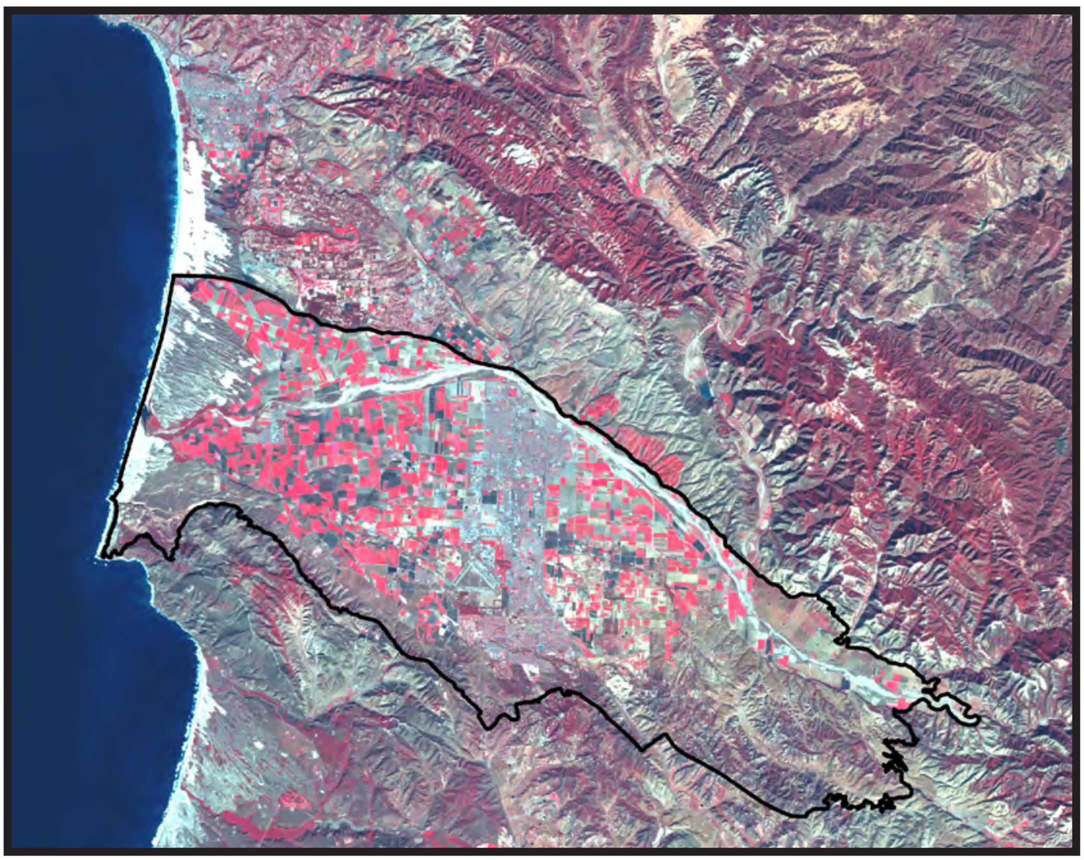
2013 Annual Report of Hydrogeologic Conditions, Water Requirements, Supplies and Disposition

Santa Maria Valley Management Area



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April, 2014

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Acronyms and Abbreviations

af, afy, af/ac	acre-feet, acre-feet per year, acre-feet/acre
AW	applied water
CCAMP	Central Coast Ambient Monitoring Program
CCRWQCB	Central Coast Regional Water Quality Control Board
CCWA	Central Coast Water Authority
CIMIS	California Irrigation Management Information System
DU	Distribution Uniformity
DWR	California Department of Water Resources
ET	evapotranspiration
ET_{aw}, ET_c, ET_o	ET of applied water, ET of the crop, Reference ET
Fm.	formation
GIS	Geographic Information System
GSWC	Golden State Water Company
K_c	crop coefficient
LSCE	Luhdorff & Scalmanini, Consulting Engineers
mg/l	milligrams per liter
MOU	Memorandum of Understanding
Nipomo CSD	Nipomo Community Services District
NMMA (TG)	Nipomo Mesa Management Area (Technical Group)
NO3-NO3	nitrate-as-nitrate
NOAA	National Oceanic and Atmospheric Administration
P_E	effective precipitation
SBCWA	Santa Barbara County Water Agency
SCWC	Southern California Water Company
SLODPW	San Luis Obispo County Department of Public Works
SMVMA	Santa Maria Valley Management Area
SMVWCD	Santa Maria Valley Water Conservation District
SNMP	Salt and Nutrient Management Plan
SWP	State Water Project
SWRCB	State Water Resources Control Board
TMA	Twitchell Management Authority
TMDL	Total Maximum Daily Load
UCCE	University of California Cooperative Extension
USGS	United States Geological Survey
umho/cm	micromhos per centimeter
WWTP	waste water treatment plant

1. Introduction

This sixth annual report of conditions in the Santa Maria Valley Management Area, for calendar year 2013, has been prepared to meet the reporting conditions of the June 30, 2005, Stipulation entered by the Superior Court of the State of California, County of Santa Clara in the Santa Maria Valley Groundwater Basin litigation. The Stipulation divided the overall Santa Maria Valley Groundwater Basin into three management areas, the largest of which overlies the main Santa Maria Valley (the Santa Maria Valley Management Area, or SMVMA) and is the subject of this report. The other two management areas, the Nipomo Mesa Management Area (NMMA) and the Northern Cities Management Area, are addressed in separate annual reports prepared by others.

The Stipulation, approved and implemented in 2008, specifies that monitoring shall be sufficient to determine groundwater conditions, land and water uses, sources of water supply, and the disposition of all water supplies in the Basin. Annual Reports for the SMVMA are to summarize the results of the monitoring and include an analysis of the relationship between projected water demand and supply. The Stipulation was preserved in the California Court of Appeal (Sixth Appellate District) decision of November 21, 2012, including the Physical Solution criteria for monitoring and managing groundwater in the basin.

In accordance with the Stipulation, this report on the SMVMA provides a description of the physical setting and briefly describes previous studies conducted in the groundwater basin, including the long-term monitoring program developed for the SMVMA. As reported herein, the Twitchell Management Authority (TMA) commissioned the preparation of a monitoring program for the SMVMA in 2008, and its complete implementation is expected to provide the data with which to fully assess future conditions. This report describes hydrogeologic conditions in the management area historically and through 2013, including groundwater conditions, Twitchell Reservoir operations, and hydrologic and climatic conditions. As with all previous annual reports (2008 through 2012), the water requirements and supplies for agricultural and municipal uses are accounted, as are the components of water disposition in the SMVMA. Discussion is included with regard to any finding of severe water shortage, which is concluded to not be the case through 2013. Finally, findings and recommendations are drawn with regard to further implementation of monitoring and other considerations that will serve as input to future annual reporting.

1.1 Physical Setting

The Santa Maria Valley Management Area (SMVMA) includes approximately 175 square miles of the Santa Maria Valley Groundwater Basin in northern Santa Barbara and southern San Luis Obispo Counties, as shown by the location map of the area (Figure 1.1-1). The SMVMA encompasses the contiguous area of the Santa Maria Valley, Sisquoc plain, and Orcutt upland, and is primarily comprised of agricultural land and areas of native vegetation, as well as the urban areas of Santa Maria, Guadalupe, Orcutt, Sisquoc, and several small developments. Surrounding the SMVMA are the Casmalia and Solomon Hills to the south, the San Rafael Mountains to the southeast, the Sierra Madre Mountains to the east and northeast, the Nipomo

Mesa to the north, and the Pacific Ocean to the west. The main stream is the Santa Maria River, which generally flanks the northern part of the Santa Maria Valley; other streams include portions of the Cuyama River, Sisquoc River and tributaries, and Orcutt Creek.

1.2 Previous Studies

The first overall study of hydrogeologic conditions in the Santa Maria Valley described the general geology, as well as groundwater levels and quality, agricultural water requirements, and groundwater and surface water supplies as of 1930 (Lippincott, J.B., 1931). A subsequent comprehensive study of the geology and hydrology of the Valley also provided estimates of annual groundwater pumpage and return flows for 1929 through 1944 (USGS, Worts, G.F., 1951). A followup study provided estimates of the change in groundwater storage during periods prior to 1959 (USGS, Miller, G.A., and Evenson, R.E., 1966).

Several additional studies have been conducted to describe the hydrogeology and groundwater quality of the Valley (USGS, Hughes, J.L., 1977; California CCRWQCB, 1995) and coastal portion of the basin (California DWR, 1970), as well as overall water resources of the Valley (Toups Corp., 1976; SBCWA, 1994 and 1996). Of note are numerous land use surveys (California DWR, 1959, 1968, 1977, 1985, and 1995) and investigations of crop water use (California DWR, 1933, and 1975: Univ. of California Cooperative Extension, 1994; Hanson, B., and Bendixen, W., 2004) that have been used in the estimation of agricultural water requirements in the Valley. Recent investigation of the Santa Maria groundwater basin provided an assessment of hydrogeologic conditions, water requirements, and water supplies through 1997 and an evaluation of basin yield (LSCE, 2000).

1.3 SMVMA Monitoring Program

In accordance with the Stipulation, a monitoring program was initially prepared in 2008 to provide the fundamental data for ongoing annual assessments of groundwater conditions, water requirements, water supplies, and water disposition in the SMVMA (LSCE, 2008). As a basis for designing the monitoring program, historical data on the geology and water resources of the SMVMA were compiled to define aquifer depth zones, specifically a shallow unconfined zone and a deep semi-confined to confined zone, into which a majority of monitored wells were classified based on well depth and completion information. Assessment of the spatial distribution of the wells throughout the SMVMA, as well as their vertical distribution within the aquifer system, provided the basis for designation of two well networks, one each for the shallow and deep aquifer zones. All network wells are to be monitored for groundwater levels, with a subset of those wells to be monitored for groundwater quality. Those wells with inconclusive depth and completion information were originally designated as unclassified wells; in 2009 and 2013, review of groundwater level and quality records allowed classification of some wells into the shallow or deep aquifer zones. Accordingly, the monitoring program was revised in 2009 and 2013 to reflect those minor changes to the well networks.

Also to be monitored are surface water conditions, specifically Twitchell Reservoir releases, stage, and storage, and stream discharge and quality, and climatic conditions, specifically precipitation and reference evapotranspiration data.

In addition to the hydrologic data described above, the monitoring program specifies those data to be compiled to describe agricultural and municipal water requirements and water supplies. These include land use surveys, to serve as a basis for the estimation of agricultural irrigation requirements, and municipal groundwater pumping and imported water records, including any transfers between purveyors.

Lastly, the monitoring program for the SMVMA specifies water disposition data be compiled, including treated water discharged at waste water treatment plants (WWTPs) and any water exported from the SMVMA. As part of this accounting, estimation is to be made of agricultural drainage from the SMVMA and return flows to the aquifer system. For reference, the SMVMA monitoring program is included in Appendix A.

In order to complete this annual assessment of groundwater conditions, water requirements, water supplies, and water disposition in the SMVMA, the following data for 2013 were acquired from the identified sources:

- groundwater level and quality data: the US Geological Survey (USGS), the Santa Maria Valley Water Conservation District (SMVWCD), the Technical Group for the adjacent NMMA (NMMA TG), the City of Santa Maria, and Golden State Water Company;

- Twitchell Reservoir stage, storage, and release data: the SMVWCD and Santa Barbara County Public Works Department;

- surface water discharge and quality data: the USGS and the Central Coast Regional Water Quality Control Board (CCRWQCB);

- precipitation data: the National Weather Service of the National Oceanic and Atmospheric Administration (NOAA), California Department of Water Resources (DWR), and SMVWCD;

- reference evapotranspiration and evaporation data: the California DWR, including California Irrigation Management Information System (CIMIS), and SMVWCD, respectively;

- agricultural land use data and aerial photography: Santa Barbara and San Luis Obispo County Agricultural Commissioner’s Offices, and US Department of Agriculture (USDA), respectively;

- municipal groundwater pumping and imported water data: the City of Santa Maria, the City of Guadalupe, and the Golden State Water Company; and

- treated municipal waste water data: the City of Santa Maria, the City of Guadalupe, the Laguna Sanitation District, and the CCRWQCB.

1.4 Report Organization

To comply with items to be reported as delineated in the Stipulation, the annual report is organized into five chapters:

- this ***Introduction***;
- discussion of ***Hydrogeologic Conditions***, including groundwater, Twitchell Reservoir, surface streams, and climate;
- description and quantification of ***Water Requirements and Water Supplies*** for the two overall categories of agricultural and municipal land and water use in the SMVMA;
- description and quantification of ***Water Disposition*** in the SMVMA; and
- summary ***Conclusions and Recommendations*** related to water resources, water supplies, and water disposition in 2013, and related to ongoing monitoring, data collection, and interpretation for future annual reporting.

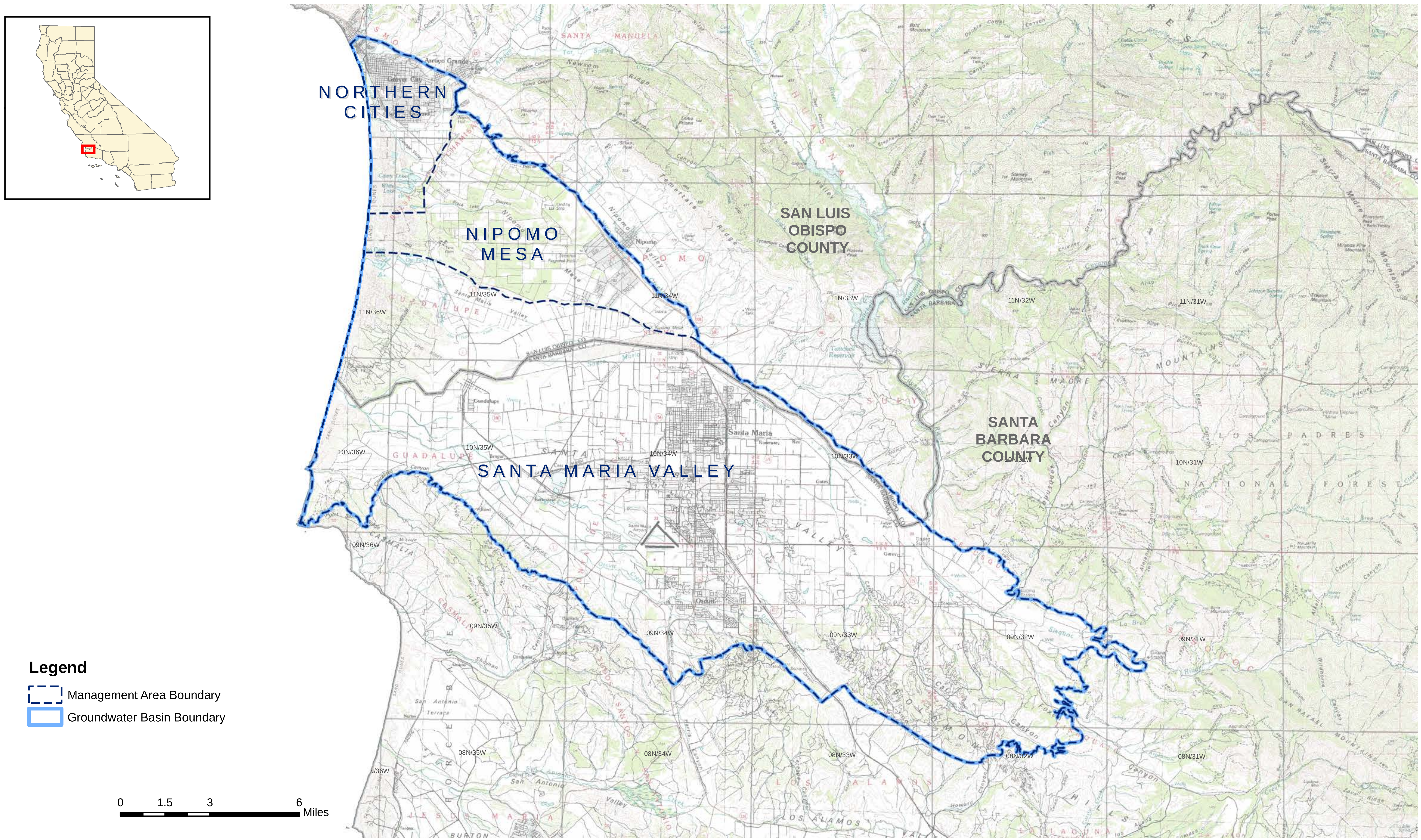

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Figure 1.1-1
Santa Maria Valley Groundwater Basin and Management Areas
Santa Maria Valley Management Area

2. Hydrogeologic Conditions

Current and historical hydrogeologic conditions in the SMVMA, including groundwater conditions, Twitchell Reservoir operations, and stream and climate conditions, are described in the following sections of this Chapter.

2.1 Groundwater Conditions

To provide a framework for discussion of groundwater conditions, the geology of the SMVMA, including geologic structure and the nature and extent of geologic formations comprising the aquifer system, is described in the following section. Current groundwater levels are then described in relation to historical trends in groundwater levels and flow directions in the SMVMA, as well as in context of Stipulation protocol for defining conditions of severe water shortage. Current and historical groundwater quality conditions are also discussed, including general groundwater quality characteristics as well as groundwater quality degradation, specifically due to elevated nitrate concentrations.

2.1.1 Geology and Aquifer System

The SMVMA is underlain by unconsolidated alluvial deposits that comprise the aquifer system, primarily gravel, sand, silt and clay that cumulatively range in thickness from about 200 to 2,800 feet. The alluvial deposits fill a natural trough, which is composed of older folded and consolidated sedimentary and metamorphic rocks with their deepest portions beneath the Orcutt area. The consolidated rocks also flank the Valley and comprise the surrounding hills and mountains; typically, the consolidated rocks do not yield significant amounts of groundwater to wells. The geologic formations comprising the alluvial deposits and the geologic structure within the study area are illustrated in a generalized geologic map (Figure 2.1-1a) and two geologic cross sections (Figures 2.1-1b and 2.1-1c).

The alluvial deposits are composed of the Careaga Sand and Paso Robles Formation (Fm.) at depth, and the Orcutt Fm., Quaternary Alluvium, and river channel, dune sand, and terrace deposits at the surface (USGS, Worts, G.F., 1951). The Careaga Sand, which ranges in thickness from about 650 feet to a feather edge, is identified as being the lowermost fresh water-bearing formation in the basin (DWR, 1970), resting on the above-mentioned consolidated rocks (specifically, the Tertiary-aged Foxen Mudstone, Sisquoc Fm., and Monterey Shale and the Jurassic/Cretaceous-aged Franciscan Fm., descriptions of which may be found in USGS, Worts, G.F., 1951). Overlying the Careaga Sand is the Paso Robles Fm., which comprises the greatest thickness of the alluvial deposits (from about 2,000 feet to a feather edge); the thickest portion of this formation is located beneath the Orcutt area. Both the Careaga Sand and Paso Robles Fm. underlie the great majority of the SMVMA (see Figures 2.1-1b and 2.1-1c). The Careaga Sand is mainly composed of white to yellowish-brown, loosely-consolidated, massive, fossiliferous, medium- to fine-grained sand with some silt and is reported to be predominantly of marine origin (USGS, Worts, G.F., 1951). The Paso Robles Fm. is highly variable in color and texture, generally composed of yellow, blue, brown, grey, or white lenticular beds of: boulders and coarse to fine gravel and clay; medium to fine sand and clay; gravel and sand; silt; and clay

(USGS, Worts, G.F., 1951). This formation is reported to be primarily fluvial (stream-laid) in origin and there is no areal correlation possible between the individual beds, with the exception of a coarse basal gravel of minor thickness in the Santa Maria Valley oil field, generally in the southeast part of the SMVMA.

Above the Paso Robles Fm. and comprising the Orcutt Upland is the Orcutt Fm., which is typically about 160 to 200 feet thick; in the remainder of the SMVMA, the Paso Robles Fm. is overlain by the Quaternary Alluvium, which comprises the majority of the Valley floor and is typically about 100 to 200 feet thick. Further north in the adjacent NMMA, the Paso Robles Fm. is overlain by the Older Dune Sand, which comprises the Nipomo Mesa and ranges in thickness from approximately 400 feet to a feather edge. Along the northeast edge of the Sisquoc plain, the Paso Robles Fm. is overlain by terrace deposits approximately 60 feet thick. The Orcutt Fm. is composed of conformable upper and lower units ("members"), both reported to be mainly of fluvial origin that become finer toward the coast. The upper member generally consists of reddish-brown, loosely-compacted, massive, medium-grained clean sand with some lenses of clay, and the lower member is primarily grey to white, loosely-compacted, coarse-grained gravel and sand (USGS, Worts, G.F., 1951).

