flows, can be impacted by the density of vegetation and whether the vegetation is comprised of native or non-native species. Native riparian species allow for dynamic action that scours the riverbed and resorts sediment in a manner that encourages natural infiltration and conveyance of flood waters in the broader active flood terraces in the river. This wider use of the floodplain by flood waters slows velocities and distributes flood waters over a broader spatial area of the riverbed.

Stream channel vegetation removes water from the river through ET. Water loss through ET from invasive species such as arundo can take up between 3.1 and 23.2 AF/yr per acre, whereas ET from native vegetation can take up to 4 AF/yr per acre (Melton and Hang, 2021; Cal-IPC, 2011). This illustrates the difference in water consumption between vegetation types and how these water consumptions can have major impacts on water in the river (Cal-IPC, 2011). The Salinas River is characterized by a braided channel in some areas of the floodplain and a confined channel in other areas. Plants can take root in channel locations that adversely impact the flow of water, resulting in either a channelized river or in creating directional velocities that can cause localized damages including levee failure. Poorly functioning sedimentation can also negatively impact water flow in drought and flood conditions, as well as impeded proper infiltration to the subsurface. Geomorphological processes are important to managing a natural riverbed and floodplain to enhance recharge, groundwater levels, and groundwater storage.

This program is not meant to restore the Salinas River to historical conditions, but rather to enhance geomorphological function through targeted maintenance sites for flood risk reduction and floodplain enhancement for increased recharge. The MCWRA has developed a science-based approach to river management that recognizes the value of critical habitat, environmental resources, cost to landowners, and coordination among stakeholders (MCWRA, 2016). A key feature of this modified management approach is providing protection for critical habitats and water quality (MCWRA, 2016). One of the important functions of a river is to provide habitat for native species. In a poorly functioning river, invasive species have more opportunities to crowd out native species and in turn, further degrade the river conditions. Therefore, this program will result in flood risk reduction, increased recharge, and a multitude of benefits that address critical functions of the Salinas River.

This program includes 4 main types of tasks: vegetation maintenance, non-native vegetation removal, sediment management, and floodplain enhancement and recharge.

- **Vegetation Maintenance.** Vegetation, both native and non-native, will be removed within designated maintenance areas using a scraper, mower, bulldozer, excavator, truck, or similar equipment to remove the vegetation above the ground and finishing by ripping roots to further mobilize the channel bottom. Vegetation maintenance includes pruning up to 25 percent of canopy cover and removing dead mass. Maintenance activities will not include disturbance of emergent wetland vegetation that provides suitable habitat for threatened California red-legged frogs or for the endangered tidewater gobies. In instances where native vegetation needs to be removed for site-specific conditions or tie-ins, these impacts can be compensated with replanting and revegetation in other areas as a form of mitigation offset for stream channel maintenance. Native trees will be planted during the rainy season to enhance their rate of success.

- **Non-Native Vegetation Removal.** Non-native vegetation removal primarily focuses on the arundo present in the region but may include tamarisk shrubs as well. Arundo is a grass that was introduced to the Americas in the 1800s for construction material and for erosion control purposes (Cal-IPC, 2011). In 2011, the California Invasive Plant Council determined that the Salinas Watershed had the second largest invasion with approximately 1500 infested acres. While arundo thrives near water, such as wetlands and rivers, it grows in many habitats and soil types. It requires a substantial amount of water, previously estimated making it one of the thirstier plants in a given region and outpacing the water demands of native vegetation. To manage this invasive species, arundo biomass is typically sprayed, sometimes mowed or hand cut if needed, and then treated with multiple applications of herbicide over several years. Permits allow arundo removal in the entire riparian corridor, including along the low-flow channel.

- **Sediment Management.** Sediment management includes channel bed grading and sediment removal. Sediment grading and removal may occur exclusively, or after vegetation maintenance activities described above. Sediment removal and grading activities help reestablish proper gradients to allow for improved drainage downstream, encourage preferential flow into and through secondary channels, and minimize resistance to flow (until dunes form) (MCWRA, 2016). Sediment removal will follow best practices to protect native species while producing maximum benefit for flood reduction and groundwater recharge.

- **Floodplain Enhancement and Recharge.** Floodplain enhancement restores areas along the River, creeks, and floodplains to slow and sink high flows and encourage groundwater recharge in areas where the Salinas Valley Aquitard is not present. Restored floodplain and riparian habitat can slow down the velocity of the River and creeks and encourage greater infiltration. Due to agricultural and urban encroachment, streams have become more highly channelized, and flow has increased in velocity, particularly during storm events. This flow has resulted in greater erosion and loss of functional floodplains.

Program Components

This multi-benefit stream channel improvement program is implemented through various program components. These build off existing programs and permits to undertake the 4 main types of tasks. During GSP implementation, these components may be modified as needed to most efficiently accomplish the program goals.

Component 1: Stream Maintenance Program

The first component continues the Salinas River Stream Maintenance Program (SMP), which maintains the river corridor to reduce flood risk and minimize bank and levee erosion, while maintaining and improving ecological conditions for fish and wildlife consistent with other priorities for the Salinas River (MCWRA, 2016). It is a coordinated Stream Maintenance Program that includes MCWRA, the Resource Conservation District of Monterey County (RCDMC), and the Salinas River Management Unit Association representing approximately 50 landowner members along the river corridor. Project benefits include increased water availability, flood risk reduction, reduced velocities during high flows to lessen bank and levee erosion, and enhanced infiltration by managing vegetation and sediment throughout the river and its tributaries.

The SMP occurs along the area of the Salinas River in Monterey County. The 92-miles of the river in Monterey County is broken into 7 River Management Units from San Ardo in the south to Highway 1 in the north. The management activities are focused on the secondary channels of the Salinas River located outside of the primary low-flow channel and are preferentially aligned with low-lying undeveloped areas that are active during times of higher flow (MCWRA, 2016). The SMP includes 3 main activities as part of stream maintenance: vegetation maintenance, non-native vegetation removal, and sediment management.

Component 2: Invasive Species Eradication

The second Component supports and/or undertakes removal of arundo and tamarisk done by the RCDMC. RCDMC is the lead agency on an estimated 15 to 20-year effort to fully eradicate arundo from the Salinas River Watershed, working in a complementary manner with the SMP. This project focuses on removal of woody invasive species such as arundo, tamarisk (*Tamarix sp*.), and tree tobacco (*Nicotiana glauca*) along the Salinas River, as well as retreatments needed to keep it from coming back. It includes 3 distinct phases: initial treatment, re-treatment, and on-going monitoring and maintenance treatments. As of April 2021, estimated arundo under treatment was 850 acres. Original mapped acreage had expanded by 20%, leaving 900 arundo acres remaining to be treated. The initial treatment phase includes mechanical and/or chemical treatment in all areas of the river that have yet to be treated. The re-treatment phase includes re-treatment of the approximately 850 acres that have already had an initial treatment and re-treatment of the remaining 900 acres done in stages, with each area treated over a 3- to 5-year period following initial treatment. The final phase is the ongoing monitoring and maintenance treatment phase. This phase requires monitoring for regrowth of the invasive species or new invasive species and chemical treatment every 3 to 5 years.

Component 3: Floodplain Enhancement and Recharge

The third component complements the first 2 by restoring and enhancing floodplains to enable high flows to be slowed and directed toward areas where it can infiltrate into the ground. For this component, SVBGSA will partner with the Greater Monterey County RWMG, Central Coast Wetlands Group (CCWG), and other organizations that are already undertaking creek and floodplain restoration efforts and encourage inclusion of features that would enhance recharge.

Restored floodplain and riparian habitat along creeks can slow down the velocity of creeks and encourage greater infiltration. Due to agricultural and urban encroachment, streams have become more highly channelized, and flow has increased in velocity, particularly during storm events. This flow has resulted in greater erosion and loss of functional floodplains.

9.5.1.1 Relevant Measurable Objectives

Relevant measurable objectives benefiting from this project include:

- **Groundwater levels measurable objective.** Removing the invasive species, better managing streams, and directing high flows into restored floodplains will facilitate more water infiltrating and percolating into the subsurface to raise groundwater elevations where there is no Salinas Valley Aquitard present. This has the effect of adding water to the principal aquifers. Adding water to the principal aquifers will ultimately increase groundwater elevations or decrease their decline in the southern part of the Subbasin. Decreasing ET will also leave more of the water released from the Reservoirs in the River for use in CSIP, which may help reduce groundwater extraction in the coastal area.

- **Groundwater storage measurable objective.** Adding water to the principal aquifer will ultimately have the effect of increasing groundwater in storage. Decreasing extraction for CSIP will also increase groundwater in storage.

- **Land subsidence measurable objective.** Increasing both groundwater elevations and groundwater storage will have the added benefit of preventing any potential land subsidence. Maintaining and adding water in the subsurface will keep pore spaces saturated with positive pressure and inhibit land surface collapse associated with groundwater depletion.

- **ISW measurable objective.** By removing vegetation pathways for ET, less interconnected groundwater and less surface water will be depleted, leaving more water available in the river for flows as well as for connection to the principal aquifer in the southern part of the Subbasin.

9.5.1.2 Expected Benefits and Evaluation of Benefits

The groundwater-related expected benefits are increased groundwater elevations in the vicinity of the river channel due to increased infiltration and percolation to the principal aquifers, increased groundwater in storage, better water quality, decreased depletion of ISW, and protection against any potential land subsidence due to groundwater extractions. In addition, the project provides habitat restoration, increased connectivity for wildlife, and flood risk reduction.

Increased storage of flood waters can increase groundwater elevations in the vicinity of the Salinas River where the Salinas Valley Aquitard is not present. This typically will be seen as groundwater mounding subparallel to the river corridor. However, as more water infiltrates into the subsurface, more water will flow laterally, thereby expanding the zone of influence from the river outward and raise groundwater elevations laterally. Additionally, water stored underground is not subject to ET in the same way water stored above ground is. With annual removal of arundo, ET will decrease over time, allowing for more water to remain in the system. Arundo removal is coupled with identified native species removal where native species have encroached in high flow channels where they may not typically grow; however, there is significant uncertainty in the recharge benefits, as arundo and many native species draw both surface and groundwater.

Removal of arundo on 900 acres along the entire Salinas River will decrease ET by 2,790 to 20,880 AF/yr throughout the Salinas Valley. This will enhance recharge from the Salinas River within the southern part of the Subbasin and leave more water in the River to get down to the CSIP, where surface water is used in lieu of groundwater to help address seawater intrusion and declining groundwater elevations. With this reduction of non-productive water consumption, less water can be released from the reservoirs to get the same amount of water downstream, which increases the Valley's sustainable yield and drought resilience. It also results in indirect recharge as removal reduces groundwater use by the plants. Groundwater modeling from the original GSP for the original scope of invasive species eradication showed an expected benefit to groundwater elevations and seawater intrusion; however, because the project scoping has progressed and modeling does not reflect the current scope, the results are not included here. During the implementation period, project benefit estimates will be refined, accounting for variation between dry, wet, and normal years.

Component 3 of this project includes various floodplain enhancement features and restoration activities. Preliminary project scoping includes the development of 4 recharge basins within the Upper Valley Subbasin, each with a recharge capacity of about 100 AF/yr. However, greater analysis is needed to determine the exact number, size, and type of features. The combined benefit of the 4 recharge basins is expected to be 400 AF/yr in increased recharge.

This program will also enhance streamflow by returning patterns of flow to a more natural state. Arundo infestation decreases the natural channel migration and complexity of sandy-bottomed streams by confining the channel to an armored, single stem with faster flowing water, which then becomes susceptible to erosion and incision. A narrowing channel with reduced capacity also heightens flood risk. Removing arundo will allow greater normalization of natural geomorphic processes and sediment transport by de-armoring low-flow channel banks and adjacent floodplain areas to enable channel migration and braiding.

Stream channel improvements will provide many additional ecosystem benefits, including:

Habitat restoration. This project will help restore riparian habitat. Results from 4 years of plant community monitoring of arundo sites initially treated in 2016 show that diversity and abundance of native plants have increased over this time period and this trend is expected to continue. Field biologists conducting pre-activity surveys have also observed increased wildlife activity post-arundo removal.

Increased connectivity for wildlife. Within the Central Coast region there are several mountain ranges, coastal areas, valley floors, and upland habitats that need to be connected to allow for the wildlife movement necessary for gene flow and healthy populations (Thorne *et al.* 2002). The Salinas River riparian area is an important linkage for wildlife movement between upland habitat via tributaries. Removal of dense arundo stands will reduce physical impediments to movement for wildlife species such as mountain lion, bobcat, deer, and American badger. RCDMC has documented this through wildlife camera monitoring, which has shown increased detections of large mammals such as deer, bobcat, and coyote after arundo removal. This project will promote habitat use and movement of wildlife by increasing availability of food and nesting resources.

Flood risk reduction. Stream maintenance has the societal benefit of reducing flood risk to neighboring lands, which are mostly agricultural fields. Arundo's dense structure creates increased surface roughness, thus backing up water and causing flooding during high flow events. When agricultural fields are flooded with river water, farmers lose crops and thus considerable income, and must leave their fields fallow for months after flooding due to food safety concerns. Flooding can also damage levees which then have to be repaired and bring weed seeds and propagules (including arundo) into fields which then have to be controlled.

Enhanced conveyance and infrastructure protection. The work conducted in the SMP improves conveyance of storm, flood, and nuisance waters by keeping water in the stream channel and flowing freely rather than being blocked by the invasive species. The SMP protects city infrastructure by keeping water more in the channel rather than blocked and rerouted by arundo, which reduces the cost of infrastructure repairs to nearby cities.

Project benefits will be measured using the monitoring networks described in Chapter 7. Groundwater elevations will be measured with a network of wells that is monitored by MCWRA. Land subsidence will be measured using InSAR data provided by the DWR. When data gaps are filled, ISWs will be measured through shallow groundwater wells and river flow.

The expected benefits to groundwater in the 180/400-Foot Aquifer Subbasin will be defined through further investigation.

9.5.1.3 Circumstances for Implementation

The SMP and invasive species eradication are ongoing projects with MCWRA, the RCDMC, and the Salinas River Management Unit Association. Program administration is provided by the RCDMC and the Salinas River Management Unit Association. Landowners currently pay for all maintenance activities in the maintenance channels and for associated biological monitoring and reporting. SVBGSA could support the program, become an administrative partner in the program with other program partners, or fund maintenance and monitoring activities.

Floodplain enhancement will be implemented if additional water is required to maintain sustainability. A number of agreements and rights must be secured before individual projects are implemented. Primarily, a more formal cost/special benefit analysis must be completed to determine how many site options are preferable. Water diversion rights may need to be secured to divert stormwater, which may take a significant number of years.

9.5.1.4 Permitting and Regulatory Process

For Components 1 and 2, the permitting process has already been initiated by MCWRA and RCDMC and permits are in place until 2025 for the program. Invasive species eradication will be continued under existing permitting. All participants in the SMP must enter into an agreement with MCWRA and comply with all terms, conditions, and requirements of the permits and Program Guidelines.

Component 3 may require a CEQA environmental review process and may require an Environmental Impact Report (EIR) or a Mitigated Negative Declaration (the review could also result in a Negative Declaration or Notice of Exemption). Additionally, permits from a variety of state and federal agencies may be necessary, and any project that coordinates with federal facilities or agencies may require National Environmental Policy Act (NEPA) documentation.

Permits for all 3 components are detailed below.

Component 1 Permits:

- ***U.S. Army Corps of Engineers (USACE)*** – The Department of the Army Regional General Permit (RGP) 20 for the SMP, Corps File No. 22309S, was executed on September 28, 2016, by the USACE. The RGP is authorized under §404 of the Clean Water Act (33 U.S.C. §1344) through November 15, 2021. The NMFS and the USFWS concurred with the USACE determination that the project was not likely to adversely affect the following federally endangered or threatened species: the San Joaquin kit fox (*Vulpes macrotis mutica*), the California tiger salamander (*Ambystoma californiense*), the Monterey spineflower (*Chorizanthe pungens* var. *pungens*) , the yellow-billed cuckoo (*Coccyzus americanus*), or the South-Central California Coast (S-CCC) steelhead (*Oncorhynchus mykiss*). The USFWS issued a Biological Opinion on August 22, 2016, for the federally endangered least Bell's vireo (*Vireo bellii pusillus*) and tidewater goby (*Eucyclogobius newberryi*) and its critical habitat and the federally threatened California red-legged frog (*Rana draytonii*).

- ***National Marine Fisheries Service (NMFS)*** – The RCDMC also has a letter of concurrence in which NMFS supports USACE's decision that the SMP "is not likely to adversely affect species listed as threatened or endangered or critical habitats designated under the Endangered Species Act."

- ***State of California Regional Water Quality Control Board*** – The Clean Water Act §401 Water Quality Certification for Discharge of Dredged and/or Fill Materials, Certification No. 32716WQ02, was approved on August 31, 2016, and is set to expire on November 30, 2025. The Central Coast Water Board staff will assess the implementation and effectiveness of the SMP after 5 years and consider modifications to this Certification for the second 5 years of the permit term.

- ***California Department of Fish & Wildlife*** – The SMP is authorized under a Routine Maintenance Agreement (RMA) 1600-2016-0016-R4, approved October 14, 2016, and held by the RCDMC. The RMA was amended and restated on June 16, 2017, and subsequently amended on April 10, 2018. The RMA covers all impacts under the program from the original date of approval through December 31, 2026.

- ***California Natural Resources Agency*** – An EIR was completed in compliance with the CEQA.

Component 2 Permits:

- ***California Department of Fish & Wildlife*** – The invasive species eradication is authorized under an RMA 1600-2012-0154-R4, approved April 11, 2014, and held by the RCDMC. The RMA was amended on September 30, 2014. It covers all impacts under the program from the original date of approval through April 10, 2026.

- ***Environmental Protection Agency (EPA)*** – National Pollutant Discharge Elimination System (NPDES) permit CAG990005 allows the Salinas River Arundo Control Program to apply pesticides to waterways.

- In addition, the Salinas River Arundo Control Program filed a CEQA Mitigated Negative Declaration, received a technical assistance letter from NMFS, completed a USFWS No Take Request, and received a technical assistance letter from USFWS.

Component 3 Permits that may be required for floodplain enhancement include:

- ***United States Army Corps of Engineers (USACE)*** – A Regional General Permit may be required if there are impacts to wetlands or connections to waters of the United States.
- ***California Department of Fish and Wildlife (CDFW)*** – A Standard Agreement is required if the project could impact a species of concern.
- ***EPA Region 9*** –NEPA documentation must be submitted for any project that coordinates with federal facilities or agencies. Additional permits may be required if there is an outlet or connection to waters of the United States.
- ***NMFS*** – A project may require authorization for incidental take, or another protected resources permit or authorization from NMFS.
- ***California Natural Resources Agency*** – Projects of a magnitude capable of having a demonstrable impact on the environment will require a CEQA environmental review process. Projects will require either an EIR, Negative Declaration, or a Mitigated Negative Declaration.

9.5.1.5 Implementation Schedule

If selected, the components of this program may be implemented on different schedules. The annual implementation schedule for Component 1 is outlined on Figure 9-2. About 40 new acres could be added to the program each year, taking about 10 years to add the remaining acres if selected for full implementation. Annual maintenance needs to be continued indefinitely. For Component 2, up to 100 of the remaining 900 acres of uncontrolled arundo could begin treatment each year, as shown on Figure 9-3. Component 3 is contingent on the first 2 components but could be initiated shortly after Component 2. This schedule is shown on Figure 9-4.

Task Description	Dec 1	Mar 31	Sep 1	Nov 30
Phase I – Annual RMU report, Work Plan, and noticing				
Phase II – Pre-maintenance surveys				
Phase III – Maintenance activities				

Figure 9-2. Annual Implementation Schedule for Stream Maintenance

	Year												
Task Description	1	2	3	4	5	6	7	8	9	10	11	12	13
Treat and retreat first 100 acres													
Treat and retreat second 100 acres													
Treat and retreat third 100 acres													
Treat and retreat fourth 100 acres													
Treat and retreat fifth 100 acres													
Treat and retreat sixth 100 acres													
Treat and retreat seventh 100 acres													
Treat and retreat eighth 100 acres													
Treat and retreat ninth 100 acres													

Figure 9-3. Implementation Schedule for Invasive Species Eradication

	Year				
Task Description	1	2	3	4	5
Studies/Preliminary Engineering Analysis					
Agreements/Right of Way					
CEQA					
Permitting					
Design					
Bid/Construct					

Figure 9-4. Implementation Schedule for Floodplain Enhancement and Recharge

9.5.1.6 Legal Authority

MCWRA has legal authority over the Component 1 SMP for program administration and permitting. Private landowners and local cities who conduct maintenance in the permitted work areas must agree to permit conditions and execute an agreement annually with each agency. Private landowners and local cities currently pay for all maintenance activities including heavy equipment work and biological monitoring and reporting.

For Component 2 invasive species removal, the RCDMC has legal authority for program administration and permitting. The RCDMC obtains Landowner Access Agreements with property owners or managers (tenants) to allow them to do the work or to allow the RCDMC to oversee landowner-conducted work.

For floodplain restoration activities, the SVBGSA has the right to divert and store water once it has access to the appropriate water rights. Pursuant to California Water Code §10726.2 (b), the SVBGSA has the right to acquire and hold real property, and to divert and store water once it has acquired any necessary real property or appropriative water rights.

9.5.1.7 Estimated Cost

Component 1 program permits have been completed and are operational through 2026. Renewal of the 401 Certification with the Central Coast Regional Water Control Board will include a cost of $95,000 in the timeframe of 2024 to 2026. The annual administrative cost of Component 1 of this program is approximately $150,000. This cost does not include stream maintenance activities, required biological monitoring, and reporting, which are currently paid by program participants. These costs vary from year to year based on number of participants and work site conditions. This program could cover the costs of stream maintenance activities, biological monitoring, and/or reporting in order to reach higher participation rates from landowners and therefore increased project benefit. The cost for the vegetation management is approximately $1,200/acre for the first year and $700/acre for annual maintenance thereafter. This does not include the cost of sediment management, which can be costly. The cost estimate for stream maintenance activities, required biological monitoring, and reporting is included in Table 9-3, which may continue to be paid by participants, be funded by the GSA, or be funded through a different source. So far 254 acres have received their first year of vegetation management.

Table 9-3. Cost Estimate of Vegetation Management

	Acres	First year of vegetation management ($1,200/acre)	Subsequent years of vegetation management ($700/acre)
Upper Valley	250	$300,000	$175,000
Forebay	263	$315,600	$184,100
180/400-Foot Aquifer Subbasin	137	$164,400	$95,900
Subtotal	650	$780,000	$455,000

For Component 2, the estimated capital cost is estimated at between $14,536,943 and $18,898,026. Annual O&M costs are anticipated to be approximately $165,200. The indirect projected yield for the invasive species eradication project is estimated at between 3.1 AF/yr and 23.2 AF/yr per acre of invasive species removed. With the range of costs and range of project benefits, the amortized cost of water for this project is estimated to range between $60/AF and $600/AF.

Component 3 includes the construction of 4 recharge basins, each with an expected benefit of 100 AF/yr and a capital cost of $1,116,000 each, for a total of $4,464,000. Spread over 25 years and assuming a 6% discount rate, the annualized cost is $93,300 per recharge basin, including annual maintenance. The unit cost is $930/AF. These costs were estimated assuming that only

1 recharge basin would be built, but there may be economies of scale that lower the cost if more are built. These costs are approximate; exact costs will depend on site specifics.

9.5.1.8 Public Noticing

Component 1 implementation and permitting requires annual notification of potential program participants and this notification is announced via direct mail to program participants as well as announced on MCWRA website. Program related annual reporting as required and is published on the MCWRA website.

Component 2 public noticing practices and requirements of the existing RCDMC invasive species eradication programs will be continued as part of this project. This includes reaching out to specific landowners and tenants in areas of potential work and completing annual permit reports that are posted to the RCDMC website.

Component 3 public noticing will be conducted prior to any project initiates construction to ensure that all groundwater users and other stakeholders have ample opportunity to comment on projects before they are built. The general steps in the public notice process will include the following:

- SVBGSA staff will bring an assessment of the need for the project to the SVBGSA Board in a publicly noticed meeting. This assessment will include:
  - A description of the undesirable result(s) that may occur if action is not taken
  - A description of the proposed project
  - An estimated cost and schedule for the proposed project
  - Any alternatives to the proposed project
- The SVBGSA Board will notify stakeholders in the area of the proposed project and allow at least 30 days for public response.
- After the 30-day public response period, the SVBGSA Board will vote whether or not to approve design and construction of the project and notify the public if approved via an announcement on the SVBGSA website and mailing lists.

In addition to the process detailed above, all projects will follow the public noticing requirements per CEQA or NEPA.

9.5.2 P2: CSIP System Optimization

The CSIP system, shown on Figure 9-5, is owned by the MCWRA and operated by M1W by agreement with MCWRA. MCWRA and M1W have evaluated opportunities to optimize the CSIP distribution system. Over the 22 years since CSIP was built, the system has slowed the rate of seawater intrusion; however, current infrastructure cannot meet all pressure and flow demands during peak summer irrigation, due to restrictions in capacity along some critical pipeline segments. Groundwater must be pumped to increase pressure at some sites when demand peaks during certain hours and conveyance needs exceed pipeline capacities. The existing infrastructure and software do not allow for continuous monitoring water use at "turnouts" (points of use for irrigation), nor for effective scheduling and managing of water use and deliveries. In addition, there is not enough water storage within the system to take advantage of all the available supplies. These bottlenecks in the system and lack of storage lead to the need for CSIP supplemental wells to meet total irrigation needs when either the treated or diverted water is not available, or the pressure is not sufficient.

This Project addresses these challenges through infrastructure and program implementation improvements. The CSIP system will be optimized to better accommodate diurnal and seasonal fluctuation in irrigation demand, maximizing use of water supplied from the Salinas Valley Reclamation Plant and the SRDF, thereby reducing the need for groundwater pumping. Furthermore, this project aligns CSIP irrigation with water availability, rather than on demand, to ensure the available supply water can be used to a greater extent.

This CSIP project includes the following general activities:

1. **Installation of Remote Monitoring Units.** These will track water use at turnouts and provide data for hydraulic modeling and irrigation scheduling. Second, with information from the Remote Monitoring Units, this Component includes dynamic hydraulic modeling. This activity is currently underway by MCWRA.
2. **Hydraulic Modeling.** This activity will develop and calibrate a hydraulic model of the CSIP water distribution system to enhance water production and conveyance, including use of algorithms for meeting demands in a variety of seasonal and diurnal water use scenarios. The modeling will enable CSIP operators to identify the most critical conveyance deficiencies, and recommend upgrades to enhance the delivery system. This activity is currently being started by MCWRA.
3. **Irrigation/Scheduling System Development.** This activity will develop a program that will allow growers to order and schedule their water deliveries, and water deliveries are scheduled to increase the use of recycled and River water and reduce peak demands in the system. Incentives for farmers to modify irrigation practices that will promote use of water during off-peak times may complement irrigation scheduling.
4. **Piping Upgrades.** This component upgrades a critical CSIP pipeline segment, specifically at the A-1 Monitoring Station (or A-1 Site), to be able to convey higher flows to most of the CSIP system and to optimize pressure. In addition, the hydraulic model will identify deficiencies in the water distribution system that will require piping upgrades. Aside from A-1 Site, the exact piping upgrades are unknown. This component

of the project is a placeholder for anticipated upgrades required to the system to assist in the regulation of flow and pressure.

5. **Add Water Storage and Source Water.** This activity will add storage capacity for recycled water and SRDF water diverted at the Reclamation Plant throughout the water distribution system and/or additional source water for CSIP. The hydraulic modeling will identify preferred locations for storage that would provide the most benefit to the system. Additional storage reservoirs will allow the CSIP system to store water produced by the Reclamation Plant or diverted by SRDF during low demand periods for later delivery when demand is high. Storage reservoirs would also assist in maintaining adequate pressure in the existing system and provide more flexibility in the timing of Reclamation Plant and SRDF deliveries. Additional source water will help meet CSIP demand from non-groundwater sources, particularly during the peak irrigation season and droughts. Additional storage or source water may also reduce the need to drill additional CSIP supplemental wells.
6. **Maximize SRDF Diversion.** MCWRA owns the SRDF and M1W operates the SRDF by agreement with MCWRA. The SRDF operates normally at 36 cfs and has a maximum capacity of 48 cfs if necessary. The facility operates between April 1st and October 31st and can theoretically deliver annually up to approximately 15,000 AF/yr to the CSIP system. However, since its startup in 2010 it has provided an average of 3,850 AF/yr between April and October, with a maximum delivery in WY 2018-19 of 6,500 AF/yr, a deficit largely attributable to a misalignment between the timing of supply and demand for the water. In many years, such as during droughts, the SRDF cannot operate due to lack of releases from the reservoirs to the Salinas River and percolation of remaining river water to the groundwater basin upstream of the SRDF. After the CSIP system is optimized, the MCWRA could increase the production from the SRDF in some years with no added capital expenditures. In addition, there would be additional capacity available to offset a portion of the demand if CSIP area is expanded. The other components of CSIP optimization must be completed to be able to maximize the SRDF deliveries.

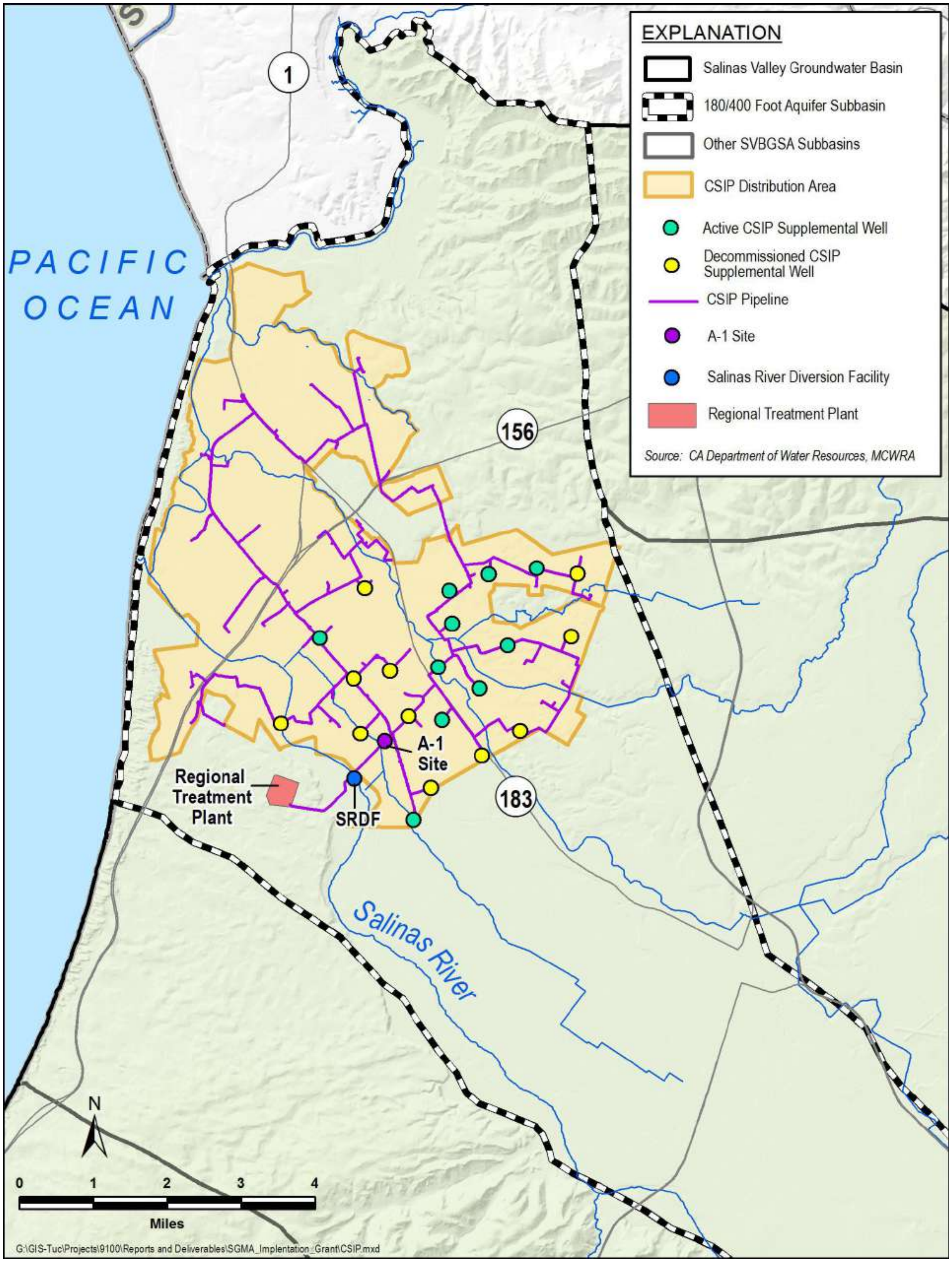

Figure 9-5. Castroville Seawater Intrusion Project Location

9.5.2.1 Relevant Measurable Objectives

Relevant measurable objectives benefiting from this project include:

- **Groundwater level measurable objective** – This project reduces groundwater extraction and leaves more water in the aquifers than would otherwise occur, thereby raising or helping prevent further declines of groundwater levels.

- **Seawater intrusion measurable objective –** By reducing extraction and raising or helping prevent further declines of groundwater levels, this project will help prevent further seawater intrusion.

- **Groundwater storage measurable objective** – By reducing extraction and helping prevent further seawater intrusion, this project will increase groundwater in storage.

- **Land subsidence measurable objective** – By helping prevent further declines in both groundwater elevations and groundwater storage, this project will have the added benefit of helping prevent land subsidence. Maintaining and adding water in the subsurface will keep pore spaces saturated with positive pressure and inhibit land surface collapse associated with groundwater depletion.

9.5.2.2 Expected Benefits and Evaluation of Benefits

The primary benefit from CSIP optimization includes reduction or avoidance of groundwater pumping from wells in the CSIP area throughout the year. Two types of wells pump groundwater in the CSIP area: CSIP supplemental wells and privately owned wells used to provide groundwater for irrigation either in lieu of, or in addition to, irrigation water provided by the CSIP system. CSIP supplemental wells are MCWRA owned wells that provide water to the CSIP system when the combination of recycled and river water is insufficient to meet demands. This project will benefit other subbasins, such as the Monterey, Eastside, and Langley Subbasins by reducing pumping that impacts the neighboring subbasins.

Groundwater modeling in the original GSP estimated the joint benefits of CSIP optimization, M1W winter modifications, and maximize SRDF diversions in terms of groundwater elevation and seawater intrusion. The GSP jointly estimates project benefits for all 3 CSIP projects included in the GSP, rather than for each project independently, because they are intertied. Model results suggest that these projects reduce seawater intrusion by approximately 2,200 AF/yr on average. They are not included here because the project scoping has progressed, and modeling does not reflect the current scope. Nevertheless, this project is anticipated to significantly reduce groundwater extraction. During the implementation period, project benefit estimates will be refined.

Historical data of CSIP standby well pumping provided by MCWRA indicates that since 2010, the average pumping of CSIP standby wells located within the CSIP distribution area was around 2,000 AF/yr. The combination of projects P2 and P3 are intended to minimize this pumping by standby wells.

A sharp decline in CSIP supplemental well pumping occurred in 2010 when the SRDF came online. Omitting years 2014 through 2016 when the SRDF was offline, the average CSIP supplemental well yield since 2010 is approximately 3,800 AF/yr. Combining the average CSIP standby well pumping and the CSIP supplemental well pumping yields an average benefit of approximately 5,800 AF/yr of reported well pumping within the CSIP area that could be offset by this project together with P3.

Reductions in groundwater pumping will be measured through GEMS. Changes in groundwater elevation will be measured with the groundwater level monitoring program detailed in Chapter 7. Subsidence will be measured using the DWR provided subsidence maps detailed in Chapter 7. Seawater intrusion will be measured using MCWRA's existing seawater intrusion mapping approach. A direct correlation between CSIP optimization and changes in groundwater elevations, subsidence, or seawater intrusion is likely not possible because this is only one among many management actions and projects that will be implemented in the Subbasin.

9.5.2.3 Circumstances for Implementation

MCWRA is in the process of implementing some parts of CSIP optimization, such as installation of RMUs and hydraulic modeling. MCWRA and SVBGSA have applied for funding to upgrade A-1 Site. Other improvements will be considered when funds become available. No additional circumstances for implementation are necessary.

