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Salinas Valley: 180/400-Foot Aquifer Subbasin Groundwater Sustainability Plan

VOLUME 1

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Prepared for:

Salinas Valley Basin Groundwater Sustainability Agency

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1.1 Purpose of the Groundwater Sustainability Plan

The State of California enacted the Sustainable Groundwater Management Act (SGMA) in 2014. This law requires groundwater basins or subbasins that are designated as medium or high priority to be managed sustainably. The Salinas Valley Groundwater Basin comprises nine subbasins, of which seven are within Monterey County. The subject of this report is one of those subbasins: the 180/400-Foot Aquifer Subbasin.

Satisfying the requirements of SGMA generally requires four basic activities:

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

This document satisfies the GSP requirement for the Salinas Valley – 180/400-Foot Aquifer Subbasin (Subbasin or 180/400-Foot Subbasin). The purpose of this GSP is to outline how the Salinas Valley Basin Groundwater Sustainability Agency (SVBGSA) and its partner GSAs will achieve groundwater sustainably in the Subbasin in 20 years, and maintain sustainability for an additional 30 years. The SVBGSA developed this GSP in coordination with the Marina Coast Water District Groundwater Sustainability Agency (MCWD GSA) and the County of Monterey Ground Water Sustainability Agency (County GSA), each of which has exclusive jurisdiction over part of the 180/400-Foot Aquifer Subbasin.

1.2 Description of the 180/400-Foot Aquifer Subbasin

The 180/400-Foot Aquifer Subbasin is identified by DWR as Subbasin 3-004.01. The Subbasin is part of the greater Salinas Valley Groundwater Basin in the Central Coastal region of California (DWR, 2016a). DWR has designated the 180/400-Foot Aquifer Subbasin as a critically overdrafted basin. DWR defines critically overdrafted basins as basins in which the continuation of present water management practices would probably result in significant adverse overdraft-related environmental, social, or economic impacts. The Subbasin is named for its two primary water-bearing units: the 180-Foot Aquifer and the 400-Foot Aquifer. The Subbasin encompasses an area of approximately 89,700 acres, or 140 square miles (DWR, 2019). The Subbasin lies in Monterey County and contains parts of the urban areas of Salinas, Castroville, Moss Landing, Marina, Chualar, and Gonzales (Figure 1-1).

The Subbasin is bounded by Monterey Bay to the northwest. Five groundwater basins or subbasins adjoin the 180/400-Foot Subbasin (Figure 1-1).

- The Corralitos - Pajaro Valley Basin is located along the northern Subbasin boundary. The boundary with the Corralitos – Pajaro Valley Basin coincides with the inland projection of a clay-filled paleodrainage of the Salinas River buried beneath Elkhorn Slough which acts as a flow barrier between the basins (DWR, 2004).
- The Eastside Aquifer Subbasin (DWR subbasin number 3-004.02) is located along most of the northeastern boundary of the Subbasin. There is some, although potentially limited, hydraulic communication between the Eastside Aquifer Subbasin and the 180/400-Foot Aquifer Subbasin.
- The Langley Area Subbasin (DWR subbasin number 3-004.09) is located along a short length of the northeastern boundary of the Subbasin.
- The Forebay Aquifer Subbasin (DWR subbasin number 3-004.04) is located along the southeastern boundary, near the city of Gonzales. The boundary is the approximate limit of confining conditions in the up-valley direction (DWR, 2004).
- The Monterey Subbasin (DWR subbasin number 3-004.10) is located along the southwestern boundary of the Subbasin. The boundary roughly follows portions of the King City fault and a groundwater divide.

All five surrounding basins and subbasins are medium or high priority and are required to develop GSPs under SGMA. GSPs for the Eastside,Langley Area, and Upper Valley Subbasins will be developed by the SVBGSA. The GSP for the Forebay Subbasin will be developed jointly by the SVBGSA and the Arroyo Seco GSA. The GSP for the Monterey Subbasin will be developed jointly by the SVBGSA and the MCWD GSA. An alternative GSP submittal for the Corralitos – Pajaro Valley Basin was submitted by the Pajaro Valley Water Management Agency and accepted by DWR in August 2019.

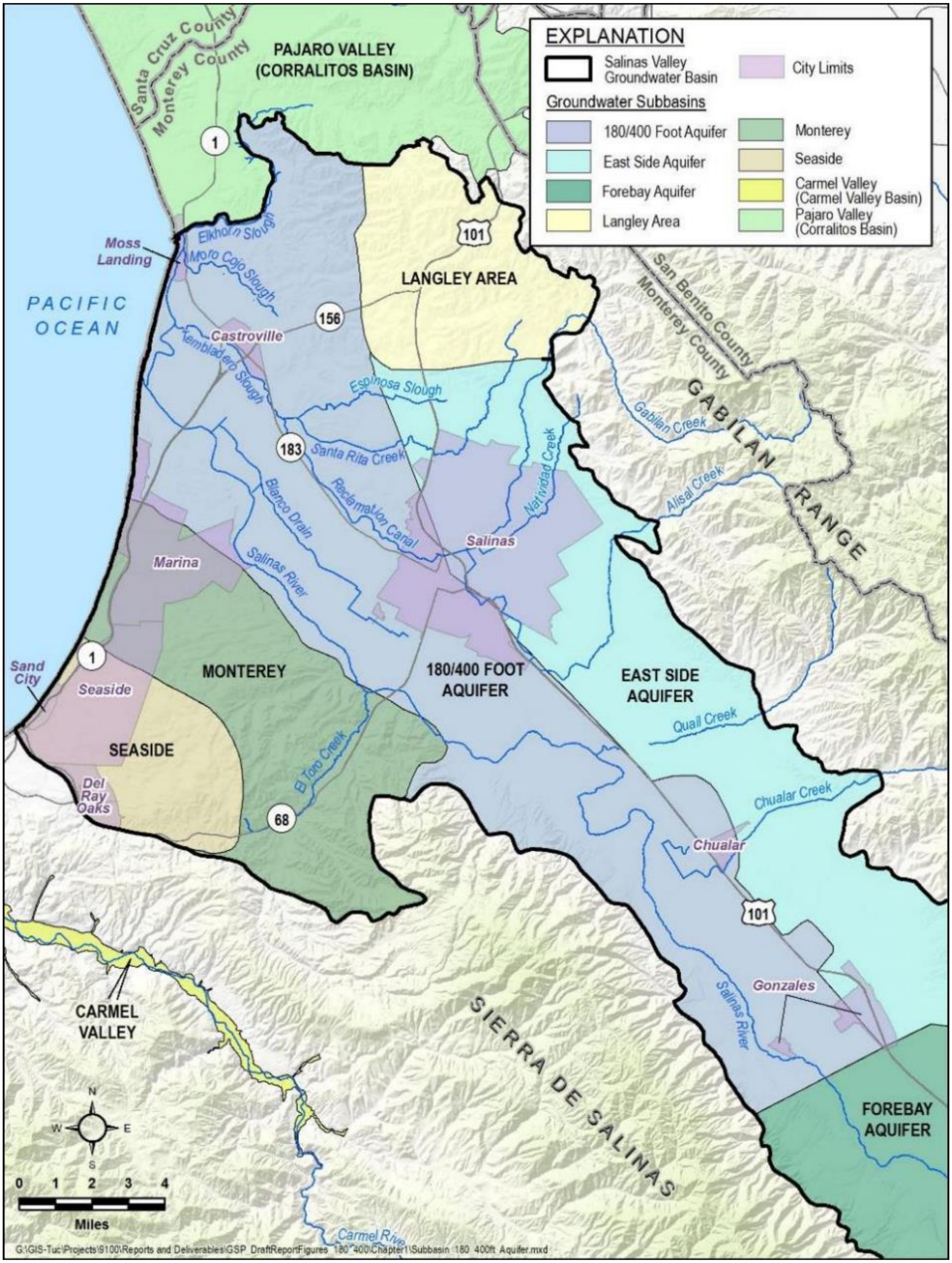


Figure 1-1. 180/400-Foot Aquifer Subbasin Location

1.3 Overview of this GSP

The SVBGSA, with input from MCWD and County GSA, developed this GSP for the entire 180/400-Foot Aquifer Subbasin. This GSP 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. The projects and programs presented in this GSP are part of a cohesive set of projects and programs designed to achieve sustainability throughout the entire Salinas Valley Groundwater Basin. The 180/400-Foot Aquifer Subbasin is referred to as the Subbasin throughout this GSP, and the collection of Salinas Valley Groundwater Basin 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 11 details the stakeholders that participated, and process followed to develop this GSP. Stakeholders worked together to gather existing information, define sustainable management criteria for the Subbasin, and develop a list of projects and management actions.

This GSP includes the SVBGSA's administrative information, describes the basin setting, presents the hydrogeologic conceptual model, 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 defines local sustainable management criteria, details required monitoring networks, and outlines projects and programs for reaching sustainability in the Subbasin by 2040. Finally, it describes the communication and outreach strategy used to develop the Plan.

The SVBGSA used best available existing data to develop this GSP. The SVBGSA intended to use the Salinas Valley Integrated Hydrologic Model (SVIHM) developed by the United States Geological Service (USGS) for this GSP. The USGS provided SVBGSA with limited information from the SVIHM during part of GSP development; however, the model could not be used as initially intended. The USGS anticipates releasing the revised SVIHM in spring 2020, at which point the SVBGSA plans to use the Model to update and implement this GSP.

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 SMCs and projects and management actions to reflect updates and future conditions. Adaptive management will be reflected in the required five-year updates to GSPs and annual reports. The SVBGSA also envisions completing a two-year update to this Plan as the GSPs for surrounding subbasins are developed.

2 AGENCY INFORMATION

Three GSAs cover the GSP area: the SVBGSA, MCWD GSA, and 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 jurisdictional areas of all three GSAs in relation to the Subbasin boundary are shown on Figure 2-1.

2.1 Agency Names and Mailing Addresses

Contact information is provided for each GSA that is a signatory to this GSP, pursuant to California Water Code § 10723.8.

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

Marina Coast Water District Groundwater Sustainability Agency
Attn.: Keith Van Der Maaten, General Manager
11 Reservation Road
Marina, CA 93933
http://www.mcwd.org

County of Monterey Ground Water Sustainability Agency
Attn: Brian Briggs, Deputy County Counsel
169 W Alisal St, 3rd Floor
Salinas, CA 93901
https://www.co.monterey.ca.us/

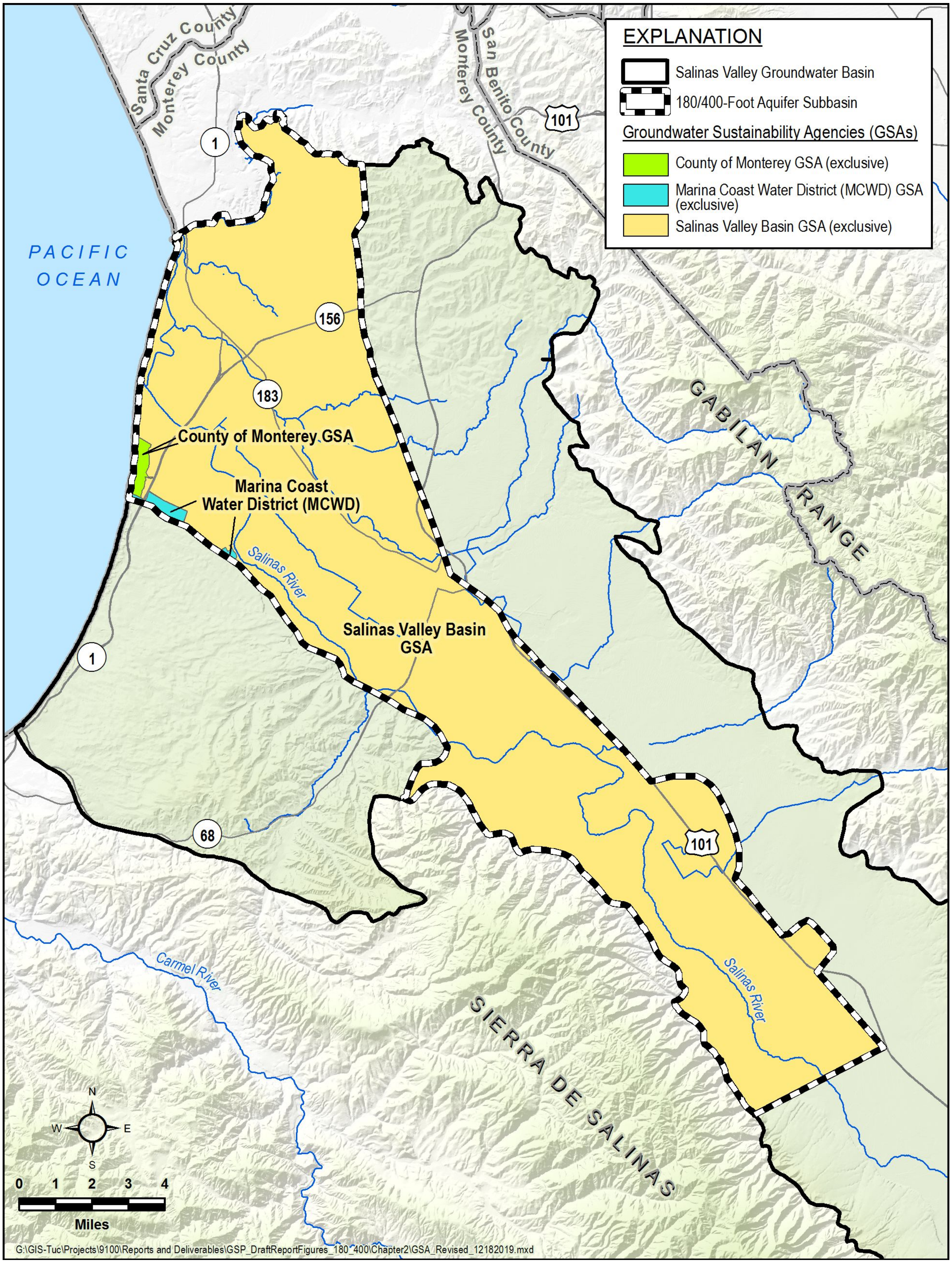


Figure 2-1. Map of Areas Covered by GSAs and Overlap Areas

2.2 Agencies' Organization and Management Structure

The organization and management structure of each of the three GSAs that cover the GSP area are described in the sections below. Relevant documentation regarding the formation of the GSAs is included in Appendix 2A.

2.2.1 SVBGSA

The SVBGSA was formed in 2017. The SVBGSA represents agriculture, public utility, municipal, county, and environmental stakeholders; and is partially or entirely responsible for developing GSPs in six of the Salinas Valley Groundwater Subbasins.

The SVBGSA is a Joint Powers Authority (JPA). The JPA membership comprises the County of Monterey, Water Resources Agency of the County of Monterey (Monterey County Water Resources Agency, or 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 eleven-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 eleven 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 eight of the eleven Board members, including an affirmative vote by three of the four 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 five 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, and input to, the

Board of Directors by constituencies whose interests are not directly represented on the Board. The SVBGSA's GSA activities are coordinated by a general manager.

2.2.2 MCWD

MCWD is governed 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's GSA activities are coordinated by the MCWD's existing staff.

2.2.3 County GSA

The 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 coordianted by its Deputy General Counsel.

2.3 Authority of Agency/Agencies

All GSAs involved in the development of this GSP were formed in accordance with the requirements of California Water Code § 10723 *et seq*. Each agency's specific authorities for GSA formation and groundwater management are listed below.

2.3.1 SVBGSA

SVBGSA is a JPA that was formed in accordance with the requirements of California Government Code §6500 *et seq*. The JPA agreement is included in Appendix 2A. In accordance with California Water Code §10723 *et seq*, the JPA signatories are all cities, counties, and water agencies with water or land use authority; and are all 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 County of Monterey is therefore a local agency under California Water Code §10721 with the authority to establish itself as a GSA.
- The MCWRA is a California Special Act District with broad water management authority in Monterey County. The MCWRA is therefore a local agency under California Water Code §10721 with the authority to establish itself as a GSA.
- 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 is therefore a local agency under California Water Code §10721 with the authority to establish itself as a GSA.

- 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 is therefore a local agency under California Water Code §10721 with the authority to establish itself as a GSA.
- 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. The City is therefore a local agency under California Water Code §10721 with the authority to establish itself as a GSA.
- 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 City is therefore a local agency under California Water Code §10721 with the authority to establish itself as a GSA.
- 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. Castroville CSD is therefore a local agency under California Water Code §10721 with the authority to establish itself as a GSA.
- Monterey One Water is itself a joint powers authority whose members include many members of the SVBGSA. Monterey One Water is a local agency under California Water Code §10721 with authority to establish itself as a GSA.

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.

2.3.2 MCWD GSA

MCWD 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*.

2.3.3 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 372-acre parcel within the 180/400-Foot Aquifer Subbasin currently owned by RMC Pacific Materials, LLC, known as the CEMEX site.

2.3.4 Coordination Agreements

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 County GSA are not required (California Water Code section §10720.7). However, the SVBGSA and MCWD GSA developed agreements to cooperatively develop this GSP. Likewise, the SVBGSA and County GSA developed a Cooperation Agreement to ensure that the GSAs that are adopting the same GSP, GSP implementation is synchronized, and the legal authorities to implement the GSP for the entire Subbasin exist. According to these agreements, MCWD GSA and 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 2B.

2.3.5 Contact Information for Plan Manager

Mr. Gary Petersen, General Manager
Salinas Valley Basin Groundwater Sustainability Agency
1441 Shilling Place
Salinas, CA 93901 | (831) 682-2592
peterseng@svbgsa.org
https://svbgsa.org

3 DESCRIPTION OF PLAN AREA

3.1 GSP Area Introduction

This GSP 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 2-1. 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, 2019a). 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.

3.2 Adjudicated Areas, Other GSAs, and Alternatives

An adjudicated basin is one in which, through legal action, the basin has certain requirements placed on it by the Court, and those requirements are normally administered by a Watermaster that is appointed by the Court. The 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. The adjudicated Seaside Subbasin is shown by the shaded area on Figure 3-2.