The Quaternary Alluvium is also composed of upper and lower members that are reported to be mainly fluvial in origin. The composition of the upper member becomes progressively finer toward the coast, with boulders, gravel, and sand in the Sisquoc plain area; sand with gravel in the eastern/central Valley area; sand with silt from the City of Santa Maria to a point approximately halfway to Guadalupe; and clay and silt with minor lenses of sand and gravel from that area westward. The lower member is primarily coarse-grained boulders, gravel and sand with minor lenses of clay near the coast. The Older Dune Sand is composed of loosely- to slightly-compacted, massive, coarse- to fine-grained, well-rounded, cross-bedded quartz sand that is locally stained dark reddish-brown (California DWR, 1999). The terrace deposits, in general, are similar in composition to the coarse-grained parts of the Quaternary Alluvium.

Two geologic cross sections illustrate several points about the geologic structure and variable aquifer thickness throughout the SMVMA. Longitudinal geologic cross section A-A' (see Figure 2.1-1b) begins in the area near the mouth of the Santa Maria River, traverses the Orcutt Upland, and terminates in the Sisquoc plain area near Round Corral, immediately southeast of the SMVMA. It shows the relative thicknesses of the various geologic formations and their general "thinning" from the central valley area toward the Sisquoc plain. This cross section also shows the Quaternary Alluvium and Orcutt Fm., essentially adjacent to each other and comprising the uppermost aquifer in the SMVMA, divided into the above-described upper and lower members.

Transverse geologic cross section B-B' (see Figure 2.1-1c) begins in the Casmalia Hills, traverses the western portion of the Valley (near the City of Guadalupe) and the southern Nipomo Mesa, and terminates at Black Lake Canyon. It shows the prominent asymmetrical syncline (folding of the consolidated rocks and Paso Robles Fm.) within the SMVMA and adjacent NMMA, with the deepest portion of Paso Robles Fm. toward the southern edge of the SMVMA, gradually becoming thinner and more shallow toward the north where it extends beneath the NMMA. This cross section also shows that both the upper and lower members of the Quaternary Alluvium extend north to the Santa Maria River, but only the upper member extends beyond the River to the southern edge of the Nipomo Mesa, and neither member extends northward beneath the Mesa.

Several faults have been reported to be located in the SMVMA and adjacent portion of the NMMA. The Santa Maria and Bradley Canyon faults, located in the Valley in the area between the City of Santa Maria and Fugler Point (at the confluence of the Cuyama and Sisquoc Rivers to form the Santa Maria River), are concealed and they are reported to be northwest-trending, high-angle faults, that vertically offset the consolidated rocks, Careaga Sand, and Paso Robles Fm., but not the overlying Quaternary Alluvium or Orcutt Fm. (USGS, Worts, G.F., 1951). The Oceano and Santa Maria River faults are of a similar nature (the latter fault also has a significant strike-slip component of movement), but they are primarily located in the southern Nipomo Mesa. The maximum vertical offset on the Oceano fault is reported to be in the range of 300 to 400 feet within the Careaga Sand and Paso Robles Fm.; on the other faults, the vertical offset is reported to be much less, within the range of 80 to 150 feet (USGS, Worts, G.F., 1951; California DWR, 1999). However, these faults do not appear to affect groundwater flow within the SMVMA, based on the review of historical groundwater level contour maps (USGS, Worts, G.F., 1951; LSCE, 2000).

There is no known structural (e.g., faulting) or lithologic isolation of the alluvial deposits from the Pacific Ocean; i.e., the Quaternary Alluvium, Orcutt Fm., Careaga Sand, and Paso Robles Fm. aquifers continue beneath the Ocean. Thus, there is geologic continuity that permits groundwater discharge from the SMVMA to the Ocean, and the potential exists for salt water to intrude into the coastal (landward) portions of the aquifers if hydrologic conditions within them were to change.

The aquifer system in the SMVMA is comprised of the Paso Robles Fm., the Orcutt Fm., and the Quaternary Alluvium (USGS, Worts, G.F., 1951). The upper member of the Quaternary Alluvium is consistently finer-grained than the lower member throughout the Valley. Further, the upper member becomes finer grained toward the Ocean such that it confines groundwater in the lower member from the approximate area of the City of Santa Maria's waste water treatment plant westward (approximately eight miles inland from the coast). The result of this has been some artesian conditions in the western valley area (historically, flowing artesian wells were reported until the early 1940s in the westernmost portion of the Valley) (USGS, Worts, G.F., 1951). More recently, many wells belonging to local farmers in the western valley area, specifically in the Oso Flaco area, began flowing again in response to rising confined groundwater levels, such as during the winter of 1999.

Analysis of the geology, groundwater levels, and groundwater quality indicates that the aquifer system varies across the area and with depth, and this variation was the basis for the shallow and deep aquifer zone designations of the SMVMA monitoring program (LSCE, 2008). In the central and major portion of the SMVMA, there is a shallow unconfined zone comprised of the Quaternary Alluvium, Orcutt Fm., and uppermost Paso Robles Fm., and a deep semi-confined to confined zone comprised of the remaining Paso Robles Fm. and Careaga Sand. In the eastern portion of the SMVMA where these formations are much thinner and comprised of coarser materials, particularly in the Sisquoc Valley, the aquifer system is essentially uniform without distinct aquifer depth zones. In the coastal area where the surficial deposits (upper members of Quaternary Alluvium and Orcutt Fm.) are extremely fine-grained, the underlying formations (lower members of Quaternary Alluvium and Orcutt Fm., Paso Robles Fm., and Careaga Sand) comprise a deep confined aquifer zone.

2.1.2 Groundwater Levels

Groundwater levels within the SMVMA have fluctuated greatly since the 1920's, when historical water level measurements began, with marked seasonal and long-term trends, as shown by a collection of representative groundwater level hydrographs from various areas throughout the SMVMA (Figure 2.1-2). The areas are designated on Figure 2.1-2 for illustrative purposes only, and include the so-called Coastal, Oso Flaco, Central Agricultural, Municipal Wellfield, Twitchell Recharge, and Sisquoc Valley areas. The historical groundwater level hydrographs illustrate that widespread decline in groundwater levels, from historical high to historical low levels, occurred between 1945 and the late 1960's. The declines ranged from approximately 20 to 40 feet near the coast, to 70 feet near Orcutt, to as much as 100 feet further inland (in the area just east of downtown Santa Maria). Those declines were observed in both the shallow and deep aquifer zones, and are interpreted today to have been the combined result of progressively increasing agricultural (and to a lesser degree, municipal) demand and long-term drier than normal climatic conditions during that period.

Since then, the basin has alternately experienced significant recharge (recovery) and decline which, collectively, reflect a general long-term stability as groundwater levels in both aquifer zones have fluctuated between historical-low and near historical-high levels over alternating five- to 15-year periods. Groundwater levels throughout the SMVMA have shown this trend, but with different ranges of fluctuation (see Figure 2.1-2); and groundwater levels have repeatedly recovered to near or above previous historical-high levels, including as recently as 2002. In the primary areas of recharge along the Santa Maria River, groundwater level fluctuations are greater in the shallow aquifer zone than the deep (see Twitchell Recharge Area and Central Agricultural Area hydrographs). Conversely, in the Municipal Wellfield and Coastal Areas, groundwater level fluctuations are greater in the deep aquifer zone. Hydrographs from wells along the coastal portion of the SMVMA show that groundwater elevations have remained above sea level, with deep (confined) groundwater levels rising enough to result in flow at the ground surface, throughout the historical period of record. The periodic groundwater level fluctuation since the late 1960's (with a long-term stability) have apparently been due to intermittent wet and dry climatic conditions, with natural recharge during wet periods complemented by supplemental recharge along the Santa Maria River from the Twitchell Reservoir project (since becoming fully operational in the late 1960's). Long-term stability would also appear to be partially attributable to a general "leveling-off" of agricultural land and water use in the basin since the early to mid-1970’s, as further described in Chapter 3.

More recently, from 2002 through 2010, groundwater levels in both the shallow and deep zones gradually declined, with the largest amount visible in portions of the Sisquoc Valley and Oso Flaco areas. Particularly in light of prevailing land use and water requirements, this overall groundwater level decline can be considered to be at least partially due to the fact that Twitchell Reservoir releases, for in-stream supplemental groundwater recharge, have been well below the historical average in most years since 2000 (including no releases in 2009 or 2010), as discussed in Section 2.2. The groundwater level decline in the Sisquoc Valley, specifically the lack of full recovery during the prolonged wet period of the mid-1990s through 2001, is in contrast to the full recovery observed in the Santa Maria Valley portion of the SMVMA during that time period. Subsequently, during 2011, groundwater levels across most of the SMVMA rose substantially, at least partially in response to above average releases from Twitchell Reservoir following above average rainfall in December 2010 and early 2011. During 2012, a year of below average rainfall and limited Twitchell releases, and 2013, a year of severely low rainfall and no Twitchell releases, groundwater levels have declined. Importantly, 2013 groundwater levels do not trigger the Stipulation provisions for defining conditions of severe water shortage because, among other considerations, they remain within the historical range of groundwater levels throughout the SMVMA. Also important is that coastal groundwater levels remain well above sea level through 2013 and, thus, conditions that would be indicative of potential sea water intrusion are absent.

Groundwater beneath the SMVMA has historically flowed to the west-northwest from the Sisquoc area toward the Ocean, and this remained the case during 2013 as illustrated by contour maps of equal groundwater elevation for the shallow and deep aquifer zones (Figures 2.1-3a through 2.1-3f). As in most years of study in the basin, a notable feature in the contour maps in 2013 is the widening of groundwater level contours beneath the central-south and western portions of the SMVMA. This indicates a reduced (flatter) groundwater gradient, likely reflecting ongoing groundwater pumping in and around the municipal wellfield near the Santa Maria Airport and Town of Orcutt. In this area, both agricultural wells and municipal water supply wells of the City of Santa Maria and the Golden State Water Company (GSWC) are operated, although municipal pumping in 2013 remained notably lower than prior to the availability of State Water Project water as discussed in Chapter 3.

The majority of municipal groundwater pumping is conducted from the purveyors' deep wells, and the groundwater elevation maps show lower groundwater levels and greater flattening of the gradient in the deep aquifer zone than shallow zone. Overall, this has had the effect of slowing (but not stopping or reversing) the movement of groundwater through that portion of the SMVMA. However, it should be noted that agricultural and/or municipal groundwater pumping has been conducted in this area for many decades, and a generally reduced groundwater gradient has been observed since about 1960 (USGS, Miller, G.A., and Evenson, R.E., 1966; USGS, Hughes, J.L., 1977; LSCE, 2000).

Also notable from the contour maps is the overall seasonal difference in shallow and deep zone water levels across the SMVMA from early spring through the fall period. A very slight decline was observed between March and April (early and late spring contour maps, respectively) with additional but minor decline through late October, presumably reflecting groundwater pumping during the year and the recharge from Sisquoc River discharge limited to early 2013.

During both spring and fall periods, and particularly in the western portion of the SMVMA, a seaward gradient for groundwater flow was maintained in both aquifer zones. Importantly, coastal groundwater levels in both aquifer zones remained well above sea level, with groundwater elevations typically exceeding 15 feet, MSL.

Of note in late 2013, the TMA, with assistance from San Luis Obispo County Department of Public Works (SLODPW) staff and LSCE, expanded groundwater level monitoring commenced along the boundary between the SMVMA and NMMA with the installation of transducers in two shallow SLODPW monitoring wells near the boundary. This focused monitoring effort should provide data during 2014 and subsequent years with which to better understand seasonal fluctuations in groundwater levels and flow directions along the boundary.

2.1.3 Groundwater Quality

Groundwater quality conditions in the SMVMA have fluctuated greatly since the 1930's, when historical water quality sampling began, with marked short- and long-term trends. Groundwater quality in the SMVMA historically reflected the various natural sources of recharge to the aquifer system, most notably streamflows of the Cuyama and Sisquoc Rivers that provided recharge along the Santa Maria River. The great majority of groundwater in the SMVMA, primarily in the eastern and central portions of the Santa Maria Valley and in the Sisquoc Valley, had historically been of a calcium magnesium sulfate type originating from the Cuyama and Sisquoc River streamflows. Groundwater had historically been of better quality toward the Orcutt Upland, Nipomo Mesa, the City of Guadalupe, and coastal areas (Lippincott, J.B., 1931).

With development of the Valley and surrounding areas in the 1940's through 1970's, including expansion of the agricultural and urban areas and addition of the Twitchell Reservoir project, groundwater quality conditions changed within the SMVMA. The changes included improvement of the general groundwater quality in the eastern to central part of the Santa Maria Valley in and near the area of Twitchell Reservoir recharge, including the current-day municipal wellfield near the Town of Orcutt. Degradation of groundwater quality occurred further west and downgradient in the Valley, specifically with elevated general mineral and nitrate concentrations (USGS, Hughes, J.L., 1977).

Subsequently, from the 1970's through 2013, general mineral concentrations in groundwater have remained essentially unchanged, including the occurrence of better quality water in the SMVMA’s eastern, central, and southern portions and poorer quality water to the west. Further, groundwater quality is generally slightly better and with less fluctuation in the deep aquifer zone compared to the shallow, as shown by a map with representative historical groundwater quality graphs from areas throughout the SMVMA (Figure 2.1-4). While groundwater quality data from 2013 for the SMVMA are spatially very sparse, assessment of those data indicates that, during 2013, specific conductance values in the shallow aquifer zone generally ranged between 1,100 and 1,500 umho/cm in the Twitchell Recharge and Municipal Wellfield Areas, and were about 1,600 umho/cm in the Coastal Area. Specific conductance values in the deep zone were between 1,200 and 1,600 umho/cm in the Twitchell Recharge Area; between 900 and 1,100 umho/cm in the Municipal Wellfield Area; and generally less than 1,600 umho/cm in the Coastal Area, although a long-term gradual increase is apparent in portions of the deep zone. Coastal Area groundwater deeper than 600 feet have specific conductance values less than 1,100 umho/cm with a long-term stability. Specific conductance values for the deep zone in the Sisquoc Valley area were about 1,100 umho/cm. Overall, specific conductance values in the SMVMA generally remain at or below the California Department of Public Health’s secondary standard of 1,600 umho/cm.

In contrast to the stability in general groundwater quality concentrations observed during this recent period, nitrate concentrations in shallow groundwater have progressively increased. In 2013, nitrate-as-nitrate (nitrate-NO3) concentrations in shallow groundwater remained elevated, in many areas above the primary drinking water standard of 45 mg/l. In the Twitchell Recharge Area, nitrate concentrations were similar to those observed in 2012. Nitrate concentrations in shallow groundwater in the Municipal Wellfield Area continue a slight increasing trend from just above 50 mg/l a decade ago to about 65 mg/l currently. In the Coastal Area, nitrate concentrations in shallow groundwater remained non-detect (less than 0.18 mg/l).

Compared to widespread elevated nitrate concentrations in shallow groundwater, deep groundwater concentrations remain markedly lower, generally less than 10 mg/l. In support of this observation, extensive nitrate data available from purveyor water supply wells (City of Santa Maria and GSWC), particularly for deep wells in the southern SMVMA, indicate nitrate-NO3 values remain less than 10 mg/l. Exceptions to this observation have been two deeper wells in the south-southeast part of the Valley (9N/33W-02A7 and 9N/34W-03F2), with nitrate concentrations between 20 and 35 mg/l, and some coastal deep monitoring wells with nitrate levels exceeding 80 mg/l, as discussed below.

Of particular importance to ongoing assessment of potential conditions of sea water intrusion are the groundwater quality data from two sets of coastal monitoring wells. During an investigation conducted in the late 1960's, for which the monitoring well sets were constructed, localized areas of degraded shallow groundwater were identified but concluded at the time to be due to environmental factors other than intrusion (California DWR, 1970). Review of the coastal monitoring results through 2013, in particular specific conductance values, provides an indication of whether sea water intrusion has occurred in the coastal SMVMA; review of coastal nitrate concentrations provides a measure of the extent and magnitude of water quality degradation from land use activities further inland. Historical water quality graphs for these wells are provided in Appendix B.

Since the commencement of coastal groundwater quality monitoring, coastal groundwater has continued to show elevated but largely unchanging specific conductance values. In 2013, shallow groundwater at the southerly monitoring well set (10N/36W-02Q, shallow well 02Q7, Figure 2.1-4) had a value of just under 1,500 umho/cm; deep groundwater values (wells 02Q1, 02Q3, and 02Q4) have been lower, between 900 and 1,000 umho/cm over the last 35 years. Groundwater at the more northerly monitoring well set (11N/36W-35J) shows more variation in specific conductance values with depth: the wells with depths of 615, 495, and 228 feet have values of 1,100 umho/cm, 1,500 umho/cm, and 1,900 umho/cm, respectively. Specific conductance values in the shallowest well (35J5, 136 feet deep), have gradually risen throughout the monitoring period from about 1,400 umho/cm in 1977 to 1,700 umho/cm in 2013.

Some coastal groundwater, specifically in portions of the deep aquifer zone near the northerly monitoring well set (11N/36W-35J), have shown gradually increasing degradation from nitrate, including through the present. Nitrate-NO3 concentrations have steadily risen from a range of 5 to 10 mg/l in the 1980’s to between 40 and 80 mg/l in 2013 (see Figure 2.1-4). In contrast, groundwater in all aquifer zones near the southerly monitoring well set (10N/36W-02Q) have consistently shown very low concentrations of nitrate through the present. Shallow groundwater continued to have non-detectable levels of nitrate (less than 0.18 mg/l) and deep groundwater concentrations remained below 3 mg/l through 2013. Nitrate concentrations in the deepest groundwater, specifically below a depth of 600 feet, along the coast (at both well sets) remain stable with values of 3 mg/l or less.

Overall, the groundwater quality monitoring results from 2013 indicate general mineral quality conditions remain generally stable across the SMVMA including along the coast, with no indication of sea water intrusion. Specific conductance values remain elevated in shallow and deep groundwater in all areas, to levels generally ranging between 900 and 1,600 umho/cm. A long-term gradual increase in specific conductance values is observed in the shallowest monitoring well at the northerly portion of the coast, to about 1,700 umho/cm in 2013. In contrast, degradation from nitrate remains generally only in shallow groundwater across the SMVMA, with concentrations in some areas well above the primary drinking water standard of 45 mg/l. Nitrate-NO3 concentrations are typically below 10 mg/l in deep groundwater, particularly as observed at the municipal wellfield. Exceptions to the poorer quality shallow and better quality deep zone data include a long-term gradual increase in nitrate concentrations in deep groundwater at the northerly portion of the coast, to between 40 and 80 mg/l, while they remain below 3 mg/l in the shallow and deep groundwater at the southerly portion of the coast. Importantly, the deepest coastal zones monitored (below 600 feet) at both the northern and southern areas remain below 3 mg/l.

It should be noted that, regarding the CCRWQCB Conditional Waiver (Ag Order), agricultural landowners and operators in the SMVMA have proceeded with groundwater quality monitoring in 2013, including analyses for general mineral constituents. It is hoped that these and future agricultural monitoring results are made available (in a manner that maintains confidentiality mandates) and compiled in order to augment groundwater quality data from the USGS, the City of Santa Maria, and the GSWC, and expand the ongoing assessment of groundwater quality conditions in the SMVMA.

2.2 Twitchell Reservoir Operations

In order to describe Twitchell Reservoir operations, monthly records of reservoir stage, storage, and releases were updated and recorded observations of reservoir conditions were noted. The historical stage, storage, and releases, including through 2013, are described in relation to observed climatic conditions in the SMVMA.