9.5.2.4 Permitting and Regulatory Requirements

Permits from the following government organizations that may be required for this project include:

- ***Monterey County*** – A-1 Site upgrades require encroachment and permits.

These improvements may be exempt from the California Environmental Quality Act (CEQA) under CEQA Guidelines, §15301. Existing Facilities. If appropriate, CEQA compliance will involve preparation of an Initial Study checklist to support a Notice of Exemption. The notice and IS will be prepared by agency staff, will be filed with the County Clerk, and will be sent to relevant Native American tribal representatives as required by AB-52 and requests from Native American/tribal entities. If not exempt, an Environmental Impact Report (EIR) or a Mitigated Negative Declaration may be required (the review could also result in a Negative Declaration or Notice of Exemption).

As currently planned, the project results in less than one acre of disturbance, therefore, a General Construction Storm Water Permit Order 2009-0009-DWQ will not be required. No sensitive or protected species, nor Waters of the State/U.S. are located on or near the site.

9.5.2.5 Implementation Schedule

Installation of the Remote Monitoring Units has already begun to be implemented. Figure 9-6 includes the anticipated schedule for each component; however, the selection of and schedule for each component is independent. It is anticipated that the full project will take approximately 8 years to implement.

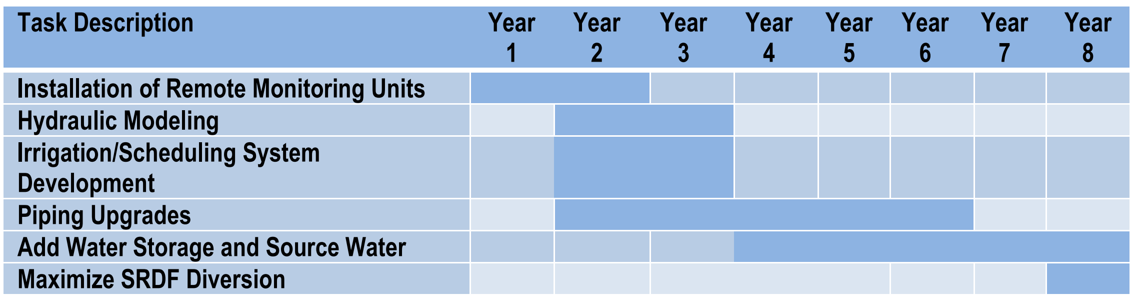

Figure 9-6. Implementation Schedule for CSIP Optimization

9.5.2.6 Legal Authority

The existing CSIP facilities and the Salinas River Diversion Facility (SRDF, or Diversion Facility) are owned by MCWRA and are located on land owned by MCWRA or over which MCWRA has permanent easements. MCWRA has an existing easement over the A-1 Site and also has the authority to control water use within the CSIP and Salinas River Diversion Facility system. M1W is under contract to operate and maintain the CSIP system (Water Recycling Agreement, 2015). The Reclamation Plant and the Diversion Facility treatment and storage components are owned by and located on property owned by M1W. The SVBGSA will work in cooperation with MCWRA and M1W to modify and optimize the CSIP system. No additional legal authority is necessary.

9.5.2.7 Estimated Cost

In the original GSP, estimated capital cost for the CSIP optimization project is $16,400,000. Annual incremental increase in O&M cost is anticipated to be approximately $240,000. The projected yield for the CSIP optimization project was estimated at 5,000 AF/yr, which resulted in an amortized cost of water estimated at $430/AF. These estimates need to be reevaluated based on scoping that has occurred since GSP submittal.

For maximization of SRDF diversion, there is no capital cost required for this project after the other steps of CSIP optimization because the facilities are already sized to deliver 15,000 AF/yr. Maximizing the diversion would require an additional $2,500,000 annual O&M for higher energy and treatment costs to supply the water. The estimated projected yield for this part of the project is 11,600 AF/yr, beyond other steps of CSIP optimization.

9.5.2.8 Public Noticing

If financed by SVBGSA, before MCWRA initiates construction on this project, it will go through a public notice process to ensure that all groundwater users and other stakeholders have ample opportunity to comment on projects before they are built. The general steps in the public notice process will include the following:

- SVBGSA staff will bring an assessment of the need for the project to the SVBGSA Board and the MCWRA Board in publicly noticed meetings. This assessment will include:
    - A description of the undesirable result(s) that may occur if action is not taken
    - A description of the proposed project
    - An estimated cost and schedule for the proposed project
    - Any alternatives to the proposed project
- The SVBGSA Board will notify stakeholders in the area of the proposed project and allow at least 30 days for public response.
- After the 30-day public response period, the SVBGSA Board will vote whether or not to approve financing design and construction of the project and notify the public if approved via an announcement on the SVBGSA website and mailing lists.

The permitting and implementation of the expansion will require notification of stakeholders, beneficiaries, water providers, member lands adjacent to the river, and subbasin committee members. In addition to the process detailed above, all projects will follow the public noticing requirements per CEQA or NEPA.

9.5.3 P3: Modify Monterey One Water Recycled Water Plant – Winter Modifications

The Salinas Valley Reclamation Plant at the Regional Wastewater Treatment Plant is owned by Monterey One Water (M1W) and delivers tertiary treated wastewater to the CSIP system for irrigation. The primary, secondary, and tertiary treatment processes have a maximum capacity of 29.6 mgd and treat approximately 16 to18 mgd of influent wastewater. During the wet weather months, the majority of secondary treated wastewater is discharged to the ocean, forgoing the opportunity for beneficial reuse. During the wet weather months, there is some demand for recycled water in the CSIP system; however, M1W cannot produce tertiary treated water at a rate lower than 5 mgd, which is needed to supply the growers in the winter. As a result, growers turn to the groundwater basin for their irrigation needs during these months. Modifications are required at the Reclamation Plant in order to efficiently treat and deliver recycled water during the wet weather months.

This Winter Modifications project consists of two parts: upgrading the chlorine scrubbers to minimize the winter maintenance shutdown and improving the Reclamation Plant to allow delivery of tertiary treated wastewater to CSIP when water demand is less than 5 mgd. The original project description in the GSP focused on increasing wintertime use of recycled water through modifications to the Plant based on the *New Source Water Supply Study* commissioned by MCWRA for the purpose of developing the Amended and Restated Water Recycling Agreement between MCWRA and M1W. It was a very preliminary analysis, and M1W commissioned further analysis on the specific steps involved in this project, which identified that upgrading of the chlorine scrubber system is the first initial step that needs to occur (Monterey One Water, 2018a). There are limitations to winter water provision if water demand is low because the Reclamation Plant cannot operate when demand is low; however, the only required system shutdown is due to the need to undertake maintenance of the wet chlorine scrubber system for two to three weeks every year.

Chlorine Scrubber Upgrade

The first part of this project is to install a dry chlorine scrubber system to replace the existing wet scrubber system. Chlorine is used to disinfect both recycled and surface water. The current scrubber system uses chlorine scrubbers to contain and remove toxic gaseous chlorine from the air in the event of an accidental release from the chlorine containment system. The current scrubber has no redundancy and is subject to corrosion, so it requires annual shutdown for testing and maintenance to comply with hazardous materials plan requirements and maintain its reliability. In addition, if a chlorine leak should occur during the summer, the entire treatment plant and river diversion facility must be shut down for repairs, also forcing CSIP to rely on groundwater. This project will enable the system to be operated year-round, which will improve both the ability to reliably irrigate agricultural land with recycled water and the sustainability of the 180/400-Foot Aquifer Subbasin.

- Based on a two-phase study conducted by Carollo Engineers, which included an alternatives analysis (Phase 1) and a technology evaluation (Phase 2), M1W and MCWRA chose to continue use of chlorine gas from 1-ton cylinders for disinfection (Carollo Engineers, 2014). Phase 2 provided an evaluation and information to assist the Agencies in determining if they should rehabilitate and continue to maintain the existing "wet" caustic soda-based emergency chlorine gas scrubber or replace the existing scrubber with a dry media-type scrubber. The study concluded the existing scrubber is prone to corrosion and leakage if not continually maintained. Installation of a new 1-ton dry scrubber has a lower life cycle cost than rehabilitation of the existing wet-type scrubber due to significantly lower maintenance costs, and it would eliminate the use of caustic soda and associated caustic leaks, reducing the potential for hazards on and off site, and reducing downtime of the chlorination system. Based on the study, this project will design and construct a reliable chlorine dry scrubber system that meets all regulatory requirements and that can be successfully phased into use as a replacement for the existing wet scrubber system.

Reclamation Plant Improvements

The second part of this project is to allow delivery of tertiary treated wastewater to the CSIP system when recycled water demand is less than 5 mgd. Improvements to the Reclamation Plant include minor modifications to the chlorine contact basins and construction of a new conveyance pipeline to the distribution system. Together with the chlorine scrubber upgrade, these improvements will provide near year-round operation of the Reclamation Plant to provide water to CSIP, even when demand is low in winter months. The exception is a short "hard" shut down for the Reclamation Plant maintenance, which is typically a 2-week window in January. SVBGSA will work closely with M1W and MCWRA to support and implement this project.

9.5.3.1 Relevant Measurable Objectives

Relevant measurable objectives benefiting from this project include:

- **Groundwater level measurable objective** – This project reduces groundwater extraction and leaves more water in the aquifers than would otherwise occur, thereby raising or helping prevent further declines of groundwater levels.
- **Seawater intrusion measurable objective –** By reducing extraction and raising or helping prevent further declines of groundwater levels, this project will help prevent further seawater intrusion.
- **Groundwater storage measurable objective** – By reducing extraction and helping prevent further seawater intrusion, this project will increase groundwater in storage.
- **Land subsidence measurable objective** – By helping prevent further declines in both groundwater elevations and groundwater storage, this project will have the added benefit of helping prevent land subsidence. Maintaining and adding water in the subsurface will keep pore spaces saturated with positive pressure and inhibit land surface collapse associated with groundwater depletion.

9.5.3.2 Expected Benefits and Evaluation of Benefits

The primary benefit from M1W Winter Modifications is additional water supply to the CSIP system during low-demand wet weather months and elimination of the winter maintenance shutdown, thus reducing groundwater pumping that is relied upon during this period. This project has the potential to yield up to 1,100 AF/yr through in-lieu recharge, providing an alternative to groundwater sources in the existing CSIP area. This project may benefit other subbasins, such as the Eastside and Monterey Subbasins by reducing pumping that impacts the neighboring subbasins.

Table 9-4 provides the groundwater well pumping for 7 years during the winter months when the Reclamation Plant is not on-line. This results in an average wet weather pumping rate of 800 AF/yr; with a minimum of 300 AF/yr in dry years, and a maximum of 1,790 AF/yr in wet years. The Reclamation Plant improvements would significantly reduce the need for wintertime groundwater pumping. The demand for water during the winter from the Reclamation Plant will also increase if CSIP Expansion is implemented; increasing the potential Project Yield from 800 AF/yr to an estimated 1,300 AF/yr.

Table 9-4. Groundwater Winter Well Pumping FY 2011-2012 to FY 2017-2018

	Dec 2011-Jan 2012	Dec 2012-Jan 2013	Dec 2013 - Jan 2014	Nov 2014-Jan 2015	Nov 2015-Feb 2016	Nov 2016-Mar 2017	Nov 2017-Mar 2018
November	238	72	35	303	213	325	28
December	723	44	730	38	199	211	38
January	1,067	253	490	516	96	62	183
February	162	334	9	115	520	102	907
March	211	218	214	411	395	580	90
Total	2,401	921	1,478	1,383	1,423	1,280	1,246

The scrubber system upgrade will improve the disinfection process by providing the following benefits: increased reliability of recycled water due to redundancy, reduced downtime and maintenance requirements, improved worker safety, reduced ocean discharges, ability to meet strict regulatory standards required for recycled water that is used for irrigation of food crops, and reduced groundwater extraction through avoidance of the winter maintenance shutdown. Reduced groundwater extraction will help combat seawater intrusion and protect the drinking water supplies of the underrepresented, disadvantaged communities of Castroville and Salinas, whose drinking water wells are near the edge of the area affected by seawater intrusion.

Upgrading the chlorine scrubbers will enable reduced use of MCWRA's Supplemental Wells during wintertime chlorine system shutdowns by approximately 345 AF/yr. MCWRA calculated this pumping reduction estimate is based on 3 weeks per year of system shutdown and 115 acre-feet per week of deliveries, the average weekly demand in January between 2012 and 2019. Reducing Supplemental Well use by 345 AF/yr will reduce the potential for increased seawater intrusion by improving the overall water balance of the groundwater basin and maintaining the groundwater elevations in the vicinity of these wells, which primarily draw water from the 400-Foot Aquifer of the Subbasin. The claimed benefits will be evaluated and quantified using M1W's flow metering of CSIP demands and Reclamation Plant production.

The original GSP shows groundwater elevation benefits to the 180-Foot Aquifer and 400-Foot Aquifers for CSIP optimization, M1W winter modifications, and maximize SRDF diversions. The GSP jointly estimates project benefits for these 3 CSIP projects included in the GSP, rather than for each project independently, because they are intertied. Model results suggest that these projects reduce seawater intrusion by approximately 2,200 AF/yr on average. They are not included here because the project scoping has progressed, and modeling does not reflect the current scope. However, this project is anticipated to significantly reduce groundwater extraction. During the implementation period, project benefit estimates will be refined.

Reductions in groundwater pumping will be measured directly and recorded in the water charges framework database. Changes in groundwater elevation will be measured with the groundwater level monitoring program detailed in Chapter 7. Subsidence will be measured using the DWR provided subsidence maps detailed in Chapter 7. Seawater intrusion will be measured using MCWRA's existing seawater intrusion mapping approach. A direct correlation between M1W improvements and changes in groundwater elevations, subsidence, or seawater intrusion is likely not possible because this is only one among many management actions and projects that will be implemented in the Subbasin.

9.5.3.3 Circumstances for Implementation

The replacement of the chlorine scrubbers is currently being planned and implemented by M1W as part of the Pure Water Monterey Groundwater Replenishment Project. No other circumstances for implementation are necessary.

9.5.3.4 Permitting and Regulatory Process

Permits from the following government organizations that may be required for this project include:

- ***Monterey Bay Air Resource District (MBARD)*** – This project requires the Authority to Construct and Permit to Operate. MBARD Rule 200 requires that M1W obtain an Authority to Construct and Permit to Operate before installing or operating new equipment or processes that may release or control air pollutants to ensure that all MBARD rules and regulations are considered.
- ***Monterey County*** – M1W will update its Injury and Illness Prevention Plan (IIPP) and other required hazardous materials registrations and documents to reflect the updated system, such as M1W's Business Response and Process Hazard Analysis.

This project may be exempt under CEQA Guidelines, §15301, Existing Facilities. If appropriate, CEQA compliance will involve preparation of an Initial Study checklist to support a Notice of Exemption. The notice and initial study will be prepared by agency staff, filed with the County Clerk, and sent to relevant Native American tribal representatives. If not exempt, an Environmental Impact Report (EIR) or a Mitigated Negative Declaration may be required (the review could also result in a Negative Declaration or Notice of Exemption).

9.5.3.5 Legal Authority

The chlorine scrubber upgrade component of the winter modification project is currently being planned and implemented by M1W with funding from MCWRA. M1W owns the site and relevant facilities. As a Joint Powers Authority responsible for wastewater collection, treatment and recycled water production, M1W has legal authority to implement the scrubber upgrade and the SVRP Modifications. No additional legal authority is necessary.

9.5.3.6 Implementation Schedule

If selected, the implementation schedule is presented on Figure 9-8. Each part is anticipated to take approximately two years to implement and could be undertaken simultaneously or staggered.

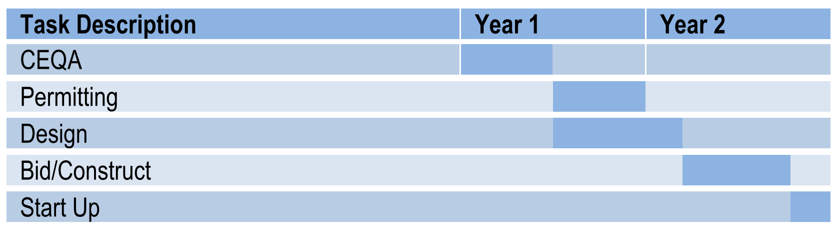

Figure 9-7. Implementation Schedule for M1W SVRP Modifications

9.5.3.7 Estimated Cost

The project cost will be covered through grants or delivery charges to existing CSIP customers.

M1W and MCWRA estimate that upgrading the chlorine scrubber system and making the Reclamation Plant Improvements will cost approximately $8,967,400, including the design and construction costs of the scrubber upgrade. The Reclamation Plant Improvements includes escalation for inflation since the original cost estimate in 2019. The amortized cost of water both portions of the project is estimated at $890/AF.

9.5.3.8 Public Noticing

If financed by SVBGSA, before MCWRA initiates construction on this project, it will go through a public notice process to ensure that all groundwater users and other stakeholders have ample opportunity to comment on projects before they are built. The general steps in the public notice process will include the following:

- SVBGSA staff will bring an assessment of the need for the project to the SVBGSA Board and the MCWRA Board in publicly noticed meetings. This assessment will include:
    - A description of the undesirable result(s) that may occur if action is not taken

  - A description of the proposed project
  - An estimated cost and schedule for the proposed project
  - Any alternatives to the proposed project
- The SVBGSA Board will notify stakeholders in the area of the proposed project and allow at least 30 days for public response.
- After the 30-day public response period, the SVBGSA Board will vote whether or not to approve financing design and construction of the project and notify the public if approved via an announcement on the SVBGSA website and mailing lists.

The permitting and implementation of the expansion will require notification of stakeholders, beneficiaries, water providers, member lands adjacent to the river, and subbasin committee members. In addition to the process detailed above, all projects will follow the public noticing requirements per CEQA or NEPA.

9.5.4 P4: CSIP Expansion

This project will increase the size and reach of the CSIP distribution system beyond the current Zone 2B boundary, to provide recycled and diverted river water to additional lands for irrigation and agricultural use. Enlarging the system's service area will replace pumped groundwater with recycled or river water in the spring and fall and lessen dependence on existing groundwater wells. The existing CSIP supplies may not be sufficient to meet the summertime demand of the expanded CSIP area without an increase in water supply from the SRDF or another source. New water sources other than river water will require additional project costs. If additional water supply sources are available in the summer, the expanded service area could be supplied summer irrigation water. The CSIP Optimization Project must be implemented prior to CSIP expansion due to system constraints.

Two potential CSIP expansion maps have been developed. MCWRA suggested an expansion of approximately 3,500-acre area, proposed in 2011, as displayed on Figure 9-10. More recently, the May 2018 *Progress Report on Pure Water Monterey Expansion*, stated the current plan for expansion considers an additional 3,500 acres, a 29% increase in its service area (Monterey One Water, 2018b). The second expansion map identified approximately 8,500 acres that could be included in the expanded service area and was identified in the *Cal-Am Coastal Water Project Draft Environmental Impact Report* (ESA, 2009), as shown on Figure 9-9.

Based on the report *Recommendations to Address the Expansion of Seawater Intrusion in the Salinas Valley Groundwater Basin*, a working group was established that recommended beginning an annexation plan for expanding the CSIP service area concurrently with optimizing the existing CSIP system (MCWRA, 2017). The working group recommended expanding into areas nearest the advancing seawater intrusion front. However, MCWRA Board of Directors put this effort is on hold due to staff resources and priorities.

Assuming 3,500 acres of new farmland are annexed into the system, and with an assumed unit agricultural water demand of 2.8 AF/acre (MCWRA, 2017), the expanded area may present an additional demand of 9,900 AF/yr. Initial estimates reported in the 2009 *Cal-Am Coastal Project Draft EIR* (ESA, 2009) suggested the 8,500-acre expansion proposal might require an additional 14,000 AF/yr of water. Assuming the lesser of these two estimates, the 9,900 AF/yr of deliveries would offset an equal amount of pumping from the Subbasin. The final size and location of CSIP expansion will be determined through additional hydraulic modeling and engineering that identifies the most cost-effective areas for expansion.

The CSIP expansion would include construction of a new distribution network. The distribution network will be developed only after the final location of CSIP expansion is agreed upon. Extrapolating from the existing CSIP system, the expanded area may include on the order of 13 miles of new pipeline. Because the existing distribution system is at its hydraulic capacity, the new network would likely be a pressurized system separate from the existing distribution system pipelines. A new 48" transmission main would extend from the existing SVRP storage pond to the expanded service area; with the exception of a smaller diameter pipeline serving an area southwest of the M1W SVRP. A crossing of the Salinas River would be required. Pipeline diameters would decrease further downstream in the distribution network. Turnouts would be installed for each new agricultural use customer.

Locations to be served in the expanded area would prioritize areas where risk of seawater intrusion is highest. Additional considerations include the cost of tank storage and booster pumps needed to supply areas east of Castroville along Highway 156.

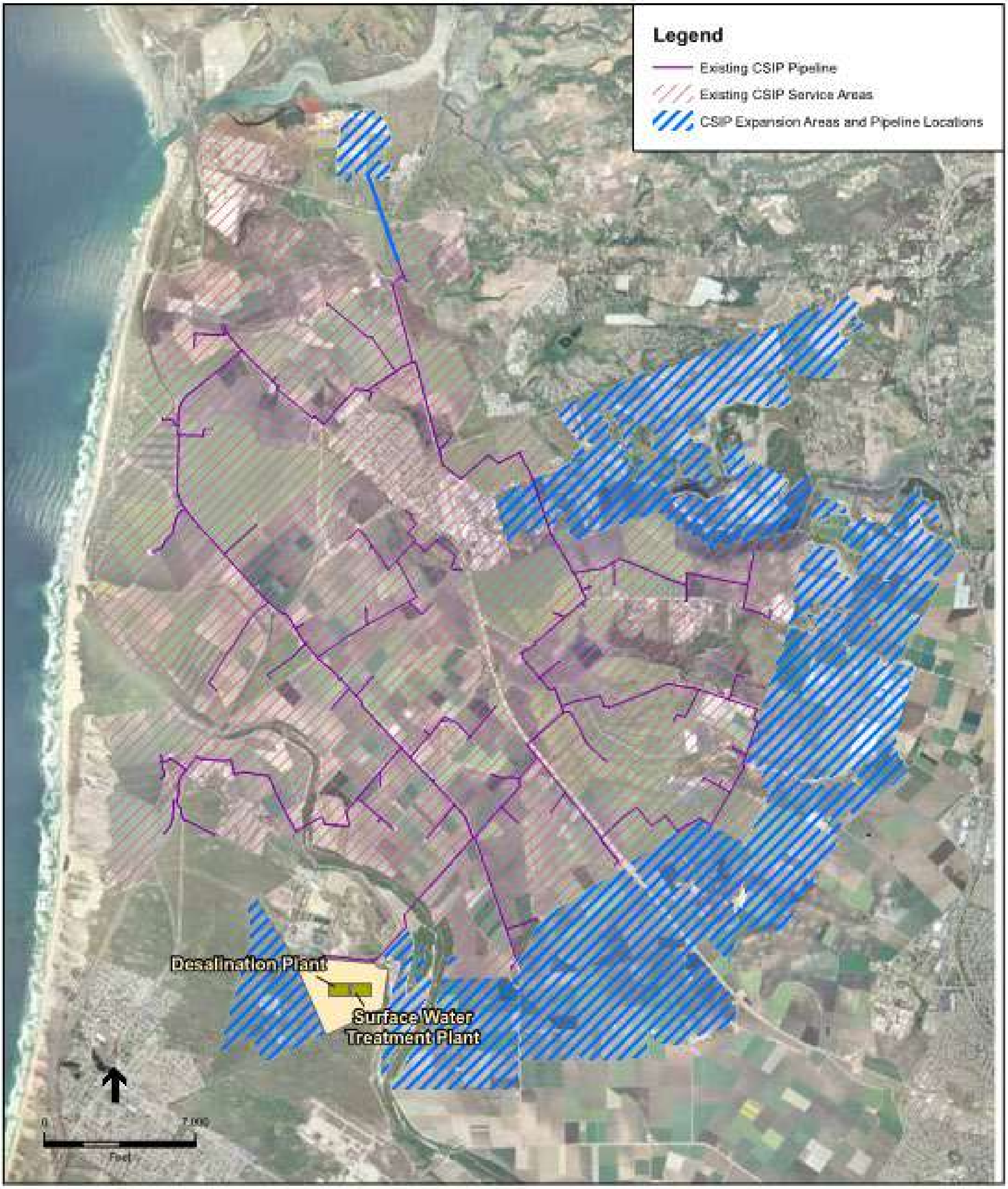

Figure 9-8. Potential CSIP Distribution System Expansion Areas
(Image from ESA, 2009)

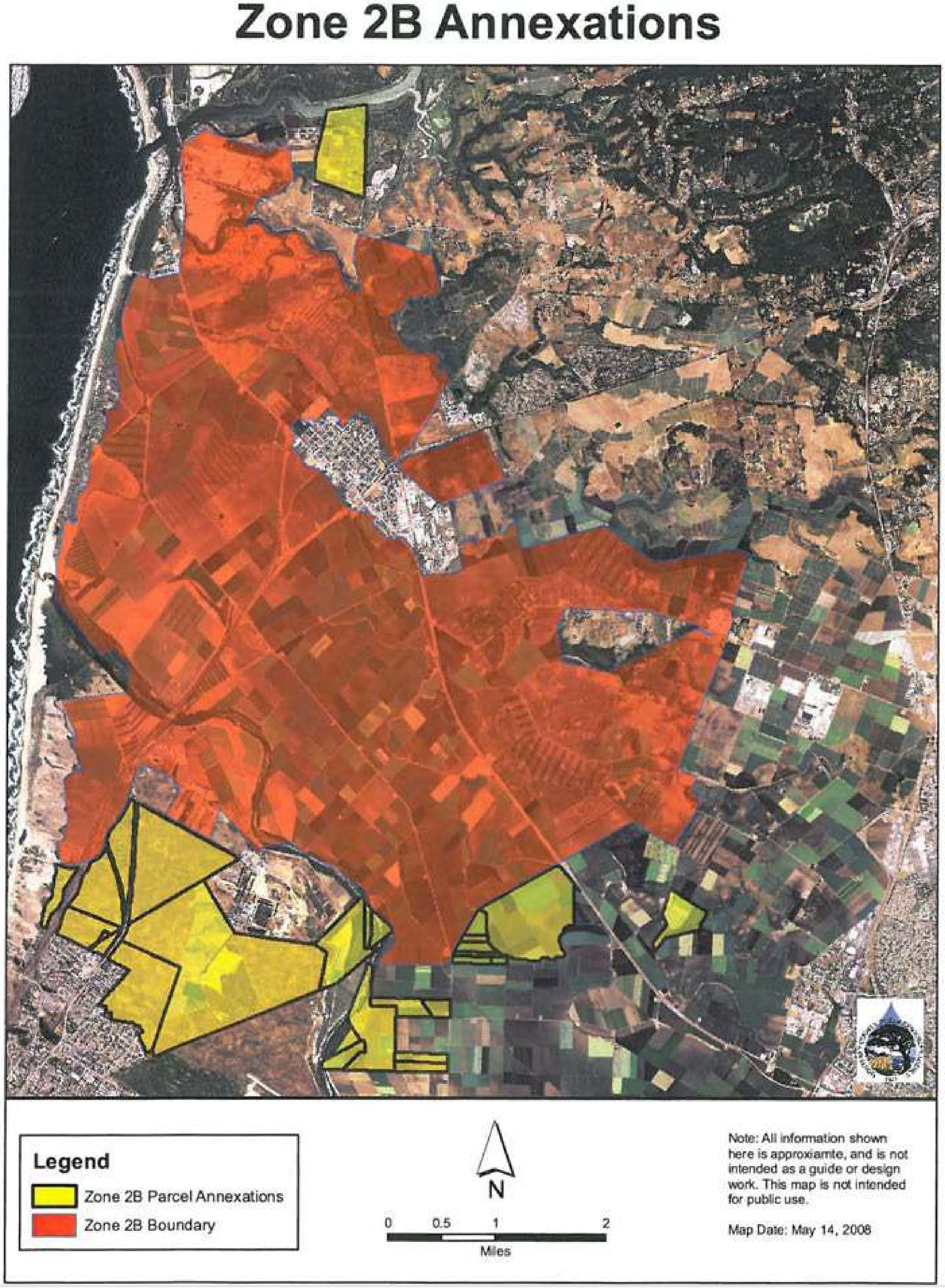

Figure 9-9. Zone 2B Requests for Annexation from 2011
(Courtesy of MCWRA)

9.5.4.1 Relevant Measurable Objectives

Relevant measurable objectives benefiting from this project include:

- **Groundwater level measurable objective.** By reducing extraction from the 180-Foot and 400-Foot Aquifers, it will have the effect of more water added to the principal aquifers as this water will be used in lieu of pumping. Reducing extraction will raise or help prevent further declines of groundwater elevations over time.
- **Groundwater storage measurable objective.** Reducing extraction from the principal aquifer will ultimately have the effect of increasing groundwater in storage.
- **Seawater intrusion measurable objective.** Using recycled and river water in lieu of groundwater will increase groundwater storage and support the natural hydraulic gradient that pushes back against the intruding seawater.
- **Land subsidence measurable objective.** By helping prevent further declines in both groundwater elevations and groundwater storage, this project will have the added benefit of helping prevent land subsidence. Maintaining and adding water in the subsurface will keep pore spaces saturated with positive pressure and inhibit land surface collapse associated with groundwater depletion.

9.5.4.2 Expected Benefits and Evaluation of Benefits

The primary benefits from CSIP expansion include the increase in demand for recycled water and river diversion water supplies, thus reducing groundwater pumping in the Subbasin. This increased demand could be supplied to the new service area during the winter, spring and fall when excess supply is available to the CSIP system. If additional water supplies are available in the summer, the new service area could also be supplied in the summer. The expanded service area would lessen groundwater pumping by an amount equal to the quantity delivered: up to approximately 7,000 AF/yr, based on an annual average of 2 AF/acre water demand within the CSIP system. Obtaining maximum benefit would require sufficient sources of river and recycled water. This project will benefit other subbasins, such as the Monterey, Eastside, and Langley Subbasins by reducing pumping that impacts the neighboring subbasins.

Figure 9-11 shows the expected groundwater elevation benefit in the 180-Foot Aquifer from the CSIP expansion project, based on modeling completed for the original GSP. Figure 9-12 shows the expected groundwater elevation benefit in the 400-Foot Aquifer from the CSIP expansion project. Model results suggest that this project reduces seawater intrusion by approximately 2,800 AF/yr on average; however, modeling was based on a previous higher estimate that the project benefit would be 9,900 AF/yr.

Reductions in groundwater pumping will be measured directly and recorded in the water charges framework database. Changes in groundwater elevation will be measured with the groundwater level monitoring program detailed in Chapter 7. Subsidence will be measured using the DWR provided subsidence maps detailed in Chapter 7. Seawater intrusion will be measured using MCWRA's existing seawater intrusion mapping approach. A direct correlation between CSIP expansion and changes in groundwater elevations, subsidence, or seawater intrusion is likely not possible because this is only one among many management actions and projects that will be implemented in the Subbasin.

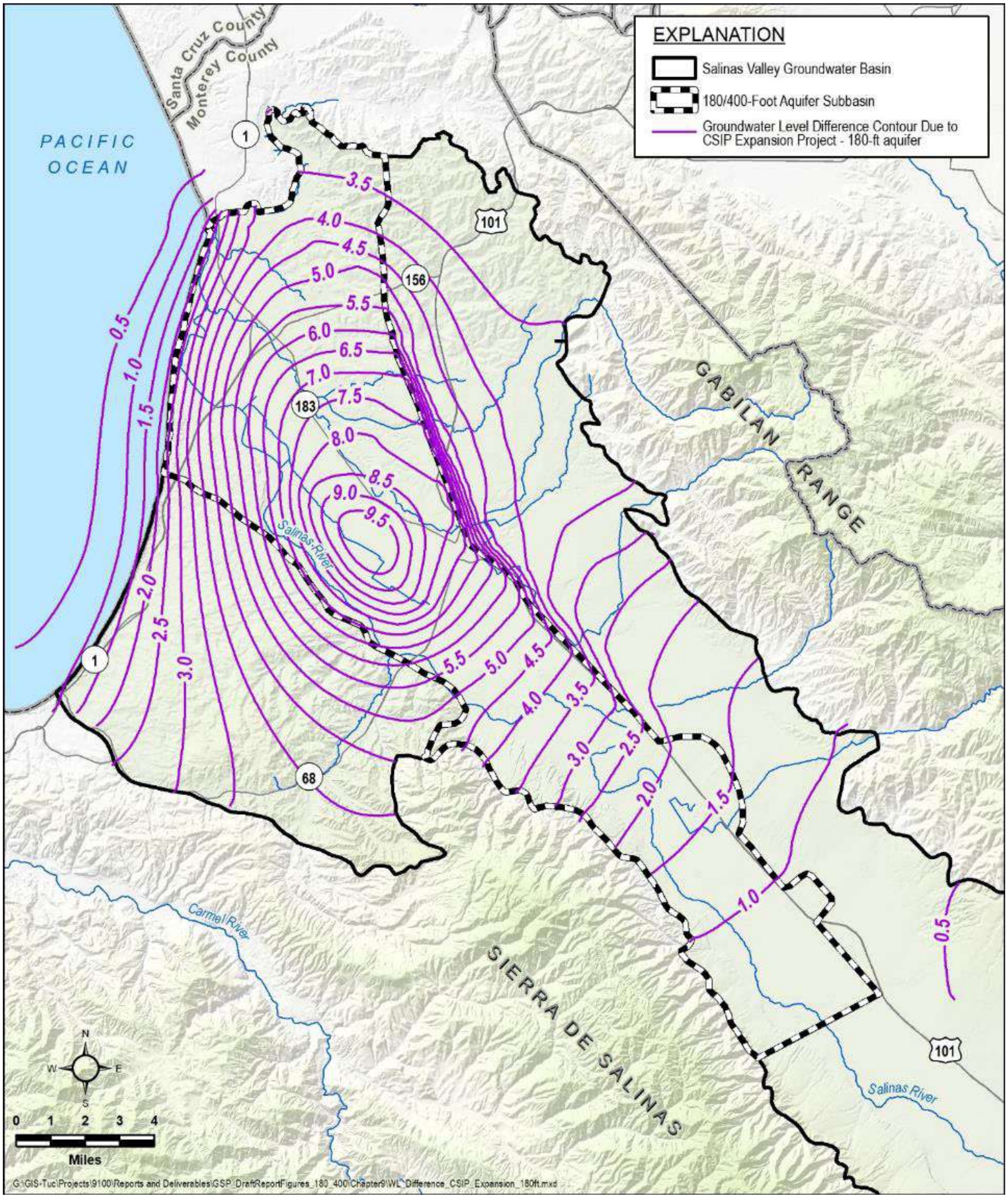

Figure 9-10: Estimated Groundwater Elevation Benefit in the 180-Foot Aquifer from the CSIP Expansion Project

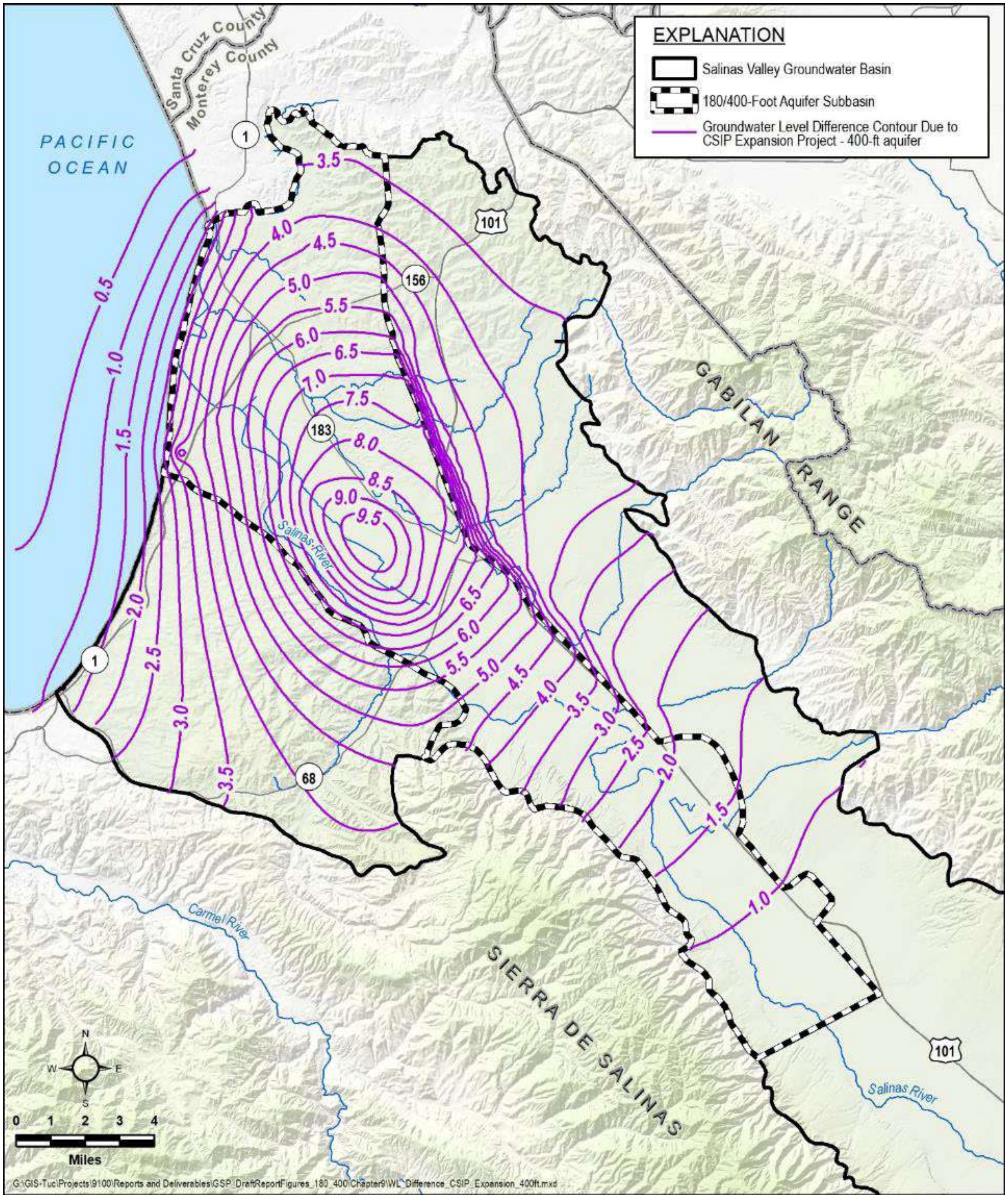

Figure 9-11. Estimated Groundwater Elevation Benefit in the 400-Foot Aquifer from the CSIP Expansion Project

9.5.4.3 Circumstances for Implementation

This project can only be implemented after CSIP optimization. After that, source water needs to be identified and the expansion area confirmed through more refined analysis and stakeholder consultation.