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

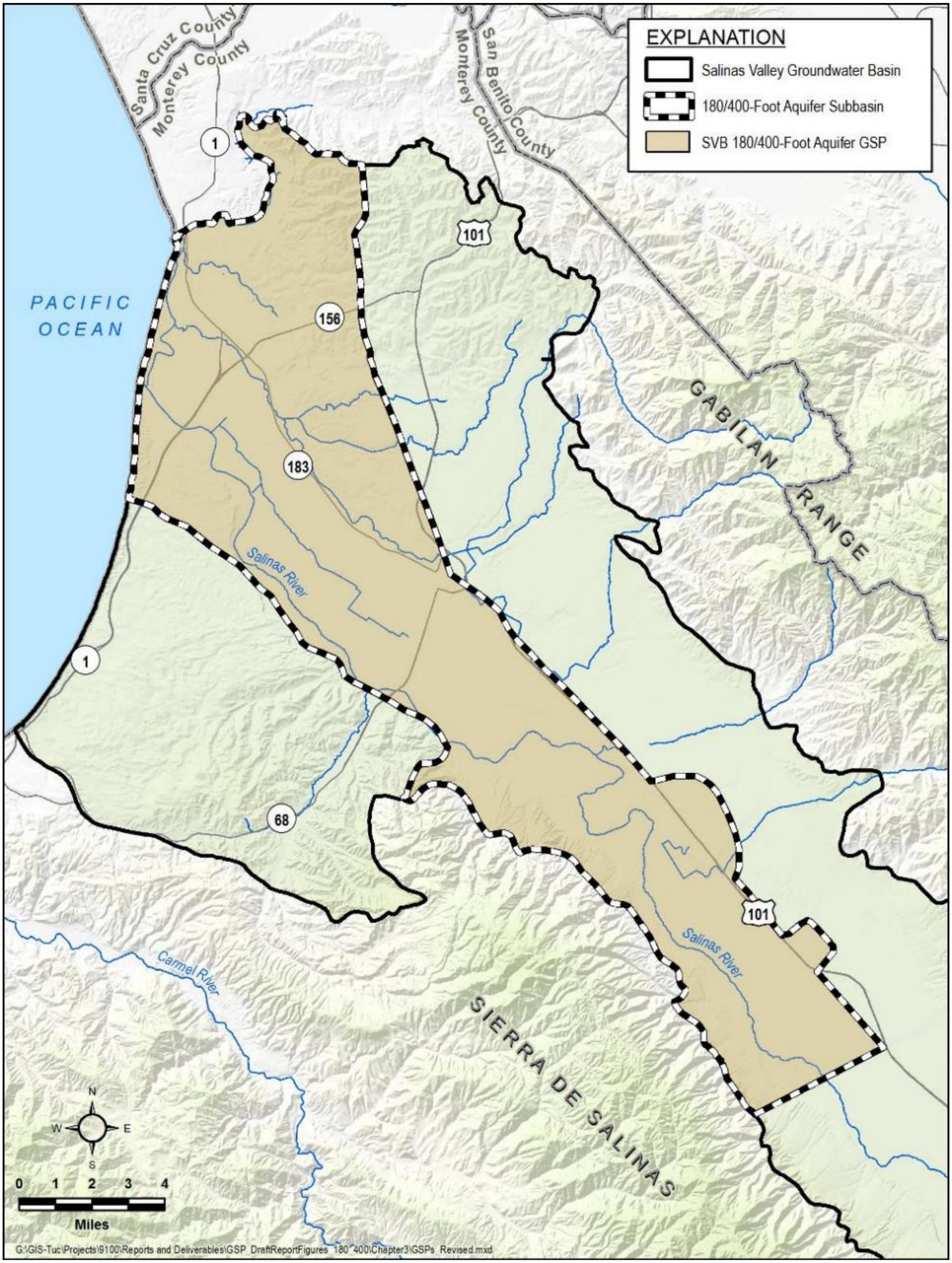


Figure 3-1: Area Covered by GSP

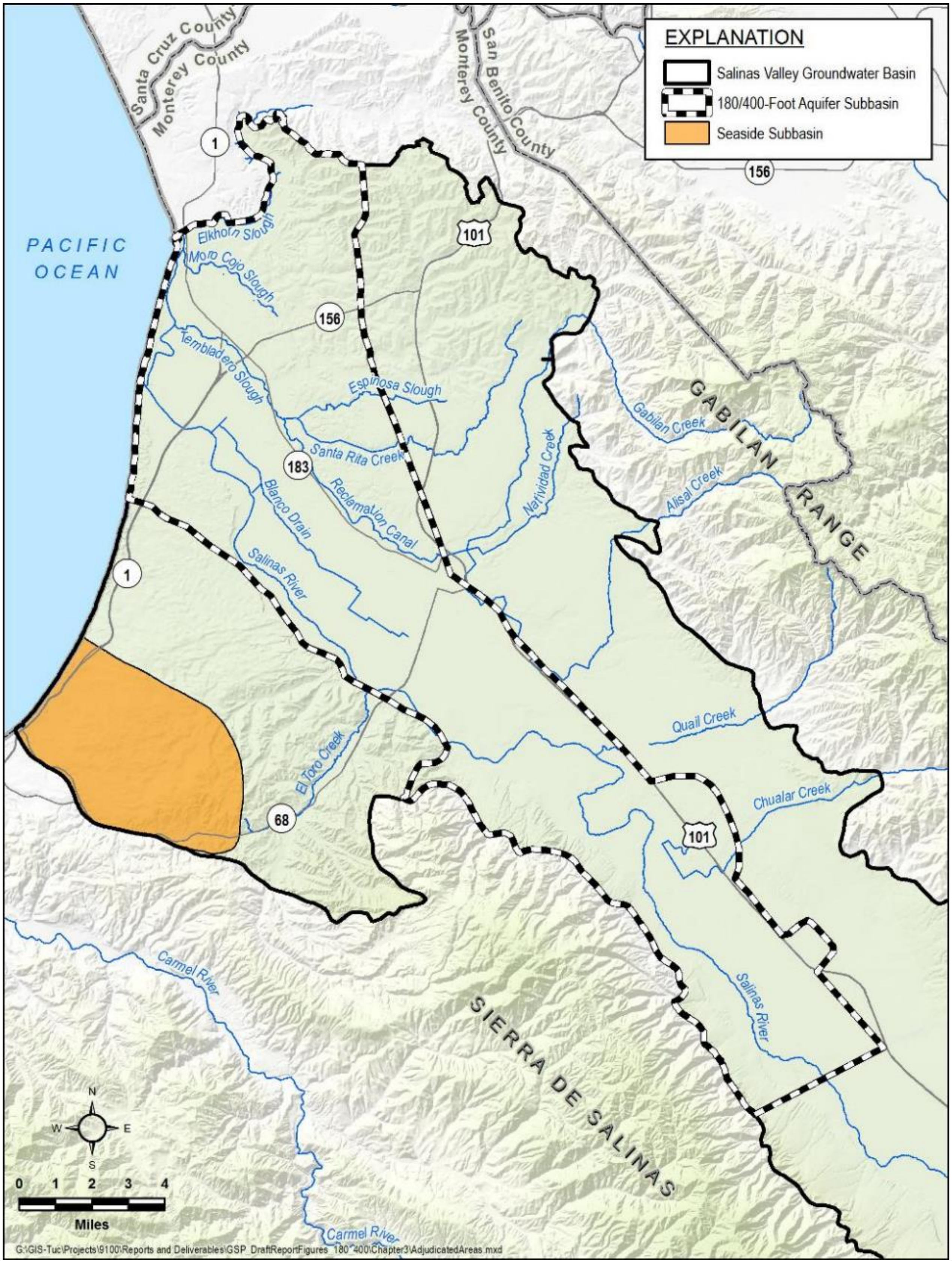


Figure 3-2. Location of the Adjudicated Seaside Subbasin

3.3 Jurisdictional Areas

There are several federal, state, and local agencies with water management authority in the Subbasin. There are no tribal lands in the Subbasin.

3.3.1 Federal Jurisdiction

Areas under federal jurisdiction are shown on Figure 3-3. 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.

3.3.2 State Jurisdiction

Areas under State jurisdiction are shown on Figure 3-3. 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.

3.3.3 County Jurisdiction

The entire Subbasin lies in Monterey County; the County of Monterey has jurisdiction over the entire Subbasin.

3.3.4 City and Local Jurisdiction

In accordance with the SGMA Regulations § 354.8 (a)(3), this section only cities and governmental agencies with water management responsibilities. The jurisdictional boundaries of these areas are shown on Figure 3-4.The cities of Salinas, Gonzales, and Marina have water management authority in their incorporated areas, although the City of Salinas is served by California Water Company and Alisal Water Corporation (Alco). 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.

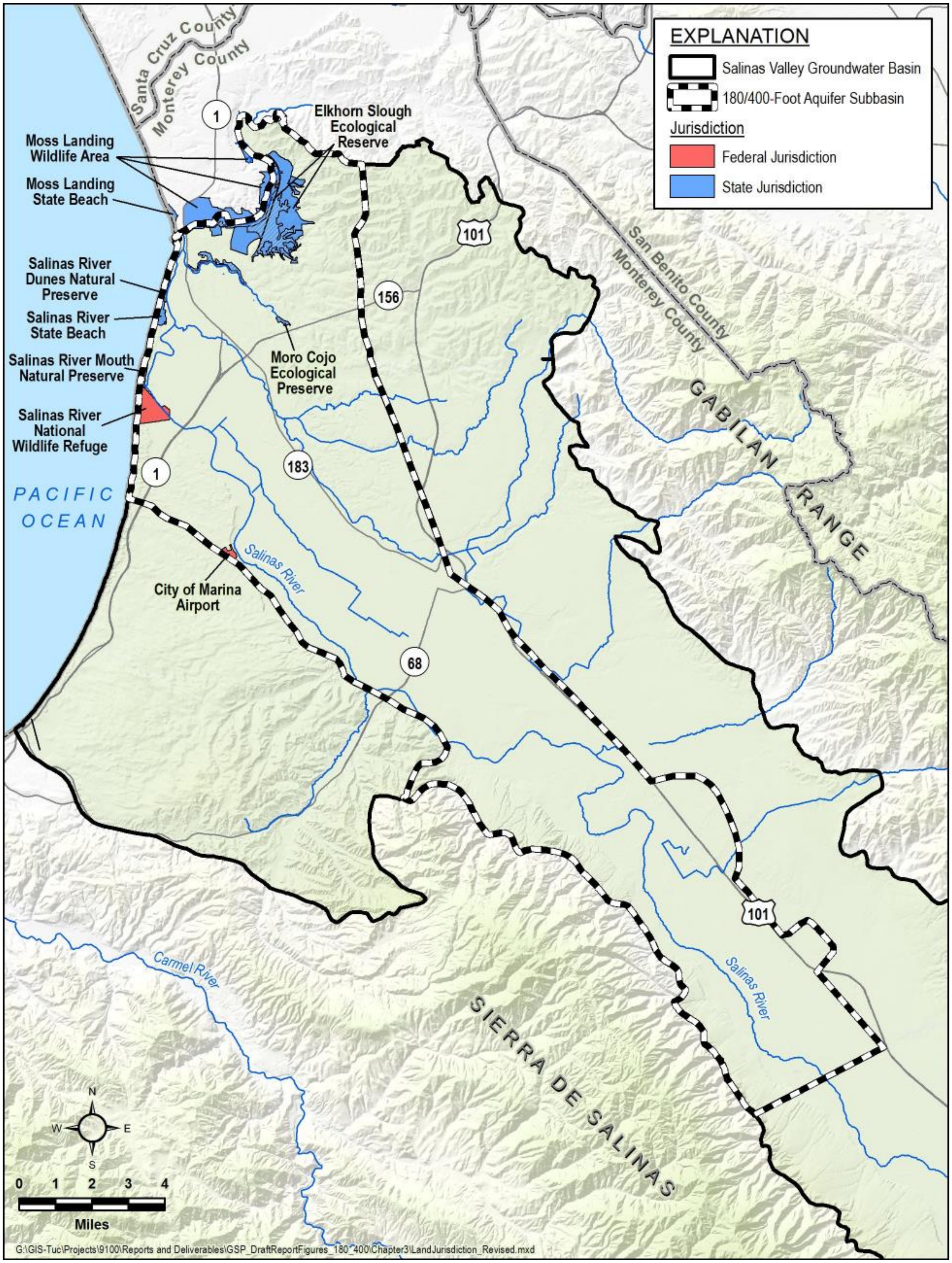


Figure 3-3. Map of Federal and State Groundwater Jurisdictional Areas

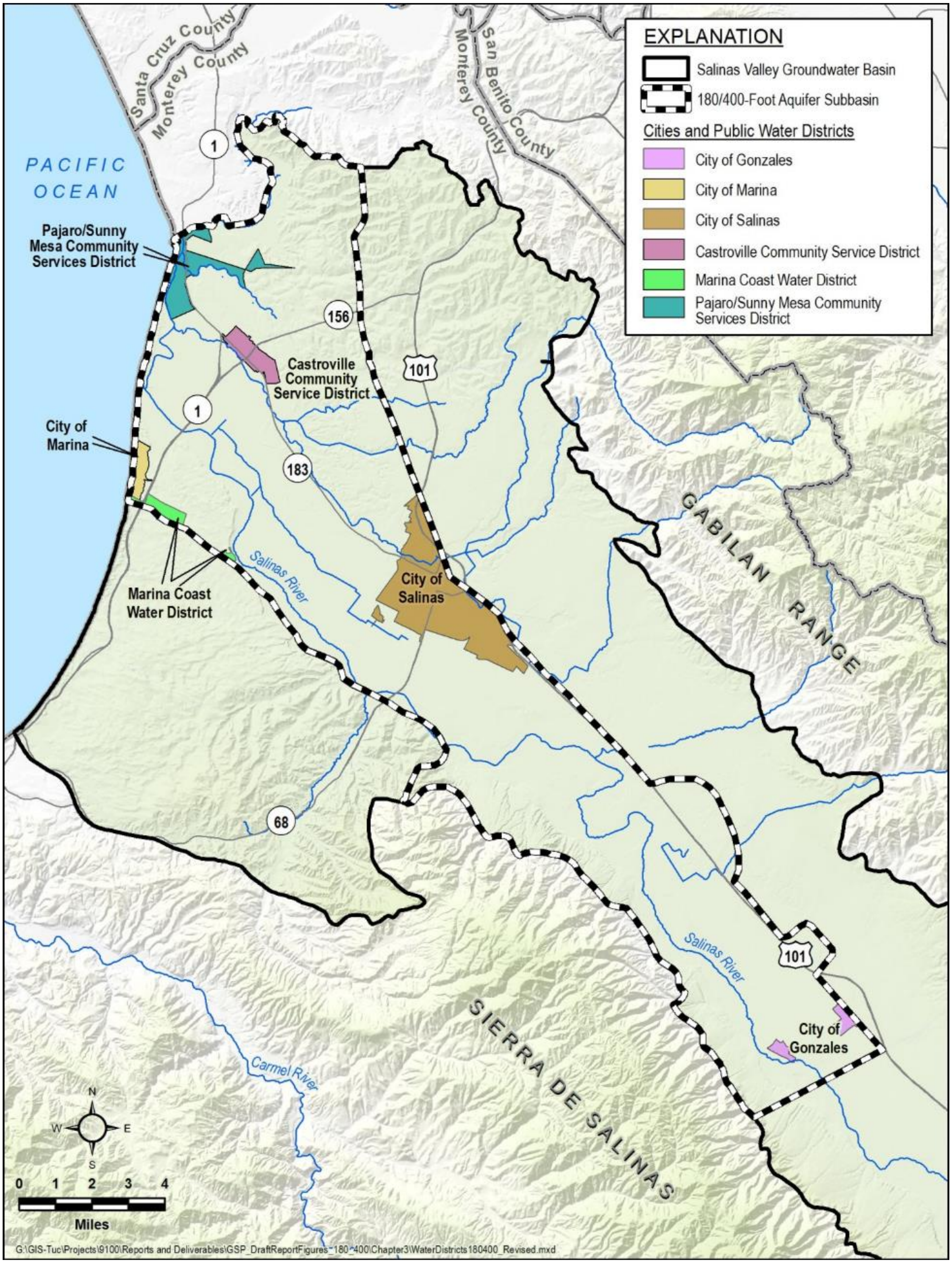


Figure 3-4. City, CSD, and Water District Jurisdictional Areas

3.4 Land Use

The Monterey County Assessor's office maintains a Geographic Information System (GIS) database of land use at the parcel level. These data were used to develop land use maps for the SVBGSA exclusive area. Current land use in the 180/400-Foot Aquifer Subbasin is shown on Figure 3-5 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)
Irrigated Agriculture	62,519
Non-irrigated Agriculture	2,534
Commercial	823
Industrial	2,175
Institutional	5,019
Miscellaneous	1,276
Multi-Family	563
Residential (Urban)	2,574
Rural	6,562
Other	1,233
Total	**85,278**

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.

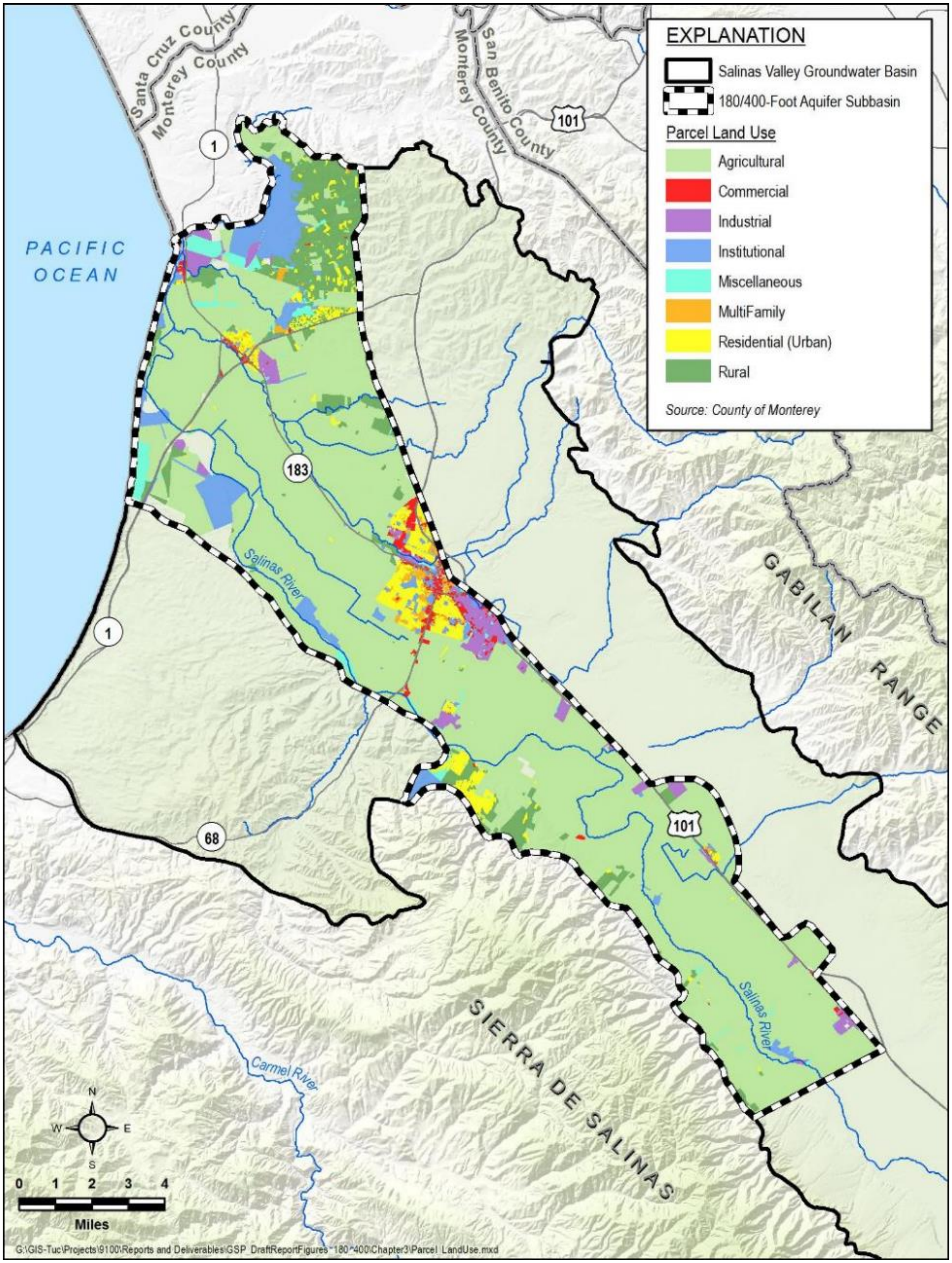


Figure 3-5. Existing Land Use

3.4.1 Water Source Types

The Subbasin has three water source types: groundwater, surface water, and recycled water. Groundwater is the primary water source for all water use sectors in the Subbasin. Water districts that depend on groundwater are shown in orange on Figure 3-6. The water districts areas shown on this figure are derived from the DWR Water Districts shapefile, which contains both municipal water districts and small state districts that rely groundwater. Groundwater is also used for rural residential areas, small community systems, and small commercial operations such as golf courses and schools.

The coastal farmland surrounding Castroville receives a combination of recycled water from SVBGSA member entity Monterey One Water, groundwater, and surface water through the Castroville Seawater Intrusion Project (CSIP). CSIP delivers this water to the agricultural land shown in green on Figure 3-6. Recycled water is additionally used for irrigation in the Las Palmas Ranch development.

Surface water supplies are derived from the Salinas River and its tributaries. Direct diversions provide surface water to agriculture, and additional surface water is diverted through a pneumatic diversion dam known as the Salinas River Diversion Facility (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.