2.2.1 Reservoir Stage and Storage

Historical stage and storage in Twitchell Reservoir, for which reliable records begin in 1967, indicate a typical seasonal rise with winter and spring rain, followed by decline through subsequent spring and summer releases. Reservoir stage has risen to as high as about 640 feet msl, corresponding to storage of nearly 190,000 acre-feet, on several occasions during the winter and spring months of years during which rainfall amounts were substantially higher than average. Historical rises in stage have been rapid, occasionally over one or two months, with subsequent declines gradually spread over the subsequent year or multiple years. During those years when releases have essentially emptied the reservoir for purposeful supplemental groundwater recharge through the Santa Maria River channel, the dam operator recorded the associated minimum reservoir stage, which has risen over time from about 480 feet msl in 1968, to 525 feet msl since 1986. This rise reflects the long-term filling of former dead pool storage (about 40,000 acre-feet below the reservoir outlet for release from conservation storage) with sediment that has naturally occurred with operation of the project (SMVWCD, 1968-2013). These seasonal fluctuations and long-term rise in minimum stage, shown in relation to the reservoir conservation, flood control, and surcharge pools, are illustrated in a graph of historical reservoir stage and storage (Figure 2.2.1a).

It is noteworthy that the sedimentation of the former dead pool storage below the conservation outlet in Twitchell Reservoir has not impeded the conservation of runoff for subsequent release for downstream groundwater recharge. Except for a few individual years over the life of the reservoir, accumulated storage in any year has been less than the designated active conservation pool of 109,000 af. In the infrequent wet years when greater storage could be conserved, e.g. 1969, 1978, 1983, 1995, and 1998, the SMVWCD has been permitted to temporarily utilize some of the dedicated flood control pool (89,000 af) to conserve those additional inflows and then shortly release them for downstream recharge. Total storage has never exceeded the combined conservation pool and flood control pool storage volume (198,000 af) and has never invaded the uppermost surcharge pool (159,000 af above the conservation and flood control pools) in the overall reservoir.

Reservoir storage has historically risen to between 150,000 and nearly 190,000 acre-feet (af) during the winter and spring months of years during which rainfall was substantially higher than average, with storage commonly below 50,000 af during most other years. As can be seen on Figure 2.2-1a, reservoir storage has repeatedly dropped to essentially zero during periods of below-average rainfall, including those associated with drought conditions in 1976-77, 1987-90. Reservoir storage was also essentially zero during most of 2000 through 2004 as a result of a drier climatic period that began in 2001. About 50,000 af of storage were accrued in both 2005 and 2006, all of which was released for downstream groundwater recharge. There was essentially no storage in 2007 and, during 2008, reservoir storage reached a maximum of about 20,000 af in March before being almost entirely released for recharge by the end of the year. In 2009, a total of only about 1,000 af accrued in February, after which storage rapidly declined through reservoir evaporation and seepage. Storage accrued in early 2010 to 14,000 af with a rapid increase to almost 40,000 af in response to more than nine inches of rainfall during December without conducting any releases. Above average rainfall continued into early 2011, building storage to almost 93,000 af (and stage to 615 feet msl) in April, with releases commencing in February and continuing through the remainder of 2011 and through March of 2012. No further releases were made in 2012, with only a minor amount of water that remained in storage declining through reservoir evaporation and seepage to about 3,000 af (540 feet msl) by December 2012. During 2013, with severely below-average rainfall, reservoir stage and storage declined further.

2.2.2 Reservoir Releases

Twitchell Reservoir annual releases for in-stream groundwater recharge since 1967 have ranged from zero during low rainfall years and drought periods to a maximum of 243,660 af in 1998, as illustrated in a bar chart of annual reservoir releases (Figure 2.2-1b). In general, and most notably in the Twitchell Recharge Area, groundwater levels have tended to track Twitchell releases since the beginning of Reservoir operations (see Figure 2.1-2 and 2.2-1b). The long-term average annual release amount for the period 1967 through 2012 is 50,750 afy, with below-average releases during slightly more than half of those years. The five-year period from 1995 through 1999 is notable for continual releases in amounts well above the annual average, reflecting a wetter climatic period from 1993 through 1998. Also notable are multiple year periods when releases dropped to zero, specifically from 1987 through 1990 and from 2002 through 2004, reflecting the drier climatic conditions during those periods of time. While releases in 2005 and 2006 amounted to about 106,000 and 80,000 af, respectively, drier climatic conditions persisted with no releases for in-stream groundwater recharge in 2009 or 2010. The release of nearly 90,000 af of water from Twitchell Reservoir was conducted from February through December 2011, with the highest amounts during the months of June through September. In 2012, releases were well below average, conducted in January through March only and amounting to 9,100 af; in 2013, with continued dry climatic conditions, essentially no water was available in storage and no releases were made from the reservoir.

2.3 Streams

The surface water hydrology of the SMVMA is characterized in this section, specifically the current conditions in relation to historical trends in stream discharge and quality.

2.3.1 Discharge

The main streams entering the SMVMA are the Cuyama and Sisquoc Rivers; these rivers join on the Santa Maria Valley floor near Garey and become the Santa Maria River, which drains the Valley from that point westward (see Appendix A, Figure 3). The headwaters of the Sisquoc River include a portion of the San Rafael Mountains and Solomon Hills, and the River's main tributaries within the SMVMA are Foxen, La Brea, and Tepusquet Creeks. Streamflow in the Sisquoc River and its tributary creeks have remained unimpaired through the present. The Cuyama River drains a portion of the Sierra Madre Mountains, including the Cuyama Valley, and streamflow into the Santa Maria River has been controlled since construction of Twitchell Dam between 1957 and 1959. The Santa Maria River receives minor streamflows from two small tributaries, Suey and Nipomo Creeks, along its course toward the City of Guadalupe and the Pacific Ocean. In the southern portion of the SMVMA, Orcutt Creek drains a portion of the Solomon Hills (Solomon Canyon) and the Orcutt area, receives intermittent flow from Graciosa Canyon, before ending near Betteravia.

Stream discharge in the Cuyama River below the dam, recorded during the initial period of Twitchell project operations between 1959 and 1983, averaged 37,350 afy. As discussed above, Twitchell Reservoir releases have averaged 50,750 afy from 1967 through 2013. The historical variation in reservoir releases and Cuyama River streamflow is shown in a bar chart of annual surface water discharge for the River (Figure 2.3-1a). Cuyama River stream discharge, which comprises the largest source of SMVMA groundwater recharge, has ranged over the historical period of record from no streamflow during several drought years, including as recently as 2010 and 2013, to a high of almost 250,000 af during 1998.

Stream discharge in the Sisquoc River, recorded at gauges at the southeast end of the Sisquoc plain and further downstream near the town of Garey, averages 37,000 (absent data from years 1999-2007) and 38,600 afy, respectively, over the historical period of record.[1] The downstream gauge provides a measure of the stream discharge entering the SMVMA from the Sisquoc plain, and it reflects inflow from the headwaters of the Sisquoc River and its tributaries, as well as gains from and losses to the shallow aquifer in the Sisquoc plain. The historical variation in Sisquoc River streamflow is shown in a bar chart of annual surface water discharge for the River at both gauges (Figure 2.3-1b). Sisquoc River stream discharge, which comprises a large source of SMVMA groundwater recharge, has ranged over the historical period of record from no streamflow during several drought years to over 300,000 af during 1998; the 2013 annual discharge (provisional/approved) into the SMVMA was well below average, less than 900 af (near Sisquoc gauge). Of note is that the upstream gauge ("near Sisquoc") was non-operational, and thus no data are available, from 1999 through 2007. Further, discharge amounts in the tributaries Foxen, La Brea, and Tepusquet Creeks have not been recorded since the early 1970's (early 1980's for the latter creek), when gauge operations were discontinued. As a result, the net amount of groundwater recharge in the Sisquoc plain from the Sisquoc River currently cannot be quantified. Reestablishment and monitoring of these currently inactive gauges (Foxen, La Brea, and Tepusquet Creeks), as previously outlined in the SMVMA Monitoring Program and recommended in this annual report, would provide for better understanding of the distribution of recharge along the Sisquoc River.

Streamflow in the Santa Maria River has been recorded at two gauges during varying periods of time (see Appendix A, Figure 3). At the Guadalupe gauge, which was operational between 1941 and 1987, stream discharge ranged from no streamflow during numerous years to almost 185,000 af during 1941, and averaged 26,800 afy prior to the commencement of Twitchell project operations compared to 17,600 afy during the period of Twitchell project operations. The historical variation in Santa Maria River streamflow is shown in a bar chart of annual surface water discharge for the River (Figure 2.3-1c). The reduction in streamflow at Guadalupe is attributed to Twitchell project operations, which are intended to maximize recharge along the more permeable portion of the River streambed by managing reservoir releases to maintain a "wetline" (downstream extent of streamflow) only as far as the Bonita School Road Crossing.

Supplemental recharge to the Santa Maria Valley from Twitchell project operations has been estimated to be about 32,000 afy based on comparison of pre- and post-project net losses in streamflow between Garey and Guadalupe (LSCE, 2000). The estimation does not account for changes in climatic conditions between the pre- and post-project periods or losses/gains along the Santa Maria River due to other processes, which could result in changes in the amount of water available for recharge over time. As a result of discontinued stream discharge measurements at Guadalupe since 1987, combined with the lack of gauged data for Suey and Nipomo Creeks, the net amount of groundwater recharge in the Santa Maria Valley from the Santa Maria River currently cannot be updated. Reestablishment and monitoring of these currently inactive gauges (Suey Creek, Nipomo Creek, and Santa Maria River at Gaudalupe), as previously outlined in the SMVMA Monitoring Program and recommended in this annual report,

[1] These values of mean annual discharge include the approved 2013 discharge (through October only) and the provisional 2013 (November, December) discharge for the near Sisquoc and near Garey gauges.

would provide for better understanding of the distribution of streamflow and recharge along the Santa Maria River.

Stream discharge in the Santa Maria River has also been recorded more recently at a gauge at Suey Crossing northeast of the City of Santa Maria. However, these data are reported only sporadically, as for years 1999 and 2006, or not at all, as in 2000 through 2005, and the discharge data for 2009 through 2013 remain problematic. However, future acquisitions of the discharge data from this gauge will also enhance an understanding of streamflow and recharge along the Santa Maria River.

Stream discharge in Orcutt Creek, recorded at Black Road crossing from 1983 through the present (absent data from years 1992 through 1994), averages about 1,650 afy, ranging from essentially no streamflow during several years to just over 10,000 af in 1995; in 2013, stream discharge was well below average, approximately 200 af. The historical variation in streamflow is shown in a bar chart of annual surface water discharge for the creek (Figure 2.3-1d). While essentially all streamflow recorded at the gauge ultimately provides groundwater recharge to the SMVMA, it is not known how much groundwater recharge or discharge occurs upstream from the gauge, specifically between the gauge and the point where Orcutt Creek enters the SMVMA.

2.3.2 Surface Water Quality

The majority of recharge to the SMVMA has historically derived from streamflow in the Santa Maria River originating from the Cuyama and Sisquoc Rivers. Thus, groundwater quality in much of the SMVMA has historically reflected the water quality of streamflow in the Cuyama and Sisquoc Rivers. Water quality in the rivers depends on the proportion and quality of the rainfall runoff and groundwater inflow contributing to streamflow in their respective watersheds above the Santa Maria Valley. The Cuyama River watershed includes the Cuyama Valley, which is reported to be underlain by geologic formations containing large amounts of gypsum; the Sisquoc River watershed is primarily steep terrain underlain by consolidated rocks (USGS, Worts, G.F., 1951).

The quality of the streamflow in both the Cuyama and Sisquoc Rivers has historically been of a calcium magnesium sulfate type, although the Sisquoc River contains less sulfate and more bicarbonate than the Cuyama River. The Cuyama River quality has improved at two points in time during the historical period, specifically the mid-1940's and the late 1960's (USGS, Hughes, J.L., 1977). The improvement observed in the mid-1940's is thought to be due to agricultural development of the Cuyama Valley that was supported by increased groundwater pumping in that Valley for irrigation. The increased pumping lowered groundwater levels in the Cuyama Valley, in turn reducing groundwater inflow to the Cuyama River, thereby reducing the contribution of dissolved salts (sulfate in particular) to the River.

The improvement observed in the late 1960's is thought to be due to implementation of Twitchell Reservoir project operations, which facilitated conservation of Cuyama River runoff and augmented recharge to the Santa Maria Valley groundwater basin. Specifically, the higher streamflow events in the Cuyama River that previously discharged to the ocean are of a better quality due to dilution by greater rainfall runoff. Releases from Twitchell Dam therefore contain lower concentrations of dissolved salts than the Cuyama River streamflows from the period preceding the project. The improvement in Cuyama River water quality from both of these developments may be seen in Table 2.3-1, which summarizes those earlier water quality results from the USGS (Hughes, J.L., 1977); more recent monitoring results from the USGS (1976 – 2012) and the Central Coast Ambient Monitoring Program (CCAMP) (2000 – 2013), are also shown (CCRWQCB, 2013).

Since operation of the Twitchell project began in the 1960s, Cuyama River water quality has remained fairly constant. Reported specific conductance values range from about 750 to 2,100 umho/cm; sulfate and chloride concentrations range from 200 to 750 mg/l, and from 25 to 85 mg/l, respectively. Nitrate-NO3 concentrations have remained low, ranging from <1 to 20 mg/l.

Water quality in the Sisquoc River has remained relatively unchanged since 1906, with general mineral constituent concentrations typically below those observed in the Cuyama River. Since the Twitchell project began, reported specific conductance values have ranged from about 700 to 1,200 umho/cm; sulfate and chloride concentrations have ranged from 270 to 380 mg/l, and from 13 to 16 mg/l, respectively. Nitrate-NO3 concentrations have remained very low, ranging from <1 to 3.2 mg/l. Sisquoc River historical water quality is shown in a graph (Figure 2.3-2a), which in particular illustrates specific conductance values maintaining a long-term stability with slight seasonal variation, presumably due to varying stream discharge. Overall, the historical water quality data for the Sisquoc River and tributary streams indicate the quality of streamflows entering the Sisquoc plain are slightly improved by tributary inflows.

As might be expected, water quality in the Santa Maria River northeast of Santa Maria (Bull Canyon) reflects the combined quality of streamflows in the Cuyama and Sisquoc Rivers. Reported specific conductance values have ranged from about 1,200 to 1,600 umho/cm; sulfate concentrations have ranged from 370 to 540 mg/l (no chloride data are available), and nitrate-NO3 concentrations have remained low, ranging from <1 to 2.7 mg/l.

In contrast, water quality is degraded in streams in the western portion of the Santa Maria Valley, including the Santa Maria River and Oso Flaco Creek near Guadalupe. Reported specific conductance values have ranged from about 200 to 3,600 umho/cm; sulfate concentrations have ranged from 440 to 1,000 mg/l (no chloride data are available), and nitrate-NO3 concentrations have exceeded 450 mg/l. Water draining in Green Canyon, a canal coursing from the central valley floor toward Guadalupe to join the Santa Maria River, is of a similar quality.

Water quality is also degraded in streams in the southern portion of the SMVMA, including Bradley Canyon and Orcutt Creek, both of which drain the Solomon Hills. Bradley Canyon drainage has specific conductance values that consistently fluctuate between about 500 and 1,500 umho/cm, and nitrate concentrations typically fluctuating between 20 and 110 mg/l (no sulfate or chloride data are available). Orcutt Creek historical water quality, shown in a graph (Figure 2.3-2b), has specific conductance values typically fluctuating between 1,100 and 3,500 umho/cm, with values that exceeded 5,500 umho/cm in 2005 and 2006. During the last decade, nitrate concentrations typically exceeded the health-based standard of 45 mg/l, in fact exceeding 125 mg/l in 2007 through 2009 before declining to 70 mg/l in 2011 and 2013 (40 mg/l in 2012).

It should be noted that review was provided to the TMA and CCRWQCB (LSCE, August 2013) regarding an assessment made of the Santa Maria River watershed as input to the total maximum daily load (TMDL) for salt (TetraTech, March 2013). Currently, the salt TMDL is still under development by the CCRWQCB. Further, an amendment to the CCRWQCB Basin Plan was recently approved (SWRCB, February 2014; CCRWQCB, May 2013), specifically establishing the TMDL for nutrients. It is suggested that evaluation be made of any methods and timeframes for implementation of the latter TMDL as specified in the Basin Plan.

2.4 Climate

The climatic data reported for the SMVMA are characterized in this section, specifically the current conditions in relation to historical trends in precipitation and evapotranspiration data.

2.4.1 Precipitation

At least three precipitation gauges have historically been located in the SMVMA, specifically at Guadalupe, Santa Maria (currently at the Airport and previously downtown), and Garey (see Appendix A, Figure 3). Additional gauges are operated by the Santa Barbara County Public Works Department at Sisquoc Ranch and Orcutt. The average annual rainfall measured at the Santa Maria Airport gauge, the most centrally located of the three gauges, is 12.80 inches, as shown in a bar chart of historical precipitation (Figure 2.4-1). Historically, the majority of rainfall occurs during the months of November through April; in calendar year 2013, the total rainfall was greatly below the average at 2.99 inches with the greatest monthly amounts in January and March, as shown in Table 2.4-1.

Long-term rainfall characteristics for the SMVMA are reflected by the cumulative departure curve of historical annual precipitation (on Figure 2.4-1), which indicates that the SMVMA has generally experienced periods of wetter than normal conditions alternating with periods of drier than normal to drought conditions. Wet conditions prevailed from the 1930's through 1944, followed by drier conditions from 1945 through the late 1960's. Subsequently, there have been shorter periods of alternating wet and dry conditions, including the most recent cycle of a wet period in the early-1990's to 1998, followed by a period of slightly dry conditions from 2001 through 2009. Since then, conditions have shown short-term variation with rainfall totals above the long-term average in 2010 and 2011 but well below the average in 2012 and 2013. This pattern of fluctuations in climatic conditions closely corresponds to the long-term fluctuations in groundwater levels described in section 2.1.2, including the substantial decline observed between 1945 and the late 1960's and the subsequent repeating cycle of decline and recovery between historical-low and historical-high groundwater levels. Most recently, groundwater levels rose substantially in much of the SMVMA through 2011 in response to large amounts of rainfall in late 2010 and early 2011 (and the associated recharge from prolonged Twitchell Reservoir releases and high Sisquoc River discharge). The slight decline in groundwater levels observed since in 2012 and 2013 is attributed in part to the below average rainfall, Twitchell releases, and Sisquoc River discharge in those two years.

2.4.2 Evapotranspiration

Three CIMIS climate stations were initially operated within the SMVMA for varying periods of time, specifically at Santa Maria, Betteravia, and Guadalupe between 1983 and 1997 (see Appendix A, Figure 3). Subsequently, CIMIS stations began operating near Sisquoc and on the southern Nipomo Mesa, the latter located just outside of the SMVMA, with climate data available for full calendar years beginning in 2001 and 2007, respectively. As reported in the 2010 and 2011 annual reports, a CIMIS climate station located on the floor of the Santa Maria Valley ("Santa Maria II" near the Santa Maria airport, see Appendix A, Figure 3) was reestablished in April 2011. A full calendar year of data from Santa Maria II was available for the first time in 2012. These six stations have recorded daily reference evapotranspiration (ETo) and precipitation amounts, with annual ETo values typically ranging between 42 and 53 inches and averaging about 48 inches, as shown in a bar chart of the historical ETo values for the SMVMA (Figure 2.4-2).

Daily climate data for 2013 from the Santa Maria II, Nipomo, and Sisquoc stations are listed in Table 2.4-2, specifically daily, monthly, and annual ETo and precipitation amounts. Annual ETo values ranged from 44.63 inches (Nipomo) to 53.10 inches (Sisquoc), and annual precipitation amounts ranged from 3.90 inches (Santa Maria II) to 14.41 inches (Sisquoc).

Several characteristics of the 2013 CIMIS station data are worthy of note. Evapotranspiration was highest during the months of April through September at all three stations, and the ETo values from the Santa Maria II station were typically intermediate to those from the other two stations. In addition, the 2013 precipitation recorded at the Santa Maria II CIMIS station was the most similar to the amount observed at the Santa Maria Airport precipitation gauge. In contrast, the precipitation recorded at the Sisquoc station, over 14 inches, and the Nipomo station, over 7 inches, greatly exceeded that observed at the Airport gauge (2.99 inches) and Santa Maria II CIMIS station (3.90 inches). A similar inconsistency in climate data, specifically a much greater precipitation amount recorded at the Sisquoc CIMIS station than at the airport, was observed in 2012. For this reason, and as described in the next chapter, the 2013 ETo data from the Santa Maria II CIMIS station and the 2013 precipitation data from the Airport gauge were utilized in the estimation of agricultural water requirements for the SMVMA in 2013.