For implementation, this project will need an engineer's report, project design, environmental and regulatory compliance (CEQA, EIR), an annexation policy for contiguous versus non-contiguous access lands and rights-of-way, an annexation policy for voluntary versus compulsory inclusion, funding, and a review of U.S. Bureau of Reclamation (USBR) loan documents (MCWRA, 2018b). Additionally, there will need to be a negotiation modification of current Reclamation Plant and CSIP loan contracts to allow CSIP boundary expansion (MCWRA, 2018b). Throughout all these major steps, this expansion project will need to work closely with stakeholders to gain consensus (MCWRA, 2018b).

9.5.4.4 Permitting and Regulatory Process

This project will require a CEQA review process, which would likely result in either an EIR or a Mitigated Negative Declaration (the review could also result in a Negative Declaration or Notice of Exemption). Additionally, any project that coordinates with federal facilities or agencies may require NEPA documentation.

There will be a number of local, county, and state permits, rights of way, and easements required depending on pipeline alignments, stream crossings, and project type. These will depend on the expansion plan, which will be developed during GSP implementation. Projects with wells will require a well construction permit from MCWRA.

Additional permits may be required depending on the source water used.

9.5.4.5 Legal Authority

The SVBGSA will use the legal authority and partnerships for this modified project contained in existing distribution, irrigation, and partnership programs. Pursuant to California Water Code §10726.2 (b), the SVBGSA has the right to acquire and hold real property, and to divert and store water once it has acquired any necessary real property or appropriative water rights.

The MCWRA has the authority, pursuant to the Monterey County Water Resources Act, to levy benefit assessments to fund projects.

The County also has the power to impose charges on a parcel or acreage basis under the County Service Area provisions of the Government Code (beginning with Section 25210). These provisions give the County the authority to provide extended services within a specified area, which may be countywide, and to fix and collect charges for such extended services.

Miscellaneous extended service for which county service areas can be established include “water service, including the acquisition, construction, operation, replacement, maintenance, and repair of water supply and distribution systems, including land, easements, rights-of-way, and water rights.”

9.5.4.6 Implementation Schedule

If selected, the proposed implementation schedule is presented on Figure 9-12

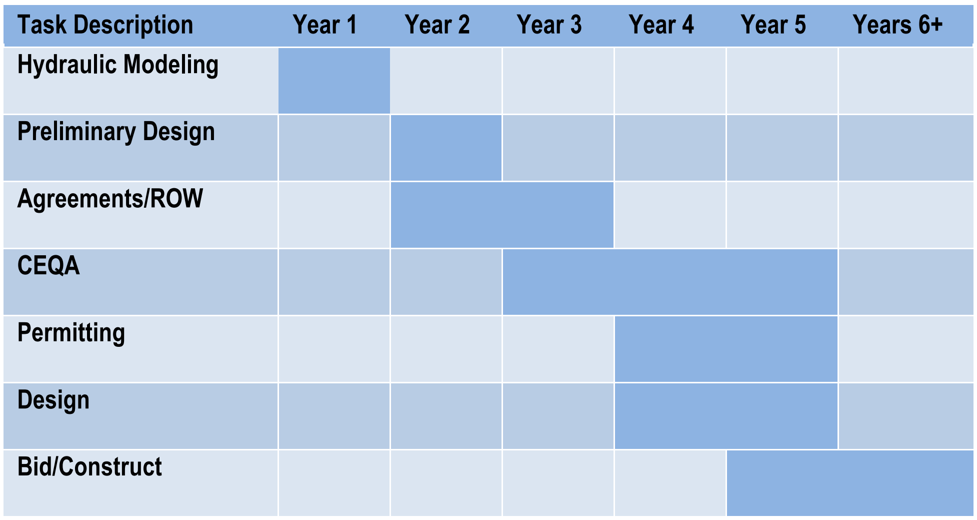

Figure 9-12. Implementation Schedule for CSIP Optimization and Expansion Project

9.5.4.7 Estimated Cost

Capital cost for the CSIP expansion project is estimated at $88,039,000. Annual O&M costs are approximately $576,000. The estimated projected yield for the project is up to 7,000 AF/yr. The amortized cost of water for this project is estimated at $1,070/AF.

Cost has not been estimated for 8,500 acres of CSIP expansion. The final size and location of CSIP expansion will be determined through additional hydraulic modeling and engineering that identifies the most cost-effective areas for expansion.

9.5.4.8 Public Noticing

If financed by SVBGSA, before MCWRA initiates construction on this project, it will go through a public notice process to ensure that all groundwater users and other stakeholders have ample opportunity to comment on projects before they are built. The general steps in the public notice process will include the following:

- SVBGSA staff will bring an assessment of the need for the project to the SVBGSA Board and the MCWRA Board in publicly noticed meetings. This assessment will include:

- A description of the undesirable result(s) that may occur if action is not taken
    - A description of the proposed project
    - An estimated cost and schedule for the proposed project
    - Any alternatives to the proposed project
- The SVBGSA Board will notify stakeholders in the area of the proposed project and allow at least 30 days for public response.
- After the 30-day public response period, the SVBGSA Board will vote whether or not to approve financing design and construction of the project and notify the public if approved via an announcement on the SVBGSA website and mailing lists.

The permitting and implementation of the expansion will require notification of stakeholders, beneficiaries, water providers, member lands adjacent to the river, and subbasin committee members. In addition to the process detailed above, all projects will follow the public noticing requirements per CEQA or NEPA.

9.5.5 P5: Seawater Intrusion Extraction Barrier

This project was named the Seawater Intrusion Pumping Barrier in the original GSP. Seawater intrusion will be halted using an extraction barrier near the coast. The barrier will be approximately 5 miles in length between Castroville and the Salinas River. As currently scoped, the intrusion barrier comprises 18 extraction wells; although this number may change as the project is refined. Nine wells will be located in the 180-Foot Aquifer and 9 wells will be located in the 400-Foot Aquifer. Supplemental water to replace the extracted water would need to come from other sources such as the regional municipal supply project described in Section 0 or injection of additional SVWP diversions. For costing purposes, the initial barrier alignment is assumed to largely parallel Highway 1, diverging to the northeast on the northern side of Castroville. This alignment will be refined as land access agreements are developed and cost estimates are refined. Wells will be installed spaced approximately every 2,000 feet. The deepest wells would be installed to the depth of the base of the 400-Foot Aquifer, approximately 750 feet below ground surface.

The 9 wells in the 180-Foot Aquifer are assumed to produce 700 gpm each, for a total extraction rate of 6,300 gpm or 14 cfs. The 9 wells in the 400-Foot Aquifer are assumed to produce 1,400 gpm each, for a total extraction of 12,600 gpm or 28 cfs. The 18 wells would withdraw up to 30,000 AF/yr. Approximately half of this 30,000 AF/yr comes from the inland side of the barrier. This number will be refined as the project design is refined. Depending on the source of supplemental water, extracted groundwater could be conveyed in a new pipeline for ultimate discharge back into the Pacific Ocean; or the extracted water could be conveyed to a new or existing desalting facility where it can be treated for direct use, such as noted in the Regional

Municipal Supply Project below. The water extracted from these wells will be brackish due to historical seawater intrusion.

A seawater intrusion barrier using injection instead of extraction was also considered; however, this option was tabled due to lack of source water for injection. This option would use the same 9 wells in the 180-Foot Aquifer and 9 wells in the 400-Foot Aquifer but would use these wells to develop an injection mound rather than a drawdown barrier. The mound developed by injection would need to be high enough to compensate for the density of seawater at the coast. Assuming the 180-Foot Aquifer has an average depth of 270 feet and using the Ghyben-Herzberg relationship for saltwater intrusion, the injection mound in the 180-Foot Aquifer at the coastline would need to be 6.75 feet above sea level to fully stop seawater intrusion. Assuming the 400-Foot Aquifer has an average depth of 550 feet, and using the same relationships, the injection mound in the 400-Foot Aquifer at the coastline would need to be 13.75 feet above sea level to fully stop seawater intrusion.

Mounding calculations presented in Appendix 9D of the original GSP suggest that approximately 46,000 AF/yr of water would need to be injected to create the required mounding; however, this will vary based on the location of the wells. Feasibility studies will evaluate the best location for extraction barrier wells and the associated benefits. Water that could be injected in accordance with existing regulations and ordinances includes treated Salinas River water, desalinated ocean water, and advanced purified recycled water. Treated Salinas River water and desalinated ocean water would be preferentially delivered to growers and municipalities rather than injected. The only likely source of water for injection is therefore advanced purified recycled water. Because it is unlikely that a reliable year-round supply of advanced purified recycled water will be available for a reasonable cost, the injection option was temporarily tabled.

9.5.5.1 Relevant Measurable Objectives

Relevant measurable objectives benefiting from this project include:

- **Seawater intrusion measurable objectives –** This project creates a localized pumping depression that prevents seawater from intruding beyond the extraction barrier. To meet the measurable objectives, wells would need to be located at or on the coastal side of the measurable objective line; however, project feasibility and scoping will evaluate the well locations that are most effective for addressing seawater intrusion.

9.5.5.2 Expected Benefits and Evaluation of Benefits

The project will stop and reverse seawater intrusion to the location of the extraction wells. Depending on the well locations, this will remediate and restore the 180/400-Foot Aquifer Subbasin.

9.5.5.3 Circumstances for Implementation

Initial feasibility for the extraction barrier project will be included in a comparison of the main projects that could address seawater intrusion. This comparison will help prioritize projects and management actions based on effectiveness at reaching sustainability, public acceptance, and cost.

9.5.5.4 Permitting and Regulatory Process

This project will require a CEQA review process, which would likely result in either an EIR or a Mitigated Negative Declaration (the review could also result in a Negative Declaration or Notice of Exemption). Additionally, any project that coordinates with federal facilities or agencies may require NEPA documentation.

There will be a number of local, county, and state permits, rights of way, and easements required depending on pipeline alignments, stream crossings, and project type. These will depend on the location of wells, which will be developed during GSP implementation. Projects with wells will require a well construction permit from MCWRA.

9.5.5.5 Legal Authority

California Water Code §10726.2(a) gives the SVBGSA the right to acquire the land necessary for the required infrastructure.

9.5.5.6 Implementation Schedule

If selected, the implementation schedule is presented on Figure 9-14. It is anticipated to take 10 years to implement.

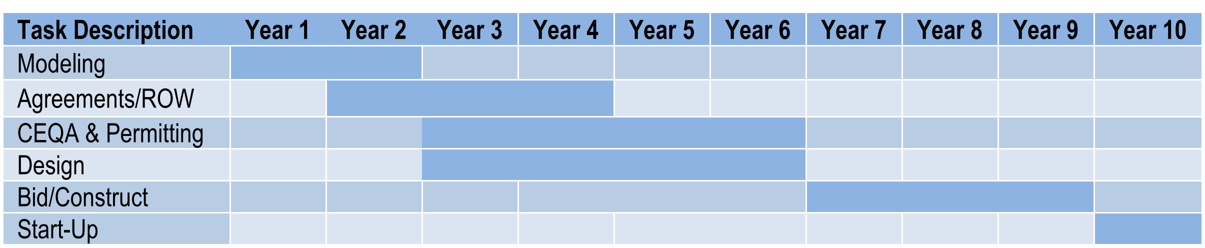

Figure 9-13. Implementation Schedule for Seawater Intrusion Extraction Barrier

9.5.5.7 Estimated Cost

Capital cost for the Seawater Intrusion Pumping Barrier project is estimated at $122,866,000. This includes 20% escalation from the 2019 cost estimate in the original GSP for inflation. This cost includes 44,000 LF of 8-inch to 36-inch pipe and use of the existing M1W outfall. Annual O&M costs are anticipated to be approximately $11,731,000. To make the project cost comparable to other projects, the total projected yield of 30,000 AF/yr is used to estimate a cost per AF. This project does not benefit the Subbasin in the same way as those that mitigate overdraft, and thus the yield is not directly comparable; the yield is only used to calculate the cost comparison. The amortized cost of water for this project is estimated at $710/AF. This project assumes the water will be discharged through the existing M1W outfall. Analysis of brine disposal needs to be completed to determine whether upgrades to the outfall are necessary. Outfall upgrades are not included in this cost estimate.

9.5.5.8 Public Noticing

If financed by SVBGSA, before MCWRA initiates construction on this project, it will go through a public notice process to ensure that all groundwater users and other stakeholders have ample opportunity to comment on projects before they are built. The general steps in the public notice process will include the following:

- SVBGSA staff will bring an assessment of the need for the project to the SVBGSA Board and the MCWRA Board in publicly noticed meetings. This assessment will include:
    - A description of the undesirable result(s) that may occur if action is not taken
    - A description of the proposed project
    - An estimated cost and schedule for the proposed project
    - Any alternatives to the proposed project
- The SVBGSA Board will notify stakeholders in the area of the proposed project and allow at least 30 days for public response.
- After the 30-day public response period, the SVBGSA Board will vote whether or not to approve design and construction of the project and notify the public if approved via an announcement on the SVBGSA website and mailing lists.

The permitting and implementation of the expansion will require notification of stakeholders, beneficiaries, water providers, member lands adjacent to the river, and subbasin committee members. In addition to the process detailed above, all projects will follow the public noticing requirements per CEQA or NEPA.

9.5.6 P6: Regional Municipal Supply Project

This project is an updated version of Project 6 in the original GSP. This project is not a stand-alone project but rather a potential supplement to the seawater intrusion extraction barrier project. This project would construct a regional desalting plant to treat the brackish water extracted from the proposed seawater intrusion extraction barrier. It would deliver water for direct potable use to municipal systems in the 180/400-Foot Aquifer Subbasin and other subbasins within Salinas Valley. This project provides in lieu recharge to the groundwater system through reduced extraction by municipal systems. If the plant produced more water than could be used for direct potable use, excess water could be used for irrigation or reinjected into the 180-Foot or 400-Foot Aquifer. The water would be available year-round.

Further analysis and scoping are needed to determine the exact location of the desalting plant, end uses, and desalting technology. Depending on the desalting plant selected, the source water pipeline would consist of approximately 11 miles of source water pipeline to convey up to 22,000 gpm (32 mgd or 35,500 AF/yr) of flow to the plant from the seawater intrusion extraction barrier. The pipeline would range from 18” to 36” in diameter. The plant would produce approximately 15,000 AF/yr of potable water for use. The distribution of that water is yet to be determined. Rough estimates of piping and needed pump stations to provide water to the main municipal areas are included in the cost estimate and will be refined during GSP implementation.

9.5.6.1 Relevant Measurable Objectives

The measurable objectives benefiting from the Regional Municipal Supply Project include:

- **Groundwater levels measurable objective.** By reducing groundwater extraction through in lieu recharge, there will be more water left in the principal aquifers. This will either raise groundwater elevations or reduce the rate of groundwater elevation decline over time.
- **Groundwater storage measurable objective.** Using desalinated water reduces groundwater extraction, which will either increase groundwater storage or reduce the rate of storage loss.
- **Seawater intrusion measurable objective.** Providing water for in-lieu storage will reduce the pumping-induced gradient that drives seawater intrusion.
- **Land subsidence measurable objective.** Increasing both groundwater elevations and groundwater storage will have the added benefit of preventing any potential land subsidence. Maintaining and adding water in the subsurface will keep pore spaces saturated with positive pressure and inhibit land surface collapse associated with groundwater depletion.

9.5.6.2 Expected Benefits and Evaluation of Benefits

The proposed plant would produce up to 15,000 AF/yr of desalted water for the Salinas Valley, based on an inflow of 30,000 AF/yr. A portion of that would go to 180/400-Foot Aquifer Subbasin. This would reduce groundwater extraction by that amount, increase the Subbasin’s groundwater storage (or lessen the decline), and reduce the risk of seawater intrusion. This will benefit all groundwater users in the Subbasin to some degree. If desalinated water is delivered to the City of Salinas, the pumping reductions and groundwater elevation benefits would occur in the locations of the wells that currently supply the City’s needs. Specific quantification of the groundwater benefit for the 180/400-Foot Aquifer Subbasin is unable to be determined prior to determining the distribution of available desalinated water.

Benefits will be measured using the monitoring networks described in Chapter 7. Groundwater elevations will be measured with a network of wells that is monitored by MCWRA. Groundwater storage will be monitored using groundwater pumping measurements and estimates. Land subsidence will be measured using InSAR data provided by DWR. Seawater intrusion will be measured using select RMS wells. A direct correlation between providing desalinated water to the Subbasin and changes in groundwater levels, subsidence, or seawater intrusion will depend in part on the suite of management actions and projects implemented concurrently in the Subbasin.

9.5.6.3 Circumstances for Implementation

This project is not a stand-alone project but is a potential supplement to the seawater intrusion extraction barrier project. This project will only be implemented if and when a brackish water extraction barrier is built to control seawater intrusion. A more detailed cost/benefit analysis will be completed before any work begins on this project. Further analysis and comparison of desalination technologies, stakeholder deliberations on the distribution of desalinated water, and identification of project sites still need to be completed. Initial feasibility for the Regional Municipal Supply Project will be included in a comparison of the main projects that could address seawater intrusion. This comparison will help prioritize projects and management actions based on effectiveness at reaching sustainability, public acceptance, and cost.

9.5.6.4 Permitting and Regulatory Process

Permits from the following government organizations that may be required for this project include:

- ***United States Fish and Wildlife Service (USFWS)*** – A Migratory Bird Treaty Act Permit (16 U.S. Code §703-711) may be required from the USFWS. Other federal agencies involved in the permitting process for this project may need to consult with USFWS in compliance with Section 7 of the Endangered Species Act. Interagency coordination is also required by the Fish and Wildlife Coordination Act (16 U.S. Code §661-667e).
- ***National Oceanic & Atmospheric Administration (NOAA)*** – Section 7 of the Endangered Species Act requires other federal agencies to consult with NOAA's NMFS if threatened or endangered species could be affected by this project. NMFS also monitors compliance with Section 305b of the Magnuson-Stevens Fishery Conservation and Management Act (16 U.S. Code §1855b) which protects essential fish habitats. The Monterey Bay National Marine Sanctuary (MBNMS), which is part of NOAA, must review National Pollutant Discharge Elimination System (NPDES) permits.

- ***United States Army Corps of Engineers (USACE)* –** Under the Rivers and Harbor Act, a Section 10 permit (33 U.S. Code §403) is required for the construction of any structure in or over any navigable water of the United States. Under the Clean Water Act, a Section 404 permit (33 U.S. Code §1341) is required to discharge dredge or fill materials into waters of the United States.
- ***State Water Resources Control Board (SWRCB)*** – A permit to operate a public water system is required from SWRCB's DDW. Construction that disturbs 1 acre or more of land and that discharges stormwater requires a General Construction Stormwater Permit (Water Quality Order No. 2009-0009-DWQ). Certification to discharge dredged or fill material is required by Section 401 of the Clean Water Act and by the Porter-Cologne Water Quality Control Act (California Water Code §13000 *et seq.*). Discharge of brine or other pollutants requires a NPDES permit under Section 402 of the Clean Water Act (33 U.S. Code §1342). If M1W's existing outfall is used, it would require an amendment to their existing NPDES permit.
- ***California Department of Fish and Wildlife (CDFW)*** – Projects that may result in the take of a threatened or endangered species require an Incidental Take Permit (California Endangered Species Act Title 14, §783.2). A Streambed Alteration Agreement (California Fish and Game Code Section 1602) is required if the project may substantially adversely affect fish and wildlife resources.
- ***California Coastal Commission (CCC)*** – Construction within the Coastal Zone requires a Coastal Development Permit (Public Resources Code 30000 *et seq.*). Under the Coastal Zone Management Act (16 U.S.C. §1456), the CCC will ensure that federal authorized work is consistent with the enforceable policies of California's Coastal Management Program. Consistency between federal and state laws in coastal areas is also required by the Federal Consistency Regulations (15 Code of Federal Regulations, Part 930, Subpart D). The County may have initial jurisdiction to issue any required permit, but that would be appealable to the full Commission.
- ***California Department of Transportation (Caltrans)*** – Work that may obstruct a State highway requires an Encroachment Permit.
- ***California Department of Toxic Substances Control (DTSC)*** – If the project encroaches into the Fort Ord area, there will be hazardous waste management and disposal requirements concerning Soluble Threshold Limit Concentrations and Total Threshold Limit Concentrations (22 California Code of Regulations §66261.24).
- ***California Department of Parks and Recreation*** – If the project encroaches into Fort Ord Dunes State Park, an easement, right of entry, and/or lease negotiation is required. Federal agencies involved in this project are required to consult with the Department of Parks and Recreation's State Historic Preservation Officer in accordance with Section 106 of the National Historic Preservation Act (16 U.S. Code §470).

- ***California Public Utilities Commission (CPUC)*** – A Certificate of Public Convenience and Necessity (California Public Utilities Code §1001 *et seq.*) is required to show that the project will benefit society.
- ***Various Entities with Jurisdiction on the Former Fort Ord*** – If the project encroaches into the Fort Ord area, it must comply with any applicable land use regulations of the entities with jurisdiction on the former Fort Ord.
- ***Monterey County*** – If the project encroaches onto any county-maintained road, an Encroachment Permit (Monterey County Code Chapter 14.04) is required from the County. Removal of 3 or fewer trees can be handled by a standalone Tree Removal Permit (Monterey County Code Chapter 16.60). Removal of more than 3 trees should be included in a County Use Permit and/or Coastal Development Permit. If there will be 55 gallons (liquid), 500 pounds (solid), or 200 cubic feet (compressed gas) of hazardous materials on site at any one time, a Hazardous Materials Business Plan, and a Hazardous Materials Inventory Statement (California Health and Safety Code Chapter 6.95) must be submitted to Monterey County Health Department's Environmental Health Bureau. Other required permits include a Well Construction Permit (Monterey County Code Chapter 15.08) and permits to construct and operate a desalination treatment facility (Monterey County Code Chapter 10.72). The project will require a Coastal Development Permit, which may be submitted to Monterey County Housing and Community Development Department. If the project will extend inland beyond the Coastal Zone, a Use Permit (MCC Chapter 21.72 Title 21) is also required. A Grading Permit (Monterey County Code Chapter 16.08) is required if total disturbance on site equals or exceeds 100 cubic yards. If the project encroaches on the Fort Ord area, an excavation permit is required for disturbances that equal or exceed 10 cubic yards (Monterey County Code Chapter 16.10). An erosion control plan (Monterey County Code Chapter 16.12) is required if there is risk of accelerated (human-induced) erosion that could lead to degradation of water quality, loss of fish habitat, damage to property, loss of topsoil or vegetation cover, disruption of water supply, or increased danger from flooding.
- ***Monterey One Water*** – A Sewer Connection Permit is required to connect to the regional sewer system.
- ***Monterey Bay Air Resources District (MBARD)*** – If the project may release or control air pollutants, an Authority to Construct and Permit to Operate is required (MBARD Rule 200).
- ***Monterey Peninsula Water Management District (MPWMD)*** – An expansion/extension permit is required to expand the current water system (MPWMD Ordinance 96).
- ***Marina Coast Water District, CalWater, Alco, and other local water agencies*** – The project will require contracts with local water agencies that plan to buy and deliver the desalinated water.

- ***Transportation Agency for Monterey County (TAMC)***– An easement for access to and use of the project site may need to be negotiated with TAMC.
- ***Local jurisdictions*** – Permits may also be required by a local jurisdiction depending on location of desalination plant, including but not limited to land use permits, building permits, public health permits, public works permits, tree removal permits, and encroachment permits.
- ***CEQA/NEPA*** – The project will have to undergo a CEQA environmental review process and will likely require an Environmental Impact Report (EIR). Additionally, permits from a variety of state and federal agencies may be necessary, and any project that coordinates with federal facilities or agencies may require National Environmental Policy Act (NEPA) documentation.

9.5.6.5 Legal Authority

Pursuant to California Water Code §10726.2 (a) and (b), the SVBGSA has the right to acquire and hold real property, appropriate and acquire surface water or groundwater, acquire water rights, and to divert and store water once it has acquired any necessary real property or appropriative water rights. Some right in real property (whether fee title, easement, license, leasehold or other) may be required to implement the project.

9.5.6.6 Implementation Schedule

If selected, the proposed implementation schedule is presented on Figure 9-14. This project would take approximately 11 years to implement, assuming the seawater intrusion barrier is already in place.

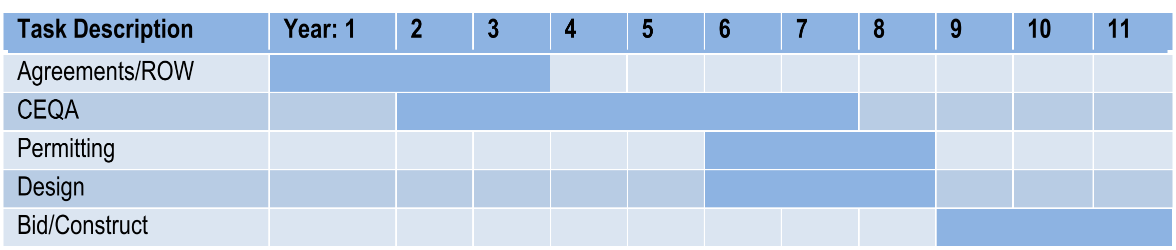

Figure 9-14. Implementation Schedule for Regional Municipal Supply Project

9.5.6.7 Estimated Cost

An initial estimate analyzed the cost to treat 15,000 AF/yr and deliver that desalinated water to municipalities in the 180/400-Foot Aquifer Subbasin, Eastside Subbasin, and Monterey Subbasin. The estimated capital cost for the pipeline from the wells to the desalination plant and desalination plant is $309,387,000. The estimated capital cost for the distribution network ranges from $65,257,000 to $84,315,000 depending on how many communities receive water. Annual

O&M are projected to cost about $13,192,000 to $13,389,000. If the total cost of the project is annualized over a 25-year term, and if production is 15,000 AF/yr, the unit cost for the desalination plant and distribution network ranges from $2,830 to $2,950/AF.

9.5.6.8 Public Noticing

If financed by SVBGSA, before MCWRA initiates construction on this project, it will go through a public notice process to ensure that all groundwater users and other stakeholders have ample opportunity to comment on projects before they are built. The general steps in the public notice process will include the following:

- SVBGSA staff will bring an assessment of the need for the project to the SVBGSA Board and the MCWRA Board in publicly noticed meetings. This assessment will include:
    - A description of the undesirable result(s) that may occur if action is not taken
    - A description of the proposed project
    - An estimated cost and schedule for the proposed project
    - Any alternatives to the proposed project
- The SVBGSA Board will notify stakeholders in the area of the proposed project and allow at least 30 days for public response.
- After the 30-day public response period, the SVBGSA Board will vote whether or not to approve financing design and construction of the project and notify the public if approved via an announcement on the SVBGSA website and mailing lists.

The permitting and implementation of the expansion will require notification of stakeholders, beneficiaries, water providers, member lands adjacent to the river, and subbasin committee members. In addition to the process detailed above, all projects will follow the public noticing requirements per CEQA or NEPA.

9.5.7 P7: Seasonal Release with Aquifer Storage and Recovery (ASR) or Direct Delivery (previously SRDF Winter Flow Injection)

This project is an updated version of the SRDF Winter Flow Injection Project in the original GSP. It has been updated based on further discussions with MCWRA and stakeholder input. As noted above, reservoir reoperation resulting from the Reservoir Reoperation Management Action feasibility study could be paired with this project. This project, however, may have more specific requirements of reservoir reoperation for maximum benefit. Any reservoir reoperation would affect the entire Salinas River, and therefore analyses and decisions regarding reservoir reoperation must consider the impact on all subbasins.

The project modifies reservoir releases for the MCWRA's Conservation Program and SRDF diversions to store at least a portion of these releases during wet seasons in the 180-Foot and 400-Foot Aquifers. This seasonal storage would reduce or eliminate the need for Conservation Program dry season releases. Initial modeling shows that this project would increase annual carryover in the reservoirs, allowing for more consistent wet seasonal releases during dry years. This wet season release water would be diverted using the existing SRDF facilities, treated, and recharged through ASR injection wells into an unimpaired part of the aquifers in the winter/spring. This water would then be extracted during peak irrigation season for use distribution through the CSIP system.

Under this project, water released during the wet season from Nacimiento and San Antonio Reservoirs would be diverted from the Salinas River using the existing SRDF at a maximum flow rate of 36 cfs. Water would then be pumped to a surface water treatment plant where it would be treated to the standard necessary for groundwater injection and conveyed to new injection wells in the 180/400-Foot Aquifer Subbasin.

The existing SRDF facilities have a maximum diversion flow of 36 cfs, or 16,000 gpm. Based on an injection rate of 560 gpm per injection well, 16 new ASR wells would be required. New injection well facilities will include wells completed in both the 180- and 400-Foot Aquifers, back-flush facilities including back wash pumps and percolation basins for water disposal into the vadose zone, electrical and power distribution, and motor control facilities.

In addition to direct injection for groundwater recharge, seasonal releases could be used for direct delivery for municipal supply. Under direct delivery use, this water would act as in-lieu recharge by reducing the need for pumping from municipal wells, resulting in less winter groundwater demand. The water left in the aquifers through this in-lieu recharge can be pumped in the summer to meet CSIP demands. As with ASR injection, winter released surface water would need to be treated prior to delivery. Other important considerations for direct use of winter releases include water quality differences between groundwater and surface water, timing and availability of flows compared to municipal demand schedules, and other infrastructure needs. Direct delivery of winter releases may be a less expensive option but will need further analysis to determine its viability and would require additional infrastructure.

This project may benefit other subbasins, such as the Monterey and Eastside Subbasins, by raising groundwater levels in the 180/400-Foot Aquifer Subbasin and providing potable water to these subbasins for direct recharge and/or municipal potable use.

9.5.7.1 Relevant Measurable Objectives

Relevant measurable objectives benefiting from this project include:

- **Groundwater levels measurable objective** – The project releases more water in dry years than under current reservoir operations. These dry-year releases will add more water to the principal aquifers in the 180/400-Foot Aquifer Subbasin, thereby helping maintain adequate groundwater elevations during dry years. It will help prevent declines in groundwater elevations near CSIP by injecting water that can be withdrawn during the peak growing season.

- **Seawater intrusion measurable objective –** By injecting water into the 180 and 400-Foot aquifers, maximizing CSIP deliveries, offsetting existing groundwater pumping used to supplement CSIP deliveries, and helping prevent further declines in groundwater elevations, this project will help prevent further seawater intrusion.

- **Groundwater storage measurable objective** – Initial modeling suggests that the project will increase groundwater in the aquifers by 6,800 AF/yr in the Subbasin.

- **Land subsidence measurable objective** – By preventing declines in both groundwater elevations and groundwater storage, this project will have the added benefit of helping prevent land subsidence. Maintaining and adding water in the subsurface will keep pore spaces saturated with positive pressure and inhibit land surface collapse associated with groundwater depletion.

- **Interconnected surface water measurable objective** - Increasing winter/spring releases from the reservoirs will be add more surface water in the river during the winter/spring, when environmental flow needs are the greatest. This increase in surface water will diminish any impacts on important surface water users by existing rates of surface water depletion.

9.5.7.2 Expected Benefits and Evaluation of Benefits

The main groundwater-related expected benefits for the 180/400-Foot Aquifer Subbasin include:

- Improve the ability to maximize annual diversions at the SRDF. Diversions at the SRDF would no longer rely on large summer reservoir releases, of which less than 10% get to the SRDF. Winter/spring releases could be coordinated with environmental releases to maximize multiple benefits.
- More water available for CSIP or other beneficial users. The consistent diversions provide a more reliable water supply to CSIP. Additionally, any water not used by CSIP could remain in the ground to further reduce seawater intrusion or be extracted for beneficial use by other groundwater pumpers, such as municipalities.
- A reduction in, or reversal of, seawater intrusion. Providing more water for extractors and potentially leaving some water in the ground reduces seawater intrusion. The groundwater from natural recharge that occurs in addition to the injection will help mitigate seawater intrusion by minimizing native groundwater extraction and altering the hydraulic gradients to reverse inland flow of saline waters.

The expected benefits were estimated assuming approximately 14,600 AF/yr of water is available for seasonal recharge, resulting in groundwater benefit of 6,800 AF/yr. Additional water may be available for recharge if water rights permit it. These estimates will be refined during further project scoping and modeling.

Groundwater modeling in the original GSP showed estimated groundwater elevation benefit in the 180-Foot and 400-Foot Aquifers from this project, and estimated that it would reduce seawater intrusion by approximately 1,600 AF/yr if 12,900 AF/yr of water is available for recharge, as originally estimated. This modeling is not included here because project scoping needs to reevaluate the location of ASR wells and the SVOM does not account for the differing density between seawater and groundwater. SVBGSA is in the process of developing a variable density seawater intrusion model, and during the implementation period SVBGSA will use that model to estimate project benefits.

In addition to the benefits to the 180/400-Foot Aquifer, this project has benefits to other subbasins, including:

- Increased annual carryover in the reservoirs, allowing for more consistent winter releases. Eliminating most summer reservoir releases would allow more water to be retained in Nacimiento and San Antonio reservoirs. This increased amount of water in the reservoirs can be used to ensure more consistent annual winter releases during dry years or droughts, with higher volume releases as a result of increased storage.

- Reduced summer water supporting invasive species in riparian zones. Eliminating most summer reservoir releases will result in less shallow water supporting invasive species such as *arundo* or tamarisk.

Benefits will be measured using the monitoring networks described in Chapter 7. Groundwater elevations will be measured with a network of wells that is monitored by MCWRA. Land subsidence will be measured using InSAR data provided by the Department of Water Resources. Seawater intrusion will be measured using MCWRA’s existing seawater intrusion mapping approach. A direct correlation between injecting winter streamflow in the Subbasin and changes in groundwater elevations, subsidence, or seawater intrusion is likely not possible because this is only one among many management actions and projects that will be implemented in the Subbasin. When data gaps are filled, interconnected surface waters will be measured through shallow groundwater wells and river flow.