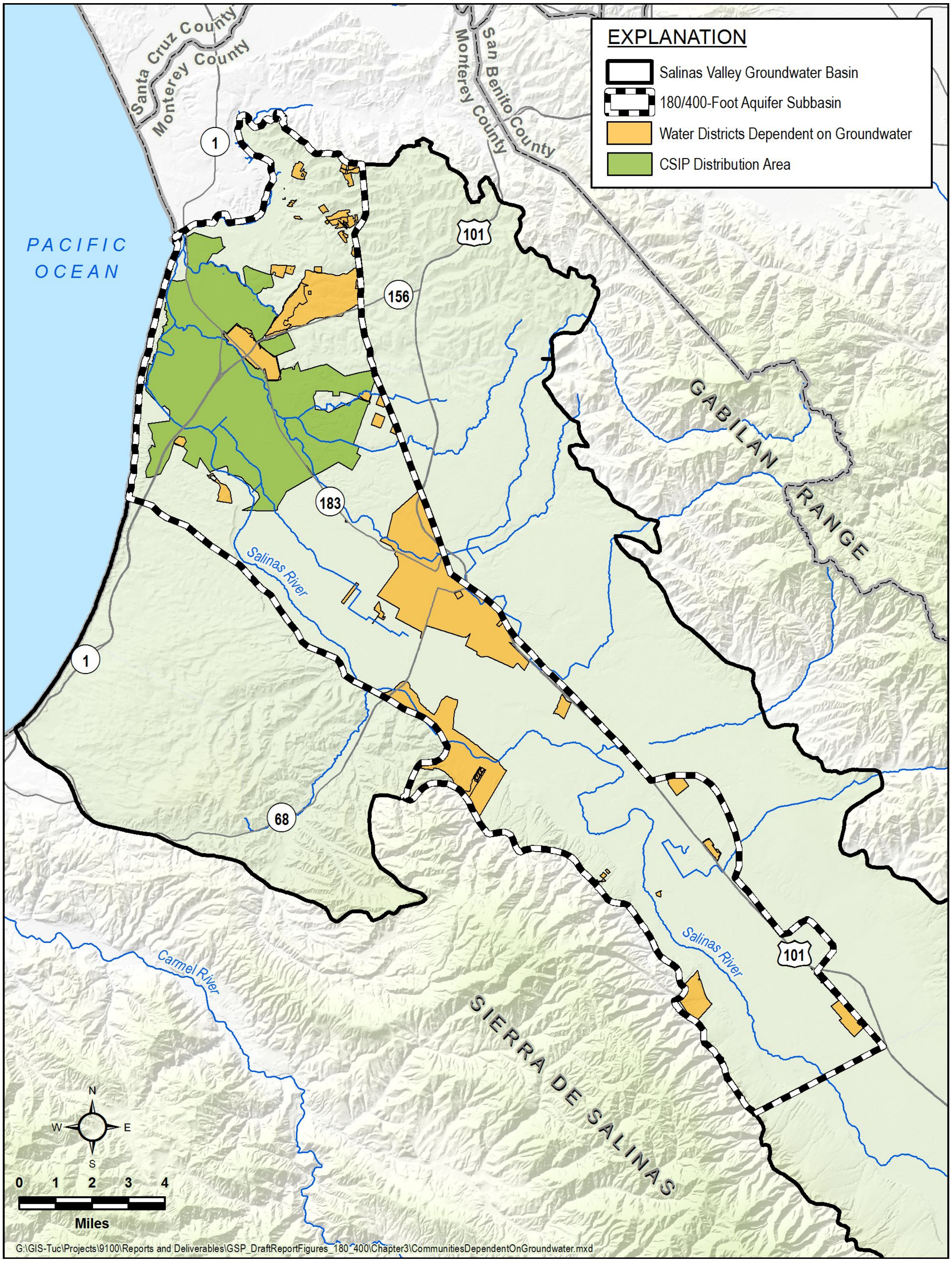


Figure 3-6. Water Districts Dependent on Groundwater and the CSIP Distribution Area

3.4.2 Water Use Sectors

Groundwater demands in the Subbasin are classified into the six water use sectors identified in the GSP Regulations. Groundwater demand categories include:

- **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. For the years 2010-2015, urban water use averaged 17,400 acre-feet (AF) and accounted for an average of 15% of the groundwater pumped in the Subbasin (MCWRA, 2015a; MCWRA, 2017a).
- **Industrial**. There is limited industrial use in the Subbasin. DWR does not have any records of wells in the Subbasin that are categorized as industrial use. MCWRA records lump industrial use and urban use together as a single type of water use.
- **Agricultural**. This is the largest water use sector in the Subbasin, with an annual average use of 96,600 AF between 2010 and 2015. Agricultural water use accounted for an average of 85% of the groundwater pumped in the Subbasin (MCWRA, 2015a; MCWRA 2017a).
- **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.** Approximately 90% of the Subbasin comprises commercial, industrial, agricultural, or residential land uses. Approximately 4% is identified as “conservation” and approximately 5% is identified as “public” or “quasi-public”. 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.

3.5 Existing Well Types, Numbers, and Density

Well density data were derived from the database of wells that DWR specifically developed for use in GSPs. Other data sources are available from MCWRA or other sources, and they may result in different well densities. The DWR data were used for simplicity and consistency with other DWR data used in this GSP.

DWR's Well Completion Report Map Application classifies wells as domestic, production, and municipal; the majority of wells classified as production wells are assumed to be used for agricultural irrigation, with some production wells used for industrial purposes. More than half of the wells in the DWR dataset are production wells. Domestic wells account for most of the remaining wells. 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. Figure 3-7 and Figure 3-8 show the density of domestic and agricultural production wells, respectively, in the Subbasin.

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.

Figure 3-9 shows the density of municipal wells in the Subbasin. As previously described, Figure 3-6 identifies municipal areas dependent upon groundwater.

Table 3-2. Well Count Summary

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

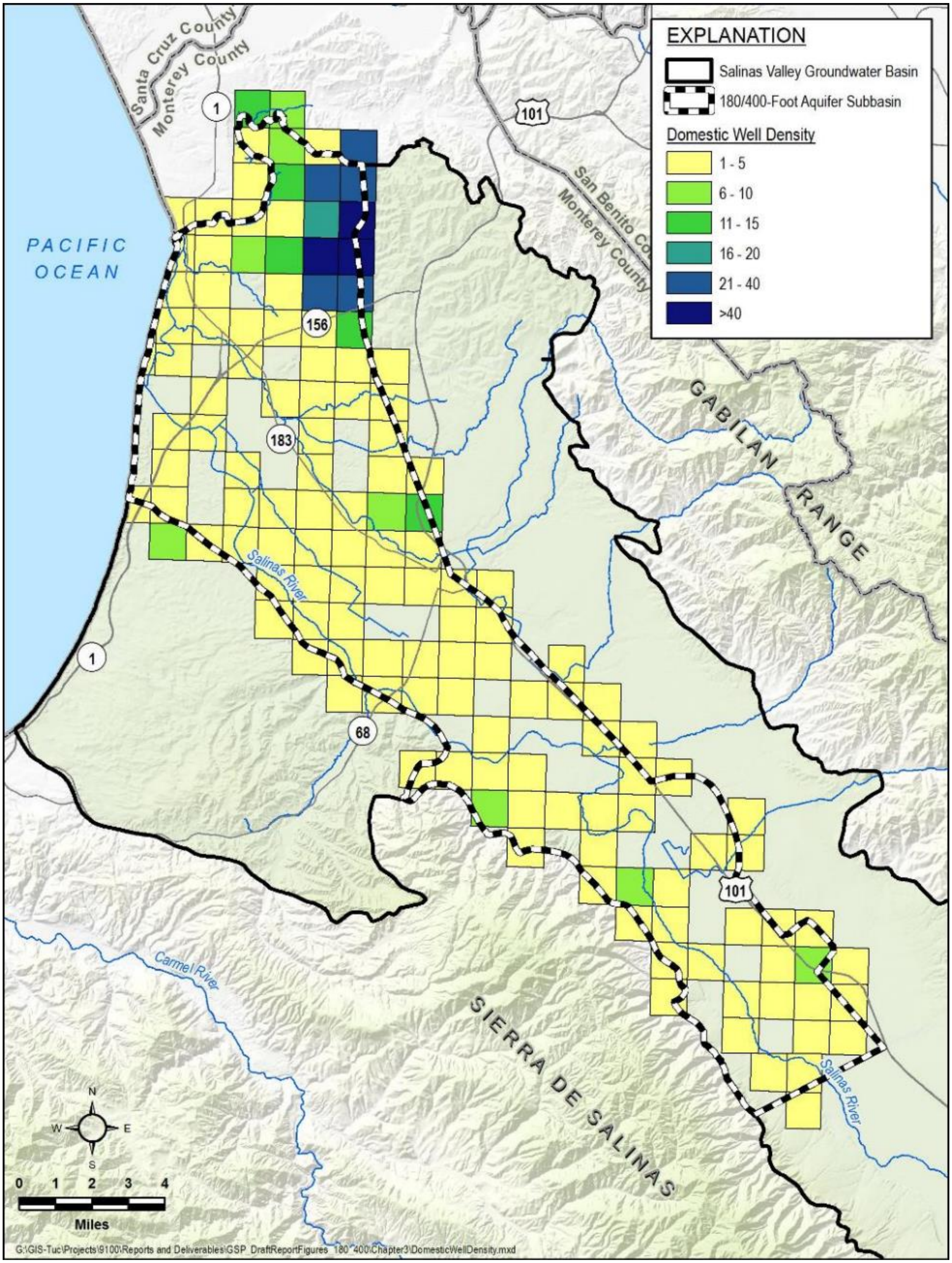


Figure 3-7. Density of Domestic Wells (Number of Wells per Square Mile)

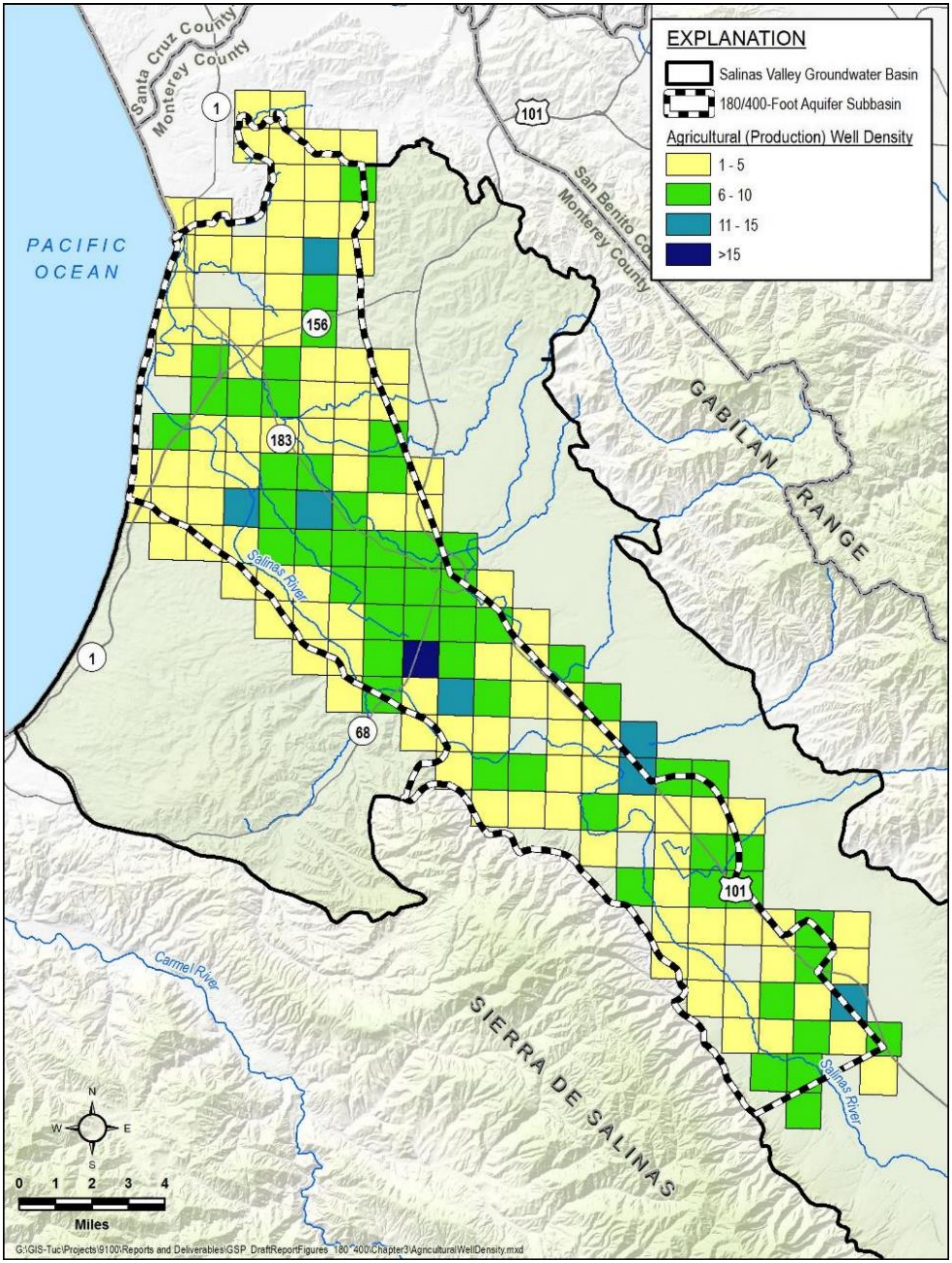


Figure 3-8. Density of Agricultural Production Wells (Number of Wells per Square Mile)

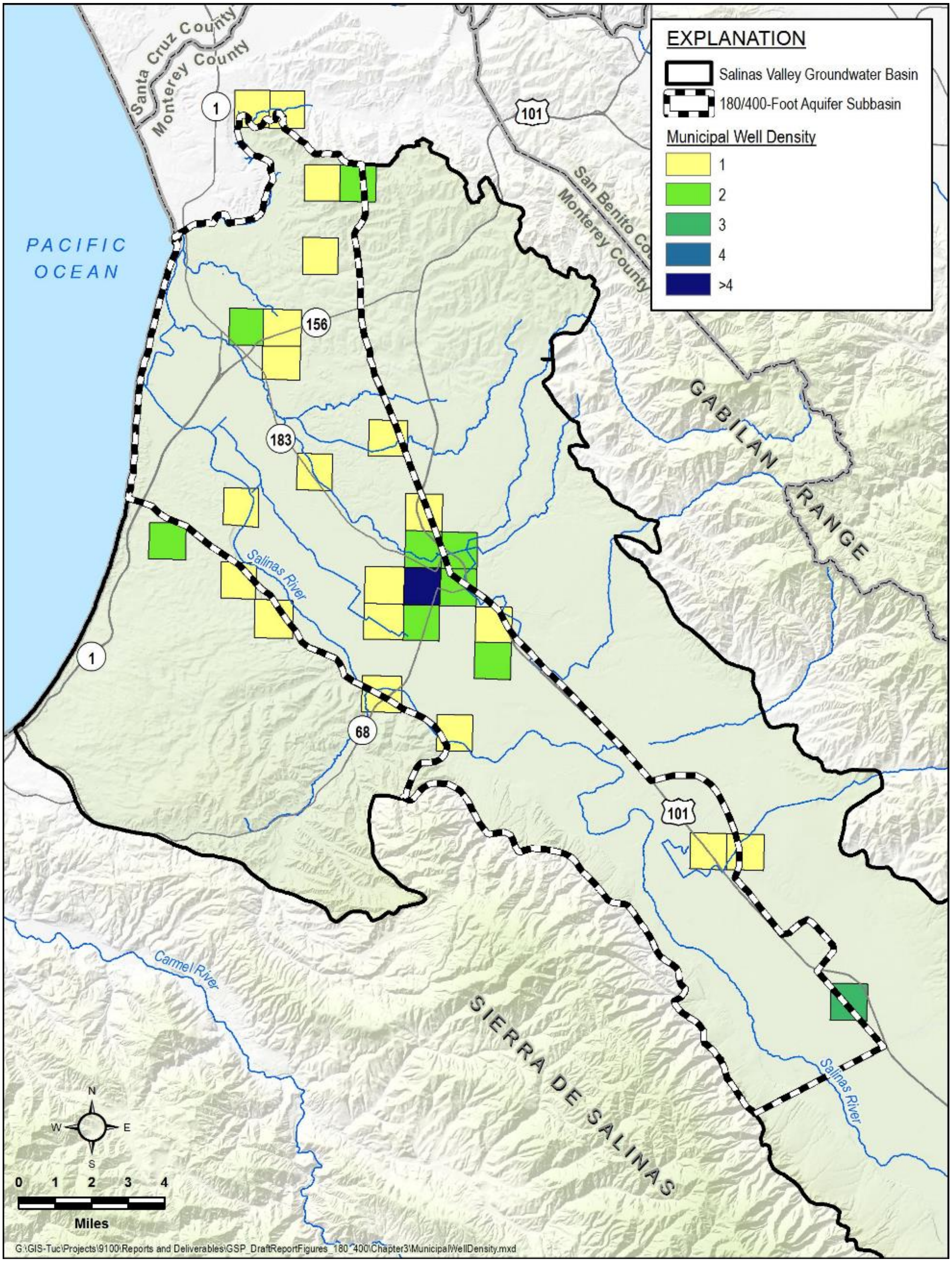


Figure 3-9. Density of Municipal Wells (Number of Wells per Square Mile)

3.6 Existing Monitoring Programs

3.6.1 Existing Groundwater Elevation Monitoring

3.6.1.1 MCWRA Monthly Groundwater Elevation Monitoring

MCWRA collects monthly groundwater elevation measurement from approximately 100 wells throughout the Salinas Valley Groundwater Basin. Of these wells, 38 are in the 180/400-Foot Aquifer Subbasin. MCWRA processes these monthly measurements to develop a computed average depth to water for the Subbasin.

3.6.1.2 MCWRA Annual Fall Groundwater Elevation Monitoring

MCWRA collects groundwater elevation measurements from an additional 120 wells in the 180/400-Foot Aquifer Subbasin each fall. MCWRA uses these annual measurements to develop contour maps depicting the annual groundwater elevation.

3.6.1.3 MCWRA August Groundwater Elevation Monitoring

MCWRA collects groundwater elevation measurements every August from approximately 100 wells in the 180/400-Foot Aquifer Subbasin to establish the location and extent of groundwater pumping depressions that drive seawater intrusion. The August measurements usually coincide with the end of the irrigation season, and groundwater elevations at this time reflect low groundwater elevations prior to the onset of seasonal winter recharge. MCWRA uses the August groundwater elevation data to develop groundwater contour maps of the coastal pumping depressions in odd-numbered years.

3.6.1.4 California Statewide Groundwater Elevation Monitoring (CASGEM)

MCWRA is the responsible agency for CASGEM monitoring in most areas of Monterey County. The monitoring network comprises 51wells throughout the Salinas Valley Groundwater Basin. Of these 51 wells, 23 are in the 180/400-Foot Aquifer Subbasin. Some of the CASGEM monitoring wells are owned by MCWRA and 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. Figure 3-10 shows the locations of the CASGEM monitoring wells in the 180/400-Foot Aquifer Subbasin.

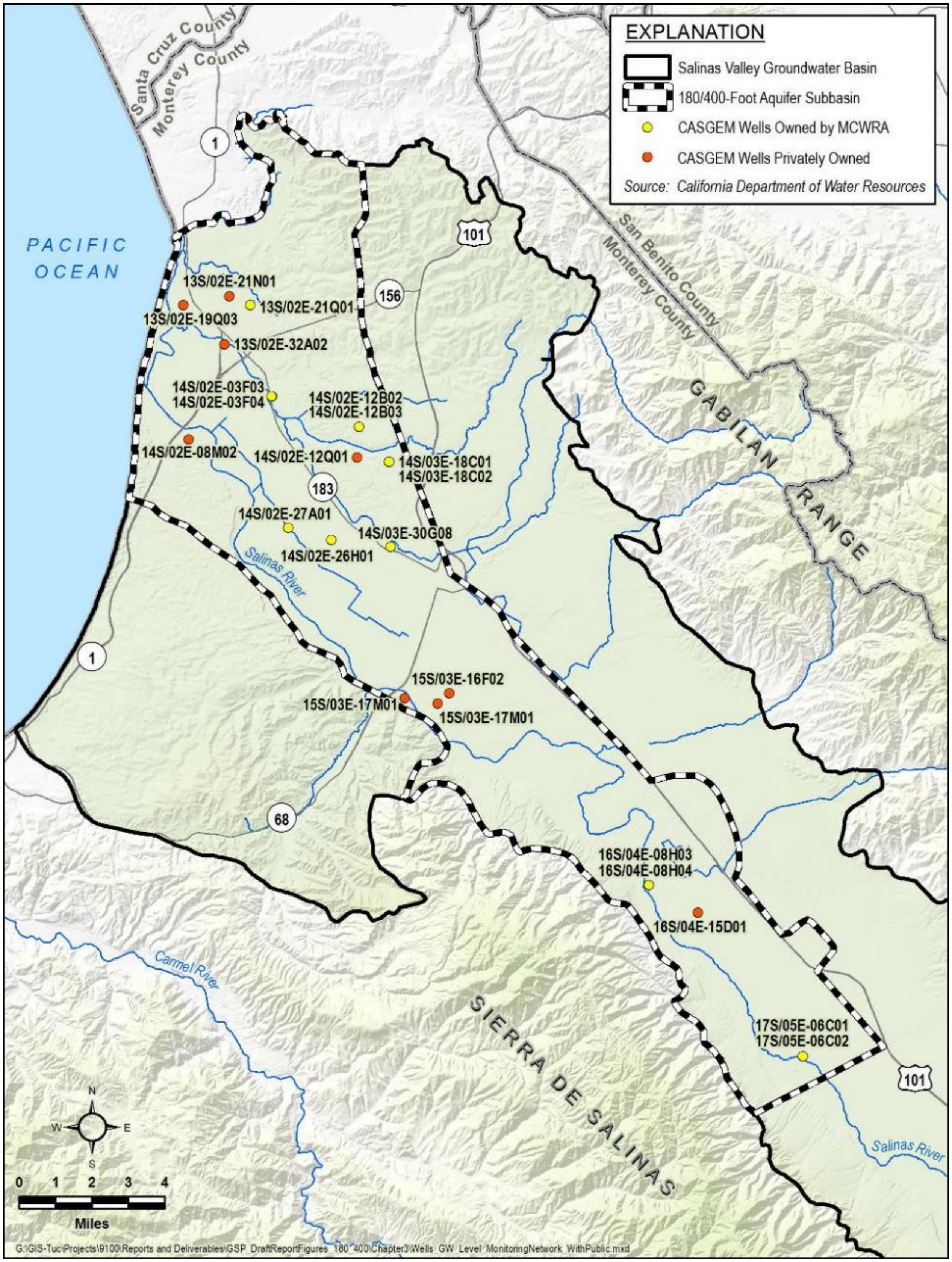


Figure 3-10. Locations of CASGEM Wells in the 180/400-Foot Aquifer Subbasin

3.6.2 Groundwater Extraction Monitoring

MCWRA collects groundwater extraction information from all wells in the 180/400-Foot Aquifer Subbasin that have discharge pipes of three inches or greater in diameter. These data have been collected since 1993. Extraction is self-reported by well owners.