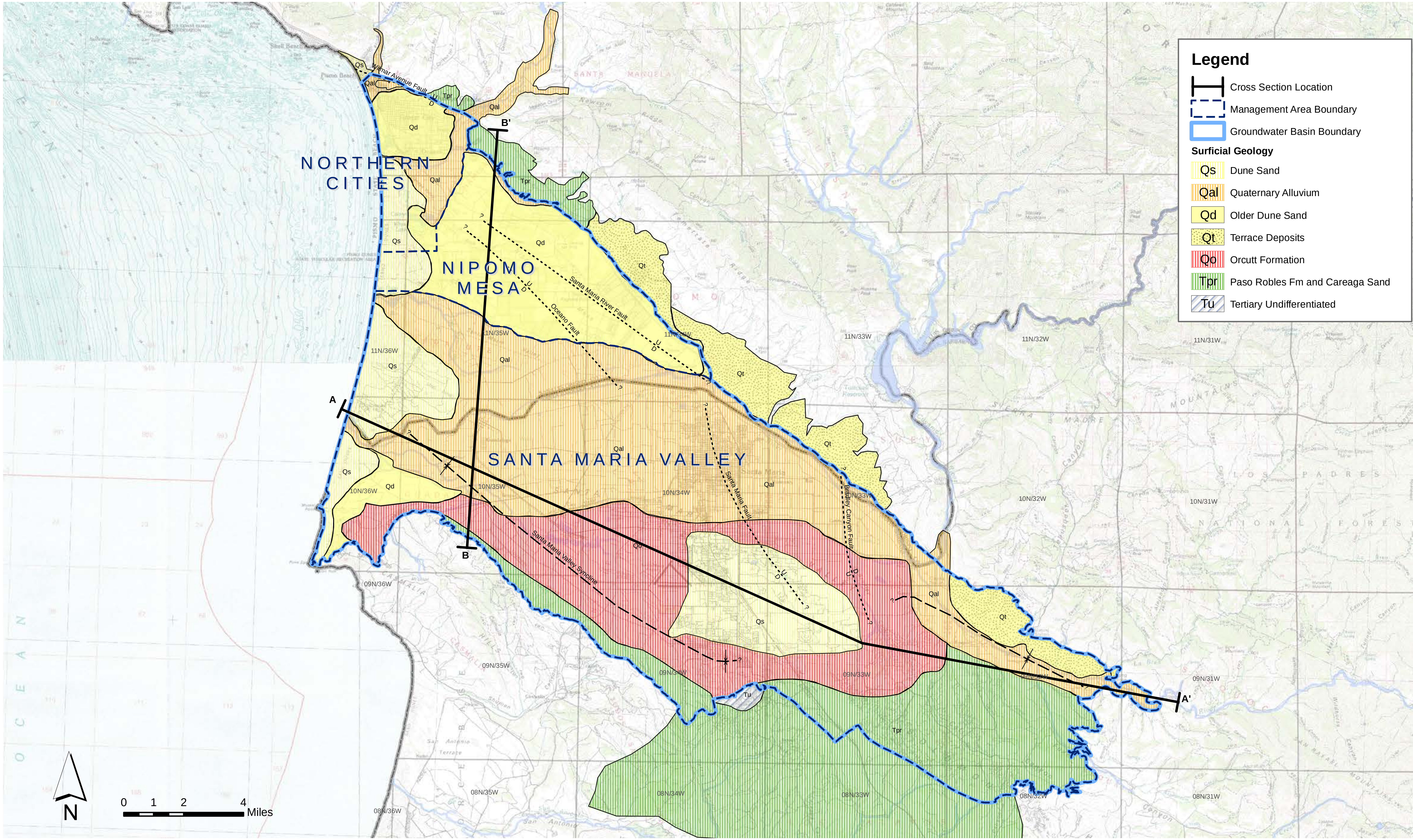

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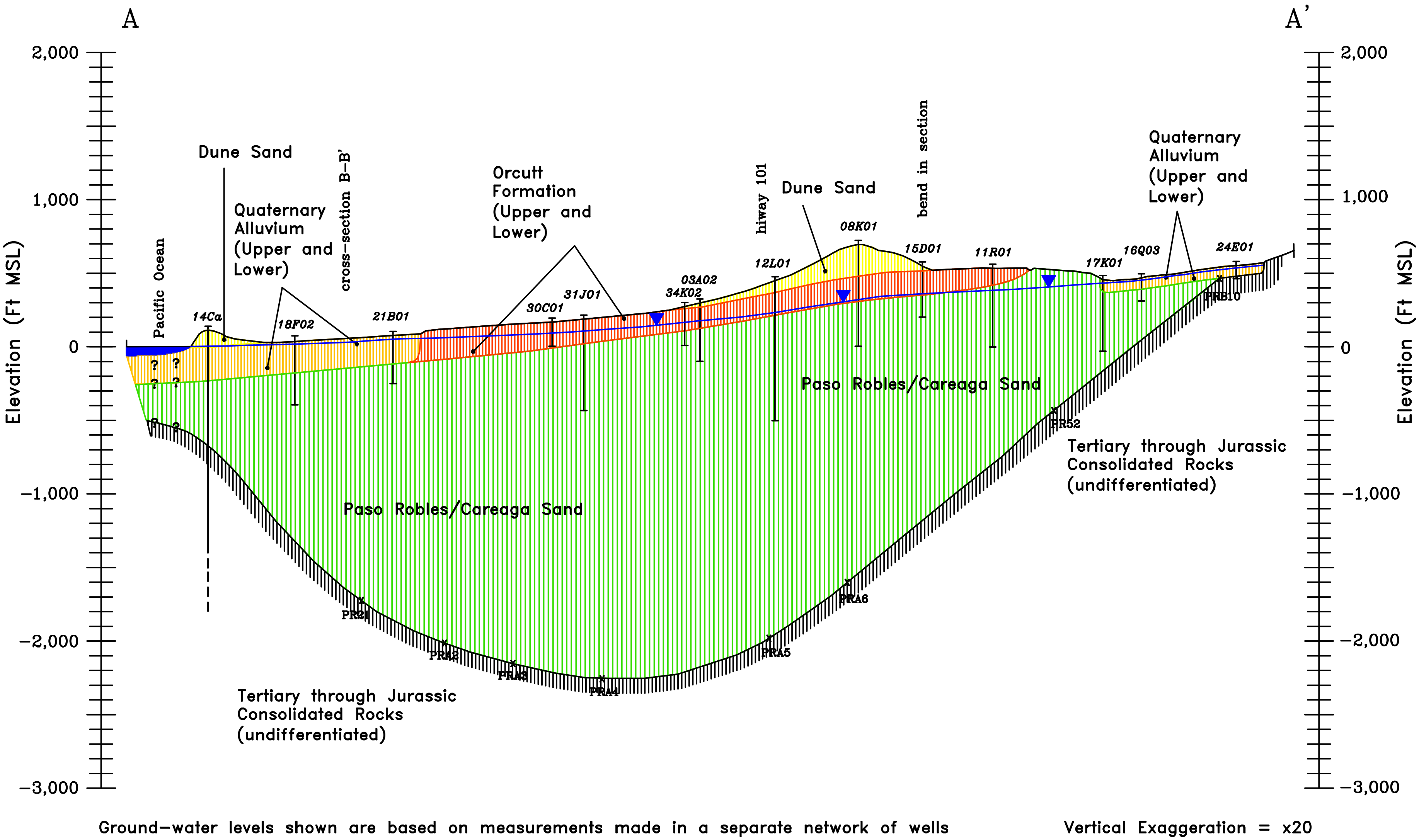
Figure 2.1-1a
Generalized Geologic Map with Cross Section Locations
Santa Maria Valley Management Area



C: \SantaMaria 2008\Annual Report 2008\Fig 2.1-1b XSec A-A' 2008.dwg

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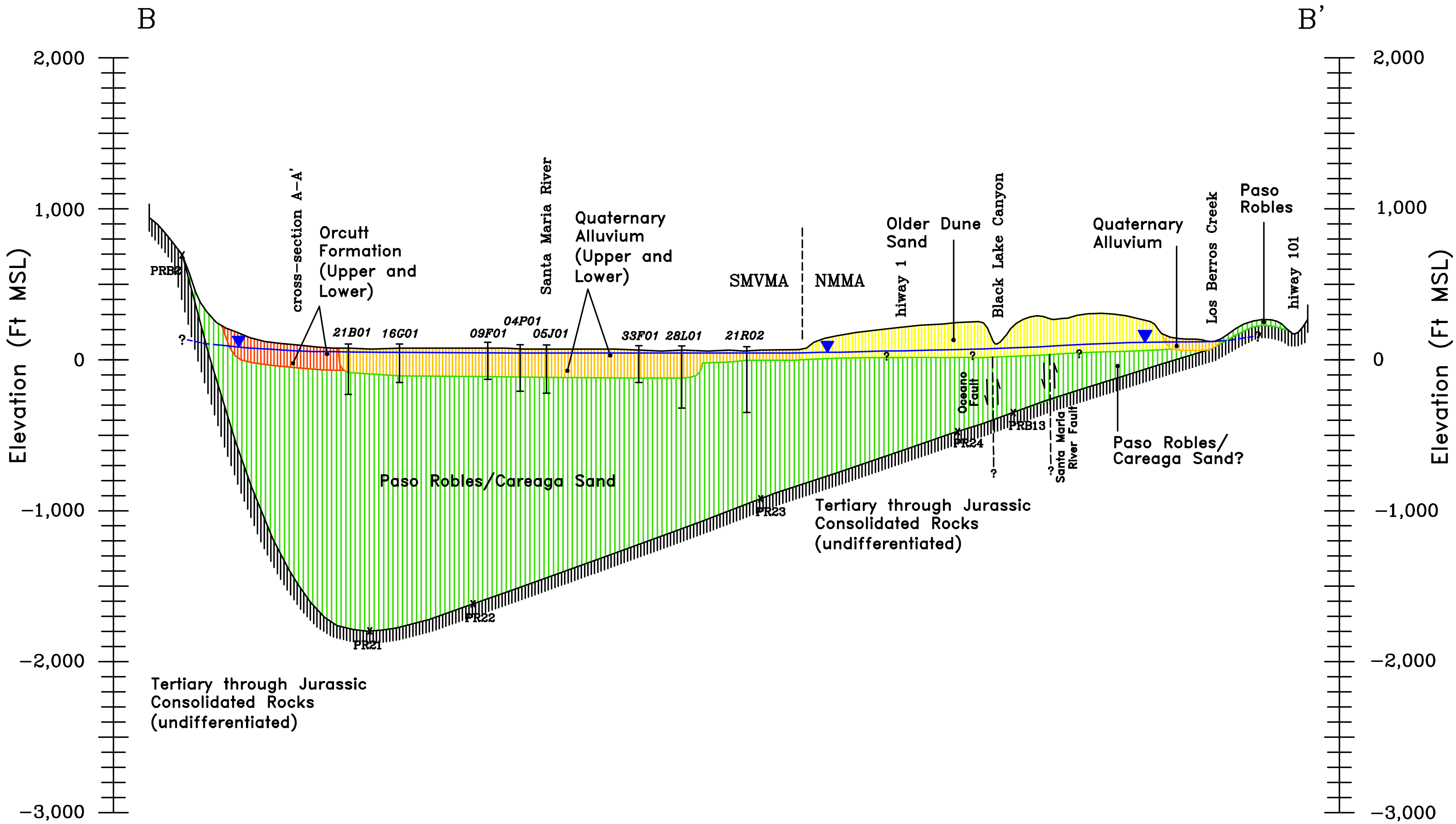
Figure 2.1-1b
Longitudinal Geologic Cross Section, A-A'
Santa Maria Valley Management Area



Ground-water levels shown are based on measurements made in a separate network of wells

Vertical Exaggeration = x10

C:\Santa Maria 2008\Annual Report 2008\Fig 2.1-1c XSec B-B' 2009.dwg

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Figure 2.1-1c
Transverse Geologic Cross Section, B-B'
Santa Maria Valley Management Area

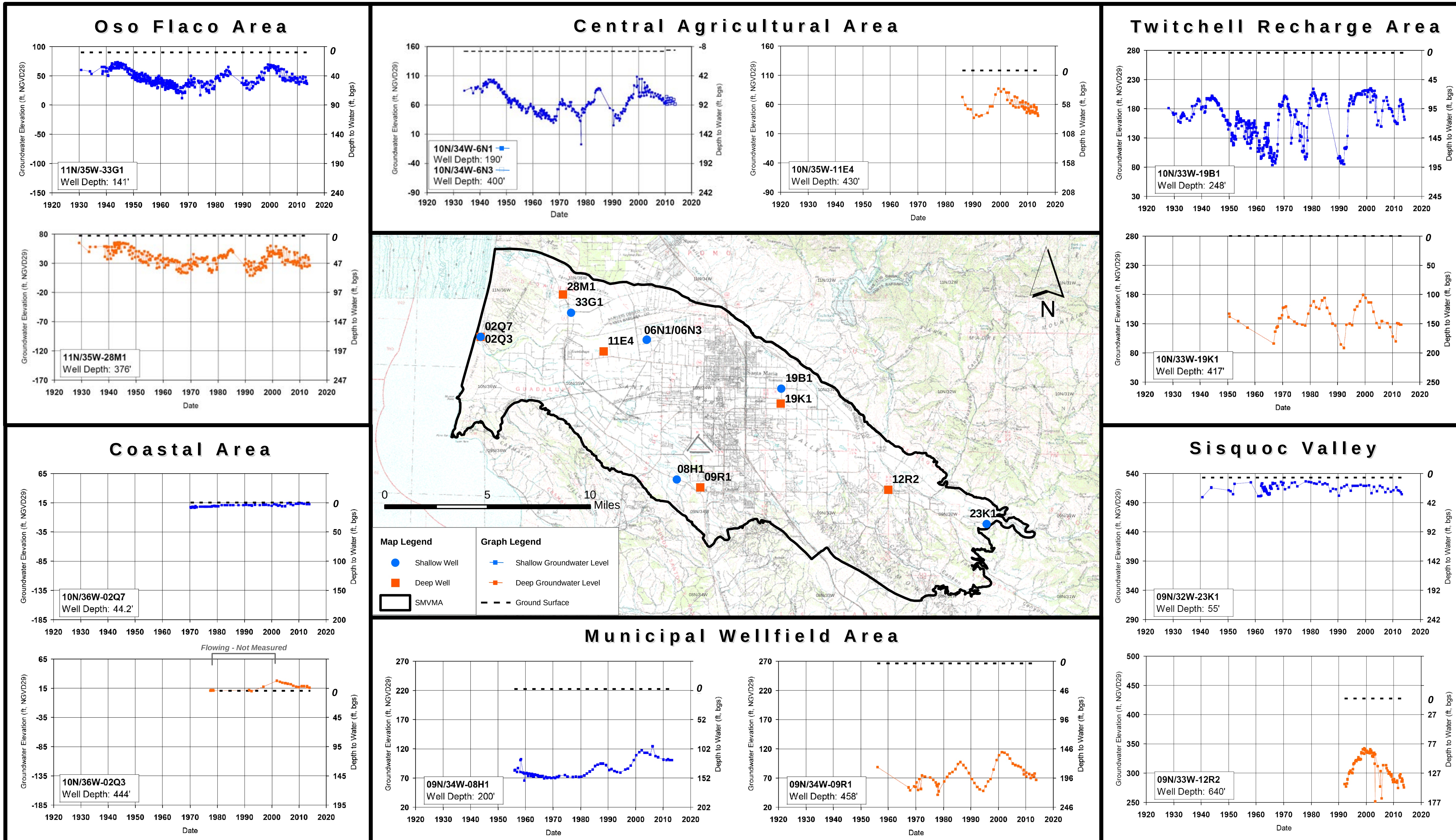

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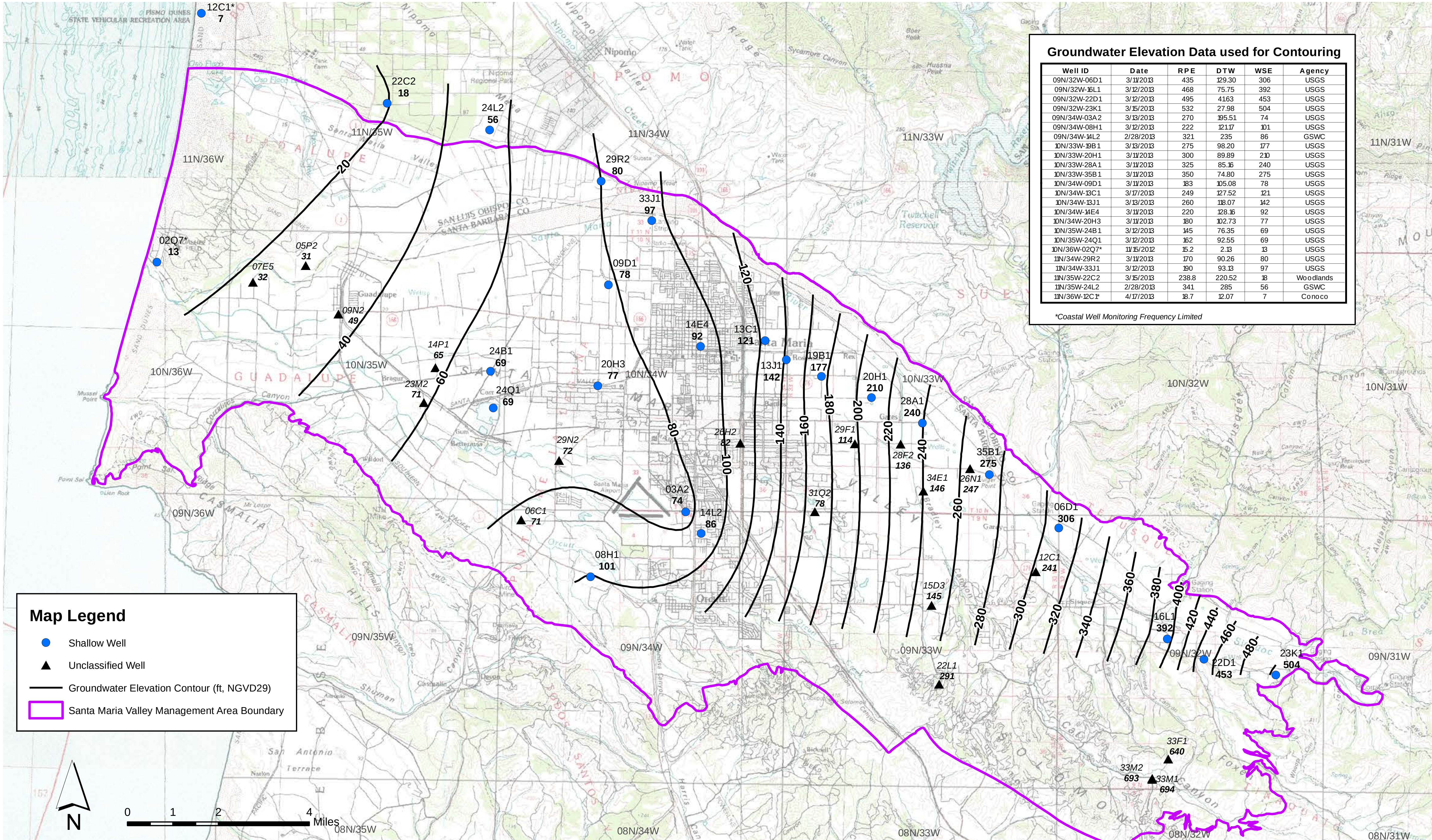
Figure 2.1-2
Historical Groundwater Levels
Santa Maria Valley Management Area