9.5.7.3 Circumstances for Implementation

If selected, this project will be implemented in coordination with MCWRA and will require agreements between MCWRA and SVBGSA. Seasonal recharge will be implemented only if the existing water rights permits allow or are modified to allow for additional reservoir releases and subsequent diversions between November and March.

This project will likely be subject to new flow restrictions and reservoir operations resulting from the planned HCP. This project will not proceed until the water rights and flow prescriptions from the HCP have been determined.

9.5.7.4 Permitting and Regulatory Process

Permits that might be required for this project include:

- ***Environmental Protection Agency (EPA)*** – All ASR projects, like this one, must register with the EPA's Underground Injection Control program.
- ***National Marine Fisheries Service (NMFS)*** – Projects that potentially affect flows in any surface water under NMFS jurisdiction must get approval from NMFS. NFMS may set conditions that will be included in the State Water Resources Control Board permit.
- ***State Water Resources Control Board (SWRCB)*** – All ASR projects must submit an Underground Storage Supplement as part of the application to receive either a Temporary Permit, a Standard Permit, or a Streamlined Permit from SWRCB. A modification to MCWRA's existing water right or re-diversion permit may be necessary.
- ***Division of Safety of Dams (DOSD)*** – The existing DOSD permit may need to be modified to allow the SRDF diversion structure to operate outside its current window of April-October.
- ***California Department of Fish and Wildlife (CDFW)*** – Any project that diverts water from a river, stream, or lake, or that has the potential to affect fish and wildlife resources, must obtain a Land and Streambed Alteration Agreement from CDFW.
- ***Regional Water Quality Control Board (RWQCB)*** – General Waste Discharge Requirements paperwork must be filed with RWQCB to comply with its General Order that governs the injection of water to recharge aquifers.
- ***Monterey County Health Department (MCHD)*** – Well construction permits must be obtained from MCHD.
- ***Monterey County*** – A Use Permit may be required. A Grading Permit is required if 100 cubic yards or more of soil materials are imported, moved, or exported. An Encroachment Permit is required if objects will be placed in, on, under, or over any County highway.

This project will require a CEQA review process, which would likely result in either an EIR or a Mitigated Negative Declaration (the review could also result in a Negative Declaration or Notice of Exemption). Additionally, any project that coordinates with federal facilities or agencies may require NEPA documentation.

9.5.7.5 Implementation Schedule

If selected, a proposed implementation schedule after initial agency agreements and any permitting or water rights alterations is presented on Figure 9-15.

Task Description	Year 1	Year 2	Year 3	Year 4	Year 5	Annually
Phase I – Agreements, CEQA, Permitting						
Phase II – Treatment Facilities and ASR well Construction						
Phase III – Winter Releases						

Figure 9-15. Implementation Schedule for Winter Releases from Reservoirs with ASR Project

9.5.7.6 Legal Authority

The SVBGSA has the right to divert and store water once it has access to the appropriate water rights. California Water Code §10726.2 (b) provides GSAs the authority to, “Appropriate and acquire surface water or groundwater and surface water or groundwater rights, import surface water or groundwater into the agency, and conserve and store within or outside the agency” (CWC, 2014). MCWRA is the legal authority for some of this project’s facilities, therefore SVBGSA will work collaboratively to use existing structures and water rights.

MCWRA operates the dams at Nacimiento and San Antonio pursuant to the terms and conditions of the permits and licenses for the two dams, and the flow prescriptions required by NMFS.

9.5.7.7 Estimated Cost

Costs for the injection of seasonal flows from the SRDF are estimated based upon the assumption that the diversion will take advantage of the existing SRDF facilities at an original calculated rate of 12,900 AF/yr, resulting in a groundwater benefit of 6,800 AF/yr. Most of the costs are for the construction of the injection wells. Capital costs are estimated to be $166,954,000 for construction of an ASR injection well field consisting of 16 wells, construction of a 4-mile conveyance pipeline between the SRDF site and the injection well system, and a filtration and disinfection plant. These costs include engineering, overhead, and contingencies.

Annual O&M costs are estimated at $4,349,000 for the operation of the ASR injection well field, including a 20% contingency. Total annualized cost is $17,410,000. Based on the calculated project yield of 6,800 AF/yr groundwater benefit, the unit cost of water is $2,560/AF. This unit cost does not include additional storage changes based on recharge from the Salinas River, nor drought benefits. This unit cost is not necessarily the cost of the project to stakeholders in the Upper Valley Aquifer Subbasin. As part of this project, benefits analysis will be undertaken to determine the zones of benefit and assessments.

9.5.7.8 Public Noticing

Before SVBGSA initiates construction on any project as part of GSP implementation, it will go through a public notice process to ensure that all groundwater users and other stakeholders have ample opportunity to comment on projects before they are built. The general steps in the public notice process will include the following:

- SVBGSA staff will bring an assessment of the need for the project to the SVBGSA Board and the MCWRA Board in publicly noticed meetings. This assessment will include:
    - A description of the undesirable result(s) that may occur if action is not taken
    - A description of the proposed project
    - An estimated cost and schedule for the proposed project
    - Any alternatives to the proposed project
- The SVBGSA Board will notify stakeholders in the area of the proposed project and allow at least 30 days for public response.
- After the 30-day public response period, the SVBGSA Board will vote whether or not to approve design and construction of the project and notify the public if approved via an announcement on the SVBGSA website and mailing lists. Additionally, the MCWRA Board will vote whether or not to approve the project concept. The boards will work cooperatively moving forward with this project.

The permitting and implementation of change to releases from the reservoirs will require notification of stakeholders, beneficiaries, water providers, member lands adjacent to the river, and subbasin committee members as well as all permit and regulatory holding agencies such as DWR, CEQA, NOAA, USACE, and others.

9.5.8 P8: Irrigation Water Supply Project

This project was included in the original GSP as Alternative Project 4: Use the Southern Portion of the 180/400-Foot Aquifer Subbasin for Seasonal Storage. A similar project is included in the Eastside Subbasin GSP as the Eastside Irrigation Water Supply Project, and is also referred to as Somavia Road Project. Both projects rely on extracting the same source water but distribute it to different locations, so one project would need to be selected or source water split between the two projects.

Under this project, conventional groundwater extraction well facilities would be constructed in the southern portion of the 180/400-Foot Aquifer Subbasin to extract seasonally stored groundwater during peak irrigation season for supply and environmental needs. Due to the laterally extensive presence of the Salinas Valley Aquitard within much of the 180/400-Foot Aquifer Subbasin, the ability of the Salinas River to effectively recharge the most productive aquifer zones for cyclic storage and extraction is limited. However, the Salinas Valley Aquitard is less prominent farther south, eventually pinching out near Chualar or potentially thinning out along specific stretches of the River. This project relies on the ability to place extraction wells in an area of the southern 180/400-Foot Aquifer Subbasin where the Salinas Valley Aquitard is thin to missing, thereby allowing the Salinas River to recharge at least some of the more productive aquifer zones in the winter and extracting that water for delivery in the summer.

This project could supplement flows to the existing Diversion Facility at times when instream flows are insufficient to meet SRDF diversion and/or environmental flow requirements. This project could also be combined with various conveyance schemes to deliver the produced water to groundwater deficit areas in other parts of the 180/400-Foot Aquifer and/or Eastside Subbasins to offset coastal pumping and seawater intrusion.

The project entails construction of traditional vertical production wells to extract water. The water would either be discharged to the Salinas River via a short pipeline, or to a centrally located sump, from which the water would be discharged to a coastal distribution network.

The extraction wells will only screen the 180-Foot Aquifer; accordingly, total well depths would likely not exceed 350 feet below ground surface (bgs). Three extraction wells would be installed. Ideally, the wellfield would be located in close proximity to the Salinas River in order to minimize costs associated with water conveyance back to the river channel during peak irrigation periods.

For costing purposes, the extraction wells are capable of production rates up to 2,000 gpm. With 2 primary wells extracting water during a typical 6-month irrigation season and the third as back-up, approximately 3,000 AF would be available as supplemental water. This water, once extracted, would create a similar volume of available storage space within the aquifer system. Well spacing could be such that the seasonal drawdown would be spread over about one mile along the river.

On average, this aquifer storage volume would be recharged by percolating Salinas River flows during a typical winter high flow season. Assuming a 5-month recharge period, this would equate to an average aquifer recharge rate of about 10 cfs over the 1-mile drawdown zone.

9.5.8.1 Relevant Measurable Objectives

Relevant measurable objectives benefiting from this project include:

- **Groundwater levels measurable objective.** This measurable objective will benefit from increased recharge nearby the River and decreased pumping in the location that receives water, both of which will result in higher groundwater levels.
- **Groundwater storage measurable objective.** This measurable objective will benefit from increased recharge nearby the River and decreased pumping in the location that receives water, both of which will have the effect of increasing groundwater in storage.
- **Land subsidence measurable objective.** This measurable objective will benefit from increased groundwater levels that reduce any potential for subsidence.

9.5.8.2 Expected Benefits and Evaluation of Benefits

The primary anticipated benefit is up to 3,000 AF of water available to the Subbasin for direct delivery and in-lieu recharge. Further investigations and field studies will confirm this anticipated benefit as part of the project feasibility study. This water could both offset coastal pumping and reduce seawater intrusion.

Reductions in groundwater pumping will be measured directly and recorded in the water charges framework database. Changes in groundwater elevation will be measured with the groundwater level monitoring program detailed in Chapter 7. Subsidence will be measured using the DWR provided subsidence maps detailed in Chapter 7. Seawater intrusion will be measured using MCWRA's existing seawater intrusion mapping approach. A direct correlation between seasonal storage of water in the upper reaches of the Subbasin and changes in groundwater elevations, subsidence, or seawater intrusion is likely not possible because this is only one among many management actions and projects that will be implemented in the Subbasin.

9.5.8.3 Circumstances for Implementation

Significant hydrogeologic studies are necessary to substantiate the Salinas River recharge rates in the area nearby Chualar to make sure that any groundwater extracted during the summer will be recharged by winter flows, and to consider fluctuations in river flows across wet and dry years. If selected, agreements with individual landowners will be necessary to put extraction wells on their property and operate the extraction wells for the benefit of the Valley.

9.5.8.4 Permitting and Regulatory Process

Surface water rights holders and groundwater pumpers both have correlative rights to the common water pool. As stated in the SVWC v. MCWRA Report of Referee (SWRCB, 2019):

> *The common source doctrine applies to groundwater and surface waters that are hydrologically connected and integrates the relative priorities of the rights without regard to whether the diversion is from surface or groundwater.*

Groundwater pumping rights and riparian surface water rights are correlative under this finding. As such, this modified project will likely have many of the same applicable permitting and regulatory processes as a surface water diversion right, which would have been necessary under the original project scope.

MCWRA collects groundwater extraction information from all wells in the Salinas Valley Basin that have discharge pipes of 3 inches or greater in diameter. These data have been collected since 1993. Extraction is self-reported by well owners. MCWRA shall promptly submit any reports, data, or other information that may reasonably be required by the State Water Board.

All wells drilled will comply with the County's well permitting process. All other state and local entities permit processes will be followed for this modified project.

9.5.8.5 Implementation Schedule

The implementation schedule is presented on Figure 9-16. It is anticipated to take approximately 5 years to implement.

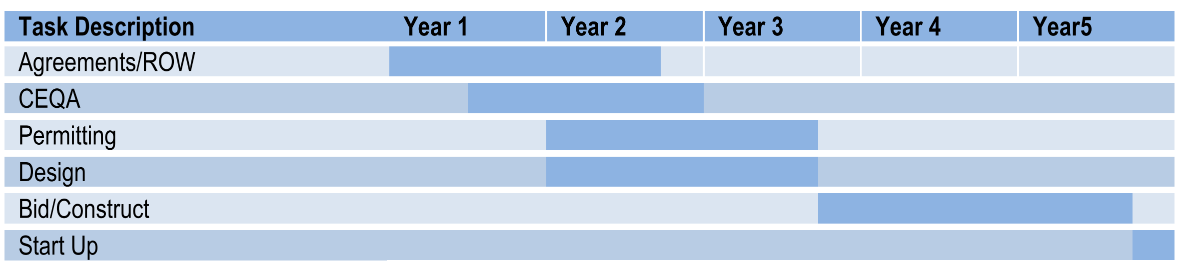

Figure 9-16. Implementation Schedule for Seasonal Storage in the Upper 180/400-Foot Aquifer Subbasin

9.5.8.6 Legal Authority

The SVBGSA will use the legal authority and partnerships for this modified project contained in existing distribution, irrigation, and partnership programs. Pursuant to California Water Code §10726.2 (b), the SVBGSA has the right to acquire and hold real property, and to divert and store water once it has acquired any necessary real property or appropriative water rights. Under California Water Code §10726.2 (b) which give the SVBGSA authority to "Appropriate and acquire surface water or groundwater …" as well as "the spreading, storing, retaining, or percolating into the soil of the waters for subsequent use."

The County also has the power to impose charges on a parcel or acreage basis under the County Service Area provisions of the Government Code (beginning with §25210). These provisions give the County the authority to provide extended services within a specified area, which may be countywide, and to fix and collect charges for such extended services. Miscellaneous extended service for which county service areas can be established include "water service, including the acquisition, construction, operation, replacement, maintenance, and repair of water supply and distribution systems, including land, easements, rights-of-way, and water rights."

A county service area can be established by the Board of Supervisors on its own initiative. It is created by a notice and hearing process or by election. County service area charges are established by ordinance and may be collected on the tax roll in the same manner and time as ad valorem property taxes.

As stated in the SVWC v. MCWRA Report of Referee (SWRCB, 2019):

> *The common source doctrine applies to groundwater and surface waters that are hydrologically connected and integrates the relative priorities of the rights without regard to whether the diversion is from surface or groundwater.*

Groundwater pumping rights and riparian surface water rights are correlative under this finding. Pumping allowances have not yet been established and are not water rights. One potential constraint on this project is clarifying water rights for recharge. Recharging excess water from this 3,000 AF/yr project could be available for recharge if water rights law permits it.

9.5.8.7 Estimated Cost

Estimated capital costs include well construction, well pumps and motors, wellhead piping infrastructure, and land access. Estimated capital costs do not include conveyance infrastructure for direct discharge to the river channel or to a coastal distribution network, contingency or administrative costs. Estimated capital costs are $5,925,000. Estimated annual O&M costs are $867,600. These costs do not include water treatment. Based on a project yield of 3,000 AF/yr of extracted water, the amortized cost of water is $440/AF.

9.5.8.8 Public Noticing

Before SVBGSA initiates any project initiates construction it will go through a public notice process to ensure that all groundwater users and other stakeholders have ample opportunity to comment on projects before they are built. The general steps in the public notice process will include the following:

- SVBGSA staff will bring an assessment of the need for the project to the SVBGSA Board in a publicly noticed meeting. This assessment will include:
    - A description of the undesirable result(s) that may occur if action is not taken
    - A description of the proposed project
    - An estimated cost and schedule for the proposed project
    - Any alternatives to the proposed project
- The SVBGSA Board will notify stakeholders in the area of the proposed project and allow at least 30 days for public response.
- After the 30-day public response period, the SVBGSA Board will vote whether or not to approve design and construction of the project and notify the public if approved via an announcement on the SVBGSA website and mailing lists.

In addition to the process detailed above, all projects will follow the public noticing requirements per CEQA or NEPA.

9.6 Cross-Boundary Projects and Management Actions

The projects listed here are projects described in other Subbasin GSPs that are anticipated to have a positive impact on the 180/400-Foot Subbasin by virtue of these other subbasins being adjacent to the 180/400-Foot Aquifer Subbasin and working on improving their groundwater conditions through these projects and management actions. All improvements and benefits in these adjacent subbasins are anticipated to have positive impact within the 180/400-Foot Aquifer Subbasin. Any analyses and decisions regarding these projects will consider the impact on all subbasins.

9.6.1 Project ES1: Eastside Floodplain Enhancement and Recharge

In the original 180/400-Foot Aquifer Subbasin GSP, this project was Alternative Project 2: Recharge Local Run-off from Eastside Range. It primarily benefits the Eastside but may have groundwater benefits for the 180/400-Foot Aquifer Subbasin. The scoping progressed with the development of Project A2 of the Eastside Subbasin GSP, which is reflected in this text.

This project restores and enhances areas along creeks and floodplains to slow and sink stormwater and encourage streambed and floodplain infiltration. SVBGSA could partner with the RWMG, CCWG, and other organizations to support existing creek and floodplain restoration efforts and encourage inclusion of features that would enhance recharge.

Restored floodplain and riparian habitat along creeks can slow down the velocity of creeks and encourage greater infiltration. Due to agricultural and urban encroachment, streams have become more highly channelized, and flow has increased in velocity, particularly during storm events. This flow has resulted in greater erosion and loss of functional floodplains. Floodplain restoration efforts could be focused on lands directly adjacent to creeks, so as not to interfere with active farming. In addition, efforts to restore creeks and floodplains could be extended to the foothills to slow water closer to its source or incorporate features such as check dams to encourage greater recharge.

For initial scoping of this project, 5 locations for floodplain restoration have been identified that focus on the watersheds in the northern part of the Eastside Subbasin, where recharge potential is higher and groundwater elevations are low. These are initial project locations identified for the purpose of estimating project benefits and costs; however, more site analysis, project design, and outreach to nearby landowners are needed before specific projects are selected. Additional sites may also be added under this project. The effect of increased recharge on surrounding groundwater quality will be considered when selecting sites.

The 5 locations identified for floodplain restoration and stormwater recharge are noted on Figure 9-17. These locations consist of recharge basins or detention ponds to be included as part of floodplain restoration or stormwater recharge. Water recharged will comply with regulatory standards. The initial projects were identified as part of Monterey County's Stormwater Management Plan, and these 5 were selected for inclusion in this GSP project due to their potential for groundwater recharge (Hunt *et. al.*, 2019). These concept project locations need further work with respect to contacting landowners, assessing regulatory challenges, considering adjacent land use, and securing agency/landowner commitment to long-term management.

One example of floodplain restoration is the Gabilan Floodplain Enhancement Project put forth by the CCWG and RWMG. Stormwater generated in the uplands of the Gabilan Creek Watershed is a flood risk to Salinas and other downstream land users. This proposed project includes buying or leasing 80 acres of land in the floodplain above Salinas and implementing floodplain restoration projects. These projects would reduce 20-year maximum flows by 43%, or 326 cubic feet per second (cfs), and provide benefits such as increased infiltration, water supply reliability, decreased flood volume risk, environmental improvement, and increased urban green space (GMCRWMG, 2018).

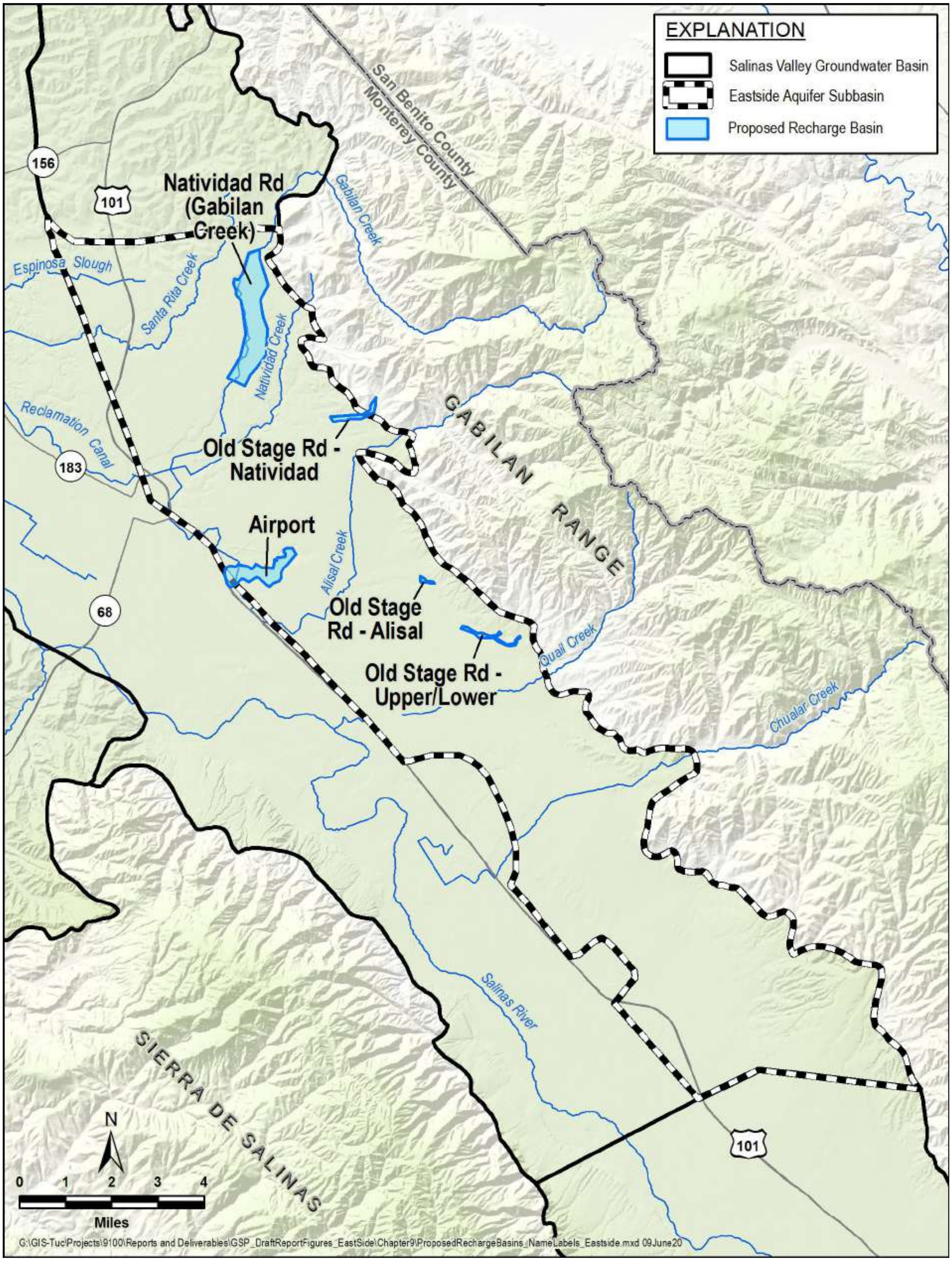

Figure 9-17. Potential Floodplain Restoration and Stormwater Recharge Projects in the Eastside Aquifer Subbasin

9.6.1.1 Relevant Measurable Objectives

Relevant measurable objectives benefiting from this project include:

- **Groundwater levels measurable objective.** By routing stormwater and runoff from streams into recharge facilities and restored floodplains in the Eastside Subbasin, more water will be added to the principal aquifer. This water will be slowed down and allowed to infiltrate, which has the effect of additional water to the aquifer. Adding water into the principal aquifer in the Eastside Subbasin, which will raise groundwater elevations over time. The 180/400-Foot Subbasin is naturally down gradient and will also benefit from increased elevations across the boundary, as groundwater elevations adjustments will translate down-gradient over time.
- **Groundwater storage measurable objective.** Adding water to the principal aquifer in the Eastside Subbasin will ultimately have the effect of increasing groundwater in storage. Groundwater storage is also calculated from measured groundwater elevations. By raising groundwater elevations, the calculation of change in storage will be positive. Similar to above, additions to the groundwater storage in the Eastside Subbasin will translate down gradient to the 180/400-Foot Subbasin over time.
- **Land subsidence measurable objective.** Increasing both groundwater elevations and groundwater storage in the Eastside Subbasin will have the added benefit of preventing any potential land subsidence. Maintaining and adding water in the subsurface will keep pore spaces saturated with positive pressure and inhibit land surface collapse associated with groundwater depletion. Increases in the groundwater elevations and storage that translate down gradient to the 180/400-Foot Subbasin will also help prevent subsidence in the 180/400-Foot Subbasin.
- **Seawater intrusion measurable objective.** Seawater intrusion has advanced inland to within a couple of miles of the Eastside Subbasin. Increasing groundwater recharge will support the natural hydraulic gradient that pushes back against the intruding seawater. The translation of increased groundwater elevations and storage over time into the 180/400-Foot Subbasin, thereby increasing the pressure buffer that helps halt and push back against seawater intrusion.

9.6.1.2 Expected Benefits and Evaluation of Benefits

The primary benefit is increased groundwater elevations near the utilized floodplains. However, the number of reengaged floodplains, the size of floodplain basins, and the number and species of plants will determine how much water may infiltrate into the subsurface. The Stormwater Management Plan used 2 models to characterize current conditions and estimate project flood management benefits of potential site locations. One is a MODFLOW water balance model that simulates rainfall-runoff relationships, and the other is a HEC-RAS flood model that simulates channel and floodplain hydraulics. Initial modeling of stormwater runoff is reported in Table 9-5. In addition, a groundwater modeling simulation using the SVOM is used to determine the potential groundwater benefits for recharge of that water. Initial model runs indicate an increase of 200 AF/yr in groundwater storage for the 180/400-Foot Subbasin from this project, out of a total benefit of 1,200 AF/yr. Additional analyses will be conducted to refine this value should this project be considered for implementation.

Table 9-5. Selected Watershed and Basin Benefits

Watershed Treatment Basin	Wet Season Daily Mean Flow (cfs)	Dry Season Daily Mean Flow (cfs)	Wet Season Annual Volume Captured (AF)	Dry Season Annual Volume Captured (AF)	Conceptual detention size (acres)
Natividad Road (Gabilan Creek)	3	0.3	1073	107	40
Old Stage Road - Natividad	0.25	0.2	89	7	1.1
Airport	2.67	0.52	955	186	32.7
Old Stage Road - Alisal	0.32	0.06	114	21	7.1
Old Stage Road - Upper/Lower	0.13	0.02	47	7	18.1

Benefits will be measured using the monitoring networks described in Chapter 7. Groundwater elevations will be measured with a network of wells that is monitored by MCWRA. Projects may include monitoring wells if they are not close enough to the existing monitoring network for the impacts to be measured. Various volumetric measurement methods may be installed along with either recharge basins or dry wells to assist in calculating increases to groundwater storage. Land subsidence will be measured using InSAR data provided by the Department of Water Resources (DWR). Seawater intrusion will be measured using select Representative Monitoring Sites (RMS) wells.

9.6.1.3 Circumstances for Implementation

The 180/400-Foot Aquifer Subbasin is unlikely to pursue this project independently of the Eastside Subbasin. The floodplain restoration and stormwater recharge project will be implemented if additional water is required to reach sustainability. A number of agreements and rights must be secured before the project is implemented. Primarily, a more formal cost/benefit analysis must be completed to determine how many site options are preferable. Water diversion rights must be secured to divert stormwater, which may take many years.

9.6.1.4 Permitting and Regulatory Process

This project may require a CEQA review process, which would likely result in either an EIR or a Mitigated Negative Declaration (the review could also result in a Negative Declaration or Notice of Exemption). Additionally, any project that coordinates with federal facilities or agencies may require NEPA documentation.

There will be a number of local, county and state permits, right of ways, and easements required depending on pipeline alignments, stream crossings, and project type. Projects with wells will require a well construction permit from MCWRA. Permits that may be required for floodplain enhancement include:

- ***United States Army Corps of Engineers (USACE)*** – A Regional General Permit may be required if there are impacts to wetlands or connections to waters of the United States.
- ***California Department of Fish and Wildlife (CDFW)*** – A Standard Agreement is required if the project could impact a species of concern.
- ***Environmental Protection Agency (EPA) Region 9*** –NEPA documentation must be submitted for any project that coordinates with federal facilities or agencies. Additional permits may be required if there is an outlet or connection to waters of the United States.
- ***National Marine Fisheries Service (NMFS)*** – A project may require authorization for incidental take, or another protected resources permit or authorization from NMFS.
- ***California Natural Resources Agency*** – An Initial Study Mitigated Negative Declaration (IS/MND) is required to comply with CEQA.

9.6.1.5 Implementation Schedule

If selected, the implementation schedule for floodplain enhancement and recharge is presented on Figure 9-18. Components of this project could be implemented separately and may take less time to implement or may be spread out over a longer time horizon.

Task Description	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Years 7+
Studies/Preliminary Engineering Analysis							
Agreements/ROW							
CEQA							
Permitting							
Design							
Bid/Construct							
Maintenance							

Figure 9-18. Implementation Schedule for Floodplain Enchancement and Stormwater Recharge

9.6.1.6 Legal Authority

The SVBGSA has the right to divert and store water once it has access to the appropriate water rights. Water rights are not needed to infiltrate on-farm runoff. Pursuant to California Water Code §10726.2 (b), the SVBGSA has the right to acquire and hold real property, and to divert and store water once it has acquired any necessary real property or appropriative water rights.

Some right in real property (whether fee title, easement, license, leasehold or other) may be required to implement the project.

9.6.1.7 Estimated Cost

The capital cost of floodplain enhancement and recharge is estimated at $12,596,000 for recharge basins of the estimated sizes. This only includes the costs of recharge basins and not additional riparian restoration work that may be done as part of this overall project. There may also be additional costs for site feasibility studies, such as pilot boreholes to assess recharge capacity, and for dry wells or injection wells if recharge basins lack permeability. Annual O&M costs are anticipated to be approximately $64,000. If there are no additional costs, the amortized cost of water for 1,000 AF/yr increased storage is estimated at $1,050/AF.

9.6.1.8 Public Noticing

If funded by SVBGSA, before any project initiates construction it will go through a public notice process to ensure that all groundwater users and other stakeholders have ample opportunity to comment on projects before they are built. The general steps in the public notice process will include the following:

- SVBGSA staff will bring an assessment of the need for the project to the SVBGSA Board in a publicly noticed meeting. This assessment will include:
  - A description of the undesirable result(s) that may occur if action is not taken
  - A description of the proposed project
  - An estimated cost and schedule for the proposed project
  - Any alternatives to the proposed project
- The SVBGSA Board will notify stakeholders in the area of the proposed project and allow at least 30 days for public response.
- After the 30-day public response period, the SVBGSA Board will vote whether or not to approve design and construction of the project and notify the public if approved via an announcement on the SVBGSA website and mailing lists.

In addition to the process detailed above, all projects will follow the public noticing requirements per CEQA or NEPA.

9.6.2 Project ES2: Eastside 11043 Diversion at Chualar

In the original 180/400-Foot Aquifer Subbasin GSP, this project was Project 7: 11043 Diversion Facilities Phase I: Chualar. It primarily benefits the Eastside but may have groundwater benefits for the 180/400-Foot Aquifer Subbasin. The scoping progressed with the development of Project B1 of the Eastside Subbasin GSP, which is reflected in this text.

MCWRA holds SWRCB Permit 11043 (Permit), which is a diversion right on the Salinas River. The current amended permit allows diversion at 2 identified locations: 1 location near Soledad called the Eastside Canal Intake, and 1 location near Chualar called the Castroville Canal Intake (Figure 9-19). The Permit has an annual maximum diversion limit of 135,000 AF. Permit Condition 13 only allows water to be diverted when there are natural flows in the river that exceed minimum specified criteria. In addition, under Condition 13, the maximum allowed diversion is 400 cfs. Based on the conditions of the permit, a 400 cfs diversion and historical natural flows, a conservative estimate is that a long-term average of up to approximately 35,000 AF/yr. of water could be diverted from either diversion point between the months of December and March. Based on physical limitations of a 50 cfs diversion structure, this number is likely considerably less; approximately 6,000 AF/yr

Per Permit Condition 13, the natural flow shall be calculated by subtracting reservoir releases from Nacimiento and San Antonio Reservoirs from total flows at the Soledad gaging station on a 3-day running average. The water right holder shall not divert water unless the natural flow of the Salinas River at Eastside Canal Intake (NAD 83, Zone 4, North 2,038,821 feet, and East 5,891,976 feet) is greater than the amounts listed in Table 9-6.

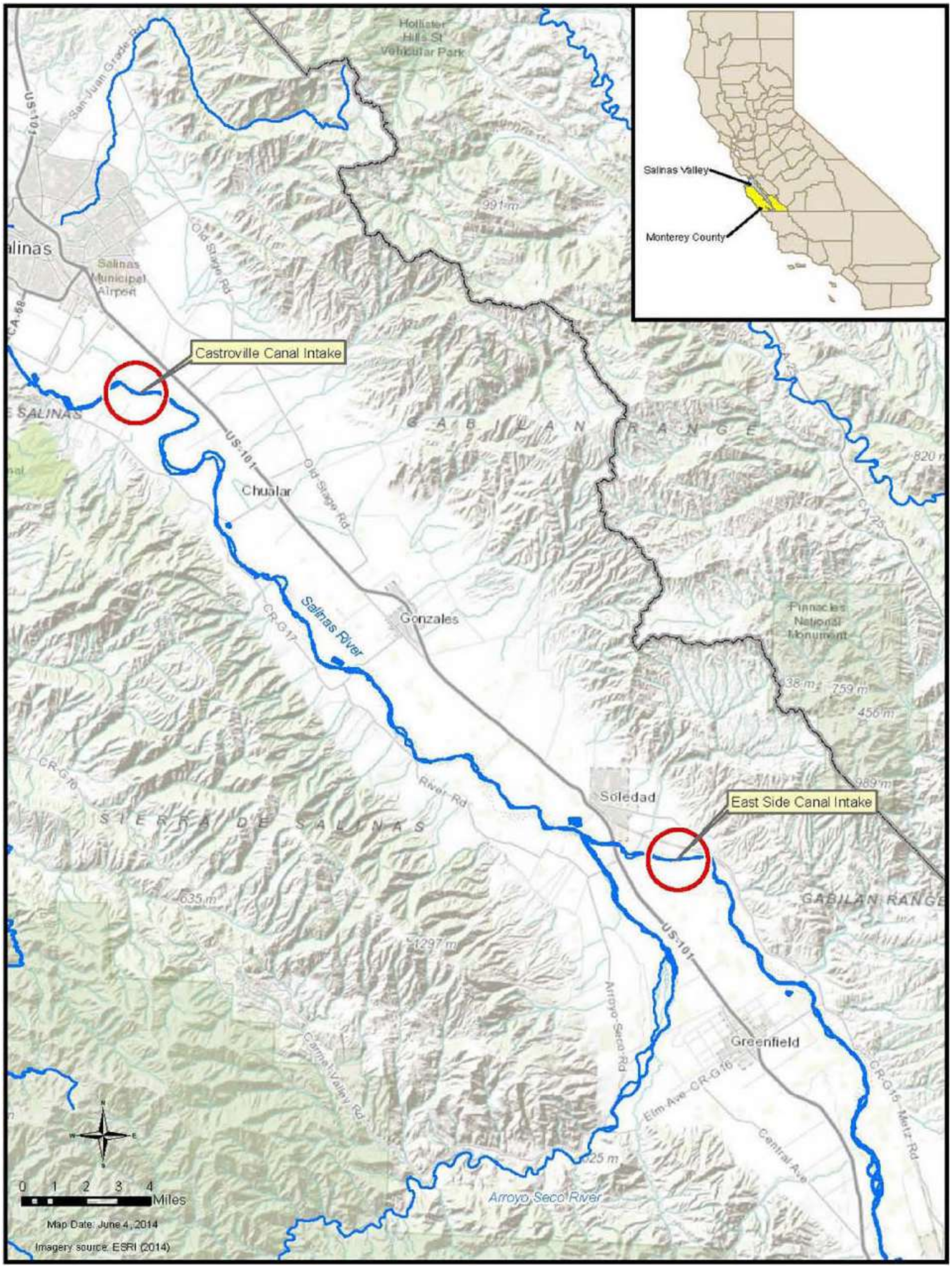

Figure 9-19. 11043 Diversion Locations

Table 9-6. Salinas River Natural Flow Rates by Month

Month	Amount (cfs)
January	3.3
February	6.2
March	6.41
April	16.43
May	17.21
June	20.62
July	24.02
August	18.89
September	20.97
October	10.51
November	4.56
December	2.64

This project proposes constructing extraction facilities at the Chualar location and pumping the water to the Eastside Subbasin where the water can be infiltrated into the groundwater basin through recharge basins at known pumping depressions and areas of poor water quality. Recharging areas of poor water quality can dilute contaminants already in the water. Projects will assess contaminants in the soil as part of project development to ensure they will avoid groundwater contamination and protect nearby domestic drinking water sources. Groundwater quality would be monitored throughout the project to ensure that it is not worsening. The diversion facility would be sized to provide approximately 6,000 to 10,000 AF/yr to farmland in the Eastside Subbasin between Chualar and Salinas.