3.6.3 Groundwater Quality Monitoring

3.6.3.1 MCWRA Seawater Intrusion Monitoring

MCWRA monitors seawater intrusion in the Salinas Valley Groundwater Basin with a network of 121 monitoring wells located in the 180/400-Foot Aquifer Subbasin. Ninety-six wells in the network are agricultural production wells that are sampled annually in June and August. Twenty-five of the wells in the network are dedicated monitoring wells that are maintained by either MCWRA or by California-American Water (Cal-Am) as part of its Monterey Peninsula Water Supply Project (MPWSP).

Water quality samples from the wells are analyzed for general water chemistry constituents, including anions and cations, conductivity, etc. The data are used to develop time-series plots of chloride and conductivity trends, stiff and piper diagrams, and to compute molar ratios of chloride to sodium. The data are used to prepare maps of seawater intrusion in the 180- and 400-Foot Aquifers in odd-numbered years. Additional information about the occurrence and extent of seawater intrusion in both the 180- and 400-Foot Aquifers is provided in Section 5.

3.6.3.2 Other Groundwater Quality Monitoring

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

- Municipal and community water purveyors must collect water quality samples on a routine basis for compliance monitoring and reporting to the California Division of Drinking Water.
- The United States Geological Survey (USGS) has sporadically collected groundwater quality data under the Groundwater Ambient Monitoring and Assessment (GAMA) program. These data are stored in the State's GAMA/Geotracker system. Figure 3-11 shows the location of wells in the State's GAMA Geotracker database that are in the 180/400-Foot Aquifer Subbasin.
- There are multiple sites at which groundwater quality monitoring is conducted as part of investigation or compliance monitoring programs through the Central Coast Regional Water Quality Control Board.

Cal-Am and MCWRA monitor Cal-Am's proposed source wells for the MPWSP.

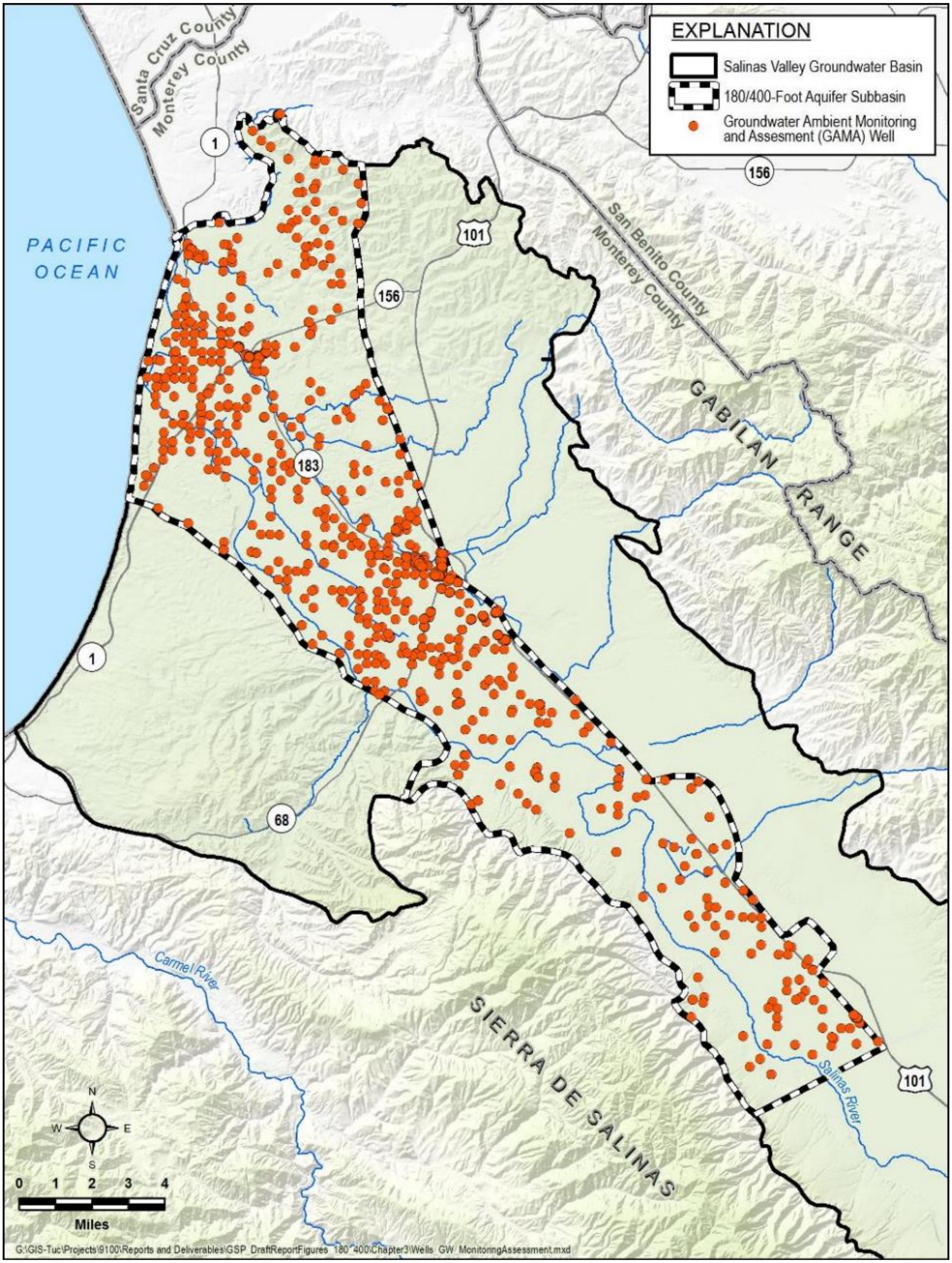


Figure 3-11. Locations of USGS GAMA Wells in the 180/400-Foot Aquifer Subbasin

3.6.4 Surface Water Monitoring

Streamflow gauges operated by the 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 3-12.

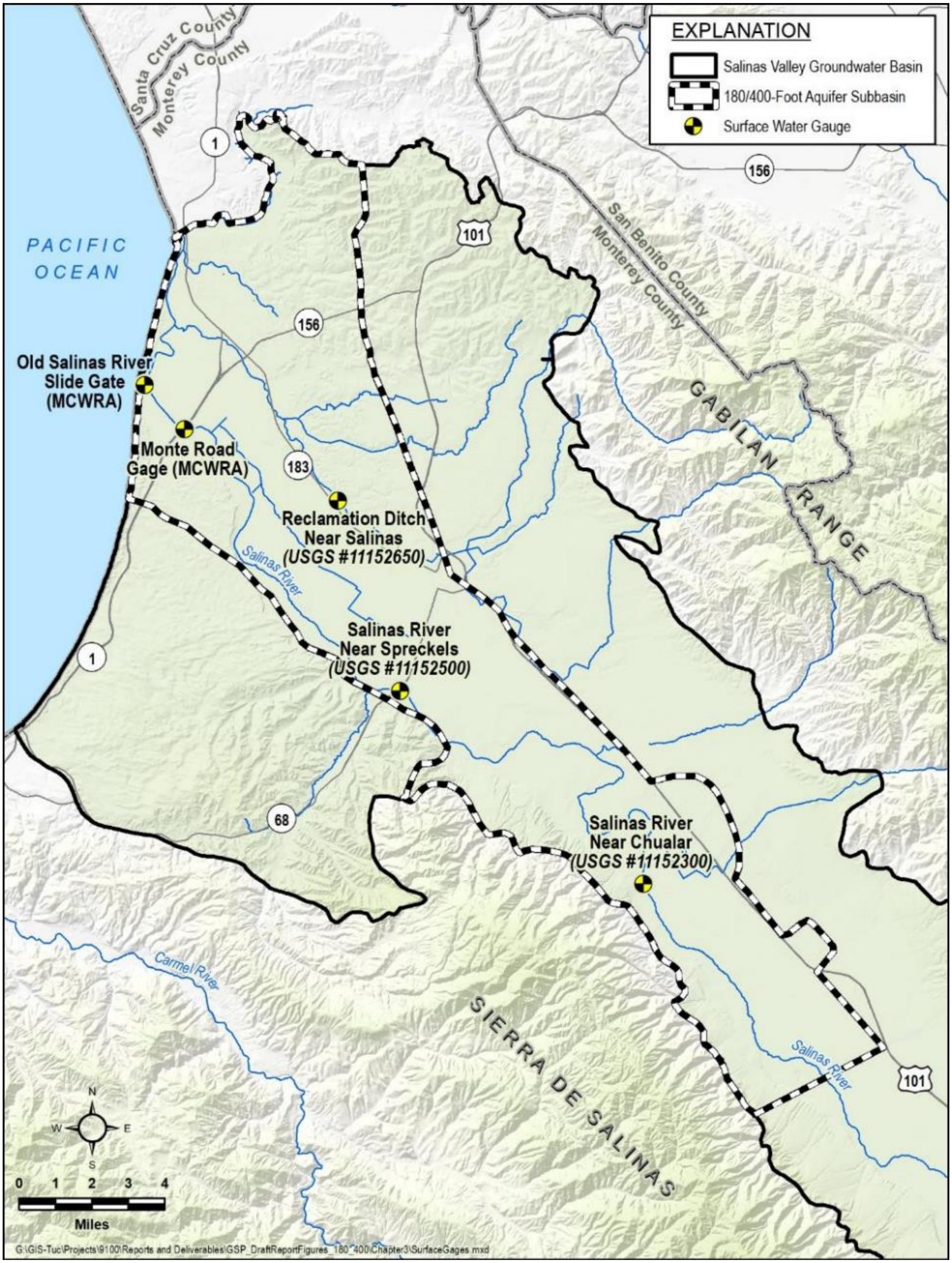


Figure 3-12. Surface Water Gaging Locations

3.6.5 Incorporating Existing Monitoring Programs into the GSP

The existing monitoring programs and monitoring networks constitute a well-developed and broadly distributed system that provides representative data throughout the Subbasin. The groundwater elevation monitoring programs are operated by an existing member of the SVBGSA, and therefore are incorporated into the GSP monitoring plan as appropriate. The existing groundwater elevation monitoring programs will be updated and improved to document the avoidance of undesirable results in each significant aquifer in the Subbasin.

MCWRA currently monitors 23 wells with publicly available data within the 180/400-Foot Aquifer Subbasin as part of the CASGEM network. This network will be used for long-term water elevation monitoring under GSP implementation. MCWRA also monitors seawater intrusion at dedicated monitoring wells and creates chloride concentration maps to track seawater intrusion in the 180/400-Foot Aquifer Subbasin aquifers. This seawater intrusion monitoring network will be used for the seawater intrusion sustainability indicator.

Groundwater quality data will be downloaded and reviewed from existing networks and programs for public water system wells, small public water system wells that are monitored by the County Department of Public Health, and the Irrigated Lands Program agricultural and domestic wells monitored under Ag Order 4.0.

The existing stream gages, primarily those maintained by the USGS, will be incorporated into this GSP monitoring plan to validate projections of surface water depletions from pumping. InSAR data provided by DWR will be used to monitor subsidence in the Subbasin.

3.6.6 Limits to Operational Flexibility

The existing monitoring programs are not anticipated to limit the operational flexibility of this GSP.

3.7 Existing Management Plans

3.7.1 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 GMP identified three 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 three 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

3.7.2 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, including:

- Big Sur Land Trust

- California State University Monterey Bay
- California Water Service Company
- Castroville Community Services District
- City of Salinas
- City of Soledad
- Elkhorn Slough National Estuarine Research Reserve
- Environmental Justice Coalition for Water
- Garrapata Creek Watershed Council
- Marina Coast Water District
- Monterey Bay National Marine Sanctuary
- Monterey County Agricultural Commissioner's Office
- Monterey County Water Resources Agency
- Monterey Regional Water Pollution Control Agency
- Moss Landing Marine Laboratories
- Resource Conservation District of Monterey County
- Rural Community Assistance Corporation
- San Jerardo Cooperative, Inc.

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).

3.7.3 Urban Water Management Plans

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

California Water Service serves a portion of the City of Salinas. Its 2015 Urban Water Management Plan (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. 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 Cal Water'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., or more, 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, 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.

3.7.3.2 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.

3.7.3.3 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

3.8 Existing Groundwater Regulatory Programs

3.8.1 Groundwater Export Prohibition

The Monterey County Water Resources Agency Act, § 52.21 prohibits the export of groundwater from any part of the Salinas Valley Groundwater 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.*

3.8.2 Agricultural Order

In 2017 the Central Coast Regional Water Quality Control Board (CCRWQCB) issued Agricultural Order No. R3-2017-0002, a Conditional Waiver of Waste Discharge Requirements for Discharges from Irrigated Lands (CCRWQCB, 2017). 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 three tiers based on the relative risk their operations pose to water quality.

Growers must enroll, pay fees, and meet various monitoring and reporting requirements according to the tier to which they are assigned. All growers are required to implement groundwater monitoring, either individually or as part of a cooperative regional monitoring program. Growers electing to implement individual monitoring and not participate in the regional monitoring program implemented by the Central Coast Groundwater Coalition (CCGC) are required to test all on-farm domestic wells and the primary irrigation supply well for nitrate or nitrate plus nitrite, and general minerals; including, but not limited to, TDS, sodium, chloride and sulfate.

Negotiations with the CCRWQCB staff and Board Members for the next iteration of the Agricultural Order are on-going, and expected to conclude in March 2020 with the adoption of a new Irrigated Lands Regulatory Program (ILRP) Waste Discharge Requirements (WDR) for farming operations in the Salinas Valley Groundwater Basin area. As mandated by the State Water Resources Control Board (SWRCB), specific reporting requirements for nitrogen applications and removal, irrigation and surface water discharge management, and groundwater quality monitoring will be included with quantifiable milestones. While the outcome is not certain, the expectation is that the next Agricultural Order will be more complex with additional compliance reporting measures for all growers.

3.8.3 Water Quality Control Plan for the Central Coast Basins

The Water Quality Control Plan for the Central Coastal Basin was most recently updated in September 2017 (SWRCB, 2017). 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 benceficial users, describes the water quality which must be maintained to allow those uses, provides an implementation plan, details SWRCB and CCRWQCB plans and policies to protect water quality, and details statewide and regional survelliance and monitoring programs. The SWRCB's Sources of Drinking Water Policy, adopted in Resolution No. 88-63 and incorporated in its entirety in the CCRWQCB's Basin Plan, provides that water with TDS less than or equal to 3,000 mg/L is considered suitable or potentially suitable for drinking water beneficial uses.

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.

3.8.4 Requirements for New Wells

In October, 2017, Governor Brown signed Senate Bill (SB) 252 which became effective on January 1, 2018. SB 252 requires well permit applicants in critically overdrafted basins to include information about the proposed well, such as location, depth, and pumping capacity (California Legislature, 2017). The bill also requires the permitting agency to make the information easily accessible to the public and the GSAs. These requirements expire on January 30, 2020.

3.8.5 Title 22 Drinking Water Program

The SWRCB Division of Drinking Water (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 less 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) for various waterborne contaminants, including volatile organic compounds, non-volatile synthetic organic compounds, inorganic chemicals, radionuclides, disinfection byproducts, general physical constituents, and other parameters.

3.8.6 County Moratorium on Accepting and Processing New Well Permits

On May 22, 2018, the Monterey County Board of Supervisors adopted Ordinance No. 5302 pursuant to Government Code Section 65858. The ordinance was an Interim Urgency Ordinance, which took effect immediately upon adoption. The ordinance prohibits the acceptance or processing of any applications for new wells in the defined Area of Impact within the180/ 400-Foot Aquifer Subbasin, with stated exceptions including municipal wells and replacement wells. The ordinance was originally only effective for 45 days, but at the June 26 Monterey County Board of Supervisors meeting, the Board of Supervisors extended the ordinance to May 21, 2020, by adoption of Ordinance No. 5303. During the moratorium, the County has stated that it will conduct further studies to assess groundwater conditions in the Subbasin.

3.8.7 County Ordinance 3709

County Ordinance 3709, passed in 1993, prohibits groundwater extractions and the drilling of new extraction wells in certain portions of the 180-foot aquifer after January 1, 1995.

3.8.8 County 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.

3.8.9 Incorporating Regulatory Programs into the GSP

Information in these various plans has been incorporated into this GSP and used during the preparation of Sustainability Goals, when setting Minimum Thresholds and Measurable Objectives when developing Projects and Management Actions.

3.8.10 Limits to Operational Flexibility

Some of the existing management plans and ordinances will limit operational flexibility. These limits to operational flexibility have already been incorporated into the projects and programs included in this GSP. 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 Subbasin. 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 Interim Urgency Ordinance, which imposes a temporary moratorium on wells in the Area of Impact, may limit certain activities and the SVBGSA's ability to access certain sources of water. However, the moratorium is not expected to adversely affect SVBGSA's ability to reach sustainability.
- 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.

3.9 Conjunctive Use Programs

One conjunctive use project operates in the 180/400-Foot Aquifer Subbasin. This project uses recycled water from the SVRP and distributes it through the CSIP distribution system. This project serves approximately 12,000 acres of farmland within the Subbasin. The extent of the current CSIP distribution area is shown on Figure 3-6. The recycled water in the CSIP is supplemented with groundwater and surface water diverted from the SRDF. 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.

3.10 Land Use Plans

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. Land use is an important factor in water management. The following sections provide a general description of these land use plans and how implementation may affect groundwater management in the 180/400-Foot Aquifer Subbasin. The following descriptions were taken from publicly available general plans at the time of the GSP preparation.

3.10.1 Monterey County General Plan

Relevant elements of the Monterey County General Plan (Monterey County, 2010) are summarized in Table 3-3.