Groundwater Elevation Data used for Contouring

Well ID	Date	RPE	DTW	WSE	Agency
09N/32W-06D1	3/11/2013	435	129.30	306	USGS
09N/32W-16L1	3/12/2013	468	75.75	392	USGS
09N/32W-22D1	3/12/2013	495	41.63	453	USGS
09N/32W-23K1	3/15/2013	532	27.98	504	USGS
09N/34W-03A2	3/13/2013	270	195.51	74	USGS
09N/34W-08H1	3/12/2013	222	121.17	101	USGS
09N/34W-14L2	2/28/2013	321	235	86	GSWC
10N/33W-19B1	3/13/2013	275	98.20	177	USGS
10N/33W-20H1	3/11/2013	300	89.89	210	USGS
10N/33W-28A1	3/11/2013	325	85.16	240	USGS
10N/33W-35B1	3/11/2013	350	74.80	275	USGS
10N/34W-09D1	3/11/2013	183	105.08	78	USGS
10N/34W-13C1	3/17/2013	249	127.52	121	USGS
10N/34W-13J1	3/13/2013	260	118.07	142	USGS
10N/34W-14E4	3/11/2013	220	128.16	92	USGS
10N/34W-20H3	3/11/2013	180	102.73	77	USGS
10N/35W-24B1	3/12/2013	145	76.35	69	USGS
10N/35W-24Q1	3/12/2013	162	92.55	69	USGS
10N/36W-02Q7*	11/15/2012	15.2	2.13	13	USGS
11N/34W-29R2	3/11/2013	170	90.26	80	USGS
11N/34W-33J1	3/12/2013	190	93.13	97	USGS
11N/35W-22C2	3/15/2013	238.8	220.52	18	Woodlands
11N/35W-24L2	2/28/2013	341	285	56	GSWC
11N/36W-12C1*	4/17/2013	18.7	12.07	7	Conoco

*Coastal Well Monitoring Frequency Limited

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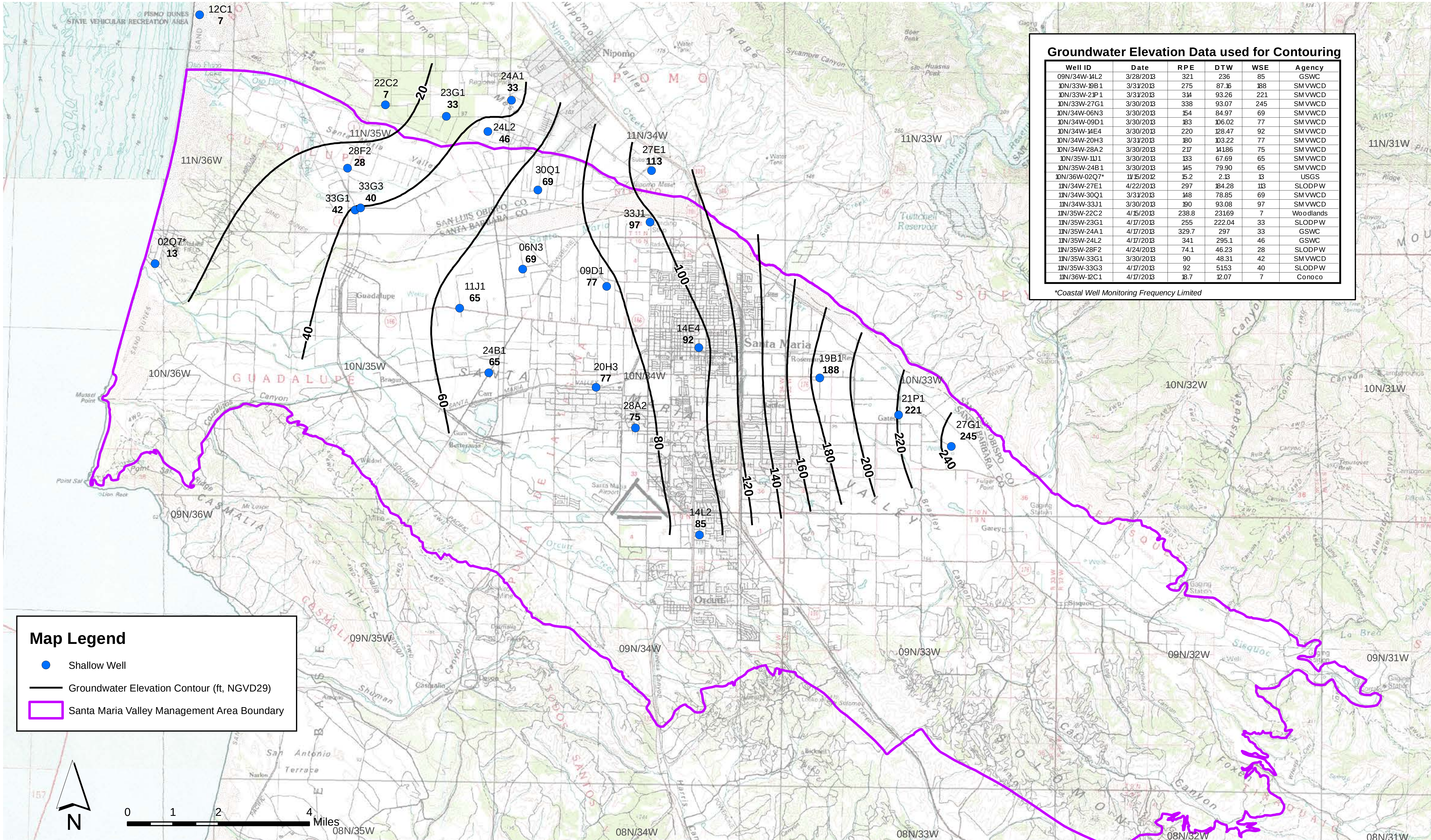
Figure 2.1-3a
Contours of Equal Groundwater Elevation, Shallow Zone, Early Spring (February 28 - March 17) 2013
Santa Maria Valley Management Area



Groundwater Elevation Data used for Contouring

Well ID	Date	RPE	DTW	WSE	Agency
09N/34W-14L2	3/28/2013	321	236	85	GSWC
10N/33W-19B1	3/31/2013	275	87.16	188	SMVWCD
10N/33W-21P1	3/31/2013	314	93.26	221	SMVWCD
10N/33W-27G1	3/30/2013	338	93.07	245	SMVWCD
10N/34W-06N3	3/30/2013	154	84.97	69	SMVWCD
10N/34W-09D1	3/30/2013	183	106.02	77	SMVWCD
10N/34W-14E4	3/30/2013	220	128.47	92	SMVWCD
10N/34W-20H3	3/31/2013	180	103.22	77	SMVWCD
10N/34W-28A2	3/30/2013	217	141.86	75	SMVWCD
10N/35W-11J1	3/30/2013	133	67.69	65	SMVWCD
10N/35W-24B1	3/30/2013	145	79.90	65	SMVWCD
10N/36W-02Q7*	11/15/2012	15.2	2.13	13	USGS
11N/34W-27E1	4/22/2013	297	184.28	113	SLODPW
11N/34W-30Q1	3/31/2013	148	78.85	69	SMVWCD
11N/34W-33J1	3/30/2013	190	93.08	97	SMVWCD
11N/35W-22C2	4/15/2013	238.8	231.69	7	Woodlands
11N/35W-23G1	4/17/2013	255	222.04	33	SLODPW
11N/35W-24A1	4/17/2013	329.7	297	33	GSWC
11N/35W-24L2	4/17/2013	341	295.1	46	GSWC
11N/35W-28F2	4/24/2013	74.1	46.23	28	SLODPW
11N/35W-33G1	3/30/2013	90	48.31	42	SMVWCD
11N/35W-33G3	4/17/2013	92	51.53	40	SLODPW
11N/36W-12C1	4/17/2013	18.7	12.07	7	Conoco

*Coastal Well Monitoring Frequency Limited

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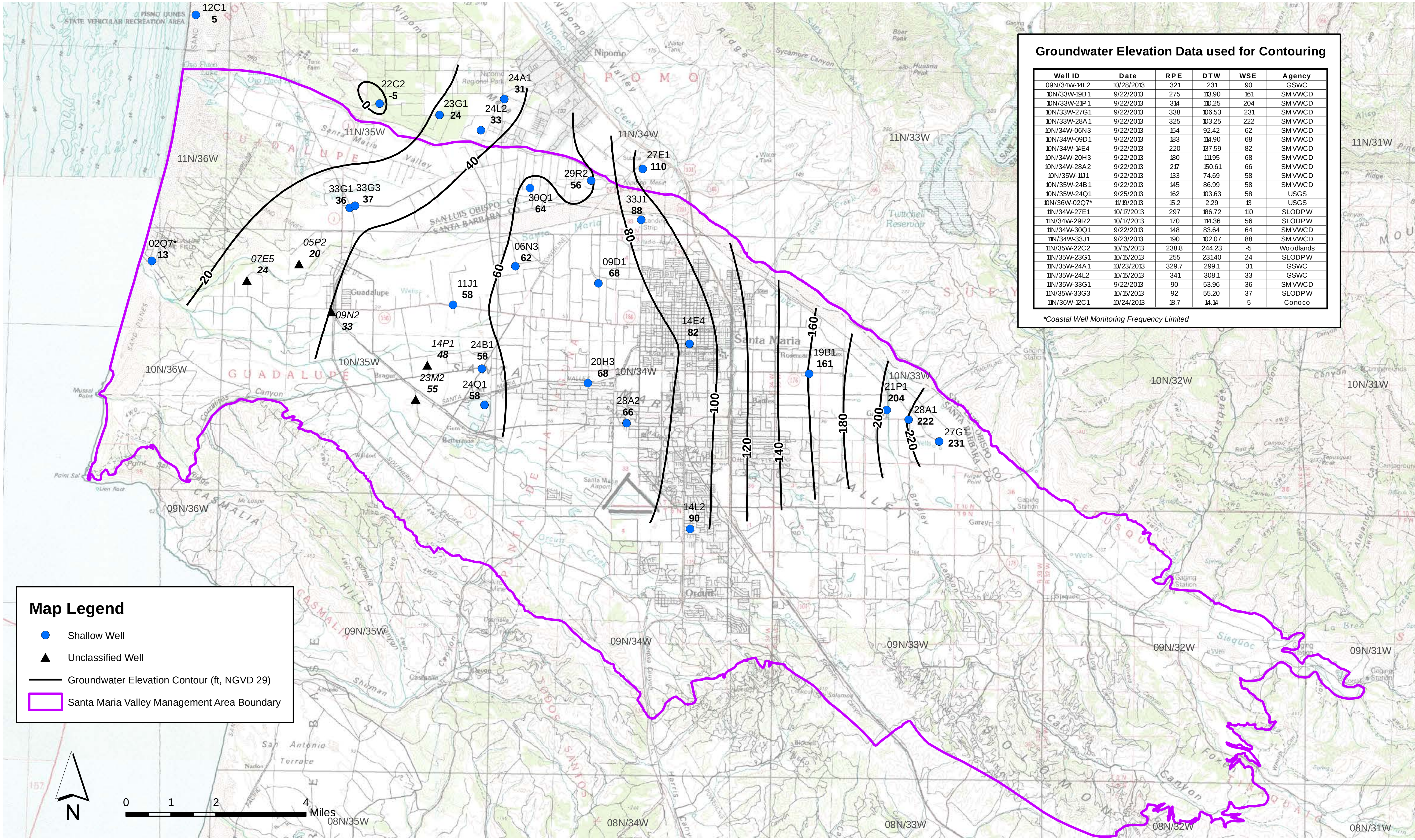
Figure 2.1-3b
Contours of Equal Groundwater Elevation, Shallow Zone, Late Spring (March 28 - April 24) 2013
Santa Maria Valley Management Area



Groundwater Elevation Data used for Contouring

Well ID	Date	RPE	DTW	WSE	Agency
09N/34W-14L2	10/28/2013	321	231	90	GSWC
10N/33W-19B1	9/22/2013	275	113.90	161	SMVWCD
10N/33W-21P1	9/22/2013	314	110.25	204	SMVWCD
10N/33W-27G1	9/22/2013	338	106.53	231	SMVWCD
10N/33W-28A1	9/22/2013	325	103.25	222	SMVWCD
10N/34W-06N3	9/22/2013	154	92.42	62	SMVWCD
10N/34W-09D1	9/22/2013	183	114.90	68	SMVWCD
10N/34W-14E4	9/22/2013	220	137.59	82	SMVWCD
10N/34W-20H3	9/22/2013	180	111.95	68	SMVWCD
10N/34W-28A2	9/22/2013	217	150.61	66	SMVWCD
10N/35W-11J1	9/22/2013	133	74.69	58	SMVWCD
10N/35W-24B1	9/22/2013	145	86.99	58	SMVWCD
10N/35W-24Q1	9/25/2013	162	103.63	58	USGS
10N/36W-02Q7*	11/19/2013	15.2	2.29	13	USGS
11N/34W-27E1	10/17/2013	297	186.72	110	SLODPW
11N/34W-29R2	10/17/2013	170	114.36	56	SLODPW
11N/34W-30Q1	9/22/2013	148	83.64	64	SMVWCD
11N/34W-33J1	9/23/2013	190	102.07	88	SMVWCD
11N/35W-22C2	10/15/2013	238.8	244.23	-5	Woodlands
11N/35W-23G1	10/15/2013	255	231.40	24	SLODPW
11N/35W-24A1	10/23/2013	329.7	299.1	31	GSWC
11N/35W-24L2	10/15/2013	341	308.1	33	GSWC
11N/35W-33G1	9/22/2013	90	53.96	36	SMVWCD
11N/35W-33G3	10/15/2013	92	55.20	37	SLODPW
11N/36W-12C1	10/24/2013	18.7	14.14	5	Conoco

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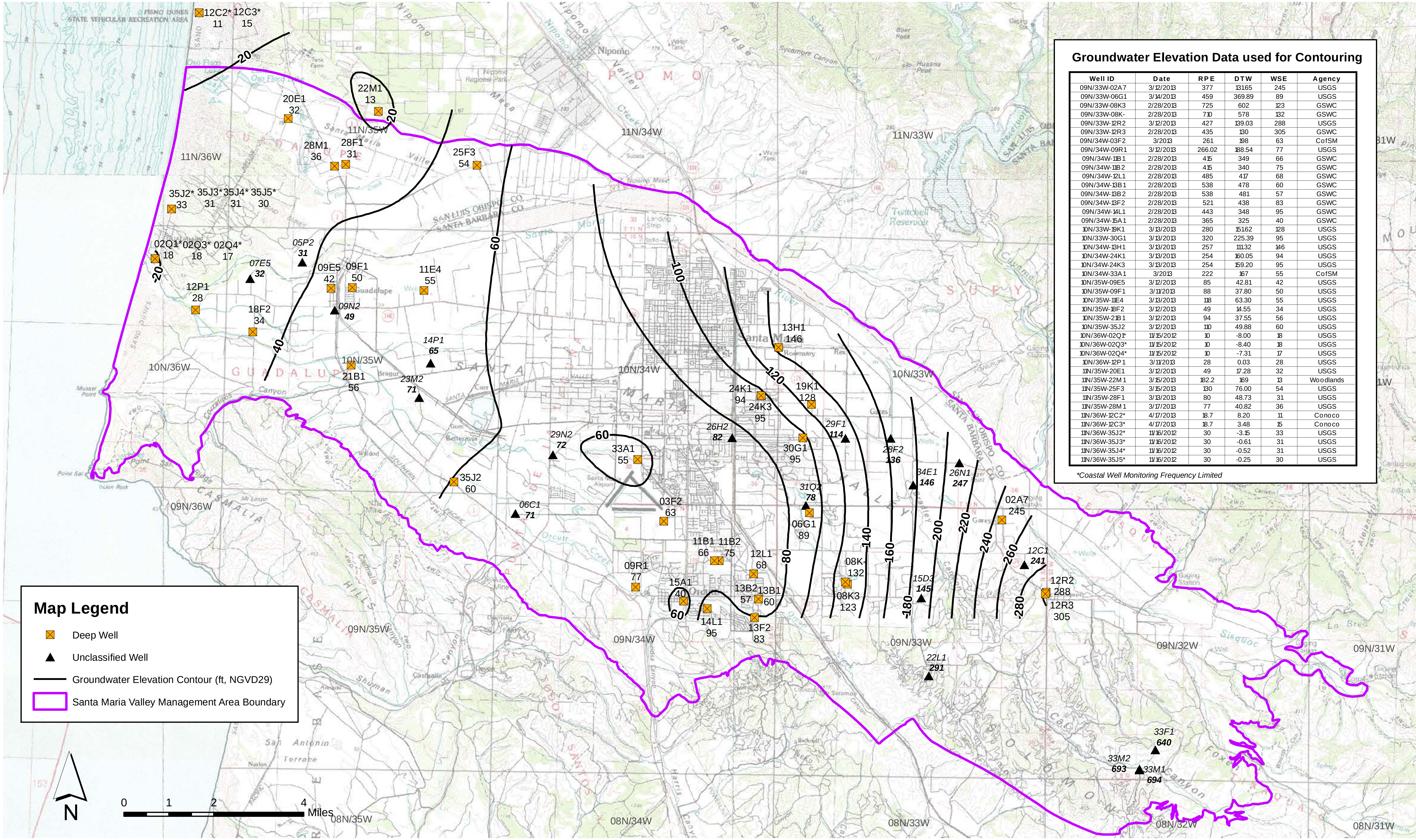
Figure 2.1-3c
Contours of Equal Groundwater Elevation, Shallow Zone, Fall (September 22 - October 28) 2013
Santa Maria Valley Management Area



Groundwater Elevation Data used for Contouring

Well ID	Date	RPE	DTW	WSE	Agency
09N/33W-02A7	3/12/2013	377	131.65	245	USGS
09N/33W-06G1	3/14/2013	459	369.89	89	USGS
09N/33W-08K3	2/28/2013	725	602	123	GSWC
09N/33W-08K-	2/28/2013	710	578	132	GSWC
09N/33W-12R2	3/12/2013	427	139.03	288	USGS
09N/33W-12R3	2/28/2013	435	130	305	GSWC
09N/34W-03F2	3/2013	261	198	63	CofSM
09N/34W-09R1	3/12/2013	266.02	188.54	77	USGS
09N/34W-11B1	2/28/2013	415	349	66	GSWC
09N/34W-11B2	2/28/2013	415	340	75	GSWC
09N/34W-12L1	2/28/2013	485	417	68	GSWC
09N/34W-13B1	2/28/2013	538	478	60	GSWC
09N/34W-13B2	2/28/2013	538	481	57	GSWC
09N/34W-13F2	2/28/2013	521	438	83	GSWC
09N/34W-14L1	2/28/2013	443	348	95	GSWC
09N/34W-15A1	2/28/2013	365	325	40	GSWC
10N/33W-19K1	3/13/2013	280	151.62	128	USGS
10N/33W-30G1	3/13/2013	320	225.39	95	USGS
10N/34W-13H1	3/13/2013	257	111.32	146	USGS
10N/34W-24K1	3/13/2013	254	160.05	94	USGS
10N/34W-24K3	3/13/2013	254	159.20	95	USGS
10N/34W-33A1	3/2013	222	167	55	CofSM
10N/35W-09E5	3/12/2013	85	42.81	42	USGS
10N/35W-09F1	3/11/2013	88	37.80	50	USGS
10N/35W-11E4	3/13/2013	118	63.30	55	USGS
10N/35W-18F2	3/12/2013	49	14.55	34	USGS
10N/35W-21B1	3/12/2013	94	37.55	56	USGS
10N/35W-35J2	3/12/2013	110	49.88	60	USGS
10N/36W-02Q1*	11/15/2012	10	-8.00	18	USGS
10N/36W-02Q3*	11/15/2012	10	-8.40	18	USGS
10N/36W-02Q4*	11/15/2012	10	-7.31	17	USGS
10N/36W-12P1	3/11/2013	28	0.03	28	USGS
11N/35W-20E1	3/12/2013	49	17.28	32	USGS
11N/35W-22M1	3/15/2013	182.2	169	13	Woodlands
11N/35W-25F3	3/15/2013	130	76.00	54	USGS
11N/35W-28F1	3/13/2013	80	48.73	31	USGS
11N/35W-28M1	3/17/2013	77	40.82	36	USGS
11N/36W-12C2*	4/17/2013	18.7	8.20	11	Conoco
11N/36W-12C3*	4/17/2013	18.7	3.48	15	Conoco
11N/36W-35J2*	11/16/2012	30	-3.15	33	USGS
11N/36W-35J3*	11/16/2012	30	-0.61	31	USGS
11N/36W-35J4*	11/16/2012	30	-0.52	31	USGS
11N/36W-35J5*	11/16/2012	30	-0.25	30	USGS