In addition to sending this water to recharge basins for groundwater recharge, diverted water under this permit could also be used for direct delivery for municipal supply. Under direct delivery use, this water would act as in-lieu recharge by reducing the need for pumping from municipal wells resulting in less groundwater demand. Through the in-lieu recharge component of direct delivery, the saved water can still be pumped in the summer to meet CSIP demands. Diverted water under this permit would first need to be sent to a treatment plant prior to delivery. Other important considerations for direct use of seasonal releases include water quality differences between groundwater and surface water, timing and availability of flows compared to municipal demand schedules, and other infrastructure needs. Direct delivery of seasonal releases may be a less expensive option but will need further analysis.

For cost estimating purposes, the project is evaluated at a diversion rate of 6,000 AF/yr. To obtain this volume of water, a diversion structure that can pump between 25 and 50 cfs is required. The diversion structure could be sized to extract more than 10,000 AF/yr; however, it may not be economical to construct a larger facility. This issue can be further evaluated during the preliminary design stages of the project. The SVBGSA will coordinate and consult with

MCWRA on planning, construction, and operation of this project. The project would require a radial collector well diversion facility, 4.5 miles of transmission pipe, and recharge basins that could be farmed in the summer and fallowed during the winter. Water recharged will comply with regulatory standards. An alternative to the infiltration basins is to construct a filtration and chlorination treatment facility and injection wells. This alternative is more expensive but potentially more effective at addressing lowering groundwater levels than the infiltration basins. Opportunities and constraints associated with this alternative will be further assessed and refined prior to the design phase of this project.

9.6.2.1 Relevant Measurable Objectives

Relevant multi-subbasin measurable objectives benefiting from this project include:

- **Groundwater levels measurable objective.** By recharging diversions when water is available, more water will be added to the principal aquifer. Adding water into the principal aquifer in the Eastside Subbasin will either raise groundwater elevations or reduce the rate of groundwater elevation decline over time. The 180/400-Foot Subbasin is naturally down gradient and will also benefit from increased elevations across the boundary, as groundwater elevations adjustments will translate down-gradient over time.
- **Groundwater storage measurable objective.** Adding water to the principal aquifer will have the effect of increasing groundwater in storage. Similar to above, additions to the groundwater storage in the Eastside Subbasin will translate down gradient to the 180/400-Foot Subbasin over time.
- **Land subsidence measurable objective.** Increasing both groundwater elevations and groundwater storage will have the added benefit of preventing any potential land subsidence. Maintaining and adding water in the subsurface will keep pore spaces saturated with positive pressure and inhibit land surface collapse associated with groundwater depletion. Increases in the groundwater elevations and storage that translate down gradient to the 180/400-Foot Subbasin will also help prevent subsidence in the 180/400-Foot Subbasin.
- **Seawater intrusion measurable objective.** Seawater intrusion has advanced inland to within a couple of miles of the Eastside Subbasin. Increasing groundwater recharge will support the natural hydraulic gradient that pushes back against the intruding seawater. The translation of increased groundwater elevations and storage over time into the 180/400-Foot Subbasin, thereby increasing the pressure buffer that helps halt and push back against seawater intrusion.

9.6.2.2 Expected Benefits and Evaluation of Benefits

This project indirectly benefits the 180/400-Foot Subbasin. The primary expected benefit of this project is to provide an alternative water supply source to recharge the Eastside Subbasin, thereby either raising groundwater elevations or lowering the rate of groundwater elevation decline. The increase in groundwater elevations in the Eastside Subbasin is anticipated to translate across the boundary and improve the groundwater elevations in the 180/400-Foot Subbasin. The project may also have an indirect effect of reducing seawater intrusion by increasing the groundwater elevations and storage that will help halt and push back against intruding seawater.

The groundwater-related expected benefits are increased groundwater elevations in the vicinity of the recharge, increased groundwater in storage, and protection against any potential land subsidence caused by groundwater depletion. Initial model runs indicate that if an average of approximately 6,000 AF/yr is diverted, there will be an increase of approximately 4,600 AF/yr in groundwater storage for both the Eastside and 180/400-Foot Aquifer Subbasins, with the majority of that benefiting the Eastside Subbasin, and the remaining diverted water lost to ET. Additional analyses will be conducted to refine this value and delineate the storage benefits for each subbasin should this project be considered for implementation.

The groundwater model simulations estimated the baseline Salinas River expected flows during the calendar year, as the diversion permit is based on calendar year caps. The diversions then are determined by analyzing the amount of natural flow available once all other existing releases and flow requirements are met. No additional reservoir releases are assumed for this model simulation, and the diversion does not impact the reservoir operations. The water diverted is excess natural flows only. Furthermore, climate change predictions provided by DWR indicate both warmer and wetter climate in the future, which means the flows for the Salinas River may have more water for diversion. This model does not account for the uncertainty surrounding greater variations in precipitation, timing, intensities, and subsequent flows.

Benefits will be measured using the monitoring networks described in Chapter 7. Groundwater elevations will be measured with a network of wells that is monitored by MCWRA. Projects may include monitoring wells if they are not close enough to the existing monitoring network for the impacts to be measured. Various volumetric measurement methods may be installed along with either recharge basins or dry wells to assist in calculating increases to groundwater storage. Land subsidence will be measured using InSAR data provided by the Department of Water Resources. Seawater intrusion will be measured using select RMS wells.

9.6.2.3 Circumstances for Implementation

The 180/400-Foot Aquifer Subbasin is unlikely to pursue this project independently of the Eastside Subbasin. The 11043 diversion at Chualar project needs to be more fully scoped and evaluated prior to implementation. This includes the identification of the end use of diverted water and the planning of the distribution system. A number of land and access agreements and permits will be needed before the project can be implemented.

9.6.2.4 Permitting and Regulatory Process

MCWRA holds the SWRCB Permit 11043 diversion right. Implementing this project will require close coordination with MCWRA and may require changes to the Permit approved by SWRCB. The project will be implemented in full compliance with the conditions of the Permit.

This project will require a CEQA review process. Additionally, any project that coordinates with federal facilities or agencies may require NEPA documentation.

There will be a number of local, county, and state permits, right of ways, and easements required depending on pipeline alignments, stream crossings, and project type. Permits that may be required for the 11043 diversion include, but may not be limited to:

- ***United States Army Corps of Engineers (USACE)*** – A Regional General Permit may be required if there are impacts to wetlands or connections to waters of the United States.
- ***State Water Resources Control Board (SWRCB)*** – A permit to operate a public water system is required from SWRCB's DDW. Construction that disturbs 1 acre or more of land and that discharges stormwater requires a General Construction Stormwater Permit (Water Quality Order No. 2009-0009-DWQ).
- ***National Marine Fisheries Service (NMFS)*** – A project may require authorization for incidental take, or another protected resources permit or authorization from NMFS.
- ***California Department of Fish and Wildlife (CDFW)*** – Projects that may result in the take of a threatened or endangered species require an Incidental Take Permit (California Endangered Species Act Title 14, §783.2). This project may also require a Lake and Streambed Alteration Agreement.
- ***California Department of Transportation (Caltrans)*** – Work that may obstruct a State highway requires an Encroachment Permit.
- ***Environmental Protection Agency (EPA) Region 9*** –NEPA documentation must be submitted for any project that coordinates with federal facilities or agencies. Additional permits may be required if there is an outlet or connection to waters of the United States.

9.6.2.5 Implementation Schedule

If selected, the proposed implementation schedule is presented on Figure 9-20 below.

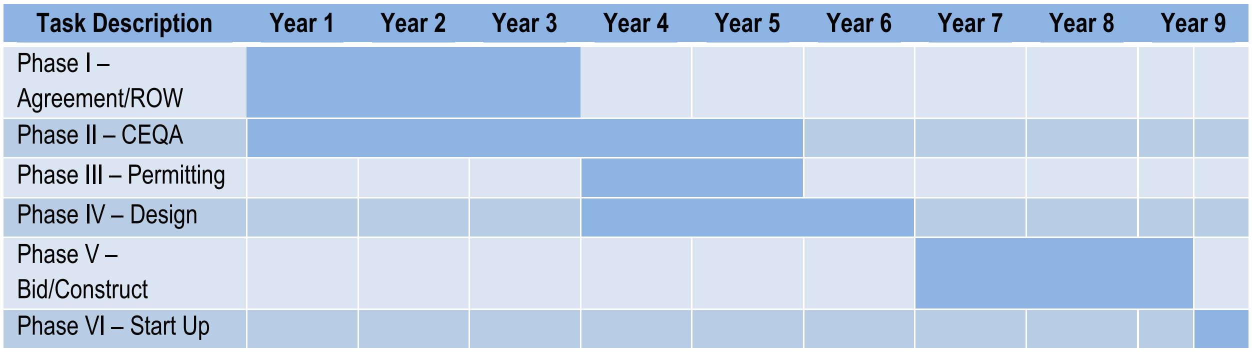

Figure 9-20. Implementation Schedule

9.6.2.6 Legal Authority

MCWRA, the holder of the 11043 permit, is a member of the SVBGSA. Either MCWRA will use the permit as a member of the SVBGSA, or MCWRA will need to transfer the permit to SVBGSA in order to implement this project.

The SVBGSA has the right to divert and store water once it has the approval to utilize the 11043 Permit. Pursuant to California Water Code §10726.2 (b), the SVBGSA has the right to acquire and hold real property, and to divert and store water once it has acquired any necessary real property or appropriative water rights. Some right in real property (whether fee title, easement, license, leasehold or other) may be required to implement the project.

9.6.2.7 Estimated Cost

The capital cost for the 11043 Chualar Diversion Facilities is estimated at $55,684,000. Annual O&M costs for the diversion project are anticipated to be approximately $1,538,700. The amortized cost of the benefit of 4,600 AF/yr of water added to storage for this project is estimated at $1,280/AF.

9.6.2.8 Public Noticing

Before SVBGSA initiates construction on this project, it will go through a public notice process to ensure that all groundwater users and other stakeholders have ample opportunity to comment on projects before they are built. The general steps in the public notice process will include the following:

- SVBGSA staff will bring an assessment of the need for the project to the SVBGSA Board and the MCWRA Board in publicly noticed meetings. This assessment will include:
    - A description of the undesirable result(s) that may occur if action is not taken
    - A description of the proposed project
    - An estimated cost and schedule for the proposed project

    - Any alternatives to the proposed project
- The SVBGSA Board and the MCWRA Board will notify stakeholders in the area of the proposed project and allow at least 30 days for public response.
- After the 30-day public response period, the SVBGSA Board will vote whether or not to approve design and construction of the project and notify the public if approved via an announcement on the SVBGSA website and mailing lists.

The permitting and implementation of the diversion will require notification of stakeholders, beneficiaries, water providers, member lands adjacent to the river, and subbasin committee members as well as all permit and regulatory holding agencies such as DWR, CEQA, NOAA, USACE, and others. In addition to the process detailed above, all projects will follow the public noticing requirements per CEQA or NEPA.

9.6.3 Project ES3: Eastside 11043 Diversion at Soledad

In the original 180/400-Foot Aquifer Subbasin GSP, this project was Project 8: 11043 Diversion Facilities Phase II: Soledad. It primarily benefits the Eastside but may have groundwater benefits for the 180/400-Foot Aquifer Subbasin. The scoping progressed with the development of Project B2 of the Eastside Subbasin GSP, which is reflected in this text.

MCWRA holds SWRCB Permit 11043 (Permit), which is a diversion right on the Salinas River. The current amended permit allows diversion at 2 identified locations: 1 location near Soledad called the East Side Canal Intake, and 1 location near Chualar called the Castroville Canal Intake (Figure 9-19). The Permit has an annual maximum diversion limit of 135,000 AF. Permit Condition 13 only allows water to be diverted when there are natural flows in the river that exceed minimum specified criteria. In addition, under Condition 13, the maximum allowed diversion is 400 cfs. Based on the conditions of the permit, a 400 cfs diversion and historical flows, a conservative estimate is that a long-term average of up to approximately 35,000 AF/yr of water could be diverted from either diversion point between the months of December and March. Based on physical limitations of a 50 cfs diversion structure, this number is likely considerably less; approximately 6,000 AF/yr.

Per Permit Condition 13, the natural flow shall be calculated by subtracting reservoir releases from Nacimiento and San Antonio Reservoirs from total flows at the Soledad gauging station on a 3-day running average. The water right holder shall not divert water unless the natural flow of the Salinas River at Eastside Canal Intake (NAD 83, Zone 4, North 2,038,821 feet, and East 5,891,976 feet) is greater than the amounts listed in Table 9-7.

Table 9-7. Salinas River Natural Flow Rates by Month

Month	Amount (cfs)
January	3.3
February	6.2
March	6.41
April	16.43
May	17.21
June	20.62
July	24.02
August	18.89
September	20.97
October	10.51
November	4.56
December	2.64

This project proposes constructing extraction facilities at the Soledad location and pumping the water to the Eastside Subbasin where the water can be infiltrated into the groundwater basin at known pumping depressions and areas of poor water quality. Recharging areas of poor water quality can dilute contaminants already in the water. Projects will assess contaminants in the soil as part of project development to ensure they will avoid groundwater contamination and protect nearby domestic drinking water sources. Groundwater quality would be monitored throughout the project to ensure that it is not worsening. The diversion facility would be sized to provide approximately 6,000 to 10,000 AF/yr to farmland in the Eastside Subbasin between Soledad and Gonzales.

In addition to sending this water to recharge basins for groundwater recharge, diverted water under this permit could also be used for direct delivery for municipal supply. Under direct delivery use, this water would act as in-lieu recharge by reducing the need for pumping from municipal wells resulting in less groundwater demand. Through the in-lieu recharge component of direct delivery, the saved water can still be pumped in the summer to meet CSIP demands. Diverted water under this permit would first need to be sent to a treatment plant prior to delivery. Other important considerations for direct use of seasonal releases include water quality differences between groundwater and surface water, timing and availability of flows compared to municipal demand schedules, and other infrastructure needs.

For cost estimating purposes, the project is evaluated at a diversion rate of 6,000 AF/yr. To obtain this volume of water, a diversion structure that can pump between 25 and 50 cfs is required. The diversion structure could be sized to extract more than 10,000 AF/yr; however, it may not be economical to construct a larger facility. This issue can be further evaluated during the preliminary design stages of the project. The SVBGSA will coordinate and consult with MCWRA on planning, construction, and operation of this project. The project would require a radial collector well diversion facility, 12.5 miles of transmission pipe, and recharge basins that could be farmed in the summer and fallowed in the winter. Water recharged will comply with regulatory standards. An alternative to the infiltration basins is to construct a filtration and chlorination treatment facility and injection wells. This alternative is more expensive but potentially more effective at addressing lowering groundwater levels than the infiltration basins. Opportunities and constraints associated with this alternative will be further assessed and refined prior to the design phase of this project.

9.6.3.1 Relevant Measurable Objectives

Relevant measurable objectives benefiting from this project include:

- **Groundwater levels measurable objective.** By recharging diversions when water is available, more water will be added to the principal aquifer in the Eastside Subbasin. Adding water into the principal aquifer will either raise groundwater elevations or reduce the rate of groundwater elevation decline over time. The 180/400-Foot Subbasin is naturally down gradient and will also benefit from increased elevations across the boundary, as groundwater elevations adjustments will translate down-gradient over time.
- **Groundwater storage measurable objective.** Adding water to the principal aquifer will have the effect of increasing groundwater in storage. Groundwater storage is also calculated from measured groundwater elevations. By raising groundwater elevations, the calculation of change in storage will be positive. Similar to above, additions to the groundwater storage in the Eastside Subbasin will translate down gradient to the 180/400-Foot Subbasin over time.
- **Land subsidence measurable objective.** Increasing both groundwater elevations and groundwater storage will have the added benefit of preventing any potential land subsidence. Maintaining and adding water in the subsurface will keep pore spaces saturated with positive pressure and inhibit land surface collapse associated with groundwater depletion. Increases in the groundwater elevations and storage that translate down gradient to the 180/400-Foot Subbasin will also help prevent subsidence in the 180/400-Foot Subbasin.
- **Seawater intrusion measurable objective.** Seawater intrusion has advanced inland to within a couple of miles of the Eastside Subbasin. Increasing groundwater storage will support the natural hydraulic gradient that pushes back against the intruding seawater. The translation of increased groundwater elevations and storage over time into the 180/400-Foot Subbasin, thereby increasing the pressure buffer that helps halt and push back against seawater intrusion.

9.6.3.2 Expected Benefits and Evaluation of Benefits

This project indirectly benefits the 180/400-Foot Subbasin. The primary expected benefit of this project is to provide an alternative water supply source to recharge the Eastside Subbasin, thereby either raising groundwater elevations or lowering the rate of groundwater elevation decline. The increase in groundwater elevations in the Eastside will translate across the boundary and improve the groundwater elevations in the 180/400-Foot Aquifer Subbasin. This project likely will have an indirect effect of reducing seawater intrusion by increasing the groundwater elevations and storage and help push back against intruding seawater.

The groundwater-related expected benefits are increased groundwater elevations in the vicinity of the recharge, increased groundwater in storage, protection against any potential land subsidence caused by groundwater depletion, and water quality benefits. Initial model runs of the 11043 diversion at Chualar indicate that if 6,000 AF/yr is diverted, there will be an increase of 4,600 AF/yr in groundwater storage for both the Eastside and 180/400-Foot Aquifer Subbasins, with the majority of that benefiting the Eastside Subbasin, and with the remaining diverted water lost to ET. Although scoping of specific recharge locations has yet to be determined for the 11043 project at either diversion point, the groundwater storage benefit for the Soledad diversion is assumed to be the same as for the Chualar diversion. The difference between the projects is the location of diversion and piping to reach the recharge locations in the Eastside. Additional analyses will be conducted to refine this value and delineate the storage benefits for each subbasin should this project be considered for implementation.

The groundwater model simulations estimated the baseline Salinas River expected flows during the calendar year, as the diversion permit is based on calendar year caps. The diversions then are determined by analyzing the amount of natural flow available once all other existing releases and flow requirements are met. No additional reservoir releases are assumed for this model simulation, and the diversion does not impact the reservoir operations. The water diverted is excess natural flows only. Furthermore, climate change predictions provided by DWR indicate both warmer and wetter climate in the future, which means the flows for the Salinas River may have more water for diversion. This model does not account for the uncertainty surrounding greater variations in precipitation, timing, intensities, and subsequent flows.

Benefits will be measured using the monitoring networks described in Chapter 7. Groundwater elevations will be measured with a network of wells that is monitored by MCWRA. Projects may include monitoring wells if they are not close enough to the existing monitoring network for the impacts to be measured. Various volumetric measurement methods may be installed along with either recharge basins or dry wells to assist in calculating increases to groundwater storage. Land subsidence will be measured using InSAR data provided by the Department of Water Resources. Seawater intrusion will be measured using select RMS wells.

9.6.3.3 Circumstances for Implementation

The 180/400-Foot Aquifer Subbasin is unlikely to pursue this project independently of the Eastside Subbasin. The 11043 diversion at Soledad project needs to be more fully scoped and evaluated prior to implementation. This includes the identification of the end use of diverted water and the planning of the distribution system. A number of land and access agreements and permits will be needed before the project can be implemented.

9.6.3.4 Permitting and Regulatory Process

MCWRA holds the SWRCB Permit 11043 diversion right. Implementing this project will require close coordination with MCWRA and may require changes to the Permit approved by SWRCB. The project will be implemented in full compliance with the conditions of the Permit.

This project will require a CEQA review process. Additionally, any project that coordinates with federal facilities or agencies may require NEPA documentation.

There will be a number of local, county, and state permits, right of ways, and easements required depending on pipeline alignments, stream crossings, and project type. Permits that may be required for the 11043 diversion include, but may not be limited to:

- ***United States Army Corps of Engineers (USACE)*** – A Regional General Permit may be required if there are impacts to wetlands or connections to waters of the United States.
- ***State Water Resources Control Board (SWRCB)*** – A permit to operate a public water system is required from SWRCB's DDW. Construction that disturbs 1 acre or more of land and that discharges stormwater requires a General Construction Stormwater Permit (Water Quality Order No. 2009-0009-DWQ).
- ***National Marine Fisheries Service (NMFS)*** – A project may require authorization for incidental take, or another protected resources permit or authorization from NMFS.
- ***California Department of Fish and Wildlife (CDFW)*** – Projects that may result in the take of a threatened or endangered species require an Incidental Take Permit (California Endangered Species Act Title 14, §783.2). This project may also require a Lake and Streambed Alteration Agreement.
- ***California Department of Transportation (Caltrans)*** – Work that may obstruct a State highway requires an Encroachment Permit.
- ***Environmental Protection Agency (EPA) Region 9*** –NEPA documentation must be submitted for any project that coordinates with federal facilities or agencies. Additional permits may be required if there is an outlet or connection to waters of the United States.

9.6.3.5 Implementation Schedule

If selected, the proposed implementation schedule is presented on Figure 9-21 below.

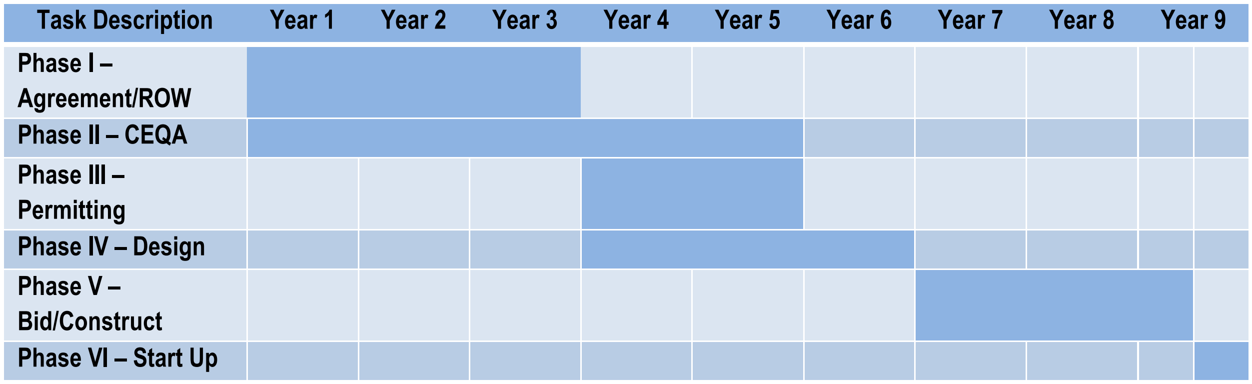

Figure 9-21. Implementation Schedule

9.6.3.6 Legal Authority

MCWRA, the holder of the 11043 permit, is a member of the SVBGSA. Either MCWRA will use the permit as a member of the SVBGSA, or MCWRA will need to transfer the permit to SVBGSA in order to implement this project.

The SVBGSA has the right to divert and store water once it has the approval to utilize the 11043 Permit. Pursuant to California Water Code §10726.2 (b), the SVBGSA has the right to acquire and hold real property, and to divert and store water once it has acquired any necessary real property or appropriative water rights. Some right in real property (whether fee title, easement, license, leasehold or other) may be required to implement the project.

9.6.3.7 Estimated Cost

The capital cost for the 11043 Soledad Diversion Facilities is estimated at $104,688,000. Annual O&M costs for the diversion project are anticipated to be approximately $1,538,700. The amortized cost of the benefit of 4,600 AF/yr of water added to storage for this project is estimated at $2,110/AF.

9.6.3.8 Public Noticing

Before SVBGSA initiates construction on this project, it will go through a public notice process to ensure that all groundwater users and other stakeholders have ample opportunity to comment on projects before they are built. The general steps in the public notice process will include the following:

- SVBGSA staff will bring an assessment of the need for the project to the SVBGSA Board and the MCWRA Board in publicly noticed meetings. This assessment will include:
    - A description of the undesirable result(s) that may occur if action is not taken
    - A description of the proposed project

    - An estimated cost and schedule for the proposed project
    - Any alternatives to the proposed project
- The SVBGSA Board and the MCWRA Board will notify stakeholders in the area of the proposed project and allow at least 30 days for public response.
- After the 30-day public response period, the SVBGSA Board will vote whether or not to approve design and construction of the project and notify the public if approved via an announcement on the SVBGSA website and mailing lists.

The permitting and implementation of the diversion will require notification of stakeholders, beneficiaries, water providers, member lands adjacent to the river, and subbasin committee members as well as all permit and regulatory holding agencies such as DWR, CEQA, NOAA, USACE, and others. In addition to the process detailed above, all projects will follow the public noticing requirements per CEQA or NEPA.

9.6.4 Project M1 – MCWD Demand Management Measures

In the past two decades, MCWD has made significant strides in reducing its per capita potable water demand above and beyond targets delineated by the Water Conservation Act. Conservation reductions have come primarily from water conservation retrofits as well as from behavioral changes driven by increasing water rates, drought awareness, and public education programs. During the twenty-year period of 1999 through 2020, per capita water demand within the MCWD service area decreased from 144 gallons per capita per day (GPCD) to 80 GPCD, a decrease of approximately 44% (Schaaf & Wheeler, 2021). At the current population of 30,480 served by MCWD, this decrease in per capita water use provides an approximately 2,500 AF/YR of in-lieu recharge benefits.

Following the 2014-2016 drought, the State of California developed the "Making Water Conservation a California Way of Life" framework to address the long-term water use efficiency requirements called for in executive orders issued by Governor Brown. In May of 2018, Assembly Bill (AB) 1668 and Senate Bill (SB) 606 went into effect, which built upon the executive orders implementing new urban water use objectives for urban retail water suppliers.

SB 606 and AB 1668 establish guidelines for efficient water use and a framework for the implementation and oversight of the new standards, which must be in place by 2022. The bills call for creation of new urban efficiency standards for indoor use, outdoor use, and water loss, as well as any appropriate variances for unique local conditions. These water use standards will be adopted by the State Water Resources Control Board (SWRCB) by regulation no later than June 30, 2022. Using the adopted standards, each urban retail water agency will annually, beginning January 1, 2024, calculate its own objective.

MCWD plans to continue to implement conservation efforts within its service area to meet and exceed new legislative requirements as part of the "Making Water Conservation a California Way of Life" framework. Potable water demand reductions will be achieved through the following strategies.

- MCWD has adopted design standards and guidelines for new construction that exceed the State's plumbing code requirements for water-conserving features, codified in Section 3.36 of the District Ordinances.
- MCWD will implement demand management measures discussed in Section 7 of its 2020 UWMP.
- Phased redevelopment of the Ord Community will include the replacement of a significant amount of water distribution system that is over 50-years old. These replacements should reduce system water losses.

In addition, MCWD plans to use recycled water to offset non-potable uses or augment groundwater production (see Project M3 – Recycled Water Reuse Through Landscape Irrigation and Indirect Potable Reuse).

9.6.4.1 Relevant Measurable Objectives

The measurable objective benefiting from demand management measures includes:

- **Groundwater levels measurable objective -** Demand management measures will result in less demand on groundwater pumping and higher groundwater levels, particularly near the location of production wells. The 180/400-Foot Subbasin is naturally down gradient from the Monterey Subbasin and will also benefit from increased elevations across the boundary, as groundwater elevations adjustments will translate down-gradient over time.
- **Groundwater storage measurable objective –** Reducing pumping from the principal aquifer(s) will ultimately have the effect of increasing groundwater in storage. Similar to above, additions to the groundwater storage in the Monterey Subbasin will translate down gradient to the 180/400-Foot Subbasin over time.
- **Seawater intrusion measurable objective –** Seawater intrusion has advanced a few miles inland in both the 180/400-Foot Aquifer and Monterey Subbasins. Increasing groundwater storage and groundwater elevation will support the natural hydraulic gradient that pushes back against the intruding seawater. The translation of increased groundwater elevations and storage over time into the 180/400-Foot Aquifer Subbasin, thereby increasing the pressure buffer that helps halt and push back against seawater intrusion.

9.6.4.2 Expected Benefits and Evaluation of Benefits

Continued implementation and expansion of demand management efforts will reduce demand on groundwater resources from the Monterey Subbasin and provide in-lieu recharge to the Subbasin. As described above, the decrease in per capita water use historically provided up to 2,500 AF/yr of in-lieu recharge benefits. As the population expands, these in-lieu recharge benefits will increase. No quantification of cross-boundary benefits has been conducted at this time. However, an increase of in-lieu recharge is likely to have the added benefit of increasing groundwater levels and storage in the shared principal aquifers.

Pursuant to Section 7.3 of MCWD's 2020 UWMP:

> *The District will continue to track per capita demand rates to assess overall savings, in addition to comparing water consumption of new residential development against older households and households which have been retrofitted with conservation devices. The District will continually reassess rebate programs to address saturation rates and emerging technologies.*

9.6.4.3 Circumstances for Implementation

Implementation of demand management measures is ongoing. No additional circumstances for implementation are necessary.

9.6.4.4 Permitting and Regulatory Process

As detailed above, MCWD is implementing demand management measures to meet and/or exceed the following legislative requirements:

- **Water Conservation Act -** With the adoption of the Water Conservation Act of 2009, also known as SB x7-7, the state is required to reduce urban water use by 20% by the year 2020. Each urban retail water supplier was required to develop a baseline daily per capita water use ("baseline water use") in their 2010 Urban Water Management Plan (UWMP) and establish per capita water use targets for 2015 and 2020 to help the state achieve the 20% reduction. Per the 2020 UWMP, MCWD's 2020 per capital water demand (or 80 GPCD) was approximately 32% lower than its per capita water use target for 2020 (117 GPCD).

- **SB 606 and AB 1668 water use objectives -** Following the 2014-2016 drought, the State of California developed the "Making Water Conservation a California Way of Life" framework to address the long-term water use efficiency requirements called for in executive orders issued by Governor Brown. In May of 2018, AB 1668 and SB 606 went into effect, which built upon the executive orders implementing new urban water use objectives for urban retail water suppliers.

SB 606 and AB 1668 establish guidelines for efficient water use and a framework for the implementation and oversight of the new standards, which must be in place by 2022. The bills call for creation of new urban efficiency standards for indoor use, outdoor use, and water loss, as well as any appropriate variances for unique local conditions. These water use standards will be adopted by the State Water Resources Control Board (SWRCB) by regulation no later than June 30, 2022. Using the adopted standards, each urban retail water agency will annually, beginning January 1, 2024, calculate its own objective.

- **California plumbing code and design standards -** As discussed above, MCWD has adopted design standards and guidelines for new construction that exceed the State's requirements, including the California Green (CALGreen) Building Code Standards and Model Water Efficient Landscape Ordinance (MWELO).

  CalGreen requires installation of water-efficient fixtures and equipment in new buildings and retrofits. CalGreen includes prescriptive indoor provisions for maximum water consumption of plumbing fixtures and fittings in new and renovated properties. It also allows for an optional performance path to compliance, which requires an overall aggregate 20% reduction in indoor water use from a calculated baseline using a set of worksheets provided with the CalGreen guidelines.

  The MWELO establishes a structure for planning, designing, installing, maintaining and managing water-efficient landscapes in new construction and rehabilitated projects. It promotes low water use landscaping through more efficient irrigation systems, greywater usage, onsite stormwater capture, and limiting the portion of landscapes that can be covered in turf.

9.6.4.5 Implementation Schedule

Implementation of demand management measures is ongoing and will be carried throughout GSP implementation.

9.6.4.6 Legal Authority

This action is implemented pursuant to MCWD's authority as a public water system. Plumbing standards are adopted in Section 7 of the Marina Coast Water District Code.

9.6.4.7 Estimated Cost

MCWD has increased its conservation program budget in recent years, from a total expense of $336,553 in fiscal year 2018-19 to an estimated budget of $438,000 for fiscal year 2021-22 (MCWD, 2020). The major change in conservation program budget over the past 5 years reflects increases in MCWD's educational outreach efforts and resultant demand for rebates and retrofits. It is anticipated that MCWD will maintain its current level of conservation spending.

9.6.4.8 Public Noticing

MCWD’s UWMP is updated every five years and documents historical and planned implementation of demand management measures. The plan is adopted by MCWD following a public hearing and is publicly available.

Beginning January 1, 2024, MCWD is anticipated to calculate its urban water use objectives pursuant to SB 606 and AB 1668 and report its water use according to the water use objectives.

9.6.5 Project M2 – Stormwater Recharge Management

The Cities of Marina and Seaside, the two major municipalities within the Marina-Ord Area, have policies that will facilitate additional stormwater catchment and infiltration beyond existing efforts as development and redevelopment occurs.

The City of Marina has historically relied on onsite infiltration as a means of stormwater management and continues to implement policies for onsite infiltration. The City of Marina storm drain design standards specify retention of stormwater runoff from new development or redevelopment sites and require that no runoff from a project site to flow to public streets.

The portion of the City of Seaside within the Monterey Subbasin similarly relies on onsite infiltration of stormwater. Although the City of Seaside historically had not required onsite infiltration of stormwater, the city manages stormwater runoff in accordance with its National Pollutant Discharge Elimination System (NPDES) permit, which is through requirement of Best Management Practices that encourages onsite infiltration or other methods of reducing stormwater runoff. Furthermore, the City of Seaside’s recent General Plan update includes policies to promote groundwater recharge by implementing stormwater infiltration.

As discussed in Section 3.5.1.4 in the Monterey Subbasin GSP, redevelopment at the former Fort Ord was governed by the Fort Ord Base Reuse Plan, which was later incorporated into each individual jurisdictional area’s land use plans. The 1997 Fort Ord Base Reuse Plan called for eliminating all ocean stormwater discharges and infiltrating all stormwater runoff east of Highway 1. Pursuant to this Plan, most stormwater outfall pipes that historically extended into Monterey Bay has been removed and several percolation basins were constructed west of Highway 1. In addition, the US Army Garrison Presidio of Monterey (USAGPOM) is currently developing plans to decommission a 66-inch diameter stormwater outfall located within the Fort Ord Dunes State Park, anticipated to occur by 2025. The percolation basins were considered temporary with the long-term objective to percolate all stormwater on the east side of Highway 1 as part of the redevelopment of the former Fort Ord. The Fort Ord Storm Water Master Plan (Creegan + D’Angelo, 2005) was prepared to provide guidelines for meeting the obligation for onsite infiltration.

The current and planned urbanized areas within the Marina-Ord Area overlies well-drained, highly permeable dune sands. Infiltration basins or subsurface infiltration systems are effective stormwater disposal methods. It is anticipated that as future development and redevelopment within the Marina-Ord Area occur, additional stormwater from urbanized areas and construction sites will be captured and infiltrated, providing recharge to the groundwater basin.

9.6.5.1 Relevant Measurable Objectives

The measurable objective benefiting from demand management measures includes:

- **Groundwater levels measurable objective** – Promoting and requiring stormwater infiltration will percolate more water into the subsurface, which will raise groundwater elevations and add water to the principal aquifer(s). The 180/400-Foot Subbasin is naturally down gradient from the Monterey Subbasin and will also benefit from increased elevations across the boundary, as groundwater elevations adjustments will translate down gradient over time.
- **Groundwater storage measurable objective** – Adding water to the groundwater system will ultimately have the effect of increasing groundwater in storage. Similar to above, additions to the groundwater storage in the Monterey Subbasin will translate down gradient to the 180/400-Foot Aquifer Subbasin over time.
- **Seawater intrusion measurable objective** – Increasing groundwater storage and groundwater elevations will support the creation of seaward hydraulic gradients that push back against the intruding seawater. The translation of increased groundwater elevations and storage over time into the 180/400-Foot Aquifer Subbasin, thereby increasing the pressure buffer that helps halt and push back against seawater intrusion.

9.6.5.2 Expected Benefits and Evaluation of Benefits

Managed stormwater recharge is expected to increase sustainable yield and groundwater elevations. Runoff occurs when the rate of rainfall exceeds the soil infiltration rate. This project captures and infiltrates this runoff, which would otherwise flow to the ocean, and facilitates recharge to principal aquifer(s). Based on land use, stormwater catchment area, and precipitation data gathered for the Monterey Subbasin Groundwater Flow Model (MBGWFM), it estimated that approximately 540 AF/yr of stormwater runoff is generated within the current urbanized areas in the Marina-Ord Area. A significant portion of this volume is infiltrated via existing stormwater catchment facilities. The MBGWFM indicates the amount of runoff capture and re-infiltration will increase to approximately 1,100 AF/yr over time as future development occurs under the existing guidelines. The MBGWFM indicates that net infiltration rates within the Subbasin will increase by approximately 200 AFY to 500 AF/yr as a result of stormwater catchment and re-infiltration within the Subbasin.