Table 3-3 Monterey County General Plan Summary

Element		Goal / Policy
Land Use	LU-1.4	Growth areas shall be designated only where an adequate level of services and facilities such as water, sewerage, fire and police protection, transportation, and schools exist or can be assured concurrent with growth and development. Phasing of development shall be required as necessary in growth areas in order to provide a basis for long-range services and facilities planning.
Open Space	OS-3.8	The County shall cooperate with appropriate regional, state and federal agencies to provide public education/outreach and technical assistance programs on erosion and sediment control, efficient water use, water conservation and re-use, and groundwater management. This cooperative effort shall be centered through the Monterey County Water Resources Agency.
***et. seq.* Public Services**	GOAL PS-2	Assure an adequate and safe water supply to meet the county's current and long-term needs.
	PS-2.1	Coordination among, and consolidation with, those public water service providers drawing from a common water table to prevent overdrawing the water table is encouraged.
	PS-2.2	The County of Monterey shall assure adequate monitoring of wells in those areas experiencing rapid growth provided adequate funding mechanisms for monitoring are established in the CIFP.
	PS-2.3	New development shall be required to connect to existing water service providers where feasible. Connection to public utilities is preferable to other providers.
	PS-2.4	Regulations for installing any new domestic well located in consolidated materials (e.g., hard rock areas) shall be enacted by the County.
	PS-2.5	Regulations shall be developed for water quality testing for new individual domestic wells on a single lot of record to identify: a) Water quality testing parameters for a one-time required water quality test for individual wells at the time of well construction. b) A process that allows the required one-time water quality test results to be available to future owners of the well. Regulations pursuant to this policy shall not establish criteria that will prevent the use of the well in the development of the property. Agricultural wells shall be exempt from the

Element	Goal / Policy	
		regulation.
	GOAL PS-3	Ensure that new development is assured a long-term sustainable water supply.
	PS-3.1	Except as specifically set forth below, new development for which a discretionary permit is required, and that will use or require the use of water, shall be prohibited without proof, based on specific findings and supported by evidence, that there is a long-term, sustainable water supply, both in quality and quantity to serve the development [see Plan for list].
	PS-3.2	Specific criteria for proof of a Long-Term Sustainable Water Supply and an Adequate Water Supply System for new development requiring a discretionary permit, including but not limited to residential or commercial subdivisions, shall be developed by ordinance with the advice of the General Manager of the Water Resources Agency and the Director of the Environmental Health Bureau. A determination of a Long-Term Sustainable Water Supply shall be made upon the advice of the General Manager of the Water Resources Agency. The following factors shall be used in developing the criteria for proof of a long-term sustainable water supply and an adequate water supply system: [see Plan for list]
	PS-3.3	Specific criteria shall be developed by ordinance for use in the evaluation and approval of adequacy of all domestic wells. The following factors shall be used in developing criteria for both water quality and quantity including, but not limited to: [see Plan for list]
	PS-3.4	The County shall request an assessment of impacts on adjacent wells and instream flows for new high-capacity wells, including high-capacity urban and agricultural production wells, where there may be a potential to affect existing adjacent domestic or water system wells adversely or in-stream flows, as determined by the Monterey County Water Resources Agency. In the case of new high-capacity wells for which an assessment shows the potential for significant adverse well interference, the County shall require that the proposed well site be relocated or otherwise mitigated to avoid significant interference. The following factors shall be used in developing criteria by ordinance for use in the evaluation and approval of adequacy of all such high-capacity wells, including but not limited to: a) Effect on wells in the immediate vicinity as required by the Monterey County Water Resources Agency or Environmental Health Bureau. b) Effects of additional extractions or diversion of water on in-stream flows necessary to support riparian vegetation, wetlands, fish, and other aquatic life including migration potential for steelhead, for the purpose of minimizing impacts to those resources and species. This policy is not intended to apply to replacement wells.
	PS-3.5	The Monterey County Health Department shall not allow construction of any new wells in known areas of saltwater intrusion as identified by Monterey County Water Resources Agency or other applicable water management agencies: a) Until such time as a program has been approved and funded that will minimize or avoid expansion of salt water intrusion into useable groundwater supplies in that area; or b) Unless approved by the applicable water resource agency. This policy shall not apply to deepening or replacement of existing wells, or wells used in conjunction with a desalination project.
	PS-3.6	The County shall coordinate and collaborate with all agencies responsible for the management of existing and new water resources.

Element		Goal / Policy
	PS-3.7	A program to eliminate overdraft of water basins shall be developed as part of the Capital Improvement and Financing Plan (CIFP) for this Plan using a variety of strategies, which may include but are not limited to: a) Water banking; b) Groundwater and aquifer recharge and recovery; c) Desalination; d) Pipelines to new supplies; and/or e) A variety of conjunctive use techniques. The CIFP shall be reviewed every five years in order to evaluate the effectiveness of meeting the strategies noted in this policy. Areas identified to be at or near overdraft shall be a high priority for funding.
	PS-3.8	Developments that use gray water and cisterns for multi-family residential and commercial landscaping shall be encouraged, subject to a discretionary permit.
	PS-3.9	A tentative subdivision map and/or vesting tentative subdivision map application for either a standard or minor subdivision shall not be approved until the applicant provides evidence of a long-term sustainable water supply in terms of yield and quality for all lots that are to be created through subdivision.
	PS-3.10	In order to maximize agricultural water conservation measures to improve water use efficiency and reduce overall water demand, the County shall establish an ordinance identifying conservation measures that reduce agricultural water demand.
	PS-3.11	In order to maximize urban water conservation measures to improve water use efficiency and reduce overall water demand, the County shall establish an ordinance identifying conservation measures that reduce potable water demand
	PS-3.12	The County shall maximize the use of recycled water as a potable water offset to manage water demands and meet regulatory requirements for wastewater discharge, by employing strategies including, but not limited to, the following: a) Increase the use of treated water where the quality of recycled water is maintained, meets all applicable regulatory standards, is appropriate for the intended use, and re-use will not significantly impact beneficial uses of other water resources. b) Work with the agricultural community to develop new uses for tertiary recycled water and increase the use of tertiary recycled water for irrigation of lands currently being irrigated by groundwater pumping. c) Work with urban water providers to emphasize use of tertiary recycled water for irrigation of parks, playfields, schools, golf courses, and other landscape areas to reduce potable water demand. d) d. Work with urban water providers to convert existing potable water customers to tertiary recycled water as infrastructure and water supply become available.
	PS-3.13	To ensure accuracy and consistency in the evaluation of water supply availability, the Monterey County Health Department, in coordination with the MCWRA, shall develop guidelines and procedures for conducting water supply assessments and determining water availability. Adequate availability and provision of water supply, treatment, and conveyance facilities shall be assured to the satisfaction of the County prior to approval of final subdivision maps or any changes in the General Plan Land Use or Zoning designations.
	PS-3.14	The County will participate in regional coalitions for the purpose of identifying and supporting a variety of new water supply projects, water management programs, and multiple agency agreements that will provide additional domestic water supplies for the Monterey Peninsula and Seaside basin, while continuing to protect the Salinas and Pajaro River groundwater basins from saltwater intrusion. The County will also participate in

Element	Goal / Policy	
		regional groups including representatives of the Pajaro Valley Water Management Agency and the County of Santa Cruz to identify and support a variety of new water supply, water management and multiple agency agreement that will provide additional domestic water supplies for the Pajaro Groundwater Basin. The County's general objective, while recognizing that timeframes will be dependent on the dynamics of each of the regional groups, will be to complete the cooperative planning of these water supply alternatives within five years of the adoption of the General Plan and to implement the selected alternatives within five years after that time.
	PS-3.15	The County will pursue expansion of the Salinas Valley Water Project (SVWP) by investigating expansion of the capacity for the Salinas River water storage and distribution system. This shall also include, but not be limited to, investigations of expanded conjunctive use, use of recycled water for groundwater recharge and seawater intrusion barrier, and changes in operations of the reservoirs. The County's overall objective is to have an expansion planned and in service by the date that the extractions from the Salinas Valley groundwater basin are predicted to reach the levels estimated for 2030 in the EIR for the Salinas Valley Water Project. The County shall review these extraction data trends at five-year intervals. The County shall also assess the degree to which the Salinas Valley Groundwater Basin (Zone 2C) has responded with respect to water supply and the reversal of seawater intrusion based upon the modeling protocol utilized in the Salinas Valley Water Project EIR. If the examination indicates that the growth in extractions predicted for 2030 are likely to be attained within ten years of the date of the review, or the groundwater basin has not responded with respect to water supply and reversal of seawater intrusion as predicted by the model, then the County shall convene and coordinate a working group made up of the Salinas Valley cities, the MCWRA, and other affected entities. The purpose will be to identify new water supply projects, water management programs, and multiple agency agreements that will provide additional domestic water supplies for the Salinas Valley. These may include, but not be limited to, expanded conjunctive use programs, further improvements to the upriver reservoirs, additional pipelines to provide more efficient distribution, and expanded use of recycled water to reinforce the hydraulic barrier against seawater intrusion. The county's objective will be to complete the cooperative planning of these water supply alternatives within five years and to have the projects on-line five years following identification of water supply alternatives.

The Monterey County General Plan does not include population projections; however, the Association of Monterey Bay Area Governments (AMBAG) has developed population projections through 2050, as shown in Table 3-4.

Table 3-4. Monterey County Population Projections
(AMBAG, 2018)

Geography	2015	2020	2025	2030	2035	2040	Change 2015-2040	
							Numeric	Percent
AMBAG Region	**762,676**	**791,600**	**816,900**	**840,100**	**862,200**	**883,300**	**120,624**	**16%**
Monterey County	**432,637**	**448,211**	**462,678**	**476,588**	**489,451**	**501,751**	**69,114**	**16%**
Carmel-By-The-Sea	3,824	3,833	3,843	3,857	3,869	3,876	52	1%
Del Rey Oaks	1,655	1,949	2,268	2,591	2,835	2,987	1,332	80%
Gonzales	8,411	8,827	10,592	13,006	15,942	18,756	10,345	123%
Greenfield	16,947	18,192	19,425	20,424	21,362	22,327	5,380	32%
King City	14,008	14,957	15,574	15,806	15,959	16,063	2,055	15%
Marina	20,496	23,470	26,188	28,515	29,554	30,510	10,014	49%
Marina balance	19,476	20,957	22,205	22,957	23,621	24,202	4,726	24%
CSUMB (portion)	1,020	2,513	3,983	5,558	5,933	6,308	5,288	518%
Monterey	28,576	28,726	29,328	29,881	30,460	30,976	2,400	8%
Monterey balance	24,572	24,722	25,324	25,877	26,456	26,972	2,400	10%
DLI & Naval Postgrad	4,004	4,004	4,004	4,004	4,004	4,004	0	0%
Pacific Grove	15,251	15,349	15,468	15,598	15,808	16,138	887	6%
Salinas	159,486	166,303	170,824	175,442	180,072	184,599	25,113	16%
Sand City	376	544	710	891	1,190	1,494	1,118	297%
Seaside	34,185	34,301	35,242	36,285	37,056	37,802	3,617	11%
Seaside balance	26,799	27,003	27,264	27,632	28,078	28,529	1,730	6%
Fort Ord (portion)	4,450	4,290	4,340	4,490	4,690	4,860	410	9%
CSUMB (portion)	2,936	3,008	3,638	4,163	4,288	4,413	1,477	86%
Soledad	24,809	26,399	27,534	28,285	29,021	29,805	4,996	20%
Soledad balance	16,510	18,100	19,235	19,986	20,722	21,506	4,996	30%
SVSP & CTF	8,299	8,299	8,299	8,299	8,299	8,299	0	0%
Balance Of County	104,613	105,361	105,682	106,007	106,323	106,418	1,805	2%
San Benito County	**56,445**	**62,242**	**66,522**	**69,274**	**72,064**	**74,668**	**18,223**	**32%**
Hollister	36,291	39,862	41,685	43,247	44,747	46,222	9,931	27%
San Juan Bautista	1,846	2,020	2,092	2,148	2,201	2,251	405	22%
Balance Of County	18,308	20,360	22,745	23,879	25,116	26,195	7,887	43%
Santa Cruz County	**273,594**	**281,147**	**287,700**	**294,238**	**300,685**	**306,881**	**33,287**	**12%**
Capitola	10,087	10,194	10,312	10,451	10,622	10,809	722	7%
Santa Cruz	63,830	68,381	72,091	75,571	79,027	82,266	18,436	29%
Santa Cruz balance	46,554	49,331	51,091	52,571	54,027	55,266	8,712	19%
UCSC	17,276	19,050	21,000	23,000	25,000	27,000	9,724	56%
Scotts Valley	12,073	12,145	12,214	12,282	12,348	12,418	345	3%
Watsonville	52,562	53,536	55,187	56,829	58,332	59,743	7,181	14%
Balance Of County	135,042	136,891	137,896	139,105	140,356	141,645	6,603	5%

Sources: Data for 2015 are from the U.S. Census Bureau and California Department of Finance. Forecast years were prepared by AMBAG and PRB.

3.10.2 City of Salinas General Plan

The Land Use and Conservation/Open Space Elements of the City of Salinas General Plan (City of Salinas, 2002) are relevant to water-resources within the 180/400-Foot Aquifer Subbasin, and are summarized in Table 3-5.

Table 3-5. City of Salinas General Plan Summary
(City of Salinas, 2002)

Element	Goal / Policy	
Land Use	Goal LU-6	Work with water suppliers and distributors such as Cal Water and Alco to continue to provide quality water supply and treatment capacity to meet community needs.
	Policy LU-6.1	Actively work with Cal Water and Alco, as well as regional water suppliers and distributors, to ensure that high quality water is available for the community.
	Policy LU-6.2	Review development proposals to ensure that adequate water supplies, treatment, and distribution capacity is available to meet the needs of the development without negatively impacting the existing community,
	Policy LU-6.3	Participate in and support regional programs and projects that target the improvement and conservation of the region’s groundwater and surface water supply.
	Policy LU-6.4	Actively promote water conservation by City residents, businesses, and surrounding agricultural producers.
	Policy LU-6.5	Review projects subject, such as residential projects with 500 or more units, for compliance with Section 10910-10915 of the California Water Code.
Conservation	Goal COS-1	Provide a safe and adequate water supply for community uses.
	Policy COS-1.1	Work with regional and local water providers to ensure that adequate supplies of water are available to meet existing and future demand.
	Policy COS-1.2	Cooperate with local, regional, and state water agencies to develop new water sources.
	Policy COS-1.3	Work with local and regional water providers to increase the production, distribution, and use of recycled water,
	Policy COS-1.4	Maintain and restore natural watersheds to recharge the aquifers and ensure the viability of the ground water resources.
	Policy COS-1.5	Cooperate with the Monterey County Water Resources Agency, the State Water Resources Control Board and the Regional Water Quality Control Board to implement programs that address the two primary causes of poor water quality in the planning area: salt water intrusion and nitrate contamination.
	Policy COS-1.6	Enforce national (NPDES) requirements and participate in regional efforts to protect and enhance water quality.
	Goal COS-2	Encourage the conservation of water resources.
	Policy COS-2.1	Participate in and implement local and regional programs that promote water conservation.
	Policy COS-2.2	Work with water providers to institute conservation programs to address water supply problems caused by groundwater overdrafting,
	Policy COS-2.3	Apply standards that promote water conservation in agricultural, residential and non-residential uses.
	Policy COS-2.4	Enforce the City’s Water Conservation Ordinance.

3.10.3 City of Gonzales General Plan

Relevant elements of the City of Gonzales General Plan are summarized in Table 3-6.

Table 3-6. City of Gonzales General Plan Summary
(City of Gonzales, 2011)

Element	Goal / Policy	
Land Use	LU-1.2.2	New developments must have adequate water supplies.
	LU-8.3.1:	Modify proposed designs for industrial development to reduce adverse environmental impacts, particularly noise, air, and water pollution, odor, soil, and groundwater contamination, traffic, and visual blight to the degree practicable.
	LU-8.3.2	Plan for Sewer and Water Expansion. Ensure that adequate water and sewer capacity is available to support all areas designated for industrial development
Housing	HE-9.2	Promote Water Conservation. Promote the use of water-saving devices, drought-tolerant landscaping, and other water conservation measures to achieve a reduction in home water bills for residential customers
	HE-9.4.1	Water Conservation. The City will continue to promote ways to reduce monthly home water bills. Such measures already include: (a) requiring new houses to utilize low-flow toilets, low-flow shower heads, and low flow faucets consistent with the requirements of the Monterey County Water Resources Agency, and (b) requiring the use of drought-tolerant landscaping within new developments (as specified in the State Model Landscape Ordinance). The City will also support new water retrofitting programs undertaken by the Monterey County Water Resources Agency, such as providing free low-flow plumbing fixtures to existing customers in Gonzales. Responsibility: Building Department, Public Works Department, Planning Department Timing: Ongoing
Community Health and Safety	Community Health and Safety Element, Paragraph H Water Quality	Groundwater and surface water quality both affect the health of Gonzales residents. Because groundwater is the sole source of domestic water in Gonzales, a healthful supply is essential to the city's future. Surface water pollution creates negative aesthetic and environmental impacts, as well as creating potential health hazards locally and downstream. The Community Health and Safety Element includes policies to reduce the extent of water pollution that could occur from urban development in Gonzales, as well as policies to minimize potential risks if contamination does occur. The groundwater beneath Gonzales is vulnerable to contamination from lawn fertilizer, leaking underground storage tanks, failing septic systems, animal waste, and naturally occurring minerals. High nitrate levels are a persistent problem in the Salinas Valley, with about half of the 58 wells sampled exceeding the State water standard over a testing period of about 30 years. Nitrate problems around Gonzales are most prevalent on the northeast side of the Planning Area, where former greenhouse and dairy operations and the existing feed lot are probably the primary contaminant sources. Elsewhere in the Planning Area, groundwater quality is generally acceptable and meets all water quality standards. The Gonzales Public Works Department conducts regular measurements of water quality for city wells and takes corrective actions if nitrate levels exceed acceptable standards. In the past, well water quality problems have been addressed with special seals which block nitrates from entering the water supply. If activities and land uses around the wells are not properly managed in the future, contamination could result. This would require that wells be relocated or that well-head treatment be introduced.

3.10.4 City of Marina General Plan

The City of Marina General Plan (City of Marina, 2010) recognizes that future water demands will require changes in the management of water resources in the area. The City of Marina's 2020 water demand is projected to be 7,720 AF/yr. The General Plan includes the following measures related to water-supply planning.

- New developments must have identified water sources. [General Plan Section 3.45]
- A 15-percent reserve will be maintained between demand and supply. When demand exceeds 85% of the available supply, no new development will be allowed until supplemental water sources are identified. [General Plan Section 3.47].

3.10.5 Well Permitting

The Public Service element of the Monterey County General Plan addresses permitting of individual wells in rural or suburban areas. New residential or commercial lots in rural or suburban areas with limited utility services must be a minimum area of 2.5 acres if a well is the water source. Existing lots (of any size) can use an on-site well if they are outside of a water system service area. Existing lots within an established water system service area can use wells if they are greater than 2.5 acres or have a connection to a public sewage system. Table 3-7 summarizes the Monterey County General Plan's water supply guidelines for new lots (Monterey County, 2010, Table PS-1). Table 3-8 depicts the decision matrix from the Monterey County General Plan for permitting new wells for existing lots (Monterey County, 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 the County (Siskiyou County in this case), as a subdivision of the State, shares responsibility for administering the public trust. 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.

Table 3-7. Monterey County Water Supply Guidelines for New 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 3-8. Monterey County Well Permitting Guidelines for Existing 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

3.10.6 Land Use Plans Outside of Basin

The Cities of Greenfield and Soledad have general plans with land use elements in the adjoining Forebay Aquifer Subbasin. Because Soledad is a member of the SVBGSA, management actions taken by the SVBGSA will be in alignment with the concerns and plans of that city. If a cooperation agreement is reached with the City of Greenfield, management action taken by the SVBGSA should likewise be in alignment with that City's concerns. Therefore, it is unlikely that these two land use plans will affect the ability of the SVBGSA to achieve sustainable groundwater management.

3.10.7 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 general plan led to a settlement agreement that affects water supplies. The settlement agreement requires the County of Monterey to develop a study of a portion of the Basin's water supplies that 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 assumes pumping will be limited to the 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.

The settlement agreement furthermore required the USGS to develop the SVIHM that will be used during implementation of this GSP. The USGS is currently developing and working on the final calibration of this model and is planning to release it in spring 2020.

3.10.8 Effects of GSP Implementation on Water Supply Assumptions

Implementation of this GSP is not anticipated to affect water supply assumptions of relevant land use plans over the planning and implementation horizon. The water charges framework, one of the main implementation measures described in Chapter 9, will promote voluntary pumping reductions and impose a tiered pumping fee structure. 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

4.1 Subbasin Setting

The 180/400-Foot Aquifer Subbasin is at the northern 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 Subbasin slopes at an average grade of approximately 5 feet/mile to the northwest. Elevations in the Subbasin range from approximately 500 feet along the Sierra de Salinas to sea level at Monterey Bay. The colored bands on Figure 4-1 shows the topography of the Subbasin, derived from the USGS Digital Elevation Model (DEM).