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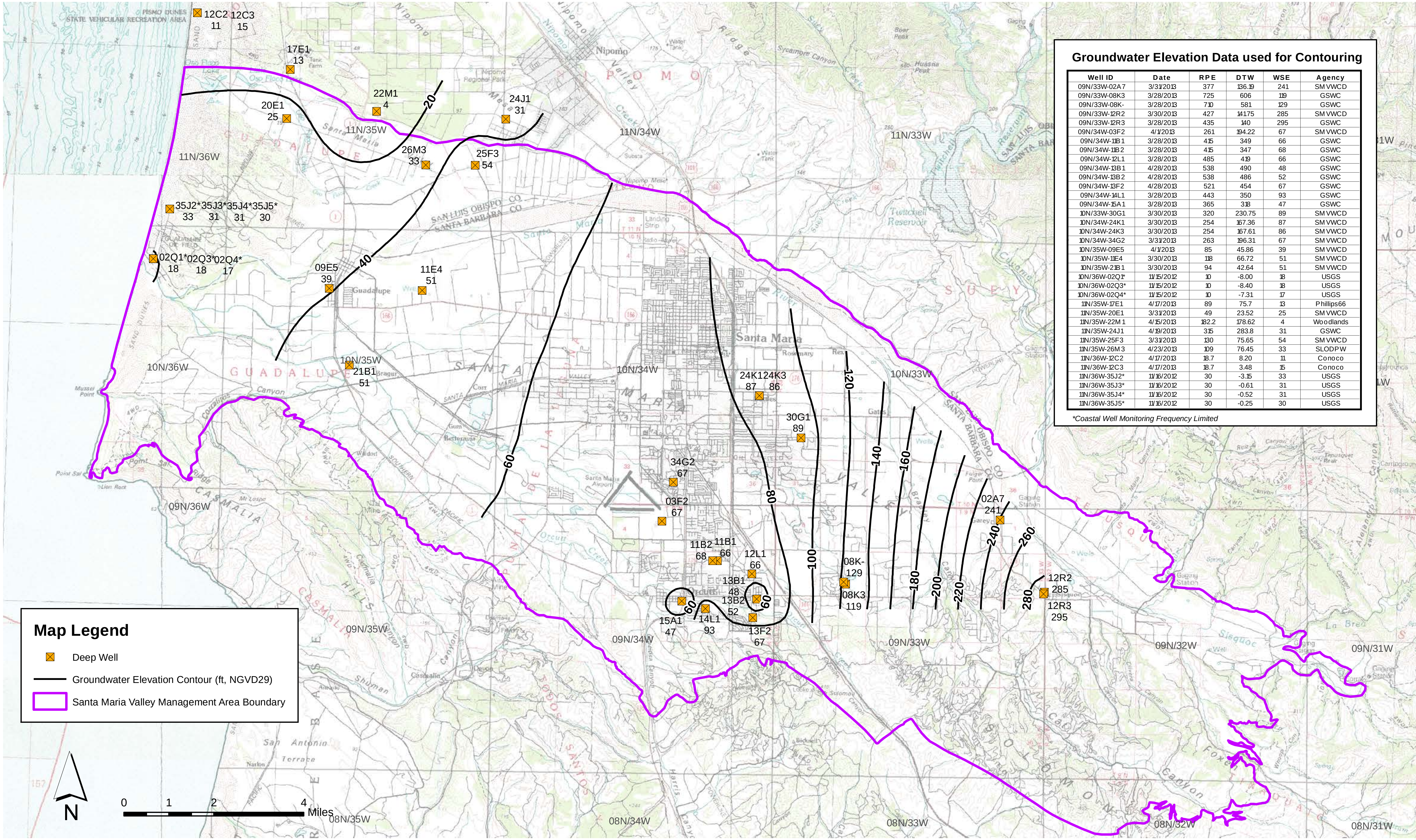
Figure 2.1-3d
Contours of Equal Groundwater Elevation, Deep Zone, Early Spring (February 28 - March 17) 2013
Santa Maria Valley Management Area



Groundwater Elevation Data used for Contouring

Well ID	Date	RPE	DTW	WSE	Agency
09N/33W-02A7	3/31/2013	377	136.19	241	SMVWCD
09N/33W-08K3	3/28/2013	725	606	119	GSWC
09N/33W-08K-	3/28/2013	710	581	129	GSWC
09N/33W-12R2	3/30/2013	427	141.75	285	SMVWCD
09N/33W-12R3	3/28/2013	435	140	295	GSWC
09N/34W-03F2	4/1/2013	261	194.22	67	SMVWCD
09N/34W-11B1	3/28/2013	415	349	66	GSWC
09N/34W-11B2	3/28/2013	415	347	68	GSWC
09N/34W-12L1	3/28/2013	485	419	66	GSWC
09N/34W-13B1	4/28/2013	538	490	48	GSWC
09N/34W-13B2	4/28/2013	538	486	52	GSWC
09N/34W-13F2	4/28/2013	521	454	67	GSWC
09N/34W-14L1	3/28/2013	443	350	93	GSWC
09N/34W-15A1	3/28/2013	365	318	47	GSWC
10N/33W-30G1	3/30/2013	320	230.75	89	SMVWCD
10N/34W-24K1	3/30/2013	254	167.36	87	SMVWCD
10N/34W-24K3	3/30/2013	254	167.61	86	SMVWCD
10N/34W-34G2	3/31/2013	263	196.31	67	SMVWCD
10N/35W-09E5	4/1/2013	85	45.86	39	SMVWCD
10N/35W-11E4	3/30/2013	118	66.72	51	SMVWCD
10N/35W-21B1	3/30/2013	94	42.64	51	SMVWCD
10N/36W-02Q1*	11/15/2012	10	-8.00	18	USGS
10N/36W-02Q3*	11/15/2012	10	-8.40	18	USGS
10N/36W-02Q4*	11/15/2012	10	-7.31	17	USGS
11N/35W-17E1	4/17/2013	89	75.7	13	Phillips66
11N/35W-20E1	3/31/2013	49	23.52	25	SMVWCD
11N/35W-22M1	4/15/2013	182.2	178.62	4	Woodlands
11N/35W-24J1	4/19/2013	315	283.8	31	GSWC
11N/35W-25F3	3/31/2013	130	75.65	54	SMVWCD
11N/35W-26M3	4/23/2013	109	76.45	33	SLODPW
11N/36W-12C2	4/17/2013	18.7	8.20	11	Conoco
11N/36W-12C3	4/17/2013	18.7	3.48	15	Conoco
11N/36W-35J2*	11/16/2012	30	-3.15	33	USGS
11N/36W-35J3*	11/16/2012	30	-0.61	31	USGS
11N/36W-35J4*	11/16/2012	30	-0.52	31	USGS
11N/36W-35J5*	11/16/2012	30	-0.25	30	USGS

*Coastal Well Monitoring Frequency Limited

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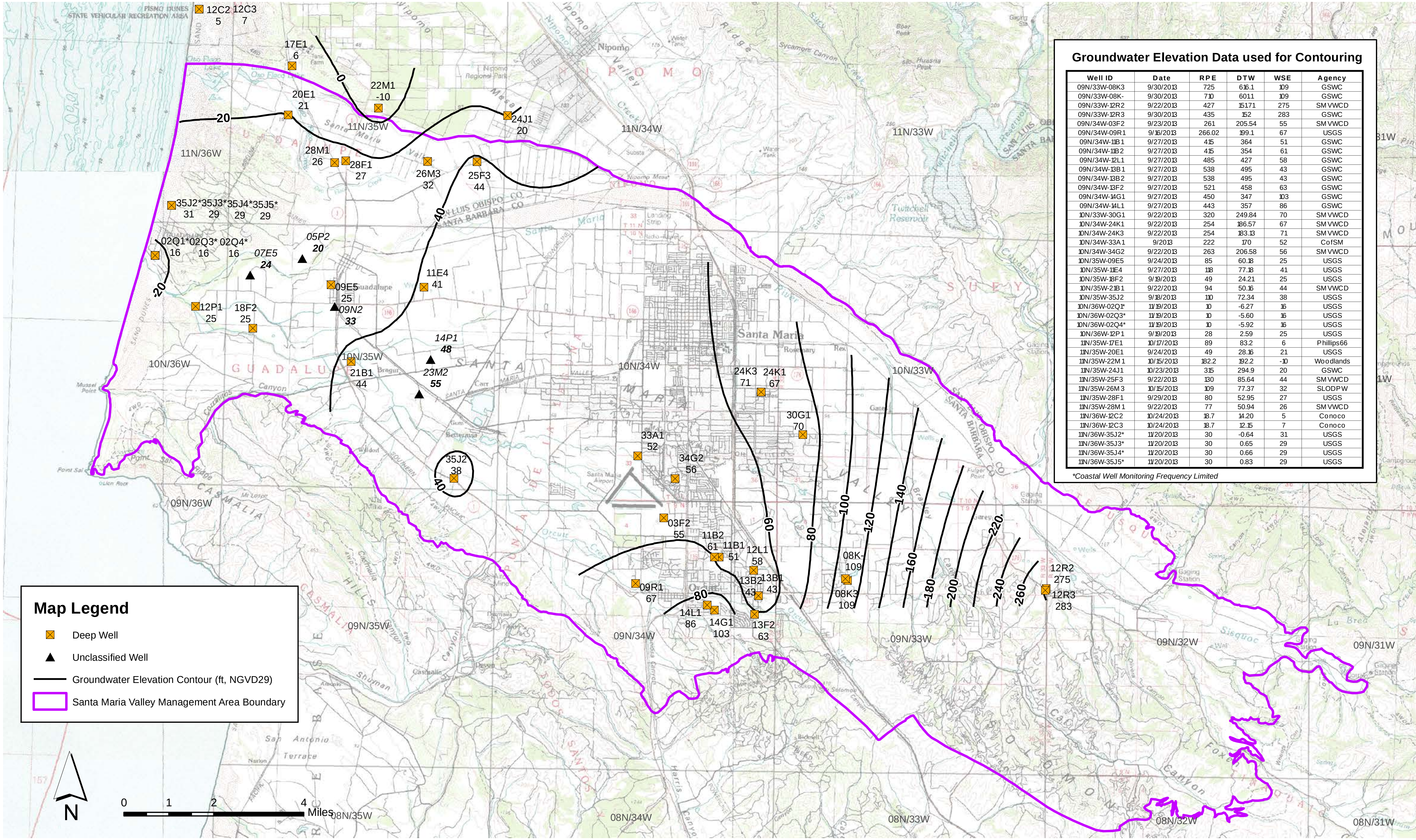
Figure 2.1-3e
Contours of Equal Groundwater Elevation, Deep Zone, Late Spring (March 28 - April 28) 2013
Santa Maria Valley Management Area



Groundwater Elevation Data used for Contouring

Well ID	Date	RPE	DTW	WSE	Agency
09N/33W-08K3	9/30/2013	725	616.1	109	GSWC
09N/33W-08K-	9/30/2013	710	601.1	109	GSWC
09N/33W-12R2	9/22/2013	427	151.71	275	SMVWCD
09N/33W-12R3	9/30/2013	435	152	283	GSWC
09N/34W-03F2	9/23/2013	261	205.54	55	SMVWCD
09N/34W-09R1	9/16/2013	266.02	199.1	67	USGS
09N/34W-11B1	9/27/2013	415	364	51	GSWC
09N/34W-11B2	9/27/2013	415	354	61	GSWC
09N/34W-12L1	9/27/2013	485	427	58	GSWC
09N/34W-13B1	9/27/2013	538	495	43	GSWC
09N/34W-13B2	9/27/2013	538	495	43	GSWC
09N/34W-13F2	9/27/2013	521	458	63	GSWC
09N/34W-14G1	9/27/2013	450	347	103	GSWC
09N/34W-14L1	9/27/2013	443	357	86	GSWC
10N/33W-30G1	9/22/2013	320	249.84	70	SMVWCD
10N/34W-24K1	9/22/2013	254	186.57	67	SMVWCD
10N/34W-24K3	9/22/2013	254	183.13	71	SMVWCD
10N/34W-33A1	9/2013	222	170	52	CofSM
10N/34W-34G2	9/22/2013	263	206.58	56	SMVWCD
10N/35W-09E5	9/24/2013	85	60.18	25	USGS
10N/35W-11E4	9/27/2013	118	77.18	41	USGS
10N/35W-18F2	9/19/2013	49	24.21	25	USGS
10N/35W-21B1	9/22/2013	94	50.16	44	SMVWCD
10N/35W-35J2	9/18/2013	110	72.34	38	USGS
10N/36W-02Q1*	11/19/2013	10	-6.27	16	USGS
10N/36W-02Q3*	11/19/2013	10	-5.60	16	USGS
10N/36W-02Q4*	11/19/2013	10	-5.92	16	USGS
10N/36W-12P1	9/19/2013	28	2.59	25	USGS
11N/35W-17E1	10/17/2013	89	83.2	6	Phillips66
11N/35W-20E1	9/24/2013	49	28.16	21	USGS
11N/35W-22M1	10/15/2013	182.2	192.2	-10	Woodlands
11N/35W-24J1	10/23/2013	315	294.9	20	GSWC
11N/35W-25F3	9/22/2013	130	85.64	44	SMVWCD
11N/35W-26M3	10/15/2013	109	77.37	32	SLODPW
11N/35W-28F1	9/29/2013	80	52.95	27	USGS
11N/35W-28M1	9/22/2013	77	50.94	26	SMVWCD
11N/36W-12C2	10/24/2013	18.7	14.20	5	Conoco
11N/36W-12C3	10/24/2013	18.7	12.15	7	Conoco
11N/36W-35J2*	11/20/2013	30	-0.64	31	USGS
11N/36W-35J3*	11/20/2013	30	0.65	29	USGS
11N/36W-35J4*	11/20/2013	30	0.66	29	USGS
11N/36W-35J5*	11/20/2013	30	0.83	29	USGS

*Coastal Well Monitoring Frequency Limited

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Figure 2.1-3f
Contours of Equal Groundwater Elevation, Deep Zone, Fall (September 16 - October 24) 2013
Santa Maria Valley Management Area

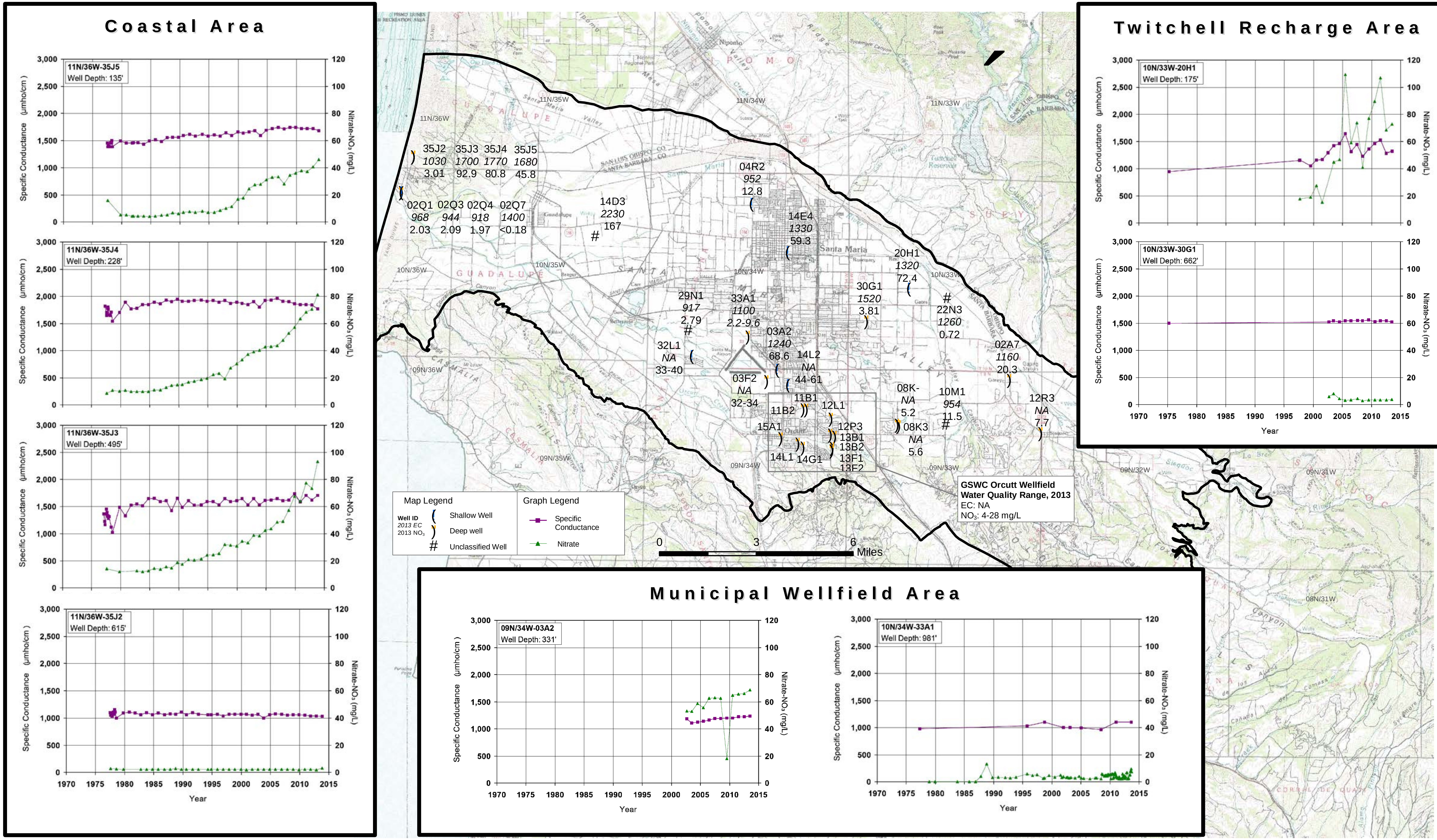

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Figure 2.1-4
Historical Groundwater Quality
Santa Maria Valley Management Area

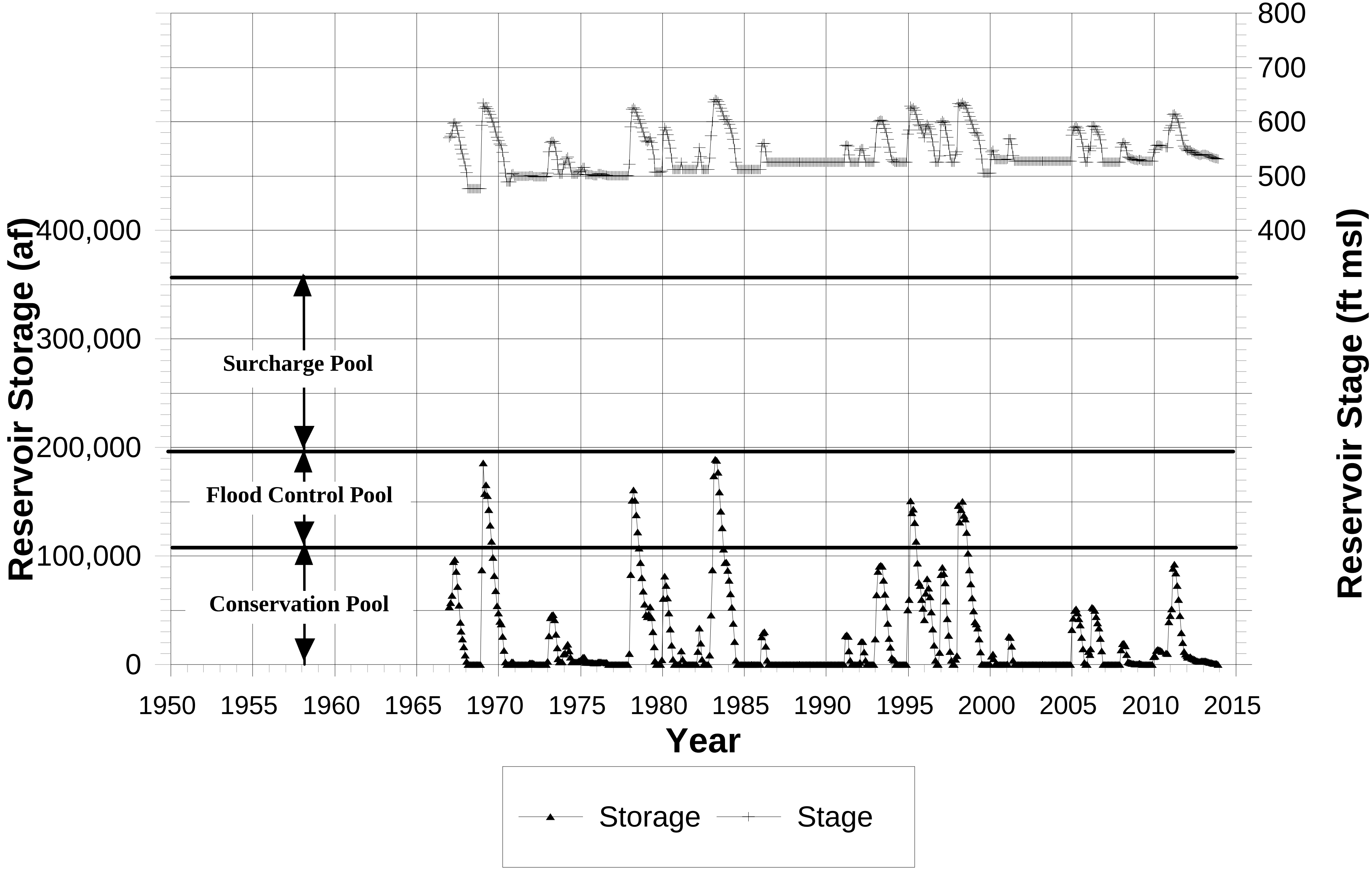

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Figure 2.2-1a
Historical Stage and Storage, Twitchell Reservoir
Santa Maria Valley Management Area