No quantification of cross-boundary benefits has been conducted at this time. However, an increase of recharge will likely have the added benefit of increasing groundwater levels and storage in the principal aquifers shared with the 180/400-Foot Aquifer Subbasin.

Benefits of stormwater recharge on attaining applicable measurable objectives will be measured using the monitoring networks described in Chapter 7.

9.6.5.3 Circumstances for implementation

Stormwater management policies implemented by the Cities of Marina and Seaside are ongoing. No additional circumstances for implementation are necessary.

9.6.5.4 Permitting and Regulatory Process

The Cities of Marina and Seaside comply with the Central Coast Regional Water Quality Control Board's Regional Municipal Stormwater Permit (i.e., Phase II NPDES Permit for Small MS4 systems). Both cities are member entities of the Monterey Regional Stormwater Management Program (MRSWMP). The regional program was developed to respond to SWRCB's implementation of the Phase II NPDES Stormwater Program. The purpose of the Phase II NPDES Stormwater Program is to implement and enforce Best Management Practices (BMPs) to reduce the discharge of pollutants from municipal separate storm sewer systems. The municipalities are responsible for conducting their stormwater management program in accordance with the terms of the regional program.

No additional permitting or regulatory process is required of this action.

9.6.5.5 Implementation Schedule

Implementation of stormwater recharge management is ongoing and will be carried throughout GSP implementation.

9.6.5.6 Legal Authority

This action is implemented by local municipalities. Chapter 8.46 of the City of Marina's municipal code and Chapter 8.46 of the City of Seaside's municipal code respectively provide these municipalities the legal authority to manage stormwater discharge within their jurisdictional limits.

9.6.5.7 Estimated Cost

There are no additional costs to implement this project.

9.6.5.8 Public Noticing

No additional public noticing is required.

9.6.6 Project M3 – Recycled Water Reuse Through Landscape Irrigation and Indirect Potable Reuse

The project consists of recycled water reuse through landscape irrigation and/or indirect potable reuse (IPR) within MCWD's service area. As described below, the source water for both of these options is recycled water from the M1W Regional Treatment Plant (RTP), which would undergo advanced treatment to meet criteria under Title 22 of the California Code Regulations (CCR) for subsurface applications of recycled water. Advanced treated recycled water is non-potable. Reuse of this water through IPR involves injection into a groundwater aquifer and recovery through an appropriately permitted Groundwater Replenishment Reuse Project (GRRP), which provides seasonal storage and generates potable water that can meet a larger portion of MCWD's water demand beyond irrigation and non-potable needs.

Recycled Water Generation, Collection and Treatment

MCWD operates two wastewater collection systems serving the City of Marina and the Ord Community (i.e., communities within the former Fort Ord). Wastewater is conveyed to the M1W RTP north of Marina. The RTP treats wastewater collected from multiple communities in Monterey County, from Pacific Grove to Moss Landing along the coast and inland to the City of Salinas. In 2020, municipal wastewater flows to the RTP were 19,000 AF, with MCWD contributing 2,170 AF, or 11%. Wastewater is treated to secondary treatment standards at the RTP facilities. That water not designated for further treatment and recycling is discharged via an ocean outfall. Water designated for further treatment is conveyed to either the Reclamation Plant or the Advanced Water Purification Facility (AWPF), as discussed below.

The SVRP is capable of producing an average of 33,000 AF/yr of tertiary-treated recycled water. It currently produces about 14,000 AF/yr of tertiary-treated recycled water meeting the standards of unrestricted reuse under Title 22 of the California Code of Regulations. The majority of the recycled water is delivered to the Castroville Seawater Intrusion Project (CSIP), irrigating farmland in the greater Castroville area and reducing demands on Salinas Valley groundwater. As agricultural demands are seasonal, this capacity cannot be fully utilized year-round.

In 2020, M1W completed the AWPF with a capacity to supply advanced treated water to the Seaside Subbasin for IPR and to meet MCWD's recycled water demand.

In 1989, MCWD entered into an annexation agreement with Monterey Regional Water Pollution Control Agency (MRWPCA; now M1W) for wastewater treatment. This agreement established MCWD's first right to receive tertiary treated wastewater from the SVRP. MCWD has the right to obtain treated wastewater from M1W's RTP equal in volume to that of the volume of MCWD wastewater treated by M1W and additional quantities not otherwise committed to other uses. MCWD's sewer flows will increase over time as MCWD's water demand increases and could be used as source water for a MCWD expansion of the AWPF. Based on MCWD's projected 2040 water demand of 9,574 AF/yr, it is anticipated that 6,130 AFY of sewer flows will be generated within MCWD's service area. Such wastewater flows could provide 5,500 AF/yr of net advanced treated water from MCWD.

Landscape Irrigation

On April 8, 2016, MCWD and M1W entered into the Pure Water Delivery and Supply Project Agreement, as amended by the 2017 First Amendment, wherein the Product Water Conveyance Facilities were designed, constructed, owned, and operated by MCWD with a capacity sufficient to convey a minimum of 5,127 AF/yr of advanced treated water, including the 3,700 AF/yr capacity for M1W and a total of 1,427 AF/yr capacity for MCWD. The Product Water Conveyance Facilities include a regional advanced treated water transmission line through Marina, the Ord Community, and into the City of Seaside and allow delivery of advanced treated water from the AWPF for landscape irrigation within these communities and IPR in the Seaside Subbasin.

The regional transmission line was completed in 2019 and placed in operation in 2020 as part of the Pure Water Monterey Project. With completion of the AWPF and the transmission line, MCWD is currently constructing a recycled water distribution system to allow delivery of its 600 AF/yr of advanced treated water for landscape irrigation by 2022 (RBF, 2003). This distribution system could increase deliveries for landscape irrigation to as much as 1,427 AF/yr or more in the future through expansion of the AWPF. MCWD's right to purchase recycled water has a contractual upper limit in the summer months, so providing 1,427 AF/yr of recycled water supply requires the commitment of summertime flows from M1W and MCWRA. The recycled water distribution system currently under construction and the regional transmission line are shown on Figure 9-23.

Landscape irrigation use of recycled water reduces groundwater demand and thus functions as an in-lieu groundwater recharge project.

IPR in Monterey Subbasin

MCWD conducted a joint, regional three-party study with FORA and M1W for water supply planning for redevelopment of the former Fort Ord (2020 Water Supply Augmentation Study) (EKI, 2020). The 2020 Water Supply Augmentation Study conceptualized various groundwater augmentation and direct supply options for screening and systematic evaluation. The recommended option under the Study was IPR through expansion of the AWPF, injection of advanced treated water into 180/400 Foot Aquifers and/or the Deep Aquifers, and extraction with new and existing MCWD production wells (EKI, 2020).

Advanced treated recycled water is non-potable unless it is injected into a groundwater aquifer and recovered as part of an appropriately permitted Groundwater Replenishment Reuse Project (GRRP). A GRRP provides seasonal storage capacity and generates potable water that can meet a larger portion of MCWD's water demand beyond irrigation and non-potable needs.

As described above, MCWD's sewer flows will increase over time as MCWD's water demand increases and could be used as source water for a MCWD expansion of the AWPF. As described above, based upon projected water demands and sewer flows, approximately 5,500 /yr. of net advanced treated water could be generated for IPR by MCWD (minus that used directly for landscape irrigation) by 2040. The majority of this water is more likely to be available during winter/spring months when CSIP is not operational and therefore is more compatible with IPR than landscape irrigation.

The recommended water supply alternative in the 2020 Water Supply Augmentation Study identified three options for IPR injection/extraction of the advanced treated water. These options include:

- Injection into and extraction from the 180/400-Foot Aquifers near existing MCWD 180/400-Foot Aquifer production wells,
- Combined injection/extraction from both 180/400-Foot Aquifer and Deep Aquifer; and
- Injection into and extraction from the Deep Aquifer, near existing MCWD Deep Aquifer wells

The current operation frequency of MCWD's production wells generally ranges from 10% to 40%. These operation frequencies are low and, barring other constraints (e.g., concerns regarding seawater intrusion), could likely be increased to an operational frequency of up to 70% to capture injected water. Additional production wells might need to be constructed to provide additional extraction capacity, depending on the volume and rate of injection. The 2020 Water Supply Augmentation Study evaluated two potential production capacities for the IPR project including 973 AF/yr and 2,400 AF/yr. The project could be readily expanded to facilitate injection of additional advanced treated water as it becomes available.

9.6.6.1 Relevant Measurable Objectives

The measurable objective benefiting from recycled water use through landscape irrigation or a IPR project includes:

- **Groundwater levels measurable objective** – The project provides either in-lieu groundwater recharge by eliminating irrigation demand and direct recharge through IPR. This has the effect of adding water to the principal aquifer(s). Adding water to the principal aquifer(s) will ultimately increase groundwater elevations or decrease their decline. The 180/400-Foot Subbasin is naturally down gradient from the Monterey Subbasin and will also benefit from increased elevations across the boundary, as groundwater elevations adjustments will translate down gradient over time.
- **Groundwater storage measurable objective** – Adding water to the groundwater system will ultimately have the effect of increasing groundwater in storage. Similar to above, additions to the groundwater storage in the Monterey Subbasin will translate down-gradient to the 180/400-Foot Aquifer Subbasin over time.
- **Seawater intrusion measurable objective** – Increasing groundwater storage and groundwater elevations will support the natural hydraulic gradient that pushes back against the intruding seawater. The option of injection/extraction into the 180/400-Foot Aquifers may provide additional benefits of creating a barrier near MCWD's existing production wells against seawater intrusion. The translation of increased groundwater elevations and storage over time into the 180/400-Foot Aquifer Subbasin, thereby increasing the pressure buffer that helps halt and push back against seawater intrusion.

9.6.6.2 Expected benefits and evaluation of benefits

The primary benefit from recycled water use is to provide an alternative water supply to address the current overdraft in the Subbasin and supply future redevelopment of the former Fort Ord. Using recycled water for landscape irrigation reduces groundwater demand, which provides an in-lieu recharge benefit and is expected to increase groundwater elevations near groundwater productions. IPR application directly recharges the groundwater aquifers, thereby increasing the Subbasin's sustainable yield and groundwater elevations. Based on current and projected wastewater flows, approximately 2,200 AF/yr to 5,500 AF/yr advanced treated water may be available to MCWD for landscape irrigation and/or IPR.

The option of injection/extraction into the 180/400-Foot Aquifer may provide additional benefits of protecting MCWD's existing production wells from seawater intrusion and contaminant migration from the former Fort Ord. However, siting of this location is constrained by Fort Ord's Groundwater Protection Zone. Additional modeling and long-term monitoring are required to assess impacts on contaminants migration and seawater intrusion.

No quantification of cross-boundary benefits has been conducted at this time. However, an increase of recharge will likely have the added benefit of increasing groundwater levels and storage in the shared principal aquifers.

Project deliveries will be quantified directly through volumetric measurements of delivered or injected advanced treated water. Benefits towards attaining applicable measurable objectives will be measured using the monitoring networks described in Chapter 7.

9.6.6.3 Circumstances for implementation

As discussed above, MCWD is currently constructing its recycled water distribution system to allow delivery of 600 AF/yr of recycled water for landscape irrigation by 2023. No additional circumstances for implementation are necessary.

Project planning for AWPF expansion for IPR use is currently ongoing. Permitting, design, and construction efforts will be initiated as soon as funds become available.

9.6.6.4 Permitting and Regulatory Process

Landscape Irrigation

The regulatory requirements for recycled water use for landscape irrigation are defined in California Code of Regulations, Title 22, Article 3. M1W and MCWD have existing permits with the RWQCB to produce, transmit, and distribute advanced treated water for landscape irrigation.

Production of disinfected, advanced treated recycled water at M1W facilities is regulated under Waste Discharge Requirements (WDR) permit Order No. R3-2017-0003. Transmission and distribution of advanced treated water from the M1W AWPF are regulated under Order No. WQ 2016-0068-DDW (General Permit). The General Permit allows MCWD's distribution of advanced treated recycled water for non-residential irrigation use in accordance with its Title 22 Engineering Report approved by the SWRCB in April 2020. The report detailed specific uses and the use area requirements for the advanced treated recycled water produced by M1W. The General Permit will need to be modified if significant changes are made to the transmission, distribution, storage, or use, and/or the volume or character of the recycled water applied within MCWD's service area.

IPR in Monterey Subbasin

Major permitting processes required for an Advanced Water Treatment Plant (AWTP) expansion and IPR use include CEQA, SWRCB permitting, and RWQCB permitting.

- **CEQA Compliance:** The project will be required to comply with CEQA requirements likely by preparing an environmental impact report (EIR). It is assumed that the EIR would build upon the Pure Water Monterey EIR, and thus may take the form of a supplemental EIR, rather than a standalone EIR.

- **State Water Resources Control Board (SWRCB) Permitting:** Regulations for subsurface application of recycled water are included in CCR Title 22, Division 4, Chapter 3, Article 5.2. These regulations include minimum treatment requirements for full advanced treatment at the AWPF, as well as requirements to demonstrate adequate retention time within the aquifer. The SWRCB Division of Drinking Water (DDW) oversees permitting of such a project.
- Detailed descriptions of all regulatory requirements for the advanced treatment of wastewater as well as implementation of a GRRP are included in Section 2 of the Pure Water Monterey Final Engineering Report (Nellor et al., 2017).
- **Regional Water Quality Control Board (RWQCB) permitting:** The Regional Water Quality Control Board is responsible for waste discharge requirements and water recycling requirements for wastewater treatment plants and thus oversees the general water quality effects of discharging treated wastewater into groundwater basins.

  M1W has an existing WDR permit for the Pure Water Monterey project, which applies to both the AWPF, as well as injection of the purified recycled water into the Seaside Subbasin. In order for MCWD to inject the purified recycled water into the Monterey Subbasin, the Pure Water Monterey WDR would either need to be modified to explicitly include this use, or a new WDR would need to be issued by the Central Coast RWQCB.

Additional construction permits are required prior to construction, including but not limited to, City of Marina encroachment permit, grading permit, and building permit, and County approval of use permitting, grading permit, and well construction permit.

9.6.6.5 Implementation Schedule

<u>*Landscape Irrigation*</u>

MCWD owns and operates the regional transmission line from the AWPF and is currently constructing a recycled water distribution system that will allow distribution of up to 1,427 AF/yr to customers. MCWD anticipating delivering its current 600 AFY of advanced treated water available to customers by 2022. MCWD’s 2020 UWMP estimates that 950 AF/yr of landscape irrigation demand can be met by recycled water by 2030 and 1,270 AF/yr by 2040.

<u>*IPR in Monterey Subbasin*</u>

MCWD is currently conducting a Recycled Water Feasibility Study to further assess the possibility of implementing an IPR project. The Recycled Water Feasibility Study includes analysis of IPR alternatives using a groundwater flow model and the development of a conceptual design. MCWD anticipates conducting preliminary investigations recommended in the Water Supply Augmentation Study during the first or second year of GSP implementation.

If selected, the IPR project is likely to take between 5 and 7 years from the initiation of additional groundwater investigations through completion of tracer study that is required to be performed within the first year of GRRP operations (Figure 9-22).

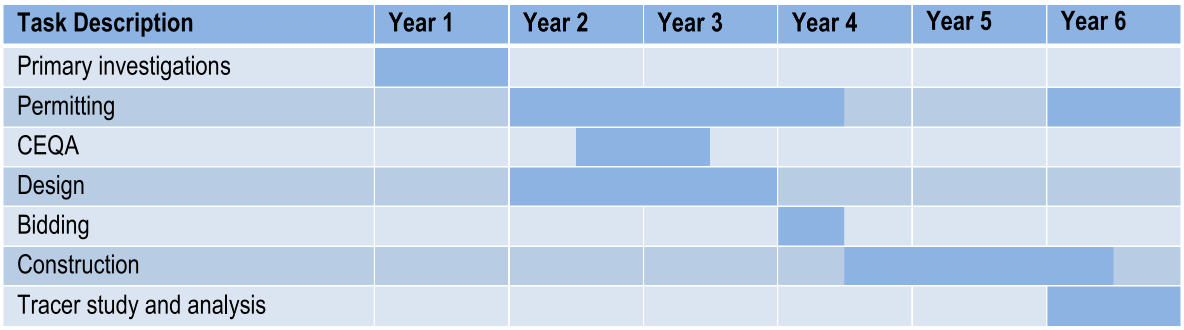

Figure 9-22. Implementation Schedule for MCWD Indirect Potable Reuse

9.6.6.6 Legal Authority

This project will be implemented pursuant to MCWD's authority as a water district.

9.6.6.7 Estimated Cost

Landscape Irrigation

Infrastructure needed to treat and deliver 1,427 AF/y of advanced treated water for landscape and other non-potable uses within MCWD has already been constructed and funded with State Revolving Fund loans and various grants. The estimated unit cost to MCWD of the advanced treated water is approximately $2,400/AF/yr.

IPR in Monterey Subbasin

Conceptual costs for the IPR option are evaluated as part of the Water Supply Augmentation Study (EKI, 2020) and adjusted to conform with GSP cost assumptions as described in Section 9.3.4. The project includes an AWPF expansion and a new transmission main from M1W to a small injection wellfield in Marina (Figure 9-23). The water would be injected using new wells and extracted using new and existing MCWD production wells. Property or pipeline easement acquisition costs were not included in these estimates. It is assumed that the source water and finished water are available and rights to these sources can be obtained.

Capital plus soft costs (planning environmental, permitting, engineering, legal, mitigation etc.) for IPR use at an assumed 2,400 AF/yr project capacity are estimated to be approximately $65 million. Annual O&M costs are estimated at $3,110,000 for operation of the AWPF, injection wells, and additional production wells. Total annualized cost is $7,820,000. Based on the assumed project capacity of 2,400 AF/yr, the unit cost of water is $3,300/AF. Project per unit cost may decrease with economies of scale.

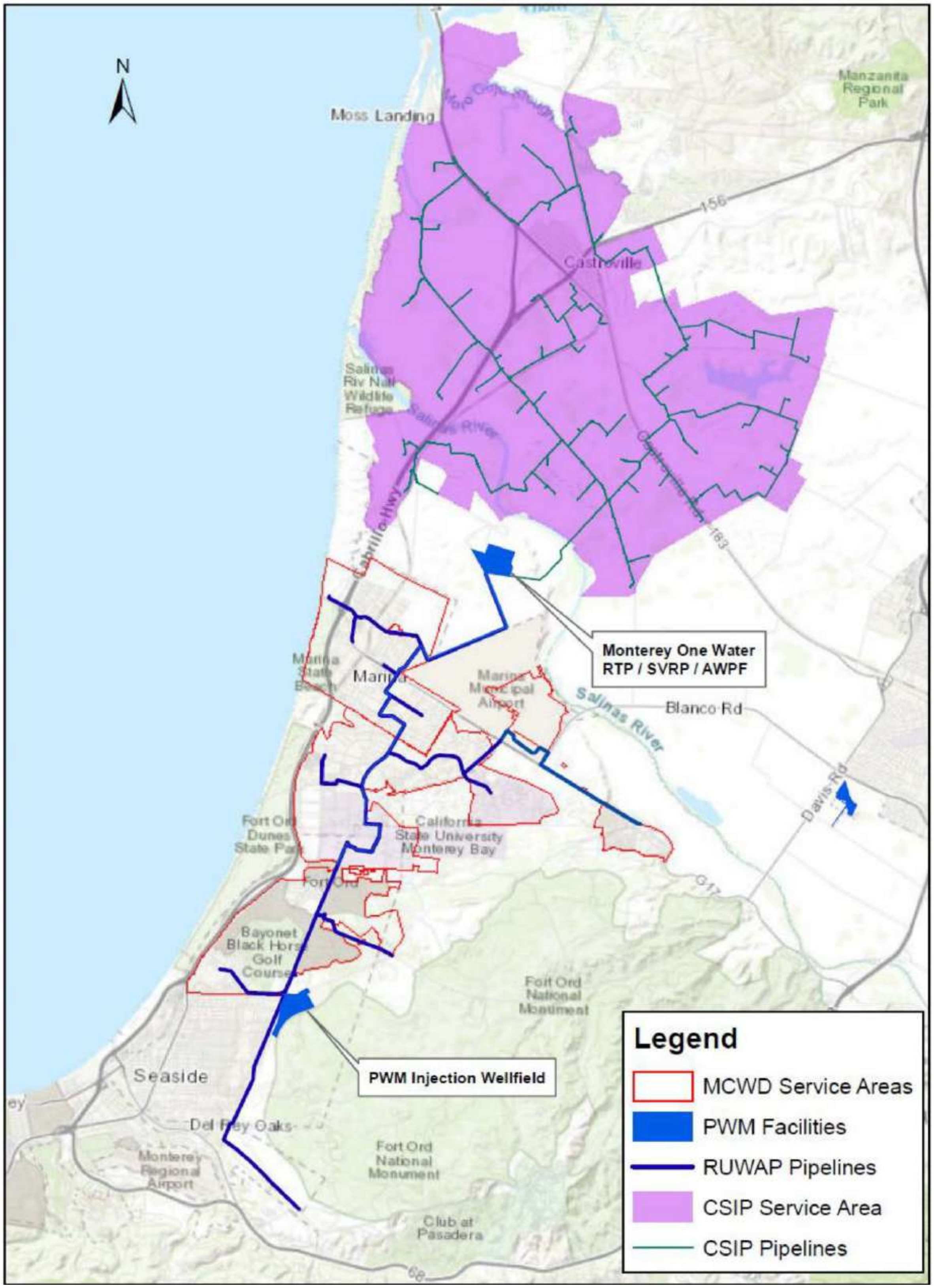

Figure 9-23. MCWD Recycled Water System

9.6.6.8 Public Noticing

Stakeholder engagement is a critical aspect of developing a successful and implementable project. Key stakeholders include the U.S. Army, local governments and adjacent municipalities, as well as the public. MCWD intends to engage stakeholders early in project development.

Before any project initiates construction, it will go through a public notice process to ensure that all groundwater users and other stakeholders have ample opportunity to comment on projects before they are built.

In addition to the public noticing detailed above, all projects will follow the public noticing requirements per CEQA.

9.6.7 Project C1 – Corral de Tierra Pumping Allocations and Controls

Pumping allocations and controls were prioritized for inclusion in the Monterey Subbasin GSP for the Corral de Tierra Management Area. While it primarily benefits the Corral de Tierra, the management action may have groundwater benefits for the 180/400-Foot Aquifer Subbasin. Pumping allocations are one demand-side approach to managing and controlling pumping. Given limited supply-side options in the Corral de Tierra, pumping allocations provide a management action to proactively determine how extraction should be fairly divided and controlled if needed.

Pumping allocations divide up the sustainable yield among beneficial users. Pumping allocations are not water rights and cannot determine water rights. Instead, they are a way to determine each extractor's pro-rata share of groundwater extraction and regulate groundwater extraction. They can be used to:

- Underpin management actions that manage pumping
- Generate funding for projects and management actions
- Incentivize water conservation and/or recharge projects

Pumping allocations can take many forms if it is needed now or in the future. Allocations can be developed based on various criteria. The SVBGSA Monterey Subbasin Planning Committee considered general options for an allocation structure; however, the actual development of allocations and pumping controls will be undertaken during GSP implementation. Including pumping allocations in the GSP shows that allocations are a management tool that can be further developed during implementation, but it does not establish pumping allocations nor pumping controls. During GSP implementation period, a full stakeholder engagement process and in-depth analysis needs to be undertaken into potential impacts and additional data that needs to be collected. Stakeholder engagement will include outreach to water systems, homeowners, and landowners so that those interested can participate in the establishment of the selected allocation structure.

Developing the selected allocations structure in order to be feasible and effective requires good groundwater extraction data. Two implementation actions that can help are GEMS Expansion and Well Registration.

Pumping allocations could also be used as the basis for pumping fees, which could raise funds for projects and management actions. For example, a fee structure could be defined such that each extractor has a pumping allowance that is based on their allocation, and a penalty or disincentive fee is charged for extraction over that amount. If the sustainable yield is lower than current extraction, a transitional pumping allowance could be developed to transition from a groundwater user's actual historical pumping amounts (estimated or measured) to their allowance based on the sustainable yield. The purpose of this transitional allowance is to ensure that no pumper is required to immediately reduce their pumping, but rather pumpers have an opportunity to reduce their pumping over a set period. Transitional pumping allowances could then be phased out until total pumping allowances in each subbasin are less than or equal to the calculated sustainable yield.

9.6.7.1 Relevant Measurable Objectives

The measurable objectives benefiting from pumping allowance and controls include:

- **Groundwater levels measurable objective -** Pumping allocations and controls that promote less pumping that will result in higher groundwater levels in the groundwater system. The 180/400-Foot Aquifer Subbasin is down gradient from the Corral de Tierra Management Area in the Monterey Subbasin and will also benefit from increased elevations across the boundary, as groundwater elevations adjustments will translate down gradient over time.
- **Groundwater storage measurable objective -** Reducing pumping from the principal aquifer will ultimately have the effect of increasing groundwater in storage. Similar to above, additions to the groundwater storage in the Corral de Tierra Management Area in the Monterey Subbasin will translate down gradient to the 180/400-Foot Aquifer Subbasin over time.
- **Land subsidence measurable objective -** Pumping allocations and controls that reduce the pumping stress on the principal aquifer and thereby reduce any potential for groundwater reduction-induced subsidence. Increases in the groundwater elevations and storage that translate down gradient to the 180/400-Foot Aquifer Subbasin will also help prevent subsidence in the 180/400-Foot Aquifer Subbasin.

9.6.7.2 Expected Benefits and Evaluation of Benefits

The primary benefit expected for this project is that it is another demand-side management tool that would help manage the sustainable yield of the Corral de Tierra Management Area and help reduce further decline of groundwater elevations. Working within a groundwater budget allows the Monterey Subbasin to bring extraction in line with the sustainable yield and mitigate overdraft.

No quantification of cross-boundary benefits has been conducted at this time. However, an increase of in-lieu recharge through reduced pumping may have the added benefit of increasing groundwater levels and storage in the shared sediments which comprise the principal aquifers. The El Toro Primary Aquifer System that is defined for the Corral de Tierra Management Area is an amalgamation of the Aromas Red Sands, the Paso Robles Formation, and the Santa Margarita Sandstone. The principal aquifers in the 180/400-Foot Aquifer Subbasin are also comprised of the Aromas Red Sands and the Paso Robles Formation. The hydraulic connection of these sandy and clayey sediments across the Reliz Fault, which generally marks the boundary between these areas, is not well studied. However, published reports indicate the Reliz Fault does not inhibit groundwater flow, therefore any improvement in groundwater conditions on one side of the boundary will invariably have a positive impact on the other side. These benefits are not quantified at this time.

Benefits will be measured using the monitoring networks described in Chapter 7. Groundwater elevations will be measured with a network of wells that is monitored by MCWRA. Groundwater storage will be monitored using groundwater extraction measurements. Land subsidence will be measured using InSAR data provided by the Department of Water Resources. Seawater intrusion will be measured using selected Representative Monitoring Sites wells.

9.6.7.3 Circumstances for implementation

The 180/400-Foot Aquifer Subbasin will not pursue this management action independently of the Monterey Subbasin; however, implementation may have cross-boundary benefits. SVBGSA will work with the Subbasin stakeholders to collect data needed to establish pumping allocations and undertake additional stakeholder outreach prior to establishing pumping allocations. As part of establishing pumping allocations, SVBGSA will determine whether to implement pumping controls immediately or to establish a trigger based on groundwater conditions, after which controls are implemented.

9.6.7.4 Permitting and Regulatory Process

The SVBGSA Board of Directors will need to authorize the establishment of pumping allocations and controls. The development and implementation of pumping controls is a regulatory activity and would be embodied in an SVBGSA regulation. The regulation could be established to provide for automatic implementation upon existence of specific criteria or to require the vote of the Board to implement.

9.6.7.5 Implementation Schedule

If selected, the proposed implementation schedule is shown on Figure 9-24. After the establishment of pumping allocations is initiated for the Monterey Subbasin, pumping controls will be implemented only when needed.

Task Description	Year 1	Year 2	Year 3	Year 4	Year 5+
Phase I – Data collection and stakeholder outreach					
Phase II – Establishment of allocation structure					
Phase III – Pumping controls, when needed					

Figure 9-24. Implementation Schedule for Pumping Management

9.6.7.6 Legal Authority

California Water Code §10726.4(a)(2) provides GSAs the authorities to control groundwater extractions by regulating, limiting, or suspending extractions from individual groundwater wells or extractions from groundwater wells in the aggregate. Imposition of pumping allocations and controls will require a supermajority plus vote of the SVBGSA Board of Directors.

9.6.7.7 Estimated Cost

Development of a pumping allocation structure and pumping controls is approximately $400,000. This includes outreach meetings to engage stakeholders, analysis of potential allocation structures, facilitation of stakeholder dialogues, refinement according to specific situations, and legal analysis. When pumping controls are enacted, there will be additional administrative costs associated with implementation.

9.6.7.8 Public Noticing

As part of the approval of the establishment of pumping allocations in the Monterey Subbasin, it will go through a public notice process to ensure that all groundwater users and other stakeholders have ample opportunity to comment on it. The general steps in the public notice process will include the following:

- GSA staff will bring an assessment of the need for allocations to the SVBGSA Board in a publicly noticed meeting. This assessment will include:
    - A description of the undesirable result(s) that may occur if action is not taken
    - A description of the proposed management action
    - An estimated cost and schedule for the proposed management action
    - Any alternatives to the proposed management action

- The SVBGSA Board will notify stakeholders in the area of the proposed project and allow at least 30 days for public response.
- After the 30-day public response period, the SVBGSA Board will vote whether or not to approve design and construction of the project and notify the public if approved via an announcement on the SVBGSA website and mailing lists.

Imposition of pumping allocations and controls may also require a CEQA review process and may require an Environmental Impact Report or a Mitigated Negative Declaration (the review could also result in a Negative Declaration or Notice of Exemption). All projects will follow the public noticing requirements per CEQA or NEPA.

9.7 Implementation Actions

Implementation actions include actions that contribute to groundwater management and GSP implementation but do not directly help the Subbasin reach or maintain sustainability. Included here for the 180/400-Foot Aquifer Subbasin are well registration, GEMS expansion and enhancement, the dry well notification system, Water Quality Coordination Group, Land Use Jurisdiction Coordination Program and support protection of areas of high recharge.

9.7.1 Implementation Action 1: Well Registration

All groundwater production wells, including wells used by *de minimis* pumpers, will be required to be registered with the SVBGSA. Well registration is intended to establish a relatively accurate count of all the active wells in the Subbasin. This implementation action will help gain a better understanding of the wells in active use, verses those that have been decommissioned. Well registration will collect information on active wells, such as the type of well meter, depth of well, and screen interval depth. Well metering is intended to improve estimates of the amount of groundwater extracted from the Subbasin. A GSA may not require *de minimis* users (as defined) to meter or otherwise report annual extraction data. Other public agencies such as the County of MCWRA may have such authority. The details of the well registration program, and how it integrates with existing ordinances and requirements, will be developed during the first 2 years of GSP implementation.

9.7.2 Implementation Action 2: GEMS Expansion and Enhancement

SGMA allows GSAs to manage groundwater extractions within a basin's sustainable yield. Accurate extraction data is fundamental to this management. The MCWRA Groundwater Extraction Monitoring System (GEMS) collects groundwater extraction data from certain areas in the Salinas Valley. The system was enacted in 1993 under Ordinance 3663 and was later modified by Ordinances 3717 and 3718. The MCWRA provides the Salinas Valley Basin GSA (SVBGSA) annual GEMS data that can be used for groundwater management.

Most of the 180/400-Foot Aquifer Subbasin's estimated groundwater extraction data is derived from MCWRA's GEMS Program, which is implemented in Zones 2, 2A, and 2B. There are limited data on groundwater extraction within the 180/400-Foot Aquifer Subbasin outside of MCWRA Zones 2, 2A and 2B.

SVBGSA will work with MCWRA to expand the existing GEMS Program to cover the entire Salinas Valley Groundwater Basin, which would capture all wells that have at least a 3-inch internal diameter discharge pipe. Program revisions will consider and not contradict related state regulations. Alternatively, SVBGSA could implement a new groundwater extraction reporting program that collects data outside of MCWRA Zones 2, 2A, and 2B. The groundwater extraction information will be used to report total annual extractions in the Subbasin. Additional improvements to the existing MCWRA groundwater extraction reporting system may include some subset of the following:

- Developing a comprehensive database of extraction wells
- Expanding reporting requirements to all areas of the Salinas Valley Groundwater Basin
- Including all wells with a 2-inch discharge or greater
- Requiring automatically reporting flow meters
- Comparing flow meter data to remote sensing data to identify potential errors and irrigation inefficiencies.

9.7.3 Implementation Action 3: Dry Well Notification System

The SVBGSA could develop or support the development of a program to assist well owners (domestic or state small and local small water systems) whose wells go dry due to declining groundwater elevations. The program could include a notification system whereby well owners can notify the SVBGSA or relevant partner agency if their well goes dry, such as the Household Water Supply Shortage System, available at: https://mydrywatersupply.water.ca.gov/report/ (DWR, 2021b). The information collected through this portal is intended to inform state and local agencies on drought impacts on household water supplies. It could also include referral to assistance with short-term supply solutions, technical assistance to assess why it went dry, and/or long-term supply solutions. For example, the SVBGSA could set up a trigger system whereby it would convene a working group to assess the groundwater situation if the number of wells that go dry in a specific area cross a specified threshold. A smaller area trigger system would initiate action independent of monitoring related to the groundwater level SMC. The SVBGSA could also support public outreach and education.

9.7.4 Implementation Action 4: Water Quality Coordination Group

The Water Quality Coordination Group will include the CCRWQCB, local agencies and organizations, water providers, domestic well owners, technical experts, and other stakeholders. The purpose of the Coordination Group is to coordinate amongst and between agencies that regulate water quality directly and the SVBGSA, which has an indirect role to monitor water quality and ensure its management does not cause undesirable water quality results.

Numerous agencies at the local and State levels are involved in various aspects of water quality. The SWRCB and CCRWQCBs are the principal state agencies with primary responsibility for the coordination and control of water quality for the health, safety, and welfare of the people of the state pursuant to the Porter-Cologne Water Quality Control Act 1969 (California Water Code §13001). There are many efforts to address water quality by the SWRCB. For example, at the State level, the Department of Drinking Water's Safe and Affordable Funding for Equity and Resilience (SAFER) program is designed to meet the goal of safe drinking water for all Californians. In addition, at the local level, the County of Monterey Health Department Drinking Water Protection Service is designed to regulate and monitor water systems and tests water quality for new building permits for systems with over 2 connections.

Locally based GSAs established pursuant to SGMA are required to develop and implement GSPs to avoid undesirable results (including an undesirable result related to water quality) and mitigate overdraft in the groundwater basin within 20 years. SVBGSA will coordinate with the appropriate water quality regulatory programs and agencies in the Subbasin to understand and develop a process for determining when groundwater management and extraction are resulting in degraded water quality in the Subbasin.

Both the State and Monterey County have committed to a Human Right to Safe Drinking Water. SGMA outlines a specific role for GSAs related to beneficial users of groundwater including drinking water, which is to manage groundwater according to the 6 sustainability indicators. The Coordination Group will help define the unique role for the GSAs, not related to specific sustainability metrics. Under this implementation action, the GSAs will play a convening role by developing and coordinating a Water Quality Coordination Group.

The Coordination Group will review water quality data, identify data gaps, and coordinate agency communication. The Coordination Group will convene at least annually to share groundwater quality conditions, as assessed for the GSP annual reports, and assesses whether groundwater management actions are resulting in unsustainable conditions. The goal of the Coordination Group will include documenting agencies' actions that address water quality concerns including outlining each agency's responsibilities. An annual update to the SVBGSA Board will be provided regarding Coordination Group efforts and convenings.

This Coordination Group will also serve to collaborate with agencies on local regulation that could affect groundwater contamination, such as county or city groundwater requirements that relate to regulation of septic systems, well drilling, capping and destruction, wellhead protection and storage and/or leaking of hazardous materials.