4.2 Subbasin Geology

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 basin and vicinity, illustrating both the locations of faults and the geologic formations present at ground surface. This geologic map was adopted from the California Geologic Survey's 2010 statewide geologic map (Jennings, et al., 2010). The locations of cross sections used to define 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.

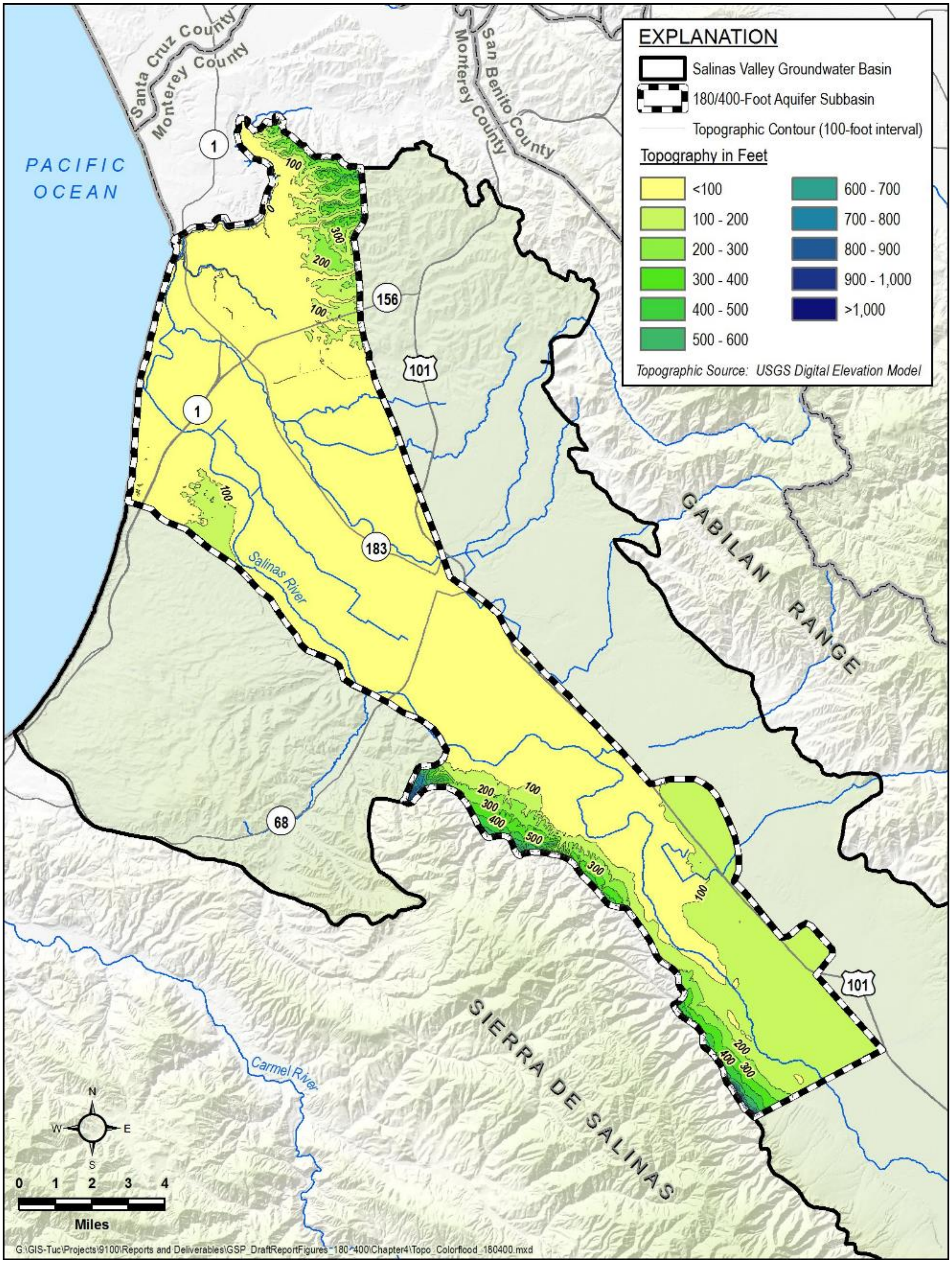


Figure 4-1. Salinas Valley Topography

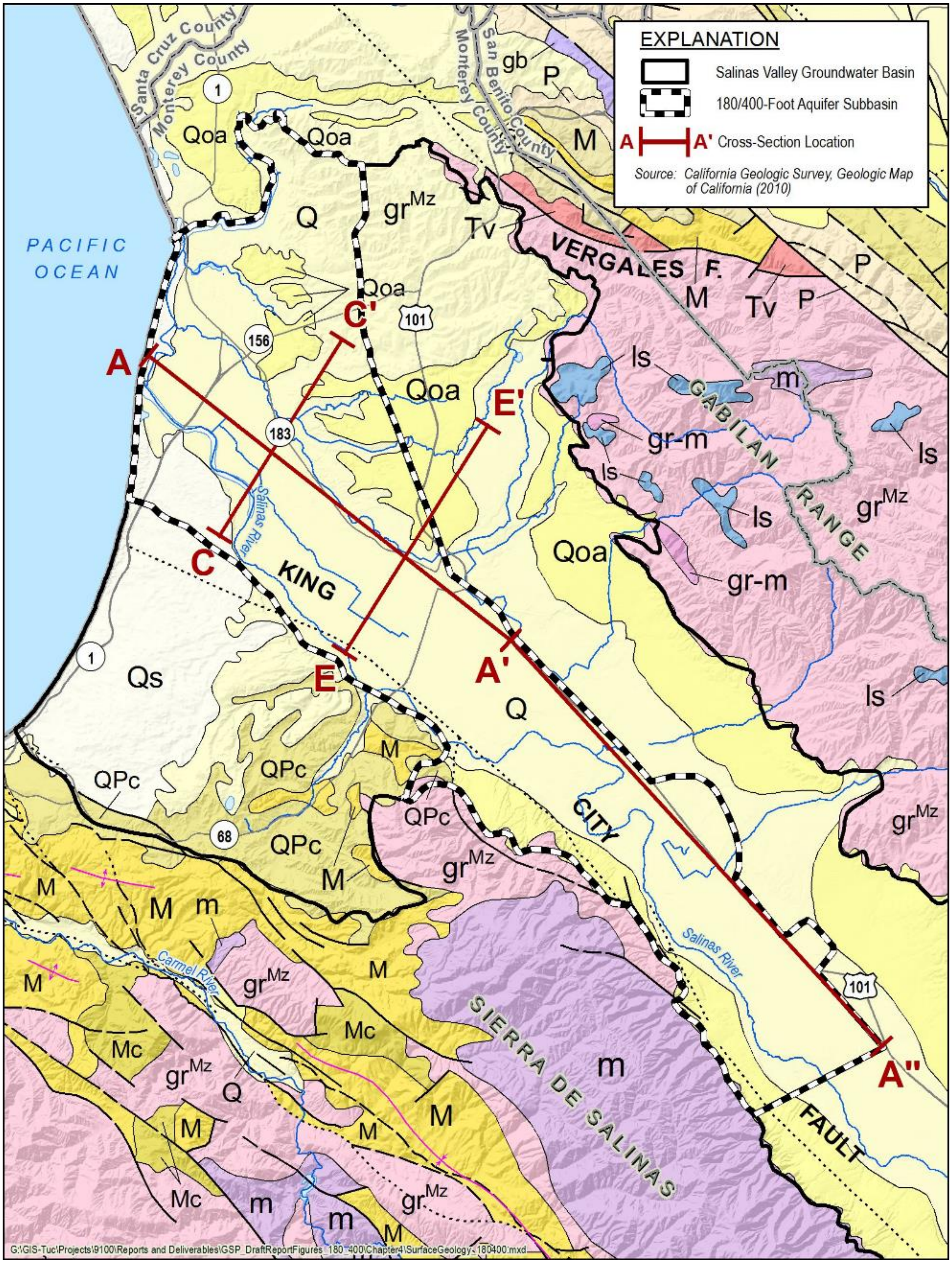


Figure 4-2. Subbasin Geology

FIGURE 4-2. EXPLANATION

QUATERNARY DEPOSITS

Qs	Extensive marine and nonmarine sand deposits, generally near the coast or desert playas
Q	Alluvium, lake, playa, and terrace deposits; unconsolidated and semi-consolidated
Qoa	Older alluvium, lake, playa, and terrace deposits
QPc	Pleistocene and/or Pliocene sandstone, shale, and gravel deposits, mostly loosely consolidated

TERTIARY SEDIMENTARY ROCKS

P	Pliocene marine sandstone, siltstone, shlae, and conglomerate, mostly moderately consolidated
M	Miocene marine sandstone, shale, siltstone, conglomerate, and breccia, moderately to well consolidated
Mc	Miocene nonmarine sandstone, shale, conglomerate, and fanglomerate, moderately to well consolidated
O	Oligocene marine sandstone, shale, and conglomerate, mostly well consolidated

TERTIARY VOLCANIC ROCKS

Tv	Tertiary volcanic flow rocks, minor pyroclastic deposits

MESOZOIC SEDIMENTARY AND METASEDIMENTARY ROCKS

ls	Limestone, dolomite, and marble whose age is uncertain but probably Paleozoic or Mesozoic

MESOZOIC MIXED ROCKS

gr-m	Mesozoic to Precambrian granitic and metamorphic rocks, mostly gneiss and other metamorphic rocks injected by granitic rocks

MESOZOIC PLUTONIC ROCKS

grMz	Mesozoic granite, quartz monzonite, granodiorite, and quartz diorite
gb	Gabbro and dark dioritic rocks, chiefly Mesozoic

PALEOZOIC MIXED ROCKS

m	Undivided pre-Cenozoic metasedimentary and metavolcanic rocks of great variety. Mostly slate, quartzite, hornfels, chert, phyllite, mylonite, schist gneiss, and minor marble

GEOLOGIC SYMBOLS

- fault, certain
- fault, approx. located
- fault, concealed
- normal fault, approx. located
- dextral fault, certain
- Plunging anticline, certain
- Syncline, certain

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 from youngest to oldest. The corresponding designation on Figure 4-2 is provided in parenthesis.

- *Alluvium (Qa)* – This Holocene unit predominately consists of unconsolidated layers of mixed sand, gravel, silt, and clay that were deposited in a fluvial environment by the Salinas River and its tributaries. In this Subbasin, this unit also includes extensive, laterally continuous clay layers that were deposited in a shallow marine to brackish-water estuarine environment during periods when sea level rise caused submergence of the northern portion of the basin (Durham, 1974). The estuarine clay deposits extend throughout most of the Subbasin and the hydrogeologic impact of these extensive clays is one of the defining characteristics of this Subbasin. This unit covers nearly the entire valley floor. The thickness is not well established because the Alluvium is difficult to distinguish from underlying units, but it is likely 100 to 300 feet thick along the axis of the valley (Durham, 1974).

  In some reports, the Alluvium is limited to the shallowest deposits overlying the first estuarine clay layer, and the remaining thickness of Alluvium is combined with the underlying Older Alluvium to form a unit called Valley Fill Deposits (e.g., Harding ESE 2001; Kennedy-Jenks, 2004). These alternative geologic descriptions have not been adopted in this GSP, and do not have a bearing on the identification of principal aquifers in this conceptual model.

- *Older Alluvium (Qoa)* – This Pleistocene unit comprises alternating, interconnected beds of fine-grained and coarse-grained deposits, predominately associated with alluvial fan depositional environments. The Older Alluvium underlies the Alluvium throughout the Subbasin but is not exposed at the ground surface. The alluvial fan deposits have an estimated maximum saturated thickness of 500 feet (Durham, 1974).

- *Aromas Sand (QPc)* – This Pleistocene unit is composed of cross-bedded sands containing some clayey layers (Harding ESE, 2001). This unit was deposited in a combination of eolian, high-energy alluvial, alluvial fan, and shoreline environments (Harding ESE, 2001; Greene, 1970; Dupre, 1990). The Aromas Sand Formation likely extends into the northern portion of the 180-400 Foot Aquifer Subbasin (MCWRA, 2017b).

- *Paso Robles Formation (Tc)* – 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 individual 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. The Paso Robles Formation underlies the entire Subbasin but is rarely exposed at the surface. Through most of the Subbasin, this is the deepest unit and the underlying marine deposits typically do not yield high rates of fresh water.

- *Purisima Formation (P)* – 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 is ranges from 500 to 1,000 feet in thickness (WRIME, 2003). It underlies most of the Subbasin.

- *Santa Margarita Sandstone and Monterey Formation (M)* – Two Miocene units generally underlie the Subbasin. The Santa Margarita Formation is a friable arkosic sandstone. The Monterey Formation is a shale or mudstone deposited in a shallow marine environment (Harding ESE, 2001; Greene, 1977). In some areas, the Santa Margarita Sandstone directly underlies the Paso Robles Formation where the Purisima Formation is absent (Greene, 1977).

4.2.2 Structural Restrictions to Flow

There are no known structural features such as faults or anticlines that restrict groundwater flow in the 180/400-Foot Aquifer Subbasin.

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 were classified into four groups (Carpenter and Cosby 1925): residual soils, old valley-filling soils, young valley-filling soils, and recent-alluvial soils. In addition, five classes of miscellaneous soils were mapped that included tidal marsh, peat, coastal beach, and dune sands.

More recent surveys classify the soils into categories based on detailed soil taxonomy (U.S. Department of Agriculture, 2019). 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 four soil orders: mollisols, entisols, vertisols, and alfisols.

- Mollisols are the most widespread soil order in the Salinas Valley Groundwater Basin. 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. Mollisols can have any moisture regime, but enough available moisture to support perennial grasses is typical.

- Entisols are the predominant soil 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. Nearly all the soils along active river corridor are entisols.

- Vertisols are present over large areas on the valley lowlands in the central and northern Salinas Valley Groundwater Basin. 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 trend to have water pooling on the surface due to the high clay content.

- Alfisols are present along portions of the margin of the management area. 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.

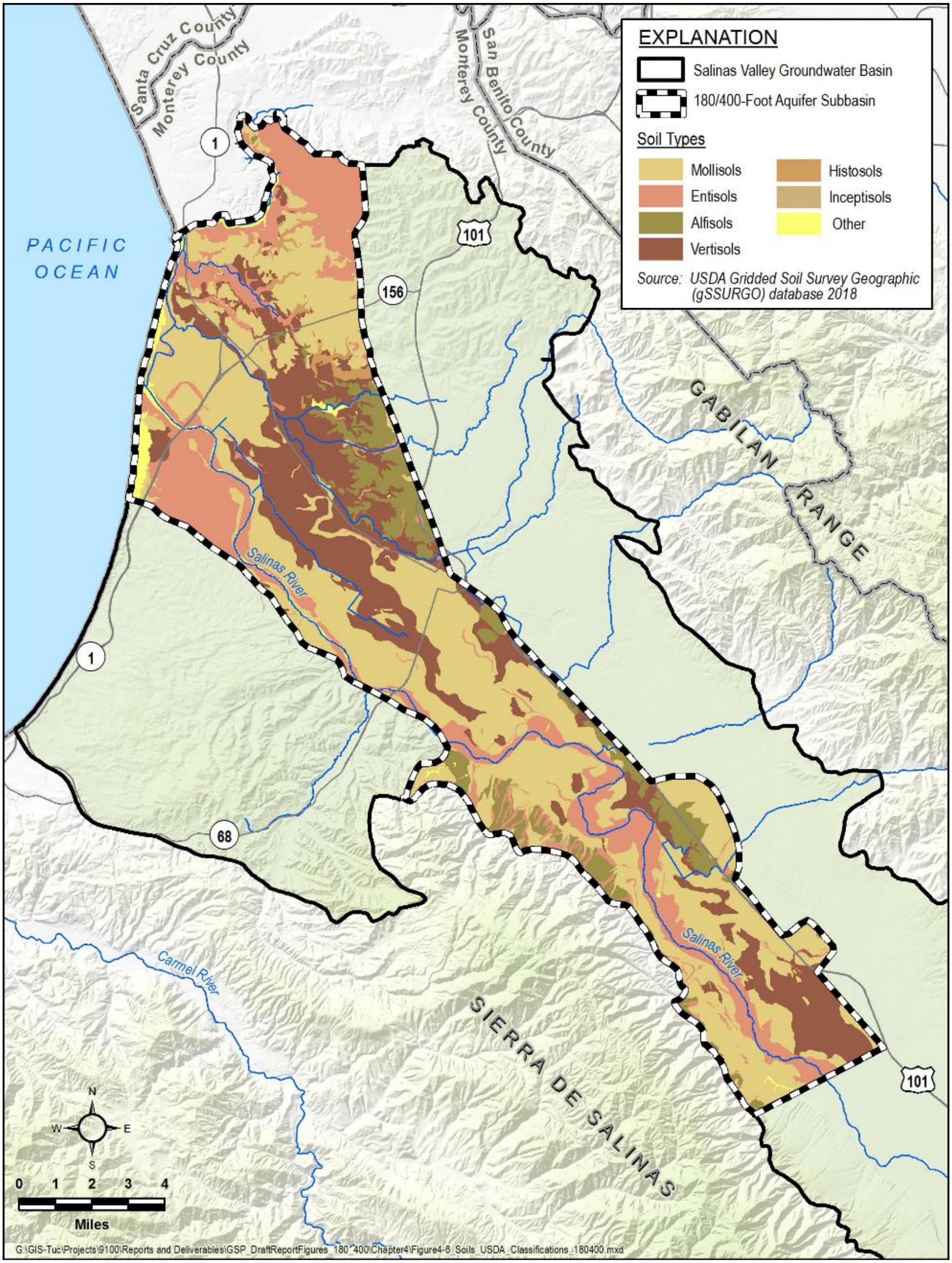


Figure 4-3. Composite Soils Map

4.3 Subbasin Extent

The 180/400-Foot Aquifer Subbasin extents are defined by the California Department of Water Resources (DWR) and are documented in Bulletin 118, (DWR, 2003; DWR, 2016a). Figure 1-1 illustrates the extent of the Subbasin.

4.1.1 Lateral Subbasin Boundaries

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

4.3.1.1 Boundaries with Adjacent Subbasins

The 180/400-Foot Aquifer Subbasin abuts four other subbasins of the Salinas Valley Groundwater Basin.

- **The Forebay Subbasin**. The southeastern boundary with the adjacent Forebay Subbasin is approximately located near the southern limit of the regional clay layers that are characteristic of the 180/400-Foot Aquifer Subbasin. Previous studies of groundwater flow across this boundary indicate there is is reasonable hydraulic connectivity with the Forebay Subbasin, although the principal aquifers change from relatively unconfined to confined near this boundary.
- **The Eastside Subbasin**. The northeastern 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 Subbasin.** The boundary with the Langley Subbasin is based on a topographic change from the valley floor to an elevated foothill area. This boundary generally coincides with the northeastern limit of confining conditions in the 180/400-Foot Aquifer Subbasin. Although the Langley Subbasin is not on the valley floor, there are no reported hydraulic barriers separating these two subbasins.
- **The Monterey Subbasin**. The 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 act as a groundwater flow barrier between subbasins beneath a cover of Holocene sand dunes (Durbin, et al*.,* 1978). Although a groundwater divide is commonly found

near the Subbasin boundary, there is potential for groundwater flow between these two subbasins.

4.3.1.2 Physical Basin Boundaries

Physical basin boundaries surrounding the 180/400-Foot Aquifer Subbasin include:

- **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.

4.1.2 Vertical Subbasin Boundaries

Investigators have estimated the sedimentary sequence in the Salinas Valley Groundwater Basin to be between 10,000 to 15,000 feet thick. However, productive fresh water principal aquifers occur only at shallower depths, with the effective thickness of the groundwater Subbasin being approximately 1,500 feet. With increasing depth, two factors limit the viability of the sediments as productive, principal aquifers:

1. Deeper strata show increased consolidation and cementation of the sediments, which decreases aquifer yields; and
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 base to the Subbasin. The SVBGSA has adopted the base of the aquifer defined by the USGS (Durbin, et al., 1978) and extrapolated that surface to the edges of the Subbasin. Figure 4-4 shows a map of elevation contours of the base of the Subbasin. Figure 4-5 shows a contour map of depth to base of the Subbasin based on the base elevation and ground surface elevation.