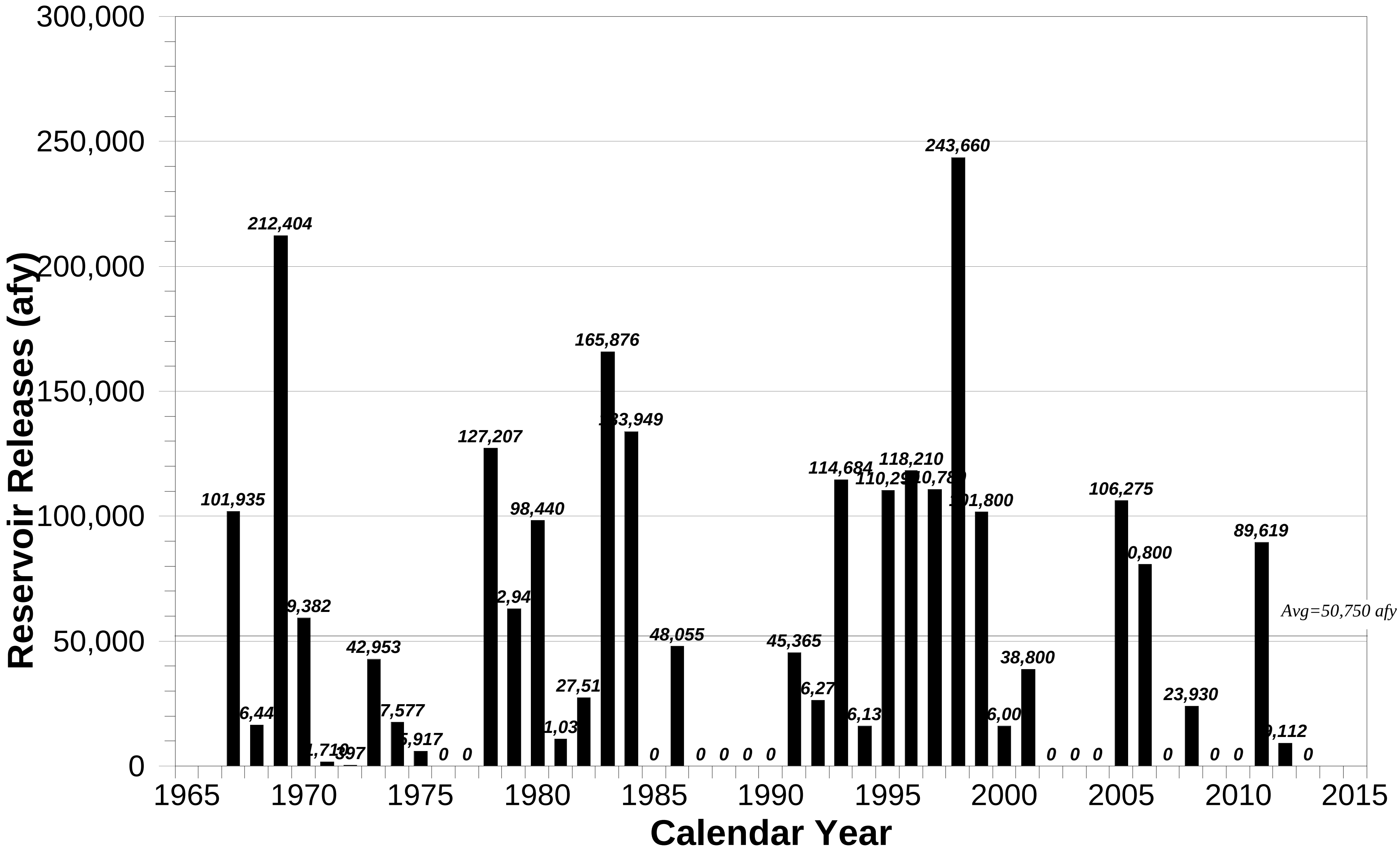

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Figure 2.2-1b
Historical Releases, Twitchell Reservoir
Santa Maria Valley Management Area

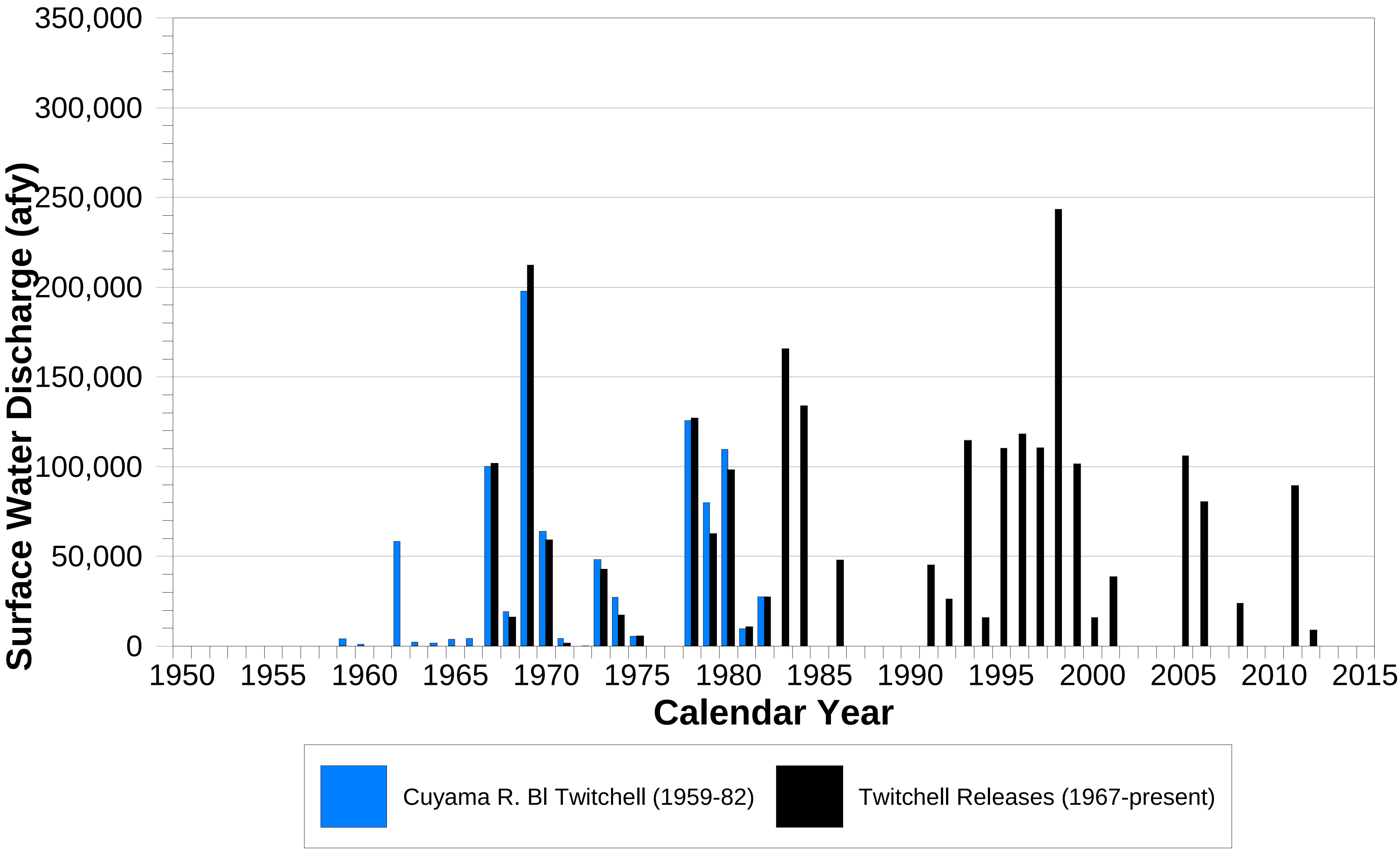

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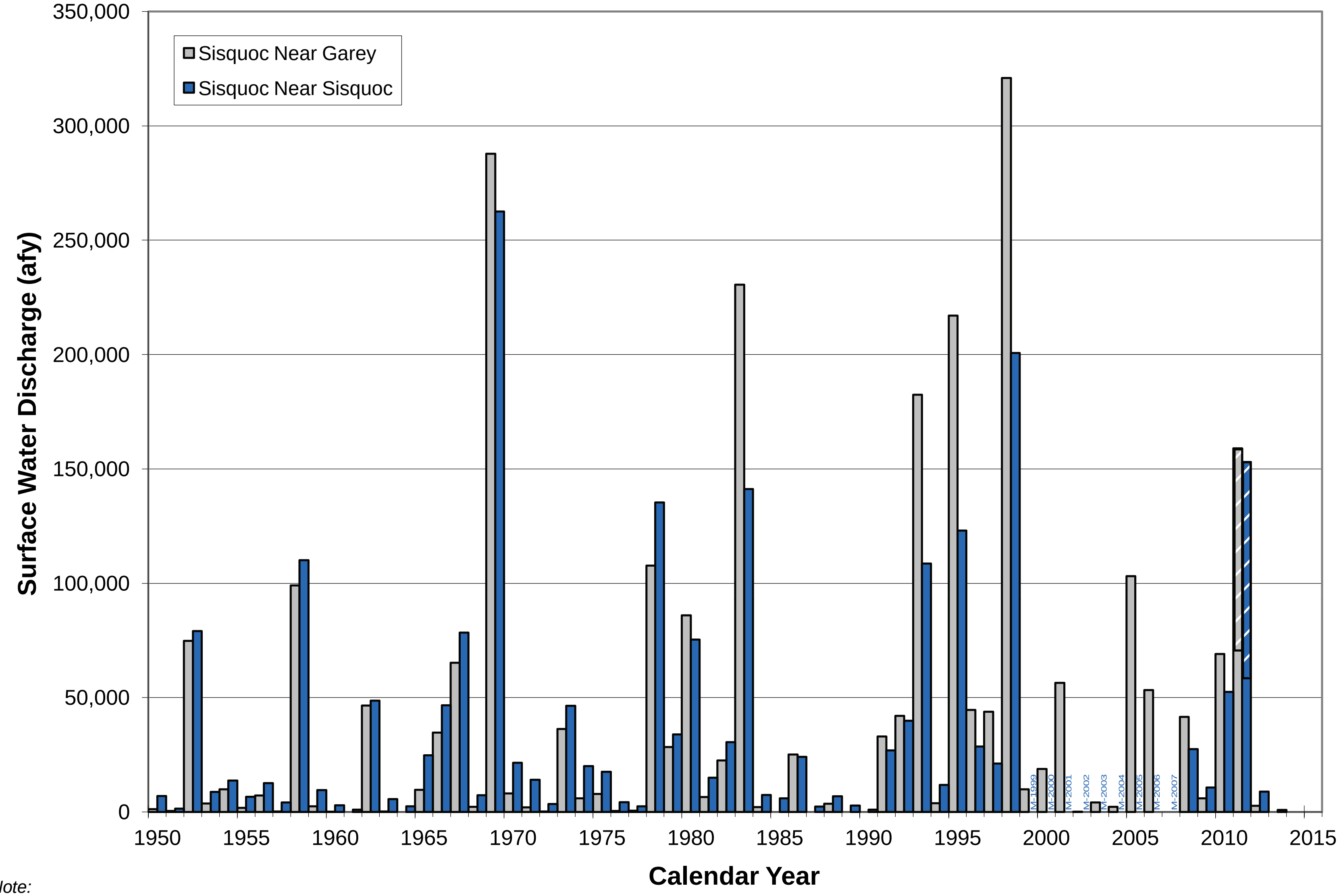
Figure 2.3-1a
Historical Discharge, Cuyama River, and Twitchell Reservoir Releases
Santa Maria Valley Management Area



Note:
The annual total discharge is comprised of daily data for the respective 'Near Sisquoc' and 'Near Garey' Gauges have been approved by the USGS through Oct 2013 and are provisional through Dec 2013. Annual total discharge for 2011 is shown with both the earlier provisional (striped and solid portions of column) and currently approved (solid portion of column) datasets due to a substantial difference between them while pending more information from the USGS.
Discharge data are unavailable for the 'Near Sisquoc' Gauge from 1999-2007; missing years are labeled with a 'M - yyyy' notation.

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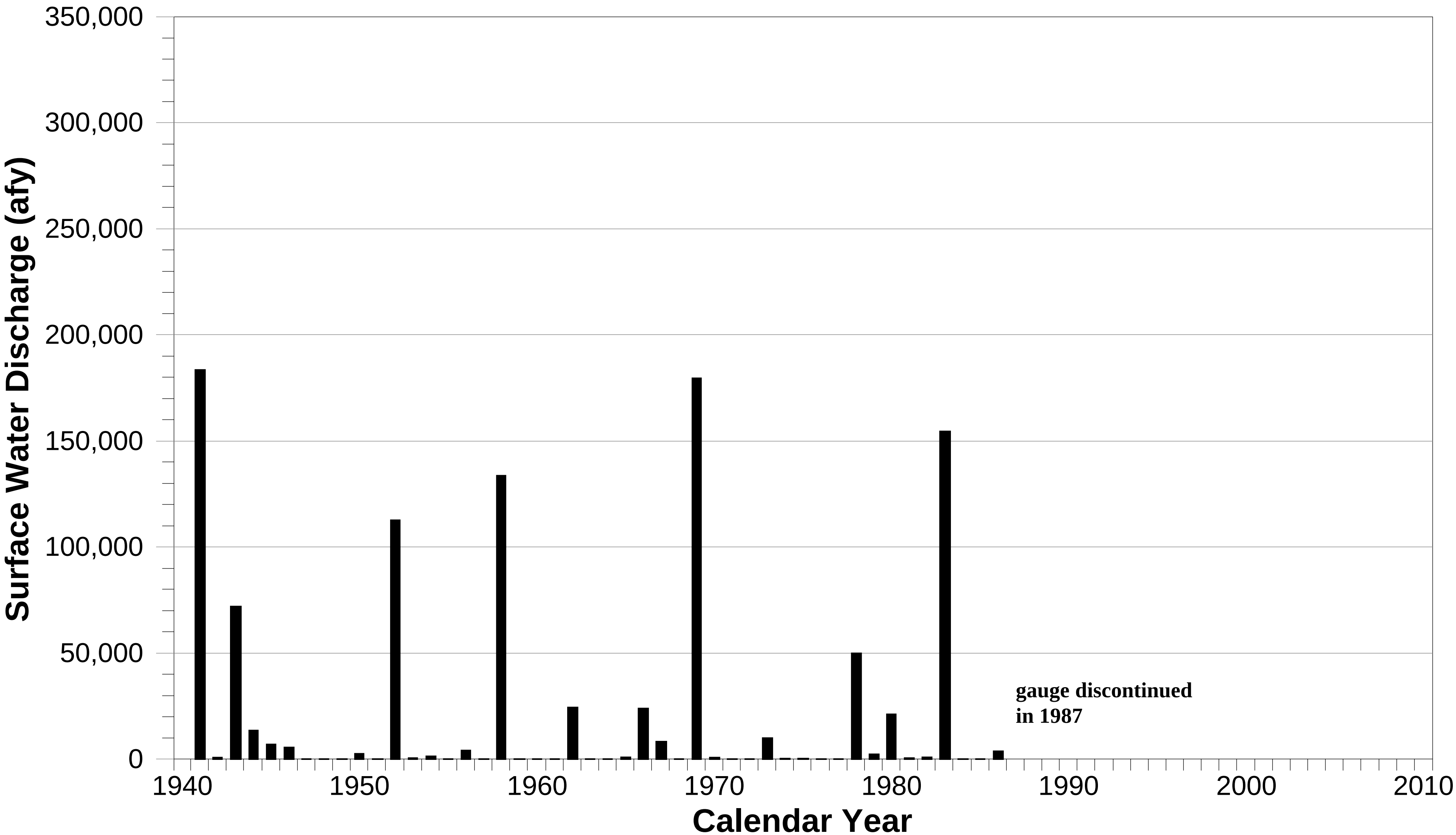
Figure 2.3-1b
Historical Stream Discharge, Sisquoc River
Santa Maria Valley Management Area



C:\Santa Maria 2008\Annual Report 2008\Fig 2.3-1c SMR Guad.dwg

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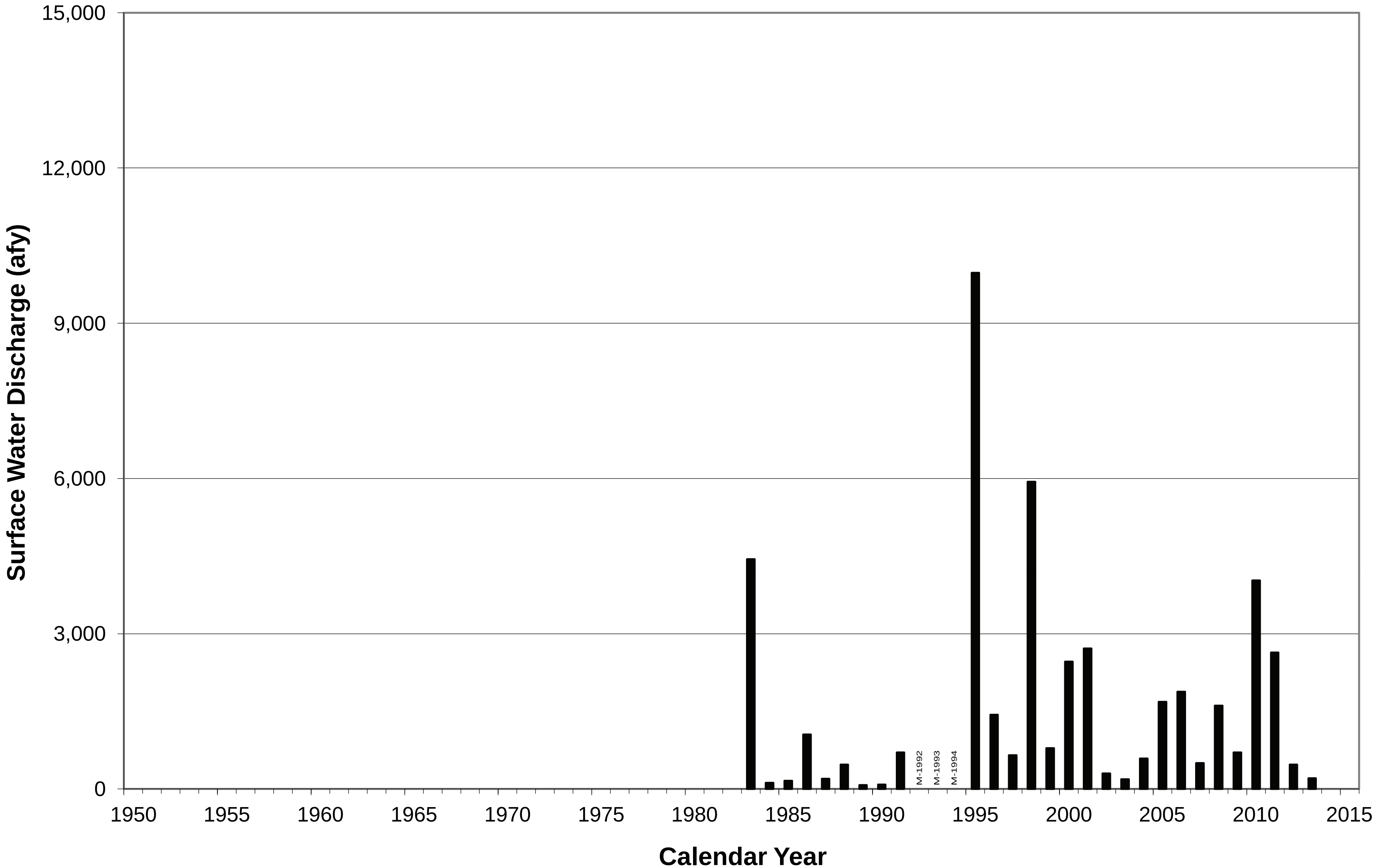
Figure 2.3-1c
Historical Surface Water Discharge, Santa Maria River at Guadalupe
Santa Maria Valley Management Area



Note:
The annual total discharge is comprised of daily data; these daily data have been approved by the USGS through October 18, 2013 and remain provisional through December 2013.
Discharge data are unavailable for the 'Orcutt Creek' Gauge from 1992-1994; missing years are labeled with a 'M - yyyy' notation.