9.7.5 Implementation Action 5: Land Use Jurisdiction Coordination Program

The Land Use Jurisdiction Coordination Program outlines how the SVBGSA review land use plans and efforts to coordinate with land use planning agencies to assess activities that potentially create risks to groundwater quality or quantity. The goal is to ensure that the GSA and Land Use Jurisdiction efforts are aligned. Examples of these activities include the application of the B-8 Zoning district by the County of Monterey in areas with water supply, water quality and other constraints on development, and the consideration of recharge potential for new developments. While the SVBGSA does not have land use authority, and the Land Use Jurisdictions retain all such authority, the Coordination Program also describes how local agencies should consider adopted GSPs when revising or adopting policies, such as adopting and amending general plans and approving land use entitlements, regulations, or criteria, or when issuing orders or determinations, where pertinent. The Coordination Program will be developed immediately upon implementation of this GSP.

9.8 Other Groundwater Management Activities

Although not specifically funded or managed by this GSP, a number of associated groundwater management activities will be promoted and encouraged by the GSAs as part of general good groundwater management practices. If any particular action is scoped further and shown to significantly improve groundwater conditions, SVBGSA may consider implementing it as a project or management action under this GSP.

9.8.1 Continue Urban and Rural Residential Conservation

Existing water conservation measures should be continued, and new water conservation measures promoted for residential users. Conservation measures may include the use of low flow toilet fixtures, or laundry-to-landscape greywater reuse systems. Conservation projects can reduce demand for groundwater pumping, thereby acting as in-lieu recharge.

9.8.2 Promote Stormwater Capture

Stormwater and dry weather runoff capture projects, including Low Impact Development (LID) standards for new or retrofitted construction, should be prioritized and implemented. The Storm Water Resource Plan outlines an implementation strategy to ensure valuable, high-priority projects with multiple benefits (Hunt *et al.*, 2019). While not easily quantified and therefore not included as projects in this document, stormwater capture projects may be worthwhile and benefit the basin.

9.8.3 Support Well Destruction Policies

Properly destroying unused wells in accordance with local and state regulations prevents the migration of poor-quality groundwater between aquifers. While well destruction does not directly address the sustainable management criteria included in this GSP, controlling the migration of poor-quality groundwater allows more efficient use of existing resources.

9.8.4 Watershed Protection and Management

Watershed restoration and management can reduce stormwater runoff and improve stormwater recharge into the groundwater basin. While not easily quantified and therefore not included as projects in this document, watershed management activities may be worthwhile and benefit the basin.

9.8.5 Support Reuse and Recharge of Wastewater

Wastewater collection and treatment provides opportunities to use and reuse water in various ways. Each wastewater treatment facility has unique infrastructure with different plans for expansion or upgrades. Potential upgrades could result in greater reliability, improved water quality, the ability to reuse treated wastewater or increase water reuse yields, or increased recharge to groundwater. These upgrades may directly or indirectly affect groundwater conditions.

9.9 Mitigation of Overdraft

As shown in Chapter 6, the 180/400-Foot Aquifer Subbasin has historically been in overdraft, and is projected to still be in overdraft throughout the GSP planning horizon unless projects and management actions bring extraction and the sustainable yield in line. The long-term overdraft in the Subbasin is projected to be 13,400 AF/yr after sustainability is met. The overdraft can be mitigated by reducing pumping or recharging the subbasin, either through direct or in-lieu means. The potential projects and management actions in this chapter are sufficient to mitigate existing overdraft, as presented in Table 9-8. These include demand planning to be used if other projects and management actions do not reach sustainability goals and mitigate overdraft. The projects and management actions selected will ensure that the chronic lowering of groundwater levels or depletion of supply during periods of drought is offset by increases in groundwater levels or storage during other periods. As noted in Chapter 6, mitigation of overdraft is not sufficient to reach sustainability because balancing the water budget will not prevent future seawater intrusion. The amount of water needed to mitigate seawater intrusion depends on the approach taken. Cross-boundary projects are not included here as key projects and management actions to mitigate overdraft; however, they may help reduce overdraft.

Table 9-8. Total Potential Water Available for Mitigating Overdraft

Project/ Management Action #	Name	Quantification of Project Benefits
MA1	Demand Planning	Range of potential project benefits
MA2	Fallowing, Fallow Bank, and Agricultural Land Retirement	Dependent on program participation
MA3	Conservation and Agricultural BMPs	Dependent on specific BMPs implemented
MA4	Reservoir Reoperation	Unable to quantify benefits until feasibility study is completed
MA5	Undertake and Operationalize Guidance from Deep Aquifers Study	Unable to quantify until Deep Aquifers Study completed
MA6	MCWRA Drought Reoperation	Unable to quantify benefits since drought operations have yet to be triggered
P1	Multi-benefit Stream Channel improvements	Component 1: Multi-subbasin benefits not quantified Component 2: Multi-subbasin benefit of 2,790 to 20,880 AF/yr of increased recharge Component 3: Multi-subbasin benefit of 1,000 AF/yr from 10 recharge basins
P2	CSIP System Optimization	Benefit of at least 5,500 AF/yr of recycled and river water provided for irrigation in-lieu of groundwater extraction.
P3	Modify M1W Recycled Water Plant	Up to 1,100 AF/yr of recycled water provided for irrigation in-lieu of groundwater extraction.
P4	CSIP Expansion	Multi-subbasin benefit for 3,500-acre expansion: 9,900 AF/yr of recycled and river water provided for irrigation in-lieu of groundwater extraction
P5	Seawater Intrusion Extraction Barrier	Will contribute to overdraft due to seawater intrusion; however prevention of seawater intrusion unable to be quantified
P6	Regional Municipal Supply Project	Multi-subbasin benefit: 15,000 AF/yr of imported desalinated water reduces groundwater extraction. Portion of this benefiting the 180/400 Subbasin has yet to be determined.
P7	Seasonal Release with ASR	6,800 AF/yr of additional storage
P8	Irrigation Water Supply Project (or Somavia Road Project)	3,000 AF/yr of extracted water for in lieu use or recharge

10 GROUNDWATER SUSTAINABILITY PLAN IMPLEMENTATION

This chapter describes how the GSP for the 180/400-Foot Aquifer Subbasin will be implemented. The chapter serves as a roadmap for addressing all of the activities needed for GSP implementation between 2020 and 2040 but focuses on the activities between 2020 and 2025.

Implementing this GSP will require the following formative activities, each of which is detailed in a subsequent subsection:

- Data, monitoring, and reporting
    - Annual monitoring and reporting
    - Updating the DMS
    - Improving monitoring networks
    - Addressing identified data gaps in the HCM
- Continuing communication and stakeholder engagement
- Refining and implementing projects and management actions
- Adapting management with the 5-year Update
- Developing a funding strategy

The implementation plan in this chapter is based on the best available data used to understand groundwater conditions in the Subbasin conditions and the current assessment of the projects and management actions described in Chapter 9. The Subbasin's conditions and the details of the projects and actions will likely evolve over time based on future data collection, model development, and input from Subbasin stakeholders.

10.1 Progress Towards GSP Implementation of GSP

This section details groundwater management activities that have occurred since GSP submittal that contribute to GSP implementation. These include activities of SVBGSA and MCWRA that promote groundwater sustainability and are important for reaching the GSP sustainability goal. Activities are separated into four main categories: coordination and engagement, data and monitoring, planning, and project and implementation activities.

10.1.1 Data and Monitoring

SVBGSA also undertook several efforts to move data collection and monitoring forward. Since GSP submittal:

- SVBGSA expanded the groundwater level monitoring network in the 180/400-Foot Aquifer Subbasin beyond the CASGEM network. To the extent possible existing wells are used. This effort expands the network from 21 to 91, of which 35 are in the 180-Foot Aquifer, 45 in the 400-Foot Aquifer, and 11 in the Deep Aquifers. These 91 wells re Representative Monitoring Sites; however, 157 wells are used in the development of groundwater elevation contours.
- SVBGSA reassessed data gaps and selected 2 to request be filled through DWR's Technical Support Services. SVBGSA evaluated land ownership and access. In doing so, SVBGSA worked with MCWRA and Marina Coast Water District to ensure the wells will be strategically located and contribute data that is useful for all agencies.
- SVBGSA received a preliminary version of the SVIHM, and it used it to develop the water budgets in this GSP Update (Chapter 6), map locations of interconnected surface water where there is recharge and discharge from the Salinas River and other streams (shown in Chapter 4), and estimate the rate of surface water depletion due to groundwater extraction (included in Chapter 5).
- SVBGSA and MCWRA began discussions on expanding and enhancing the GEMS program. This effort will primarily take place in 2022 and 2023. These early discussions focused on understanding the challenges to changing the program and steps involved.
- SVBGSA participated in DWR's planning for flying AEM across the Salinas Valley. SVBGSA undertook communication and engagement with stakeholders, and it gave feedback on flight lines.

10.1.2 Coordination and Engagement

SVBGSA continued robust stakeholder engagement and strengthened collaboration with key agencies and partners.

Cooperation Agreement with MCGSA: In January 2020, the SVBGSA worked with the MCGSA to develop a Cooperation Agreement. The Agreement lays out how the two agencies will collaborate on the 180/400-Foot Aquifer Subbasin, including the adoption of the single GSP for the Subbasin. The County Board of Supervisors approved the Agreement on January 28, 2020, and the SVBGSA Board of Directors approved it on January 30, 2020.

Continued Stakeholder Engagement: Since GSP submittal, SVBGSA has continued monthly meetings of the Advisory Committee and Board of Directors. In spring 2020, SVBGSA established planning committees for each subbasin developing a 2022 GSP, as described in Chapter 2. In spring 2021, SVBGSA undertook a concerted effort to review the existing committee structure and adjust with a focus on implementation. SVBGSA established the 180/400-Foot Aquifer Subbasin Implementation Committee and appointed 17 members in

September 2021. In line with the revised committee structure with a focus on implementation, this effort also included identifying the need for an Integrated Implementation Committee to guide development of an Integrated Implementation Plan for 6 Subbasins within the Salinas Valley. The Integrated Implementation Committee will provide input on basin wide and regional projects and management actions and resolve neighboring basin concerns. The intent of the Committee is to ensure the Salinas Valley Basin is on a cohesive path to sustainability.

Strategic Dialogue with Disadvantaged Communities: SVBGSA Board expressed an interest in understanding more about Disadvantaged Communities (DAC) experiences as stakeholders in the Salinas Valley and how the GSP development process could help better understand groundwater conditions affecting these communities. The Agency contracted with Consensus Building Institute (CBI) to conduct a work program to help the Agency better define a meaningful engagement strategy with DACs and to develop a work plan that aligned with GSP development and ultimately with Agency long term goals around groundwater sustainability. CBI conducted interviews to gage primary groundwater issues of concern in DACs, identified possible Agency focus with DACs, confirmed barriers to engagement with DACs, and identified outreach and education materials and approaches to achieve success with these communities over the long term. Disadvantaged communities are an important stakeholder for the Agency to develop meaningful and long-term relationships with regard to groundwater. sustainability.

SVBGSA and MCWRA Coordination: SVBGSA and MCWRA also increased coordination and collaboration through weekly meetings between agency leads and consultants. This resulted in increased awareness of each other's activities, objectives, and challenges. MCWRA and SVBGSA have scoped the roles of the 2 agencies and are developing a Memorandum of Understanding (MOU) to be reviewed by each agency Board. The MOU will further outline how the two agencies will coordinate through the implementation of the GSPs.

Additional Activities: SVBGSA conducted meetings throughout the year to reach out to additional agencies and stakeholders to coordinate. These included meetings with:

- NMFS on the effect of groundwater extraction on surface water depletion and steelhead and its habitat.
- Monterey County on data and the existing well permitting and water quality monitoring programs.
- Central Coast Regional Water Quality Control Board on data and future coordination with the multiple agencies involved in water quality.
- Greater Monterey County RWMG, including coordinating with CCWG on watershed coordinator grant.

10.1.3 Project Implementation Activities

SVBGSA and MCWRA undertook several activities during WY2021 that contribute to GSP Implementation. These activities help lay the groundwork for implementing projects and management actions that will ultimately effect groundwater conditions, such as through seeking funding, engaging stakeholders, and undertaking additional studies and modeling. Two have a more immediate effect on groundwater conditions: well destruction that will help prevent vertical migration of seawater- and nitrate-contaminated groundwater between aquifers and development of a drought technical advisory committee (D-TAC) that will develop a recommended release schedule for Nacimiento and San Antonio Reservoirs after a drought trigger occurs.

SGMA Planning Grant: In Fall 2019, the SVBGSA applied for and received the DWR Round 3 SGMA Planning Grant, which includes funding for implementation of the 180/400-Foot Aquifer Subbasin GSP and development of 4 additional subbasin GSPs. In addition, the SVBGSA was part of the MCWD GSA grant application for the Monterey Subbasin. In January 2020, DWR requested that the SVBGSA revise its grant to include grant activities for the Arroyo Seco Groundwater Sustainability Agency (originally submitted as a separate grant). On February 21, 2020, the SVBGSA submitted the revised grant, which was approved and will fund expansion of monitoring networks and the beginning phase of implementation activities in the 180/400-Foot Aquifer Subbasin.

Seawater Intrusion Working Group (SWIG) and SWIG Technical Advisory Committee (SWIG TAC): The SVBGSA established the SWIG to develop consensus on the science of seawater intrusion in the Salinas Valley Groundwater Basin. The ultimate goal of the SWIG is to develop a comprehensive set of projects and management actions that control seawater intrusion while providing cost effective water supplies for the region. The SWIG TAC provides technical information in support of the SWIG's policy direction and decision-making functions. The SWIG TAC provides the SWIG information on the nature and extent of seawater intrusion, the processes underlying seawater intrusion, technical advice on the effectiveness of potential projects or actions that may halt or reverse seawater intrusion, uncertainties surrounding seawater intrusion, and data needed to better assess the current status of seawater intrusion. The primary benefit of the SWIG is to compile the best available science, data, and understanding of local seawater intrusion causes and potential resolutions.

After the SWIG undertook foundational administrative groundwork, it focused on improving the working knowledge of the current concerns regarding the Deep Aquifers and supported the development of a scope of work for a Deep Aquifers Study. Then it shifted to better understanding additional projects that could stop seawater intrusion in the 180/400-Foot Aquifer Subbasin. The SWIG discussed and provided input on demand management approaches and reviewed the various project types including specific project ideas and examples such as an extraction barrier and aquifer storage and recovery.

Deep Aquifers Study: In 2021, SVBGSA developed a scope of work for the Deep Aquifers Study. The Study focuses on describing the geology, hydrogeology, and extents of the Deep Aquifers, estimating the Deep Aquifers water budgets, and providing guidance on management and monitoring of the Deep Aquifers. SVBGSA solicited contributions to fund the Deep Aquifers Study from local agencies and stakeholders and secured the $850,000 needed for the Study. SVBGSA drafted the Request for Qualifications, received proposals, and held a review committee to select the consultant. SVBGSA awarded the 2-year contract in January 2022.

Seawater Intrusion Model Expansion: SVBGSA began development on a Seawater Intrusion Model in the Monterey Subbasin through a Proposition 68 grant; however, most of the seawater-intruded area of the Valley is within the 180/400-Foot Aquifer Subbasin. SVBGSA and Monterey County decided to co-fund the expansion of the Model to cover the entire intruded or potentially intruded area within the Salinas Valley Groundwater Basin. The model is a variable density USG-TRANSPORT model. The SVIHM/SVOM developed by the USGS does not have the capability of assessing how seawater interacts with groundwater based on their differing densities. This Seawater Intrusion Model will provide a critical tool in assessing which projects and management actions can adequately address seawater intrusion and assist with scoping them.

Grant Applications: SVBGSA and MCWRA applied for a SGMA Implementation Grant, and a WaterSmart grant application in 2021. While unsuccessful, the process helped evaluate, prioritize, and further scope potential projects for early implementation, as well as better understand the project benefits in terms of contributing to GSP goals. In 2022, SVBGSA applied for and successfully was awarded $7.6 million from DWR through the SGMA Round 1 Implementation Grant. The grant includes implementation of CSIP projects, demand planning, operationalization of Deep Aquifer Study recommendations, feasibility studies for a seawater intrusion extraction barrier and aquifer storage and recovery, and compliance/filling data gaps and outreach.

Prohibition on New Wells in the Deep Aquifers: Monterey County Ordinance 5303 expired in May 2020. Before its expiration MCWRA staff published a *Recommendations Report to Address the Expansion of Seawater Intrusion in the Salinas Valley Groundwater Basin: 2020 Update* (MCWRA, 2020b). The report updated the 2017 Recommendations Report based on the MCWRA's most recent information and data analysis and outlined nine recommendations aimed at halting seawater intrusion. The updated report evaluated the effectiveness of Ordinance 5303 towards the original recommendations proposed by MCWRA to halt seawater intrusion. The updated report was brought to the MCWRA Basin Management Advisory Committee, MCWRA Board of Directors, and Monterey County Board of Supervisors; subsequently, the Board of Supervisors initiated the Deep Aquifers Well Working Group (DAWWG) via the County Administrative Office (CAO).

Well destruction: The 2017 *Recommendations Report to Address the Expansion of Seawater Intrusion in the Salinas Valley Groundwater Basin* identified the need for well destruction in the coastal Salinas Valley to prevent vertical migration of seawater- and nitrate-contaminated groundwater between aquifers. In July 2020, MCWRA and the SWRCB entered into an agreement for the *Protection of Domestic Drinking Water Supplies for the Lower Salinas Valley* project. The project is funded in part by a Proposition 1 Implementation Grant from the SWRCB with the goal of destroying a minimum of 100 abandoned or inactive wells. Project implementation is ongoing and will be completed by February 2023.

D-TAC: MCWRA formed a new D-TAC to develop standards and guiding principles for managing the operations of Nacimiento and San Antonio reservoirs during multi-year drought periods. The D-TAC is open to all interested stakeholders but is limited in attendance to third-party experts with expertise in hydrology, hydrogeology, hydrological modeling, civil engineering, or fisheries biology. The D-TAC has completed the development of standards and guiding principles for drought operations, which were adopted by the Agency Board of Directors on February 16, 2021. Moving forward, the D-TAC will meet any time a drought trigger occurs to develop a recommended release schedule for Nacimiento and San Antonio Reservoirs.

10.1.4 Planning

As an agency, SVBGSA GSP planning efforts during WY 2021 focused on the developing 5 additional groundwater sustainability plans, 4 of which are in adjacent subbasins to the 180/400-Foot Aquifer Subbasin: Forebay Aquifer, Eastside Aquifer, Langley Area, and Monterey Subbasins. While SVBGSA developed these plans through a bottom-up process working with subbasin planning committees, it ensured that they aligned with the 180/400-Foot Aquifer Subbasin GSP, particularly with regards to selecting SMC that would not prevent the 180/400-Foot Aquifer Subbasin from avoiding undesirable results. For example, all adjacent subbasin GSPs selected groundwater level minimum thresholds that are based on not exceeding recent low levels. SVBGSA coordinated with MCWD GSA and Arroyo Seco GSA throughout plan development.

In June 2021, SVBGSA received DWR's review and approval of the 180/400-Foot Aquifer Subbasin GSP. Since the 2022 GSPs were under development, SVBGSA took action immediately to address the corrective action on the water quality undesirable result. SVBGSA sought legal advice, revised the undesirable result for 2022 GSPs, and brought the revised language to the partner GSAs, subbasin planning committees, Advisory Committee, and Board of Directors for approval. SVBGSA includes the revised language in this 180/400 2-Year GSP Update.

Finally, SVBGSA appointed members to the 180/400-Foot Aquifers Subbasin Implementation Committee in September. As part of its charge, the Implementation Committee will provide stakeholder input on the 2-Year GSP Update. This Committee consists of 17 stakeholders, including landowners, municipalities, and water providers.

10.2 Data, Monitoring, and Reporting

Beginning in the first year of GSP implementation, SGMA requires submittal of annual monitoring data and development of an annual report. This annual process tracks groundwater conditions with respect to the SMC established in Chapter 8. The SVBGSA hires consultant(s), forms agreements with agencies, and/or hires staff to implement the monitoring and reporting functions.

Monitoring of the 6 sustainability indicators began upon adoption of the GSP. Most of the monitoring networks described in Chapter 7 rely on existing monitoring programs. Only ISW needs the establishment of a new monitoring network. Data from the monitoring programs is maintained in the DMS and evaluated annually to ensure progress is being made toward sustainability or to identify exceedances of minimum thresholds. SVBGSA assesses monitoring data to prepare annual reports and guide decisions on projects and management actions.

10.2.1 Annual Monitoring and Reporting

SGMA requires completion of annual reports to document Subbasin conditions relative to the SMC presented in Chapter 8. In April 2019, SVBGSA began to submit annual reports for the 180/400-Foot Aquifer Subbasin to DWR. SVBGSA makes these annual reports publicly available. The purpose of the reports is to provide monitoring, groundwater extraction, and total water use data to DWR, compare monitoring data to the SMC, and adaptively manage actions and projects implemented to achieve sustainability.

The monitoring of the 6 sustainability indicators is described below. Chapter 7 outlines the data collected through the monitoring programs that will be used to complete annual reports. Where possible, SVBGSA will leverage data collection and analysis completed by MCWRA to avoid duplication of efforts.

10.2.1.1 Groundwater Level

For groundwater level monitoring, SVBGSA relies on MCWRA's collection of groundwater elevation data and analyzes it to meet SGMA requirements. MCWRA collects groundwater elevation monitoring data under the statewide CASGEM program and their annual, monthly, and August groundwater elevation monitoring programs. The CASGEM system will be replaced by the SGMA groundwater level monitoring program after GSP submission. The new monitoring system will include the 21 existing CASGEM wells and at least 70 additional wells that are already part of MCWRA's monitoring programs. Groundwater monitoring will continue to be conducted by MCWRA, and they will make these data available to the SVBGSA. The GSA will use MCWRA's annual August trough and fall contour maps and adapt if necessary, using groundwater elevation data collected from the groundwater level monitoring network and adjacent subbasins. The GSA will also prepare summary tables and figures, compare the data to SMC, and annually upload the data for DWR and to the DMS.

10.2.1.2 Seawater Intrusion

For seawater intrusion, SVBGSA depends on MCWRA's collection and analysis of chloride data from their seawater intrusion monitoring wells. MCWRA will annually produce seawater intrusion contours and make them available to SVBGSA. These contours will be used to compare to SMC.

10.2.1.3 Groundwater Quality

For groundwater quality, SVBGSA relies on state monitoring systems and analyzes it to meet SGMA requirements. SWRCB compiles groundwater quality monitoring data for DDW and ILRP wells in their GAMA groundwater information system. The GSA will annually download these data, analyze exceedances for the COCs, prepare summary tables, compare the data to SMC, and upload them to the DMS.

10.2.1.4 Land Subsidence

For land subsidence, SVBGSA relies on data provided by the State and analyzes it to meet SGMA requirements. DWR provides InSAR data that SVBGSA will use to assess land subsidence. InSAR data will be downloaded annually and are provided through DWR's SGMA Data Viewer, if available, and used to create annual change in subsidence maps to compare to SMC in the annual report.

10.2.1.5 Interconnected Surface Water

No entity currently monitors ISW. As described in Chapter 7, the monitoring network for interconnected surface water is in the process of development. Shallow groundwater elevations will be used as proxies for depletion rates; thus, shallow wells near the areas of interconnected surface water are needed. Monitoring wells will be located near USGS stream gauges and MCWRA's Salinas River Series measurement sites to evaluate groundwater gradient and effects of groundwater levels on surface water depletion. This will also help determine the extent of interconnection. The ISW monitoring wells will be incorporated into MCWRA's existing monitoring network and MCWRA will make these data available to SVBGSA and ASGSA. Water level measurements will be made at least once a year at each ISW monitoring site during MCWRA's annual fall groundwater monitoring event that occurs from mid-November to December.

10.2.1.6 Groundwater Extraction

SVBGSA relies on MCWRA's collection of groundwater extraction data and analyzes it to meet SGMA requirements. Through the Groundwater Extraction Monitoring System (GEMS), MCWRA collects groundwater pumping data for agricultural supply wells and public groundwater system wells that have discharge pipes larger than 3 inches within Zones 2, 2A and 2B. SVBGSA will work with MCWRA to update and enhance this program, as detailed in Section 10.2.3.1. The SVBGSA will annually use these data to prepare summary tables and figures and compare the data to SMC. Due to the GEMS reporting period and submittal deadlines defined by Monterey County Ordinance No. 3717 and 3718, groundwater extraction reported in the annual reports will be lagged by 1 year.

10.2.2 Updating the Data Management System

The SVBGSA has developed a DMS that is used to store, review, and upload data collected from the monitoring programs outlined above, as described in Chapter 7. A web application reporting these data is available on the SVBGSA's website for stakeholders to view the data. The DMS will be updated as new information is collected for annual reports, developed as part of GSP implementation, and provided by stakeholders.

10.2.3 Improving Monitoring Networks

As discussed in Chapter 7, the existing seawater intrusion, groundwater quality, and subsidence monitoring networks already provide sufficient spatial coverage and do not need to be improved.

10.2.3.1 Groundwater Levels

The current groundwater level monitoring network has adequate spatial coverage of the 180-Foot and 400-Foot Aquifers. However, Chapter 7 identifies 5 general data gaps in the Deep Aquifers groundwater level monitoring network, shown on Figure 7-5, that would require at least 4 new monitoring wells to fill. The SVBGSA will obtain required permits and access agreements before drilling new wells. The SVBGSA will retain the services of licensed geologists or engineers and qualified drilling companies for drilling new wells. To the extent possible, the SVBGSA will use grant funds and technical assistance support services through DWR or other entities for new wells. Once drilled, the new wells will be tested as necessary and equipped with dedicated data loggers for monitoring. All new monitoring wells identified as RMS locations will be added to MCWRA's monitoring network for continuity and consistency in data collection. Some of these new monitoring wells will be nested to help fill vertical data gaps on the connectivity between the three principal aquifers in the Subbasin.

Additionally, some of the wells in the groundwater level monitoring network are only sampled annually resulting in a temporal data gap. Thus, SVBGSA will work with MCWRA to update monitoring protocols for these well to be sampled at least twice a year as is required by SGMA. Moreover, for wells in the monitoring network that lack well construction information, SVBGSA will try to address that data gap.

10.2.3.2 Interconnected Surface Water

Depletion of interconnected surface water will be monitored through shallow wells adjacent to locations of interconnected surface water. The SVBGSA identified 2 existing wells adjacent to the Salinas River that will be added to the ISW monitoring network. These existing wells have been deemed adequate based on their shallow groundwater elevations but still require preliminary inspection. SVBGSA has notified well owners about incorporating their wells into the monitoring network. Despite these 2 existing shallow wells, there are 2 data gaps between Spreckels and Chualar where SVBGSA plans to install a new shallow well along the Salinas River. The new shallow wells will be added to MCWRA's monitoring program. All existing shallow wells are already part of MCWRA's groundwater elevation monitoring programs.

10.2.3.3 Groundwater Extraction

Accurate extraction data is necessary to meet the SGMA requirement of reporting annual groundwater extractions. The current GEMS area that includes Zones 2, 2A, and 2B provides sufficient coverage of the 180-400-Foot Aquifer Subbasin (Figure 3-3), but SVBGSA and MCWRA will work together to potentially improve the existing GEMS Program as outlined in Chapter 9.

10.2.4 Address Identified Data Gaps in the Hydrogeologic Conceptual Model

Chapter 4 identified a few key data gaps related to the HCM. Filling these data gaps would allow the SVBGSA to improve the HCM and thus, the characterization of the Subbasin and to highlight differences and connectivity between the principal aquifers. The data gaps are related to aquifer properties for the Subbasin and the Salinas Valley, and lithologic and hydrostratigraphic data for the Deep Aquifers.

To fill these key data gaps and meet GSP Regulations §354.14, during early GSP implementation SVBGSA will implement:

- **Aquifer properties assessment.** The values and distribution of aquifer properties throughout the entire Subbasin have not been well characterized and documented. There are very few measured aquifer parameters in the Salinas Valley Groundwater Basin overall. Aquifer properties are important to understanding groundwater flow directions and magnitude within the aquifers. This informs the model with better data, which in turn leads to better model predictions. With better understanding of the aquifers and potential future conditions, SVBGSA and stakeholders will be better equipped to guide the management of water resources throughout the entire Subbasin. To develop better estimates of aquifer properties, the SVBGSA will identify up to 6 wells in the 180/400-Foot Aquifer Subbasin for aquifer testing. Each well test will last a minimum of 8 hours and will be followed by a 4-hour monitored recovery period. Wells for testing will be identified using the following criteria:

  - Wells are owned by willing well owners
  - Wells have known well completion information
  - Wellheads are completed such that water elevations in wells can be monitored with data loggers
  - Wells are equipped with accurate flow meters
  - Wells have area for discharge of test water
  - Preferred wells will have nearby wells that can be monitored during the test.

- **Lithologic and hydrostratigraphic data collection.** Lithologic data such as sediment composition and formation designation, as well as hydrologic data such as groundwater elevations and depth-specific water chemistry can be collected during drilling activities. Additionally, more hydrologic data can be collected during well development and well testing. These data will improve the understanding of the aquifer properties and potential groundwater-surface water relationships. Gathering more lithologic and hydrostratigraphic data will not only help characterize and map the lateral and vertical extent of each principal aquifer with greater resolution, but also the associated aquifer characteristics for improved understanding of groundwater flow. These data will inform SVBGSA and stakeholders for future development location decisions, injection or recharge project locations, as well as overall groundwater management directions to use the aquifer sustainably under all climatic and future development conditions. Many stakeholders have discussed the importance of data for their decisions throughout the GSP development process; acquiring these data will improve all future GSP updates and subsequent implementation activities.

10.3 Communication and Engagement

The SVBGSA will routinely report information to the public about GSP implementation and progress towards sustainability and the need to use groundwater efficiently. The SVBGSA website will be maintained as a communication tool for posting data, reports, and meeting information. This website features a link to an interactive mapping function for viewing Salinas Valley Groundwater Basin-wide data that were used during GSP development.

- **GSP Implementation – Data, Monitoring, and Reporting**. During GSP implementation, SVBGSA will engage in technical collaboration with partner agencies and stakeholders on data collection and analysis. Correspondingly, it will report out on findings to stakeholders through a variety of engagement strategies and pathways, including but not limited to:

  - Annual report presentations to the Subbasin Committees, Advisory Committee and Board of Directors
  - FAQs
  - Online communications, including SVBGSA website and Facebook page and direct emails
  - Mailings to most-impacted water users and residents
  - Media coverage
  - Talks and presentations to interested stakeholders, agencies, and groups

  This collaboration and outreach will be done on an annual basis as data are analyzed for the annual report. Additional outreach will occur more frequently depending on the data collection and analysis undertaken and its relevance for projects, management actions, and other implementation activities.

- **GSP Implementation – Projects and Management Actions.** SVBGSA will engage in outreach, communication, and engagement as part of its efforts to reach and maintain sustainability through undertaking projects and management actions. This will include engagement of stakeholders and other decision-making processes, such as the 180/400-Foot Aquifer Subbasin Committee, the Integrated Implementation Committee, the Advisory Committee, and the Board of Directors. It will also involve outreach to interested and potentially affected stakeholders through engagement strategies such as:
  - FAQs
  - Online communications
  - Mailings to most-impacted water users and residents
  - Co-promotional opportunities with partner entities
  - Talks and presentations to interested stakeholders, agencies, and groups
- **Engagement in Governance and Partnerships**. In addition to Subbasin-specific processes, SVBGSA will continue to pursue multiple means of engagement in governance and partnerships that directly or indirectly affect the 180/400-Foot Aquifer Subbasin. These include:
  - Valley-wide – The Integrated Implementation Committee will consolidate the needs of all Salinas Valley subbasins and create an integrated approach to groundwater management throughout the Salinas Valley.
  - Other agencies –In close collaboration with MCWRA, SVBGSA will also work with other local, state, and federal agencies, to meet the 180/400-Foot Aquifer Subbasin sustainability goals as detailed in this GSP. This includes working with

the CCRWQCB, Monterey County, and other agencies on water quality, and the NMFS on protection of steelhead trout.

    - General Outreach on Groundwater. SVBGSA will further pursue outreach in order to ensure stakeholders and interested or affected users are aware of SVBGSA efforts, as well as promote broader awareness of groundwater conditions and management. It will do this through means such as:
    - Offer public informational sessions and subject-matter workshops and if possible, provide online access via Facebook Live or via Zoom
    - SVBGSA Web Map
    - FAQs
    - Online communications
    - Media coverage
    - Promote/Celebrate National Groundwater Week
    - Educational materials available through mailers or at public events

- **URCs.** SVBGSA acknowledges that URCs have little or no representation in water management and have often been disproportionately less represented in public policy decision making. SVBGSA will engage more constructively with URCs, including activities such as to:
    - Conduct workshops with specific partners on the importance of water and groundwater sustainability
    - Identify URCs concerns and needs for engagement, as well as URCs specific engagement strategies
    - Plan listening sessions around GSA milestones
    - Coordinate with partner organizations to develop a "resource hub" where people can go for support
    - Identify community allies in groundwater engagement work and bring down barriers for participation
    - Consider particular URCs impacts during routine GSA proceedings
    - Convene a partnership group on domestic water, including URCs with partner entities

10.4 Road Map for Refining and Implementing Management Actions and Projects

The projects and management actions identified in Chapter 9 are sufficient for reaching sustainability in the 180/400-Foot Aquifer Subbasin. As the SVBGSA refines the projects and management actions, it will retain sufficient projects and actions to account for the level of uncertainty in the HCM. These projects and actions will be integrated with projects for the other Salinas Valley subbasins during GSP implementation. The projects and management actions described in this plan have been identified as beneficial for the 180/400-Foot Aquifer Subbasin. The impacts of projects and management actions on other subbasins will be analyzed and taken into consideration as part of the project selection process. In addition, to consider the human right to water, SVBGSA will assess the potential impacts of projects and management actions on water quality in nearby domestic wells and other wells supplying drinking water systems, and it will establish additional monitoring as necessary to monitor for groundwater quality impacts. The SVBGSA Board of Directors will approve projects and management actions that are selected to move forward. These projects assume continued operation of current infrastructure. If conditions change, such as other projects being undertaken that are outside of this GSP, SVBGSA will adapt its approach to achieving and maintaining sustainability, including the projects and management actions considered.

This section outlines a road map to refining and implementing projects and management actions. It organizes the projects and management actions into the main steps SVBGSA will undertake with respect to 180/400-Foot Aquifer Subbasin projects and management actions and the contingency of certain actions.

1. **Implementation Actions**

    Data collection and analysis are critical for the implementation of all GSPs. Even though MCWRA has collected information across most of the 180/400-Foot Aquifer Subbasin, strengthening data collection is still important to better understand the necessity of projects and management actions. Along with the expansion of monitoring networks, including updating and enhancing GEMS to improve the collection of extraction data, SVBGSA will register wells to gain more information on active wells, especially *de minimis* users. In addition, it will begin standing up the Dry Well Notification System within the first 2 years of GSP implementation, which will assist well owners whose access is jeopardized through declining groundwater elevations. SVBGSA plans to undertake the development of these actions within the first 2 years after GSP submittal, and fully implement them through years 3 and 4 through actively reaching out to well owners, visiting and checking wells, and inputting data.

    SVBGSA has already funded and begun implementing the Deep Aquifers Study. The Water Quality Coordination Group is also a critical implementation action to coordinate with other agencies that have responsibilities affecting domestic water quality and access. After undertaking preliminary planning work, SVBGSA plans to establish the Coordination Group in the first 2 years after implementation. The final implementation action in this GSP is the Land Use Jurisdiction Program. SVBGSA will begin initial conversations early in GSP implementation to identify the most appropriate strategy for accomplishing this implementation action.

2. **CSIP Projects**

   Early action to implement this GSP Update is needed given the critical state of groundwater conditions. Parts of CSIP optimization and M1W Recycled Water Plant Winter Modifications are scoped and ready to finish designs and begin construction. SVBGSA will work with MCWRA and M1W to identify funding and enable these projects to be implemented as soon as possible.

3. **Feasibility Studies**

   During the next 2 years of GSP implementation, SVBGSA will undertake further scoping and analysis of benefits and feasibility to compare and select initial projects for implementation. SVBGSA will evaluate whether any water rights permits are needed and take that into consideration in project selection and planning. For several projects, after initial project selection, more detailed analyses of facilities, recharge locations and rate, and distribution systems needs to occur, including discussions with landowners. This will include using the seawater intrusion model and SVOM to better understand project benefits with respect to addressing groundwater levels and seawater intrusion. Field studies such as temporary stream gauging will be needed for some projects. Project yields and costs will be refined to enable better comparison between projects. If needed to determine the viability of a project, preliminary designs and initial environmental permitting steps will be undertaken. SVBGSA will begin with undertaking feasibility studies for the main projects and management actions that could address seawater intrusion: demand planning, seawater intrusion extraction barrier, regional municipal supply project, and seasonal release with ASR. MCWRA will lead the projects related to CSIP.