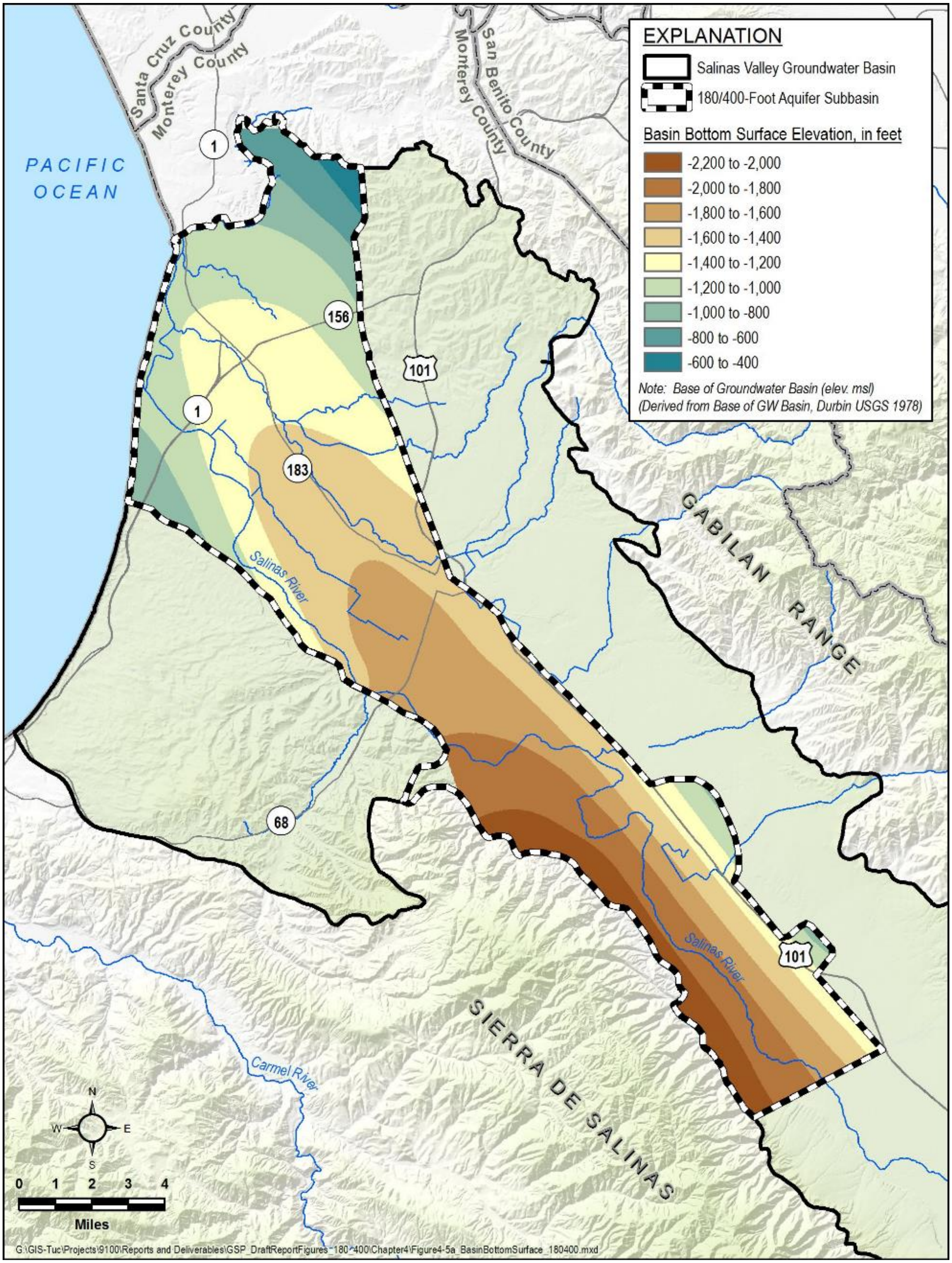


Figure 4-4. Elevation of the Base of the 180/400-Foot Aquifer Subbasin

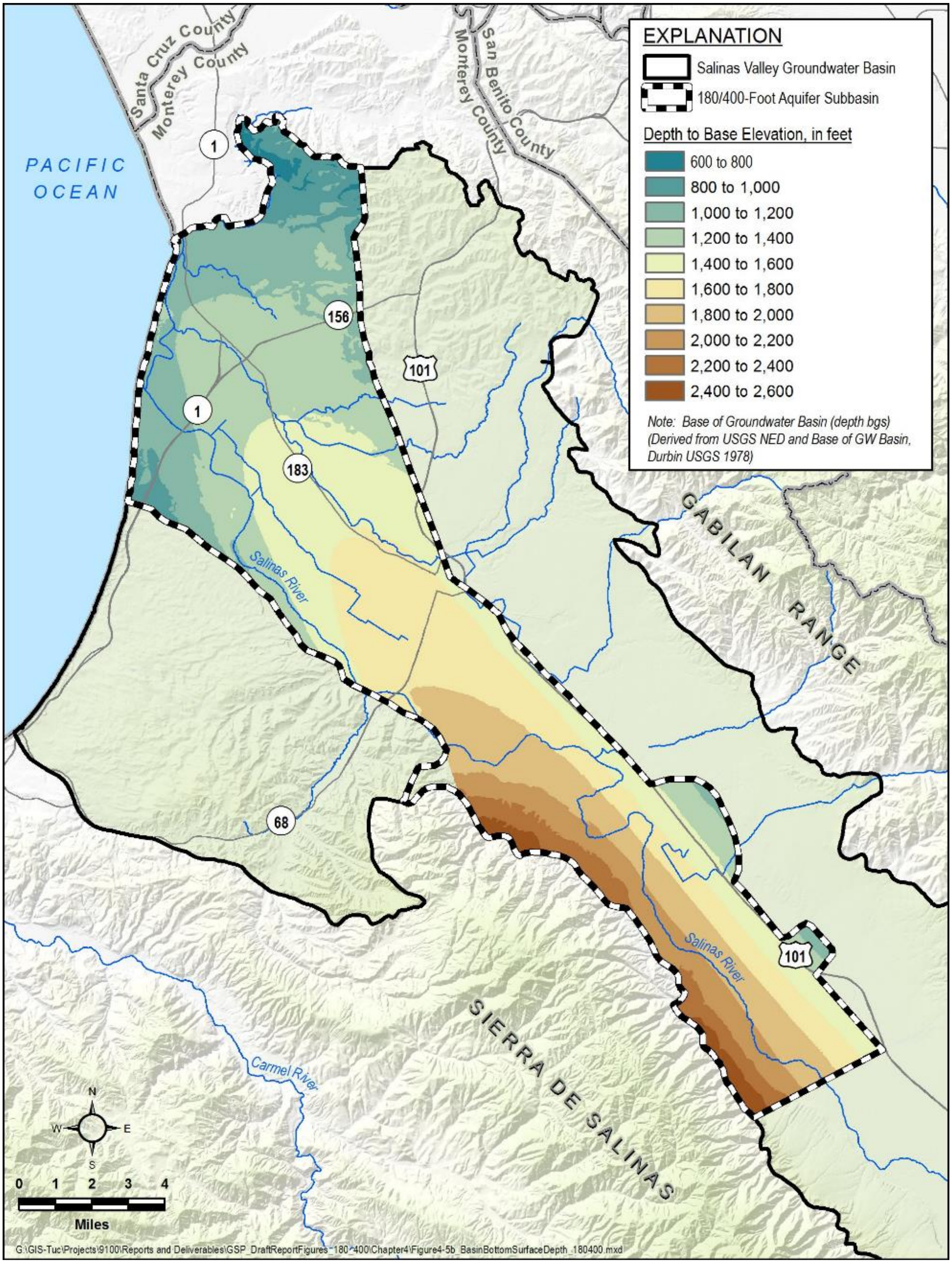


Figure 4-5. Depth Below Ground Surface of the Base of the 180/400-Foot Aquifer Subbasin

4.4 Subbasin Hydrogeology

Groundwater in the 180/400-Foot Aquifer Subbasin is primarily produced from alluvial deposits belonging to three geologic units: the Holocene Alluvium, the Quaternary Older Alluvium, and the Pliocene Paso Robles Formation described above. Although these three 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. The principal aquifers and aquitards have been historically identified and recognized based not on geologic characteristics, but rather on their depth, influence on groundwater production, groundwater elevations, and groundwater quality.

Groundwater can be found in most of the sedimentary units described above. However, not all groundwater is part of a principal aquifer, which is defined in SGMA 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 of the groundwater encountered is a part of the overall groundwater system, but the focus of this GSP is on the principal 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). Three cross-sections parallel and perpendicular to the long axis of the Subbasin are shown on Figure 4-6, Figure 4-7, and Figure 4-8. The cross-section on Figure 4-6 is adopted from the *State of the Salinas River Groundwater Basin* report (Brown and Caldwell, 2015). The cross-sections on Figure 4-7 and Figure 4-8 are adapted from the *Final report, hydrostratigraphic analysis of the Northern Salinas Valley* (Kennedy-Jenks, 2004). The locations of these cross-sections are depicted on Figure 4-2. The hydrogeologic cross-sections are based on geologic logs provided in California Department of Water Resources Water Well Drillers Reports filed by the well drillers. Geologic log descriptions were grouped into generalized sedimentary groups:

- Fine-grained sediments (e.g., clay, silt, sandy clay, and gravelly clay) are shown as aquitards;
- Coarse-grained sediments (e.g., sand, gravel, and sand-gravel mixtures) are shown as aquifers; and
- 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 (Kennedy-Jenks, 2004).

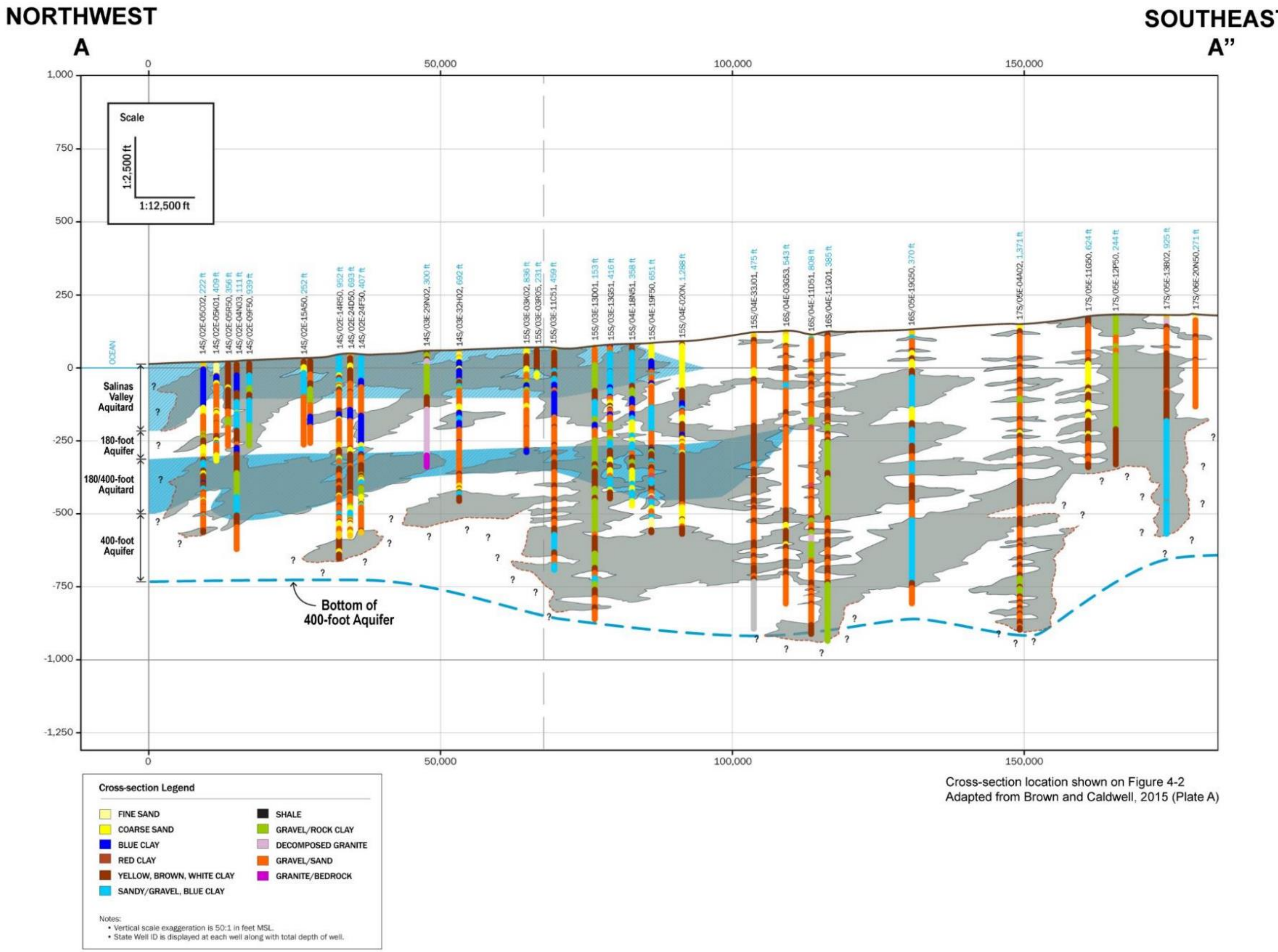


Figure 4-6. Cross-Section A-A’

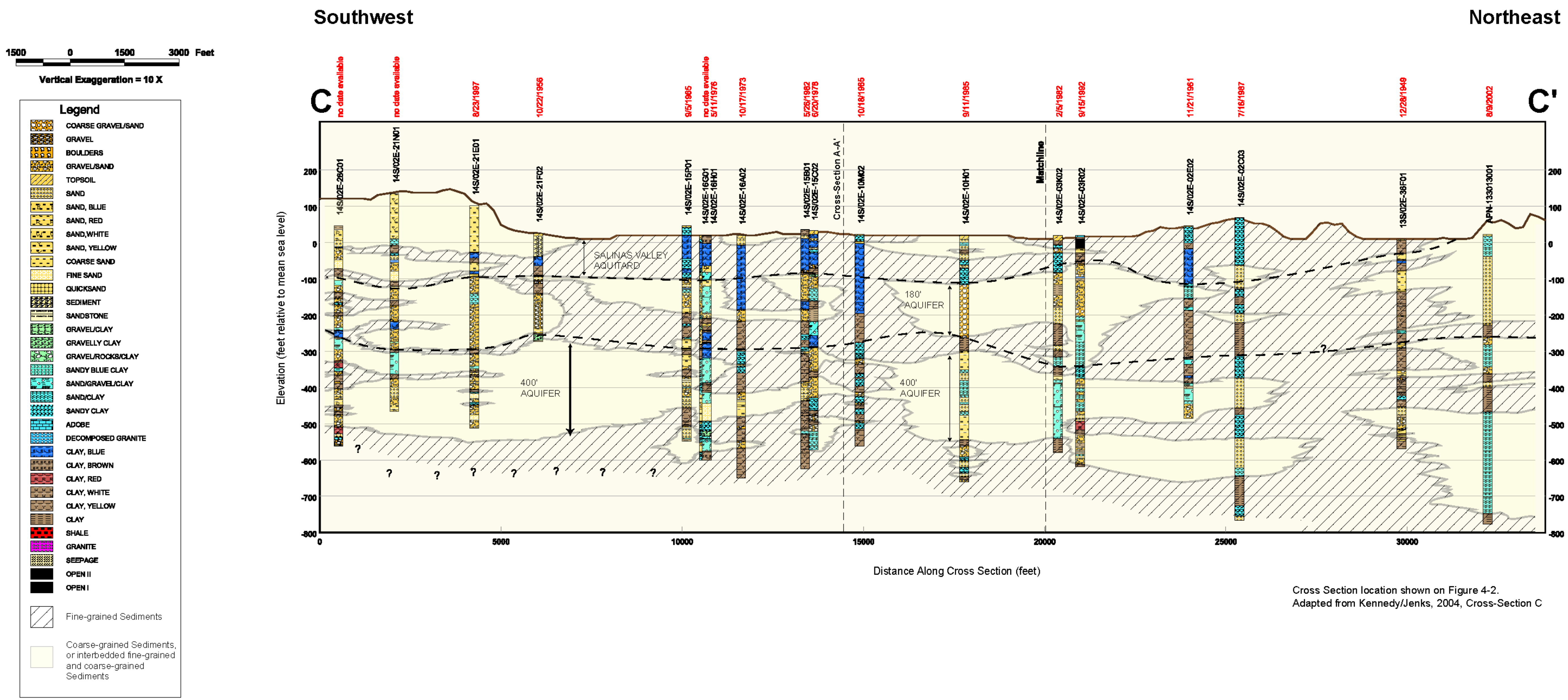


Figure 4-7. Cross-Section C-C'

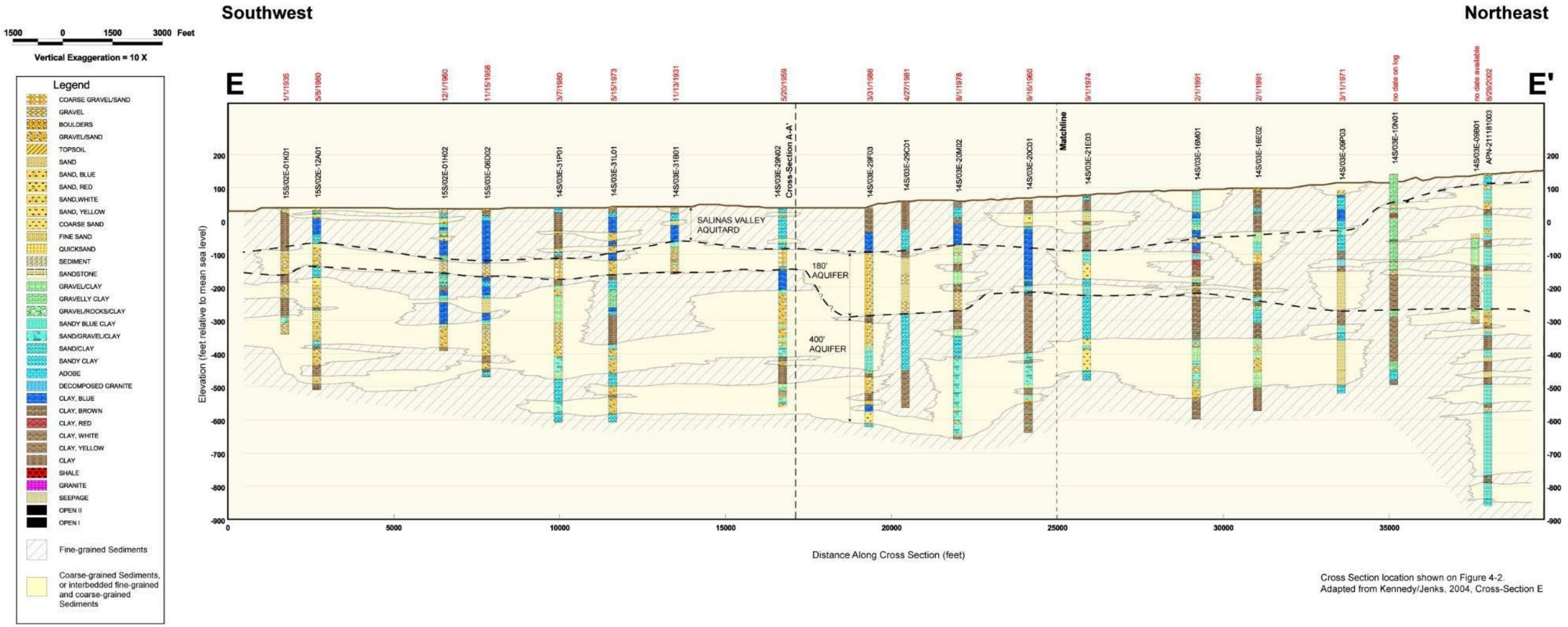


Figure 4-8. Cross-Section E-E'

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 less than 100 feet thick 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 seidments, 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.

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). The Salinas Valley Aquitard is generally encountered at depths of less than 150 feet. Close to Monterey Bay, the Salinas Valley Aquitard is over 100 feet thick but thins to 25 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.

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 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 180-Foot Aquifer are for domestic, irrigation, and municipal water supply.

4.4.1.5 400-Foot/Deep Aquitard and Deep Aquifers

The base of the 400-Foot Aquifer is the 400-Foot/Deep Aquitard. The 400-Foot/Deep Aquitard is a blue marine clay layer. This aquitard can be several hundred feet thick (Kennedy-Jenks, 2004).

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. 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.