4. **Project Prioritization**

   Since multiple projects are likely necessary to mitigate overdraft and address seawater intrusion, with stakeholder input SVBGSA will determine which projects to move forward with first, which projects to implement if the first set of projects does not reach sustainability goals, and which projects are not prioritized for implementation. After project prioritization, for the initial projects SVBGSA selects to move forward with, it will secure access agreements, undertake permitting and CEQA, and develop funding mechanisms. After that point, SVBGSA will continue an iterative, ongoing process to evaluate the status of projects in the process of being implemented, groundwater conditions, and additional potential projects.

The implementation of all projects and management actions will be a dynamic, adaptive process. Refinement of the projects and actions will occur simultaneously with adjustment of the funding mechanisms that support projects and actions. A start-up budget that covers required actions such as data, monitoring, and reporting could also cover pre-financing stages of project selection and design. Projects and management actions will be approved by the Board of Directors and will be implemented in a coordinated manner across the entire Salinas Valley.

10.5 Five-Year Update

SGMA requires the development of 5-year GSP assessment reports, starting in 2025. This 5-year update will assess whether the GSA is achieving the sustainability goal in the Subbasin. The assessment will include a description of significant new information that has been made available since GSP submittal, whether any new information warrants changes to any aspect of the plan, and how the GSP will be adapted accordingly.

The 5-year update will include updating the SVIHM and SVOM with newly collected data and updating model scenarios to reflect both the additional data and refinements in project design or assumptions. It will also include a reevaluation of climate change to ensure assumptions in the GSP are still valid.

SVBGSA will engage stakeholders in the development of the 5-year update. In contrast to the annual reports, which share monitoring data and progress related to the SMC, the 5-year update will involve a more systemic reevaluation of the SMC minimum thresholds and measurable results, as well as report on progress meeting the interim milestones.

10.6 Start-up Budget and Funding Strategy

10.6.1 SVBGSA Regulatory Fee

SVBGSA established a Valley-wide Regulatory Fee to fund the typical annual operational costs of its regulatory program authorized by SGMA, including regulatory activities of management groundwater to sustainability (such as GSP development), day-to-day administrative operations costs, and prudent reserves. The Regulatory Fee funds GSA operational costs, and therefore covers any tasks undertaken by staff, such as planning, technical review, partnership development, communication, stakeholder engagement, and support for the selection, development and implementation of projects and management actions. The fee is a regulatory fee with the purpose of implementing the regulatory program known as SGMA, and ensuring that ground water use is managed sustainably so that adequate supplies remain for all users. The Regulatory Fee is also used as local cost share for grants.

The Regulatory Fee is based on the 2018 Regulatory Fee Study (Hansford Economic Consulting, 2019) commissioned by SVBGSA. The SVBGSA has the authority to charge fees, as set forth in the California Water Code §10730, 10730.1, and 10730.2. The Regulatory Fee is a regulatory fee authorized under California Water Code §10730 and is exempt from voter approval, as it is not a tax pursuant to California Constitution Article XIIIC (Proposition 26, Section 1(e)(3)). As the fee must be proportional and related to the benefits of the program, this study analyzed options and proposed a regulatory fee structure whereby agricultural beneficiaries are responsible for 90% of the cost and all other beneficiaries are responsible for 10% of the cost. The SVBGSA Board of Directors approved this fee in March 2019.

The 180/400-Foot Aquifer Subbasin urban and agricultural groundwater are charged the Regulatory Fee by domestic connection or irrigated acreage by land use code. The Regulatory Fee funds Valley-wide activities, including initial GSP development; however, additional funding is needed for meeting future requirements, GSP implementation, and projects and management actions.

10.6.2 Start-up Budget

Table 10-1 summarizes the conceptual planning-level costs for the next 5 years of GSP implementation for the 180/400-Foot Aquifer Subbasin. This table does not include the Valley-wide costs for routine administrative operations and other Valley-wide costs funded through the SVBGSA operational fee outlined in 10.6.1. The Subbasin specific costs, shown on Table 10-1, include data collection and analysis beyond tasks already undertaken by other agencies. These tasks could be undertaken by staff, consultants, or partner agencies. The costs comprise of annual analysis and reporting of sustainability conditions; improvements to the monitoring networks, including installation of 1 new monitor well; and supplemental hydrogeologic investigations to address data gaps.

The start-up budget includes implementation actions envisioned to occur within the next 5 years of GSP implementation. It does not include funding for development or implementation of projects and management actions; however, does include some funding for refinement and selection of projects and management actions. When projects and management actions move forward with implementation, they will require additional funding for project feasibility and design studies, environmental permitting, and landowner outreach. These are initial estimates of costs and will likely change as more data become available.

These costs are independent of fees currently collected by MCWRA; no fees will be collected by SVBGSA that duplicate fees already being collected by MCWRA.

For components of this GSP being developed in coordination with other GSPs in the Salinas Valley, the establishment costs are split between subbasins, and initial implementation costs are estimated based on the direct costs to the 180/400-Foot Aquifer Subbasin. These are initial estimates; however, the final cost and division between subbasins will be reviewed and revised as necessary prior to implementation and per approval of the SVBGSA Board.

Table 10-1. 180/400-Foot Aquifer Subbasin Specific Estimated Planning-Level Costs for next 5 Years of Implementation

Activity	Valley-wide	Estimated Annual Cost	Total Cost for 5 years or Lump Sum	Assumptions
Required Compliance Activities: Data, Monitoring, and Reporting			***$2,023,700***	
Annual Monitoring and Reporting		$50,000	$250,000	
Updating the Data Management System		$5,000	$25,000	Valley-wide cost split equally between subbasins; includes hosting fee and updating information
Improving Monitoring Networks			$1,248,300	
Install up to 5 wells for groundwater elevation monitoring			$1,125,000	5 Deep Aquifer Wells
Development of GEMS expansion ordinance			$8,300	Valley-wide cost split equally between subbasins
Implementation of GEMS expansion			$50,000	Estimate for implementation in the Eastside
Install up to 2 shallow wells for monitoring ISW			$40,000	2 wells
Additional groundwater level monitoring		$5,000	$25,000	
Addressing Identified Data Gaps in the HCM			$160,500	
Aquifer properties assessment			$160,500	
GDE field verification			$100,000	
Well construction/Evaluation		$3,300	$6,600	
Coordination with MCWRA		$6,700	$33,300	Setting up a shared system; MCWRA time
Required Five-year Update			$200,000	
SVIHM and SVOM update (gathering data, getting it into model)	$45,000		$9,000	
Reevaluate climate change	$10,000		$2,000	Valley-wide cost split equally between subbasins; includes evaluating extent to which previous estimates of climate change are still valid
Update model scenarios	$70,000		$14,000	
Stakeholder engagement			$50,000	

Activity	Valley-wide	Estimated Annual Cost	Total Cost for 5 years or Lump Sum	Assumptions
Analysis and report-writing			$125,000	
Refine and Implement Projects and Management Actions			***$3,484,500***	Depends on projects and management actions pursued; Could be grant or project match
Demand management feasibility			$204,500	
Feasibility study for Seawater Intrusion Extraction Barrier with evaluation of Regional Municipal Supply Project			$1,600,000	
Feasibility study on Aquifer Storage and Recovery			$500,000	
Feasibility study on Irrigation Water Supply Project			$550,000	
Stakeholder outreach and engagement on projects and management actions, including development of a 180/400-Foot Aquifer Projects and Management Actions Feasibility and Preferred Portfolio Report			$430,000	
Other engineering feasibility studies and project design, permitting and environmental review, and cost-benefit analyses			$200,000	
TOTAL			**$5,508,200**	

10.6.3 Funding for Projects and Management Actions

The start-up budget does not include funding for specific projects and management actions. Projects and management actions implemented by other agencies and organizations that contribute to groundwater sustainability will follow the funding strategies developed by those respective agencies and organizations. For projects funded by SVBGSA or funding SVBGSA raises to contribute to the implementation of projects, SVBGSA will evaluate the most appropriate funding mechanisms and engage stakeholders and the Board of Directors in this analysis. These include:

- **Grant funding.** SVBGSA will pursue grants to the extent possible to fund projects and management actions.
- **Contributions from local jurisdictions, partner agencies, organizations, and companies.** Where appropriate, SVBGSA will work with partners to solicit contributions to jointly implement a project or management action.
- **Benefit assessment (Proposition 218 vote).** For projects with considerable capital cost or that benefit multiple subbasins, SVBGSA will consider holding a 218 vote to levy an assessment based upon the special benefits conferred from a specific project. Before doing so, SVBGSA will undertake an analysis to identify the special benefit of the conferred project, the cost of the benefit, the zone of benefit, and method of calculating the assessments to be levied. This requires a public hearing and is subject to a majority protest.
- **Fees.** Fees may be collected for a variety of purposes, such as funding a regulatory program or providing a product or service. Fees are not subject to a vote or protest proceeding, but they cannot exceed the cost of running the program or providing the product or service. Some regulatory programs need to be implemented via ordinance.
- **Fines and penalties.** With the establishment of an ordinance, SVBGSA has the authority to impose fines and penalties, such as may be associated with a regulatory program. Imposition of a fine or penalty must provide due process, usually a hearing after notice/citation and before assessment of the fine or penalty, and funds must be put back into the program.
- **Special tax.** SVBGSA has the authority to levy a special tax for a specific purpose, such as a parcel tax or some sales tax components. This requires a two-thirds vote of the electorate.

SVBGSA acknowledges that the costs associated with projects and management actions will need to be funded through mechanisms such as these. It will work with funding agencies and local partners to do so.

Funding mechanisms could be combined with pumping allocations used as the basis for pumping fees or a water market such as the Water Charges Framework described in the original GSP. Such a mechanism could raise funds for projects and management actions. For example, a fee structure could be defined such that each extractor has a pumping allowance that is based on their allocation, and penalty or disincentive fees could be charged for extraction over that amount. Fees, fines, and penalties associated with extraction need to occur through the existing funding mechanisms described above.

10.7 Implementation Schedule and Adaptive Management

The SVBGSA oversees all or part of 6 subbasins in the Salinas Valley Groundwater Basin. Implementing the 180/400-Foot Aquifer Subbasin GSP must be integrated with the implementation of the 5 other GSPs in the Salinas Valley. The implementation schedule reflects the significant integration and coordination needed to implement all 6 GSPs in a unified manner.

A general schedule showing the major tasks and estimated timeline during the next 5 years of GSP implementation is provided on Figure 10-1. This includes the 6 main sets of tasks and DWR's review and approval process. For projects and management actions, implementation will begin with evaluating and comparing projects and management actions to determine which to implement first. Projects and management actions will be revisited and adjusted as needed throughout GSP implementation. Implementation of this GSP will rely on best available science and will be continually updated as new data and analyses are available.

SVBGSA will adaptively manage groundwater and the implementation of the GSP. The work of SVBGSA and stakeholders to complete this GSP provides a solid base to guide groundwater management; however, certain conditions may provide the need to adapt and change management as envisioned in this plan. For example, if existing conditions change, such as a prolonged drought that affects groundwater conditions, or additional funding for specific projects becomes available, SVBGSA may adapt its management strategy. If that occurs, SVBGSA will work through an open and transparent process with stakeholders, partner agencies, and DWR to ensure it continues to meet regulatory requirements and reaches sustainability.

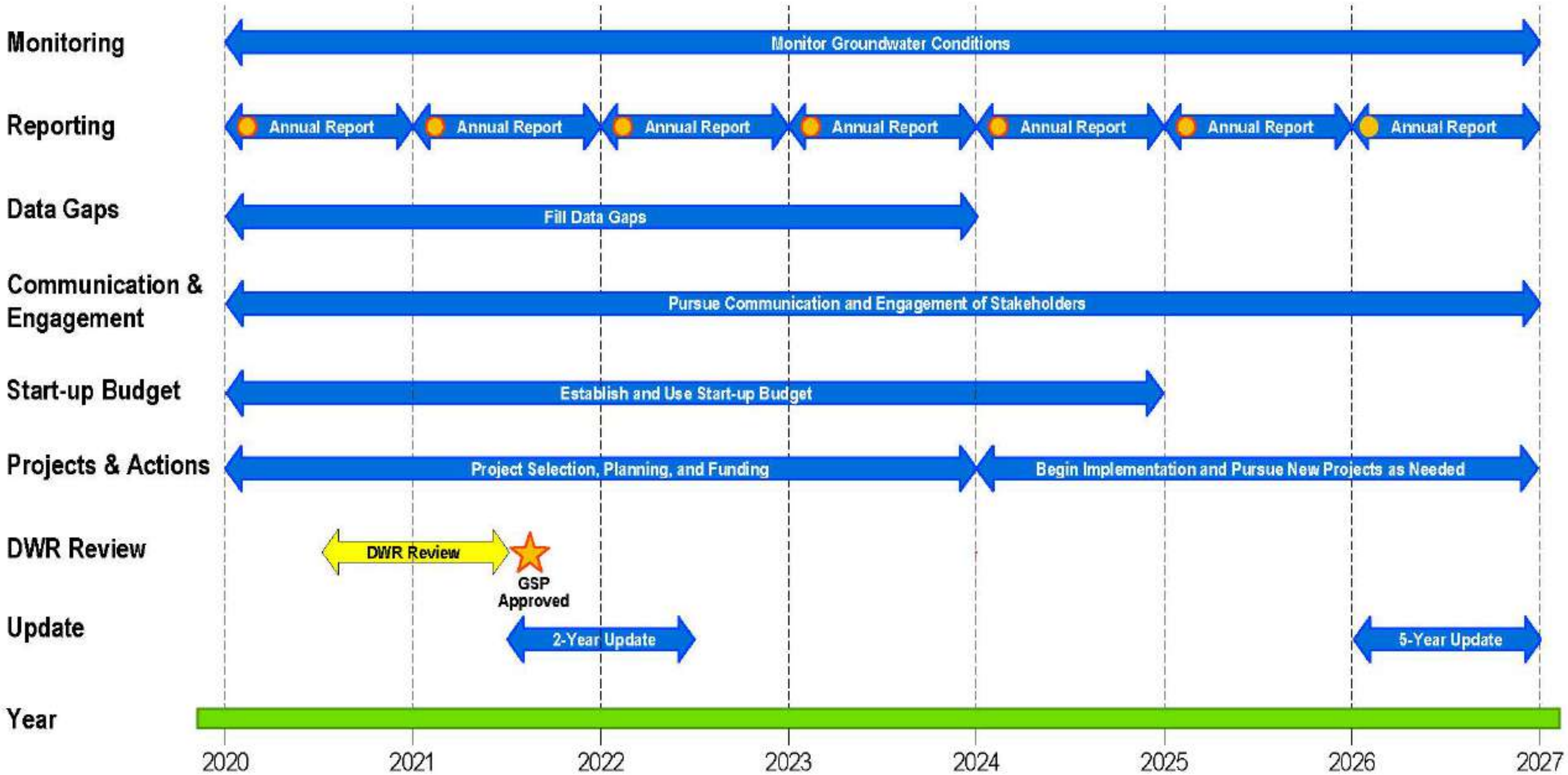

Figure 10-1. General Schedule For Start-Up Plan

REFERENCES

American Society of Farm Managers & Rural Appraisers, California Chapter. 2020. 2020 Trends in Agricultural Land & Lease Values. 124 p. https://calasfmra.com/wp-content/uploads/2021/04/Trends-2020-WebUse.pdf .

Ayers, R.S., and D.W. Westcot. 1985. Water quality for agriculture. FAO Irrigation and Drainage Paper 29.

Barlow, Paul M., and Stanley A. Leake. 2012. Streamflow Depletion by Wells – Understanding and Managing the Effects of Groundwater Pumping on Streamflow. U.S. Geological Circular 1376. 84 p. https://pubs.usgs.gov/circ/1376/.

Boyce, Scott E., Randall T. Hanson, Ian Ferguson, Wolfgang Schmid, Wesley R. Henson, Thomas Reimann, Steffen W. Mehl, and Marisa M. Earll. 2020. One-Water Hydrologic Flow Model: A MODFLOW Based Conjunctive-Use Simulation Software. U.S. Geological Survey Techniques and Methods 6-A60. https://pubs.er.usgs.gov/publication/tm6A60.

Boyle Engineering Corporation. 1991. Water Capital Facilities Plan Volume 1 Report. Prepared for MCWRA. 118 p. https://www.co.monterey.ca.us/home/showdocument?id=73378.

Brown and Caldwell. 2015. State of the Salinas River Groundwater Basin - Hydrology Report. Monterey County Water Resources Agency Water Reports. http://digitalcommons.csumb.edu/hornbeck_cgb_6_a/21.

Bureau of Land Management (BLM). 2020. BLM National Surface Management Agency Area Polygons - National Geospatial Data Asset (NGDA). Updated April 16, 2020. https://data.doi.gov/dataset/blm-national-surface-management-agency-area-polygons-national-geospatial-data-asset-ngda.

Burton, Carmen A., and Michael T. Wright. 2018. Status and Understanding of Groundwater Quality in the Monterey-Salinas Shallow Aquifer Study Unit, 2012–13: California GAMA Priority Basin Project. U.S. Geological Survey. Scientific Investigations Report 20185057. Prepared in cooperation with the California State Water Resources Control Board.132p.

California Invasive Plant Council (Cal-IPC). 2011. Arundo donax: Distribution and Impact Report. Agreement No. 06-374-559-0. Submitted to State Water Resources Control Board. https://www.cal-ipc.org/wp-content/uploads/2017/11/Arundo_Distribution_Impact_Report_Cal-IPC_March-2011_small.pdf.

California Water Code (CWC). 2014. Division 6. Conservation, Development, and Utilization of State Water Resources, Sections 10000-12999. http://leginfo.legislature.ca.gov/faces/codes_displayexpandedbranch.xhtml?tocCode=WA

T&division=6.&title=&part=&chapter=&article=.

California Water Service. 2016. *2015* Urban Water Management Plan, Salinas District. https://www.calwater.com/docs/uwmp2015/sln/2015_Urban_Water_Management_Plan_Final_(SLN).pdf.

Carollo Engineers, Inc. 2014. Chlorine System Study. Consultant's report to the Monterey Regional Water Pollution Control Agency, Monterey, CA.

Carpenter, E.J. and S. Cosby. 1925. Soil Survey of the Salinas Area, California. U.S. Department of Agriculture, Bureau of Chemistry and Soils. no. 11.

Central Coast Groundwater Coalition (CCGC). 2015. Northern Counties Groundwater Characterization: Salinas Valley, Pajaro Valley and Gilroy-Hollister Valley. Submitted to the Central Coast Regional Water Quality Control Board on June 1, 2015. Salinas, CA Prepared by Luhdorff & Scalmanini Consulting Engineers. 454 p.

Central Coast Regional Water Quality Control Board (CCRWQCB). 2018. Groundwater Quality Conditions and Agricultural Discharges in the Central Coast Region. Staff Report for Regular Meeting of May 10-11, 2018.

______. 2019. Water Quality Control Plan for the Central Coast Basin. 595 p. https://www.waterboards.ca.gov/centralcoast/publications_forms/publications/basin_plan/docs/2019_basin_plan_r3_complete_webaccess.pdf.

______. 2021. Proposed General Waste Discharge Requirements for Discharges from Irrigated Lands. Order R3-2021-0040. https://www.waterboards.ca.gov/centralcoast/board_decisions/adopted_orders/2021/ao4_order.pdf.

Clark, Joseph C., Earl E. Brabb, and Lewis I. Rosenberg. 2000. Geologic Map and Map Database of the Spreckels 7.5-Minute Quadrangle, Monterey County, California. https://pubs.usgs.gov/mf/2001/2349/.

Creegan + D'Angelo. 2005. Fort Ord Reuse Authority Stormwater Master Plan, March 2005.

Department of Toxic Substances Control (DTSC). 2021. Envirostar Website. Accessed October 27, 2021. https://www.envirostor.dtsc.ca.gov/public/

Department of Water Resources (DWR). 1946. Salinas Basin Investigation Summary Report. Bulletin 52-B. https://www.co.monterey.ca.us/home/showpublisheddocument/19576/636232667537000000.

______. 2003. California's Ground Water. Bulletin 118. Update 2003. https://water.ca.gov/-/media/DWR-Website/Web-Pages/Programs/Groundwater-Management/Bulletin-118/Files/Statewide-Reports/Bulletin_118_Update_2003.pdf.

______. 2004a. Bulletin 118 Interim Update 2004; *Salinas Valley Groundwater Basin, 180/400 Foot Aquifer Subbasin*. https://water.ca.gov/-/media/DWR-Website/Web-Pages/Programs/Groundwater-Management/Bulletin-118/Files/2003-Basin-Descriptions/3_004_01_180-400FootAquiferSubbasin.pdf.

______. 2004b. Bulletin 118 Interim Update 2004; Salinas Valley Groundwater Basin, Langley Area Subbasin. https://water.ca.gov/-/media/DWR-Website/Web-Pages/Programs/Groundwater-Management/Bulletin-118/Files/2003-Basin-Descriptions/3_004_09_LangleyAreaSubbasin.pdf.

______. 2016a. California's Groundwater. Bulletin 118 Interim Update 2016. https://cawaterlibrary.net/document/bulletin-118-californias-groundwater-interim-update-2016/.

______. 2016b. Monitoring Networks and Identification of Data Gaps. Best Management Practices for the Sustainable Management of Groundwater. 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.

______. 2017. Sustainable Management Criteria (SMC). Best Management Practices for the Sustainable Management of Groundwater. 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.

______. 2018. Guidance for Climate Change Data During Groundwater Sustainability Plan Development. 101 p. https://water.ca.gov/-/media/DWR-Website/Web-Pages/Programs/Groundwater-Management/Sustainable-Groundwater-Management/Best-Management-Practices-and-Guidance-Documents/Files/Resource-Guide-Climate-Change-Guidance_v8_ay_19.pdf.

______. 2019. Email sent by Benjamin Brezing (DWR) on May 30, 2019. Subject: Error bounds on subsidence raster.

______. 2020a. SGMA Data Viewer Map Application. Accessed July 2020. https://sgma.water.ca.gov/webgis/?appid=SGMADataViewer.

______. 2020b. Handbook for Water Budget Development With or Without Models. 446 p. https://water.ca.gov/-/media/DWR-Website/Web-Pages/Programs/Groundwater-Management/Data-and-Tools/Files/Water-Budget-Handbook.pdf?la=en&hash=30AD0DFD02468603F21C1038E6CC6BFE32381233

______. 2021a. Well Completion Report Map Application. Accessed November 2021.

https://www.arcgis.com/apps/webappviewer/index.html?id=181078580a214c0986e2da28f8623b37.

_____. 2021b. Household Water Supply Shortage Reporting System web form. https://mydrywatersupply.water.ca.gov/report/. Accessed July 16, 2021.

Durbin, Timothy J. 1974. Digital simulation of the effects of urbanization on runoff in the upper Santa Ana Valley, California. U.S. Geological Survey Water Resources Investigations. no.73-41. https://pubs.usgs.gov/wri/1973/0041/report.pdf

Durbin, Timothy J., G.W. Kapple, and J.R. Freckleton. 1978. Two-Dimensional and Three-Dimensional Digital Flow Models of the Salinas Valley Ground-Water Basin, California. U.S. Geological Survey. Water Resources Investigations Report 78-113. Prepared in cooperation with the U.S. Army Corps of Engineers. 134 p.

Durham, D.L. 1974. Geology of the Southern Salinas Valley Area. California, U.S. Geological Survey Professional Paper 819, 1974, 117p.

EKI, 2020. Water Augmentation Alternatives Study, Former Fort Ord Area, Monterey, CA, prepared for the Marina Coast Water District, June 2020.

Environmental Defense Fund (EDF). 2018. Addressing Regional Surface Water Depletions in California, A Proposed Approach for Compliance with the Sustainable Groundwater Management Act. 12 p.

Environmental Science Associates (ESA). 2009. California American Water Company Coastal Water Project Final Environmental Impact Report. 523 p.

Giessow, Jason, J. Casanova, R. Leclerc, and G. Fleming. 2011. Arundo donax: Distribution and Impacts. California Invasive Plant Council. State Water Resources Control Board Agreement No. 06-374-559-0.

Greater Monterey County Integrated Regional Water Management Group (RWMG). 2018. Greater Monterey County Integrated Regional Water Management Plan. http://www.greatermontereyirwmp.org/documents/plan/.

Greene, H.G. 1970. Geology of Southern Monterey Bay and Its Relationship to the Ground Water Basin and Salt Water Intrusion. U.S. Geological Survey Open-File Report 70-141, 51p.

Greene, H.G. 1977. Geology of the Monterey Bay Region, California. U.S. Geological Survey Open-File Report 77-718.

Hansford Economic Consulting. 2019. 2018 Regulatory Fee Study. Prepared for Salinas Valley Basin Groundwater Sustainability Agency.

Harbaugh, A.W., E.R. Banta, M.C. Hill and M.G. McDonald. 2000. MODFLOW-2000, The US Geological Survey modular ground-water model- user guide to modularization concepts and the ground-water flow process, USGS Open-File Report 00-92. https://water.usgs.gov/nrp/gwsoftware/modflow2000/ofr00-92.pdf

Harding ESE. 2001. "Hydrogeologic Investigation of the Salinas Valley Basin in the Vicinity of Fort Ord and Marina, Salinas Valley, California, prepared for Monterey County Water Resources Agency." 12 April. 166p.

Heath, R. C. 1976. "Design of ground-water level observation-well programs." *Ground Water*. v. 14, no. 2, p. 71-77.

Highland Economics. 2017. Rotational Cover Crop Plan Economic Analysis: Private Costs and Public Benefits of Cover Crop Fallowing in the Pajaro Valley and Potential Incentive Structures. Prepared for RCDSCC. 78 p. http://www.communitywaterdialogue.org/images/coveredfallow/Pajaro_Valley_Covered_Fallow_Plan_Economic_Analysis_final2.pdf.

Hopkins, J. and B. Anderson. 2016. A Field Manual for Groundwater-level Monitoring at the Texas Water Development Board. User Manual 52, 26 p. https://www.twdb.texas.gov/groundwater/docs/UMs/UM-52.pdf.

Hunt J.W., S.M. Robinson, R.P. Clark, C.A. Endris, J.N. Gregory, K.K. Hammerstrom, K.A. Null, and K.C. O'Connor. 2019. Storm Water Resource Plan for the Greater Monterey County Integrated Regional Water Management Region. California State Water Resources Control Board. 288 p. http://www.greatermontereyirwmp.org/wp-content/uploads/2019/08/Greater-Monterey-County-SWRP_Final-Plan_2019_06_27-low-res-v2-Aug-2019.pdf.

HydroFocus, Inc. 2014. Distribution of Groundwater Nitrate Concentrations, Salinas Valley, California. 30 April. 42 p.

Jennings, C.W., with modifications by C. Gutierrez, W. Bryant, G. Saucedo, and C. Wills, 2010. Geologic map of California: California Geological Survey, Geologic Data Map No. 2, scale 1:750,000. https://www.conservation.ca.gov/cgs/Pages/Program-RGMP/2010_geologicmap.aspx.

Johnson, Michael J., Clark J. Londquist, Julie Laudon, and Hugh T. Mitten. 1987. Geohydrology and Mathematical Simulation of the Pajaro Valley Aquifer System, Santa Cruz and Monterey Counties, California. U.S. Geological Survey Water-Resources Investigations Report 87-4281. https://pubs.usgs.gov/wri/1987/4281/report.pdf.

Kennedy/Jenks. 2004. Hydrostratigraphic Analysis of the Northern Salinas Valley. Prepared for Monterey County Water Resources Agency. 113 p.

Kulongoski Justin T. and Kenneth Belitz. 2005. Ground-Water Quality Data in the Monterey Bay and Salinas Valley Basins, California, 2005 - Results from the California GAMA Program. U.S. Geological Survey. Scientific Investigations Report 2011-5058. Prepared in in cooperation with the California State Water Resources Control Board. 98 p.

Marina Coast Water District (MCWD). 2020. Budget Summary of the FY 2020–2021 Draft Budget Memorandum, dated 15 June 2020.

Melton, F. and M. Hang. 2021. Remote Sensing of Evapotranspiration from Arundo donax in the Salinas River Channel. Prepared for the Resources District of Monterey County by California State University Monterey Bay & NASA Ames Research Center, Cooperative for Research in Earth Science Technology. March 31, 2021.

Mittelbach, H., F. Casini, I. Lehner, A. Teuling, and S. Seneviratne. 2011. "Soil moisture monitoring for climate research: Evaluation of a low-cost sensor in the framework of the Swiss Soil Moisture Experiment (SwissSMEX) campaign." *Journal of Geophysical Research*. 116. 11. 10.1029/2010JD014907. https://agupubs.onlinelibrary.wiley.com/doi/pdf/10.1029/2010JD014907.

Monterey County Agricultural Commissioner. 2018. 2018 Monterey County Crop Report. Accessed September 26, 2018. https://www.co.monterey.ca.us/home/showdocument?id=78579.

Monterey County Board of Supervisors. 2018. Ordinance 5302: An Interim Ordinance of the County of Monterey, State of California, Adopted Pursuant to Government Code Section 65858, Temporarily Prohibiting New Wells in Seawater Intruded Aquifers, With Specified Exemptions, Pending the County's Study and Consideration of Regulations. https://www.co.monterey.ca.us/home/showpublisheddocument/76746/636900588655270000.

Monterey County Housing and Community Development. 2010. Monterey County General Plan, Chapter 5. https://www.co.monterey.ca.us/home/showpublisheddocument/45810/636389938521570000.

Monterey County Water Resources Agency (MCWRA). 2006. Monterey County Groundwater Management Plan.

_____. 2014. Floodplain Management Plan Monterey County: 2014 Update

_____. 2015. CASGEM Monitoring Plan for High and Medium Priority Basins in the Salinas Valley Groundwater Basin.

_____. 2016. Salinas River Stream Maintenance Program Permit Application Supplemental Attachment. 229 p.

_____. 2017. Recommendations to Address the Expansion of Seawater Intrusion in the Salinas Valley Groundwater Basin. Special Reports Series 17-01.

https://www.co.monterey.ca.us/home/showdocument?id=57396.

_____. 2018a. Nacimiento Dam Operation Policy. https://www.co.monterey.ca.us/Home/ShowDocument?id=63151

_____. 2018b. New Source Water Supply Study. Prepared by Raftelis. September 28, 2018.

_____. 2019. Salinas River Long-Term Management Plan. http://www.salinasrivermanagementprogram.org/ltmp_doc.html.

_____. 2020. Interlake Tunnel Progress Report. Presented to MCWRA Board of Directors on May 18, 2020 and presented to MCWRA Board of Supervisors on June 9, 2020.

_____. 2021. 2020 Quarterly Salinas Valley Water Conditions Report. https://www.co.monterey.ca.us/home/showpublisheddocument/97605/637389800283500000

Monterey One Water. 2018a. Winter Recycled Water Use Efficiency Improvements: Technical Project Report.

_____. 2018b. Progress Report on Pure Water Monterey Expansion. http://purewatermonterey.org/wp/wp-content/uploads/PWM-Expansion-Progress-Report-5-10-18-no-attachments.pdf.

Montgomery Watson. 1998. Salinas Valley Historical Benefits Analysis (HBA). Accessed January 27, 2022. https://www.co.monterey.ca.us/government/government-links/water-resources-agency/documents/historic-benefits-analysis.

Moran, Tara, and Alletta Belin. 2019. "A Guide to Water Quality Requirements Under the Sustainable Groundwater Management Act." Stanford Water in the West. Available at https://stacks.stanford.edu/file/druid:dw122nb4780/A%20Guide%20to%20Water%20Quality%20Requirements%20under%20SGMA.pdf

Nellor et. Al., 2019. Final Engineering Report Pure Water Monterey Groundwater Replenishment Project, revised April 2019.

O'Geen, A.T., M.B.B. Saal, H. Dahlke, D. Doll, R. Elkins, A. Fulton, G. Fogg, T. Harter, J.W. Hopmans, C. Ingels, F. .Niederholzer, S. Sandovol Solis, P. Verdegaal, and M. Walkinshaw. 2015. "Soil suitability index identifies potential areas for groundwater banking on agricultural lands." *California Agriculture* 69:75-84.

Raftelis Financial Consultants. 2018. New Source Water Supply Study: Final Report. September 28. Prepared for Monterey County Water Resources Agency. https://www.co.monterey.ca.us/home/showdocument?id=74642.

RBF, 2003. Regional Urban Recycled Water Distribution Project Report.

Resource Conservation District of Santa Cruz County (RCDSCC). 2018. Pajaro Valley Covered Fallow Plan. 44 p. http://www.communitywaterdialogue.org/images/coveredfallow/Covered_Follow_Plan_FINAL_LowRes.pdf.

Rivas, T. 2006. Erosion Control Treatment Selection Guide. U.S. Forest Service National Technology & Development Program: 7700 Transportation Management. United States Department of Agriculture. 0677 1203—SDTDC. https://www.fs.fed.us/t-d/pubs/pdf/hi_res/06771203hi.pdf.

Rosenberg, Lewis I. 2001. Digital Geologic Map of Monterey County, California, 1934-2001. Monterey County (Calif.) Planning Department. http://purl.stanford.edu/cm427jp1187.

Schaaf & Wheeler, 2021. 2020 Urban Water Management Plan, Marina Coast Water District, dated June 2021. https://www.mcwd.org/docs/2021_uwmp/DRAFT_MCWD_2020_UWMP_v20210520.pdf.

Sophocleous, M. 1983. "Groundwater observation network design for the Kansas groundwater management districts, USA." *Journal of Hydrology*, 61: 371-389.

State Water Resources Control Board (SWRCB). 2019. Salinas Valley Water Coalition vs. Monterey County Water Resources Agency Report of Referee.

______. 2021a. GeoTracker Website. Accessed October 27, 2021. https://geotracker.waterboards.ca.gov/

______. 2021b. Groundwater Ambient Monitoring and Assessment Program (GAMA) Groundwater Information System Website. Accessed October 27, 2021. https://gamagroundwater.waterboards.ca.gov/gama/datadownload.

______. 2021c. Electronic Water Rights Information Management System (eWRIMS). e-WRIMS Annual Water Use Report Download. Accessed October 27, 2021. https://ciwqs.waterboards.ca.gov/ciwqs/ewrims/reportingDiversionDownloadPublicSetup.do.

Thorne, J., D. Cameron, and V. Jigour. 2002. A guide to wildlands conservation in the central region of California. California Wilderness Coalition, Davis. https://escholarship.org/uc/item/41m0z72f.

Thorup, R.R. 1976. Report on Castroville Irrigation Project Deep Test Hole and Freshwater Bearing Strata Below the Pressure 400-Foot Aquifer, Salinas Valley, CA.

Tracking California. 2020. Water System Service Areas. Accessed April 2020. https://trackingcalifornia.org/water-systems/water-systems-landing.

U.S. Census Bureau. 2018. TIGER/Line Geodatabases. Accessed December 2018. https://www.census.gov/geographies/mapping-files/time-series/geo/tiger-geodatabase-file.html.

U.S. Department of Agriculture, Natural Resources Conservation Service. 2018. National Soil Survey Handbook. Title 430-VI. Accessed September 30, 2019. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/ref/?cid=nrcs142p2_054242.

U.S. Fish and Wildlife Service (USFWS). 2017. Critical Habitat: What is it? https://www.fws.gov/endangered/esa-library/pdf/critical_habitat.pdf.

Water Recycling Agreement. 2015. Amended and Restated Water Recycling Agreement Between Monterey Regional Water Pollution Control Agency and Monterey County Water Resources Agency. November.

Winter, T.C., J.W. Harvey, O.L. Franke, and W.M. Alley. 1999. Ground water and surface water- A Single Resource. U.S. Geological Survey Circular 1139. 88 p.

WRIME, Inc. 2003. Deep Aquifer Investigation – Hydrogeologic Data Inventory, Review, Interpretation and Implications. Technical Memorandum.

Yates, Eugene B. 1988. Simulated Effects of Ground-Water Management Alternatives for the Salinas Valley, California. U.S. Geological Survey Water-Resources Investigations Report 87-4066.