4.4.2 Aquifer Properties

The magnitude and distribution of hydrogeologic properties of the principal aquifers in the Subbasin have not been well characterized or documented. The relatively sparse amount of measured aquifer properties from the Subbasin's principal aquifers is a data gap that will be addressed during implementation of this 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 model calibration. Aquifer property calibration has been completed for numerous published modeling studies including studies by Durbin (1974); Yates (1988); WRIME (2003); and the unpublished SVIHM developed by USGS.

There are two 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 water elevation measured in the aquifer, and
- **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 water elevation and volume of water in storage are specific yield for unconfined aquifers, and specific storage for confined aquifers. Storativity is equal to specific storage times aquifer thickness. 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 percent.

- Specific yield 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 the Subbasin range from 6% to 16%.
- Specific storage is the amount of water derived from a cubic foot of confined aquifer due to the pressure changes in the aquifer. Often specific storage values are 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 for each aquifer were not available at the time of this GSP 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 measured in units of feet per day. Units with higher hydraulic conductivities, such as sands and gravels, transmit groundwater more easily than units with lower hydraulic conductivities. Transmissivity is equivalent to the hydraulic conductivity of an aquifer times the thickness of an aquifer. Unfortunately, very few estimates of 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 Natural Recharge Areas

Areas of significant, natural, areal recharge and discharge within the Subbasin are discussed below. Quantitative information about all natural and anthropogenic recharge and discharge is provided in Chapter 6. Natural recharge to the overall groundwater system, which includes both the shallow sediments and principal aquifers, occurs through the following processes:

- Infiltration of surface water from the Salinas River and tributary channels
- Deep percolation of excess applied irrigation water
- Deep percolation of infiltrating precipitation

The capacity for recharge to the groundwater system is a dependent on a combination of factors, including steepness of grade, surface condition 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 UC 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 4-9 presents the SAGBI index map for the Subbasin. This map ranks soil suitability to accommodate recharge to the groundwater system based on five major factors that affect recharge potential including: deep percolation, root zone residence time, topography, chemical limitations, and soil surface condition. Areas with excellent surficial recharge properties are shown in green. Areas with poor surficial recharge properties are shown in red. Not all land is classified, but this map provides good guidance on where natural recharge to the groundwater system likely occurs.

Although Figure 4-9 shows some 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.

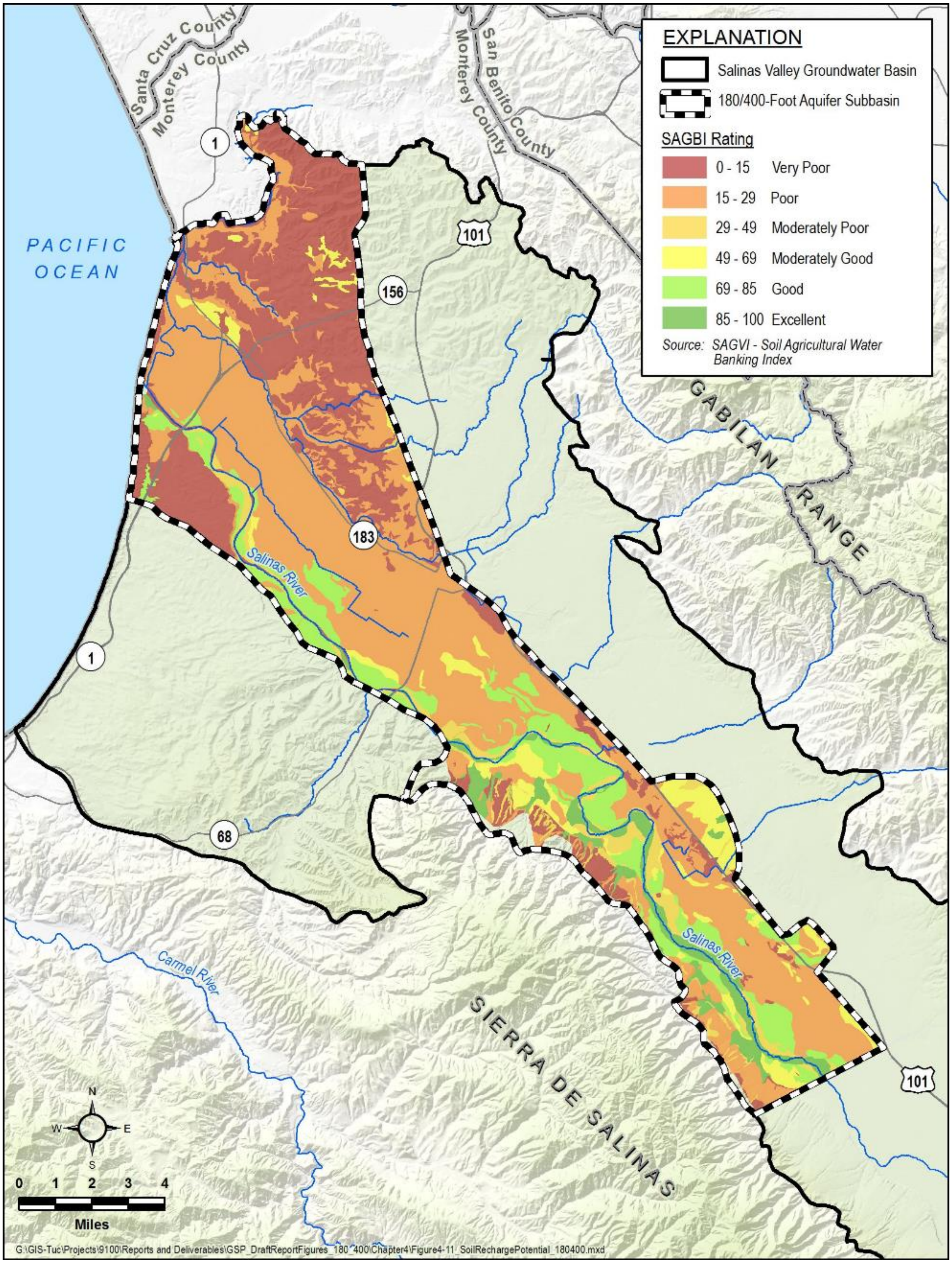


Figure 4-9. SAGBI Soils Map for Areas of Good Potential Recharge in the 180/400-Foot Aquifer Subbasin

4.4.4 Natural Discharge Areas

Natural groundwater discharge areas within the Subbasin include groundwater discharge to surface water bodies, and evapotranspiration (ET) by phreatophytes. 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. Areas of potential groundwater discharge to streams will be identified using the SVIHM, which will be available in 2020. Therefore, identifying all natural discharge areas is a data gap that will be resolved in a future GSP update.

Figure 4-10 shows the distribution of potential groundwater-dependent ecosystems (GDEs), also referred to as Natural Communities Commonly Associated with Groundwater (NCCAG), within the Subbasin area. In areas where the water table is sufficiently high, groundwater discharge may occur as ET from phreatophyte vegetation within these potential GDEs. Potential GDEs were identified based on the methodology proposed by The Nature Conservancy (TNC). Appendix 4A describes methods used to determine the extent and type of potential GDEs. Figure 4-10 shows only potential GDEs. There has been no verification that the locations shown on this map constitute verified groundwater dependent ecosystems. Additional field reconnaissance is necessary to verify the existence of these potential GDEs.

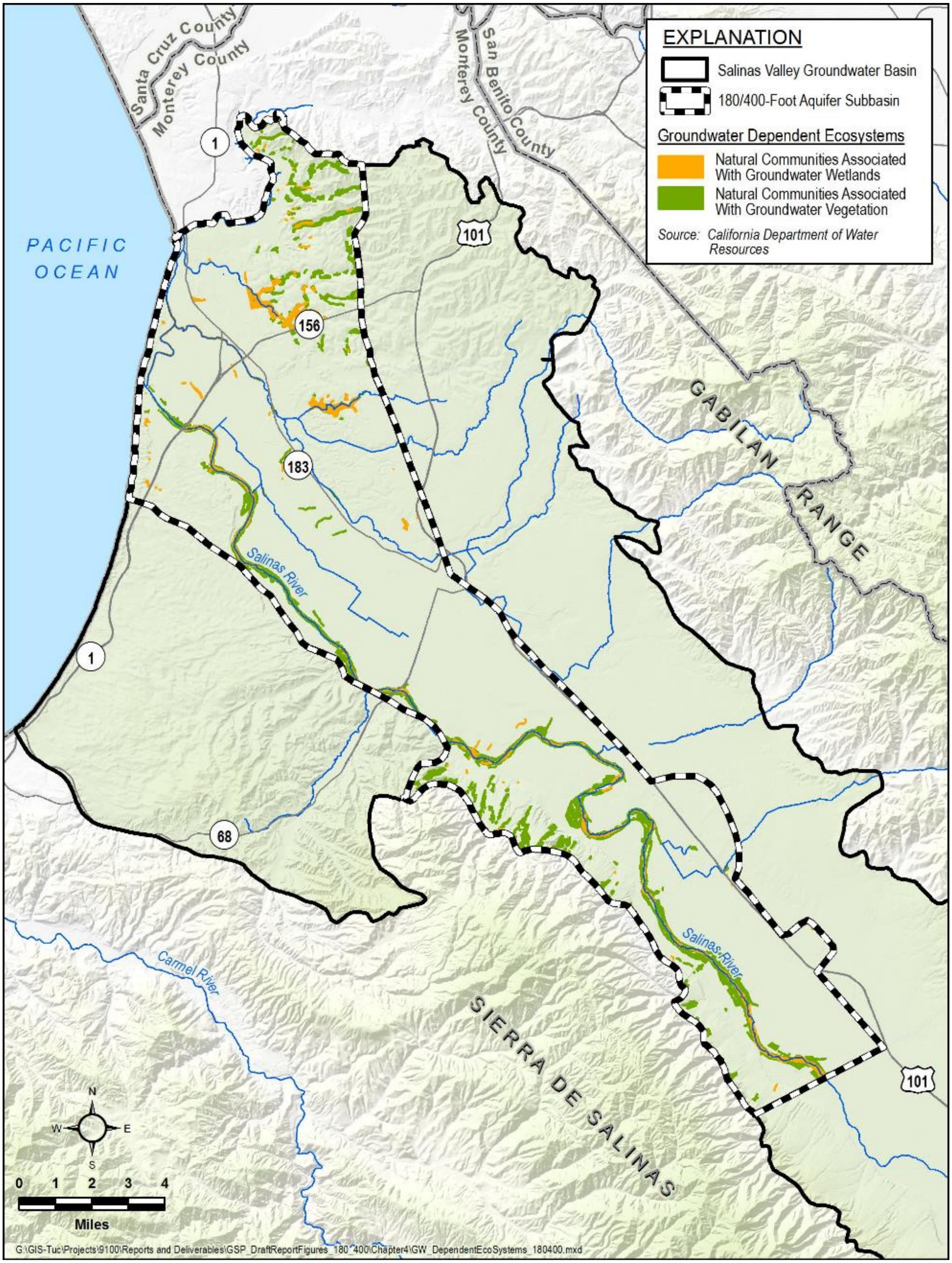


Figure 4-10. Potential Groundwater Dependent Ecosystems

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 4-11). The following surface water bodies are located outside of the Subbasin but are important controls on the rate and timing of Salinas River flows in the Subbasin:

- Two reservoirs constructed to control flooding and to increase recharge from Salinas River to groundwater including:
  - Lake Nacimiento, in San Luis Obispo County, was constructed in 1957 and has a storage capacity of 377,900 AF (MCWRA, 2015b).
  - Lake San Antonio, in Monterey County, was constructed in 1967 and has a storage capacity of 335,000 AF.
- 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 4-11. 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.

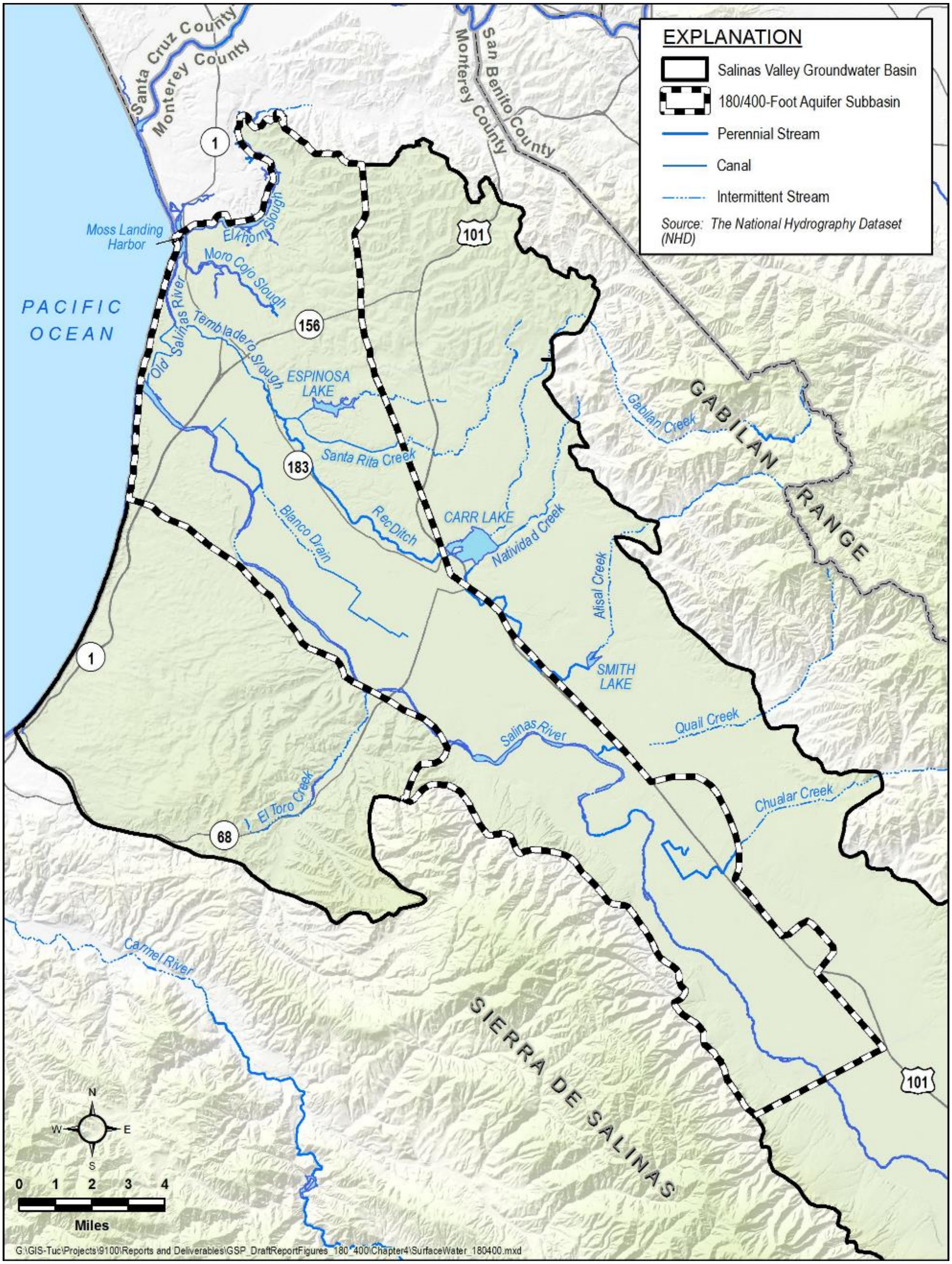


Figure 4-11. Surface Water Bodies in the 180/400-Foot Aquifer Subbasin

4.1.3 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

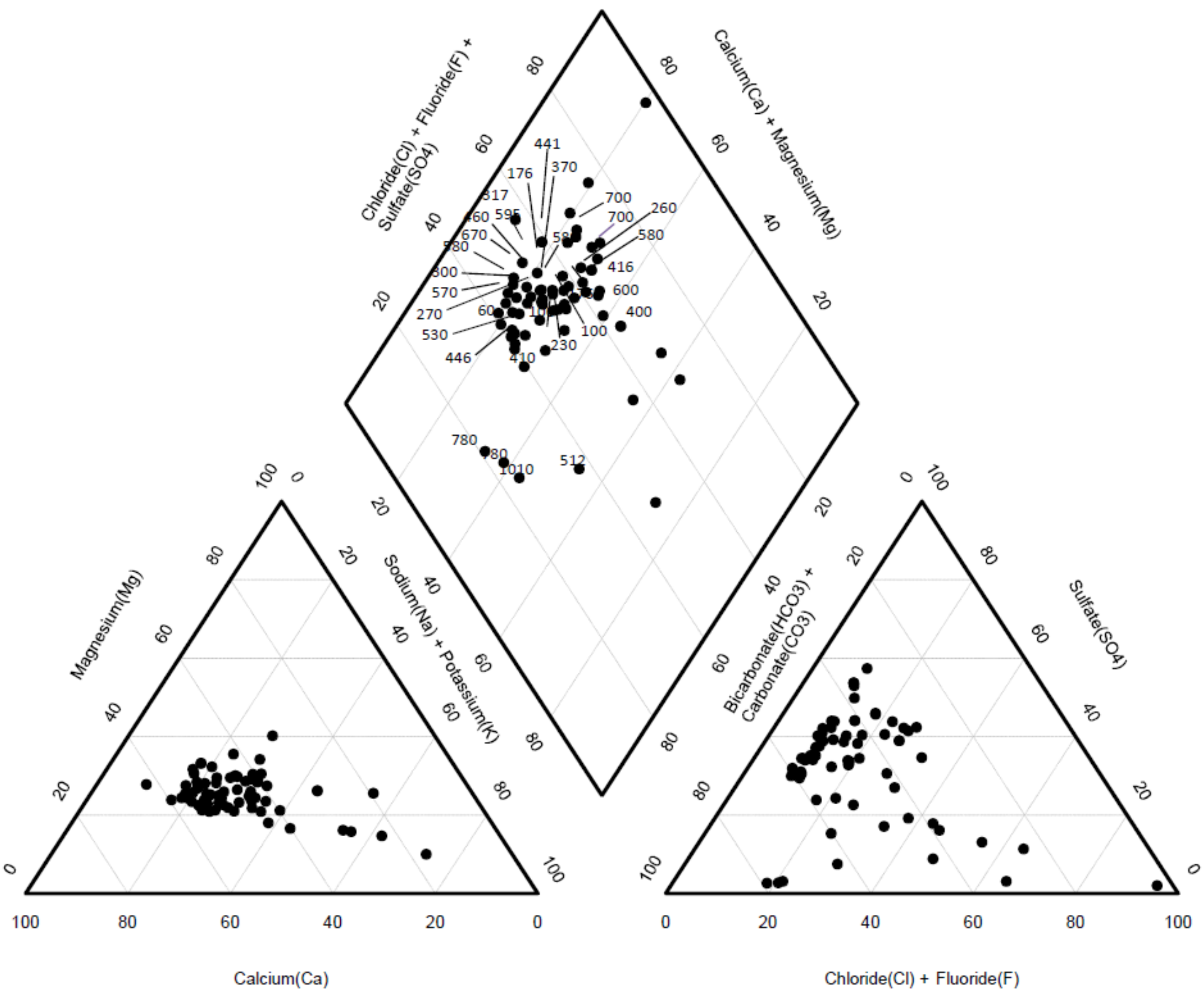
This section presents a general discussion of the natural groundwater quality in the Subbasin, focusing on general minerals. This discussion is based on data from previous reports. The distribution and concentrations of specific constituents of concern is presented in Chapter 5.

4.6.1 General Mineral Chemistry

The major ion chemistry of the Salinas Valley Groundwater Basin's groundwater was characterized in a report prepared for the CCGC titled *Distribution of groundwater nitrate concentrations, Salinas Valley, California* (HydroFocus, 2014). The purpose of the report was to respond to the Regional Board 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 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 4-12 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 4-12 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 4-12. Piper Diagram of Groundwater General Mineral Chemistry for the 180/400-Foot Aquifer Subbasin

4.6.2 Seawater intrusion

Groundwater pumping has lowered groundwater elevations to an 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

Due to decades of extensive study and groundwater development, the structure and boundaries of the hydrogeologic conceptual model in the 180/400-Foot Aquifer Subbasin is relatively well developed. However, there are notable data gaps including:

- There are very few measurements of aquifer properties such as hydraulic conductivity and specific yield in the Subbasin.
- 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 will include ongoing data collection and monitoring that will allow continued refinement and quantification of the groundwater system. Chapter 10 includes activities to address the identified data gaps and improve the hydrogeologic conceptual model.