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Figure 2.3-1d
Historical Stream Discharge, Orcutt Creek
Santa Maria Valley Management Area

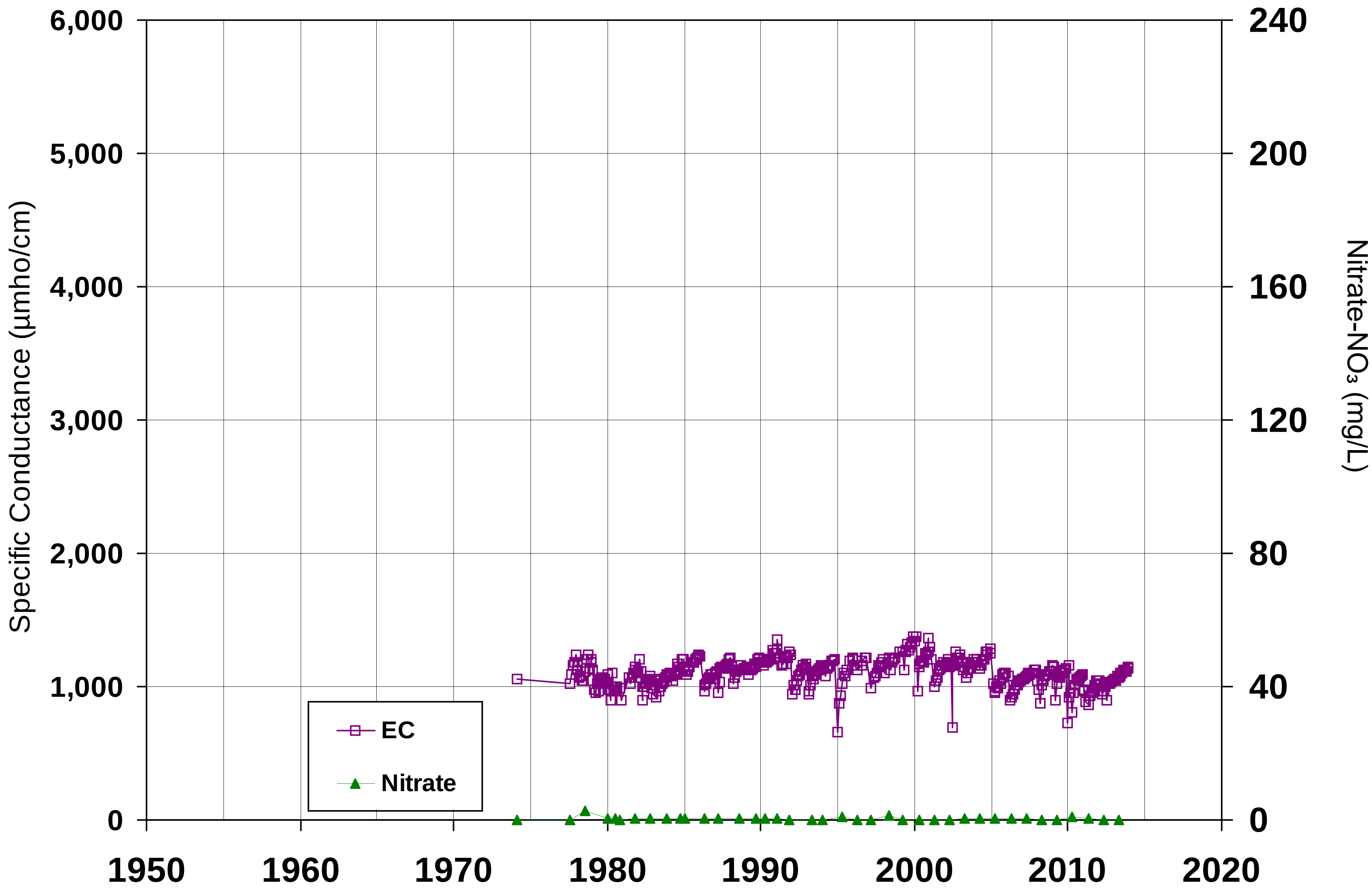

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Figure 2.3-2a
Historical Surface Water Quality, Sisquoc River Near Sisquoc
Santa Maria Valley Management Area

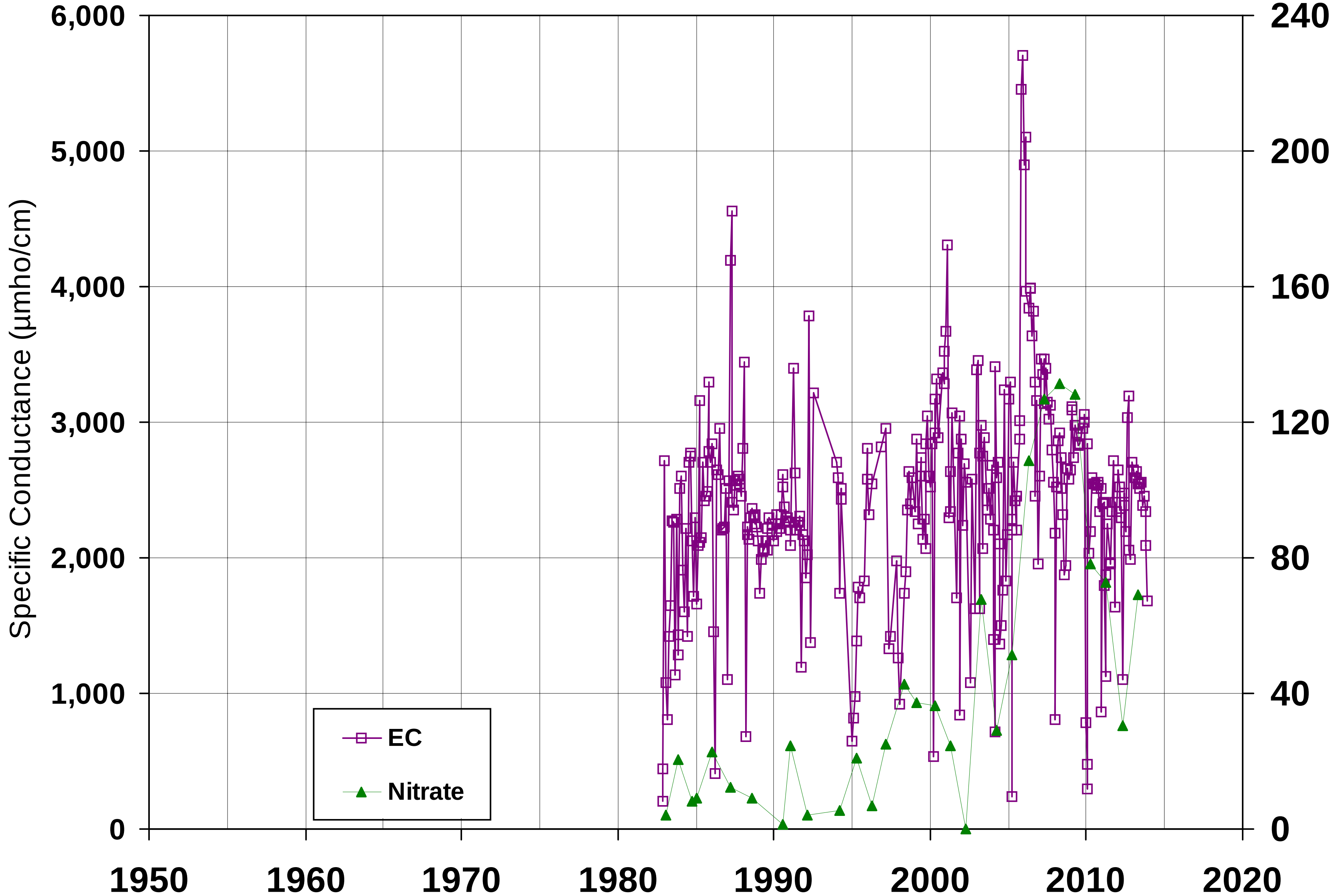

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Figure 2.3-2b
Historical Surface Water Quality, Orcutt Creek
Santa Maria Valley Management Area

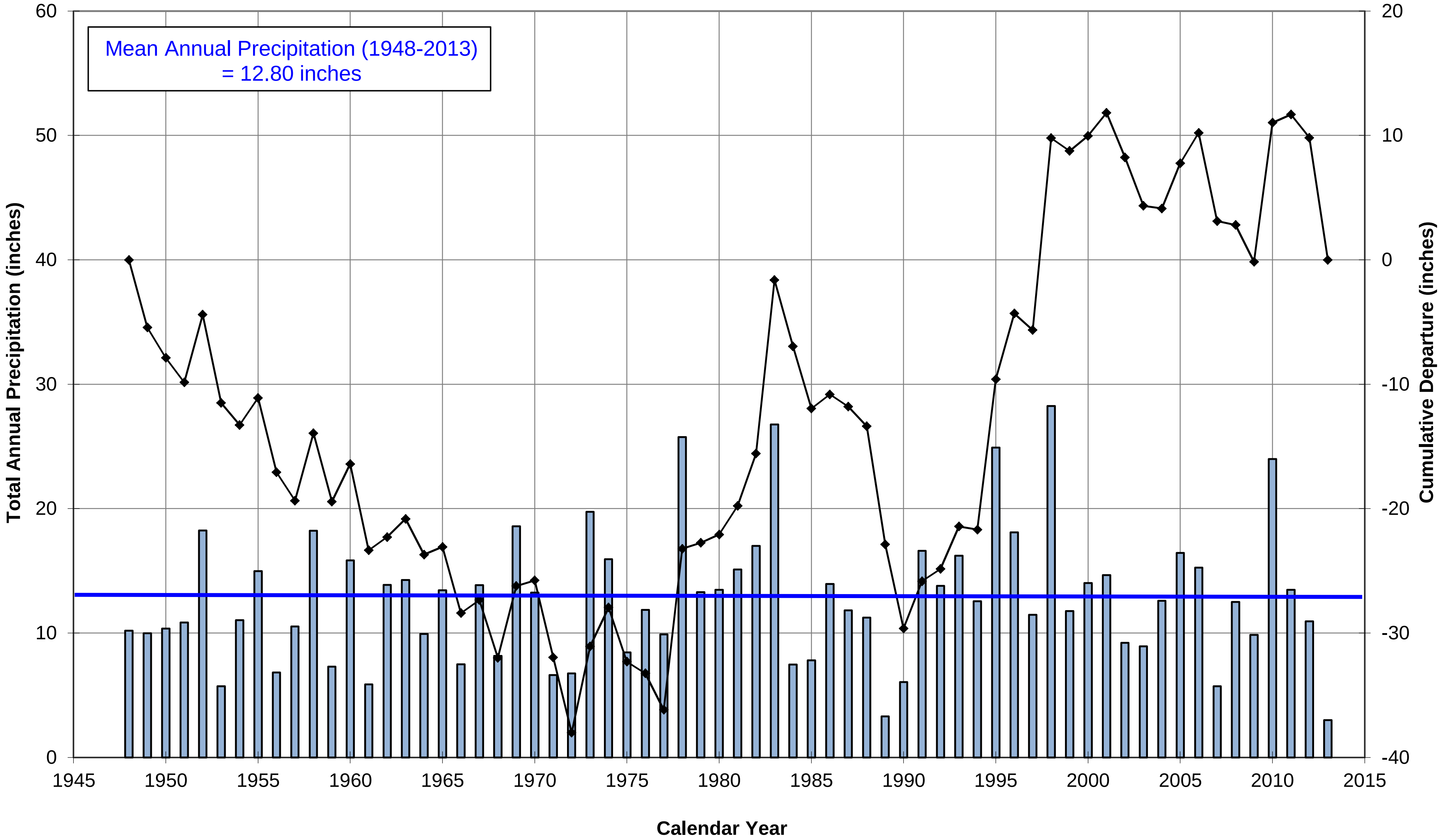

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Figure 2.4-1
Historical Precipitation, Santa Maria Airport
Santa Maria Valley Management Area

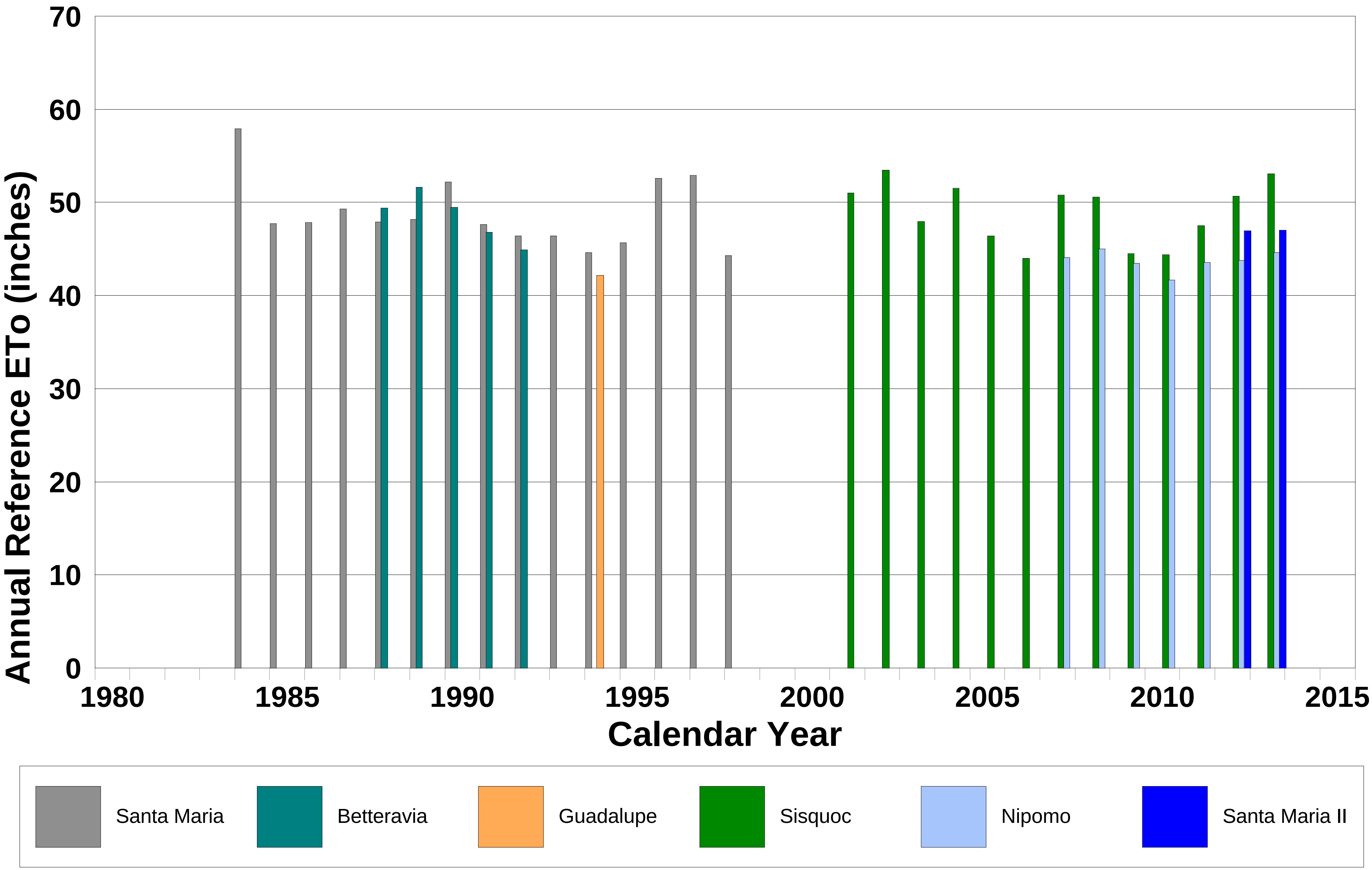

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Figure 2.4-2
Historical Reference Evapotranspiration, CIMIS Stations
Santa Maria Valley Management Area

Table 2.3-1
Selected General Mineral Constituent Concentrations
Santa Maria Valley Streams

Streams	Units	1906 - 1945		1946 - 1966		1967 - 1975		1976 - 1999		2000 - 2013	
		Concentration Range	Data Source	Concentration Range	Data Source	Concentration Range	Data Source	Concentration Range	Data Source	Concentration Range	Data Source
Cuyama River bl Twitchell Res											
Specific Conductivity	umho/cm	1,700 - 4,500	(1)	1,300 - 2,400	(1)	750 - 2,100	(1)	N/A	---	1,028 - 1,845	(3)
Sulfate	mg/l	700 - 1,700	(1)	450 - 700	(1)	190 - 550	(1)	N/A	---	700 - 760	(3)
Chloride	mg/l	90 - 140	(1)	50 - 100	(1)	25 - 85	(1)	N/A	---	N/A	---
Nitrate-NO3	mg/l	2.7 - 5.9	(1)	1.8 - 13.5	(1)	3.6 - 19.8	(1)	N/A	---	0.13 - 2.5	(3)
Sisquoc R nr Garey, nr Sisquoc											
Specific Conductivity	umho/cm	625 - 1,150	(1)	N/A	---	850 - 1,060	(1)	700 - 1,200	(2)	900 - 1,200	(2)
Sulfate	mg/l	150 - 340	(1)	N/A	---	270 - 340	(1)	N/A	---	380	(2)
Chloride	mg/l	9 - 16	(1)	N/A	---	13 - 16	(1)	N/A	---	N/A	---
Nitrate-NO3	mg/l	<1	(1)	N/A	---	<1 - 3.2	(1)	<2	(2)	<2	(2)
Santa Maria R (Bull Canyon)											
Specific Conductivity	umho/cm	N/A	---	N/A	---	N/A	---	N/A	---	1,200 - 1,600	(3)
Sulfate	mg/l	N/A	---	N/A	---	N/A	---	N/A	---	370 - 540	(3)
Chloride	mg/l	N/A	---	N/A	---	N/A	---	N/A	---	N/A	---
Nitrate-NO3	mg/l	N/A	---	N/A	---	N/A	---	N/A	---	ND - 2.7	(3)
Santa Maria R (Guadalupe)											
Specific Conductivity	umho/cm	2,390	(1)	N/A	---	650	(1)	N/A	---	200 - 3,600	(3)
Sulfate	mg/l	680	(1)	N/A	---	100	(1)	N/A	---	500 - 1,000	(3)
Chloride	mg/l	86	(1)	N/A	---	62	(1)	N/A	---	N/A	---
Nitrate-NO3	mg/l	N/A	---	N/A	---	29	(1)	N/A	---	ND - 430	(3)
Oso Flaco Ck (Guadalupe)											
Specific Conductivity	umho/cm	N/A	---	N/A	---	N/A	---	N/A	---	500 - 3,000	(3)
Sulfate	mg/l	N/A	---	N/A	---	N/A	---	N/A	---	440 - 950	(3)
Chloride	mg/l	N/A	---	N/A	---	N/A	---	N/A	---	N/A	---
Nitrate-NO3	mg/l	N/A	---	N/A	---	N/A	---	N/A	---	ND - 450	(3)
Orcutt Ck											
Specific Conductivity	umho/cm	N/A	---	N/A	---	N/A	---	200 - 4,500	(2)	300 - 5,700	(2)
Sulfate	mg/l	N/A	---	N/A	---	N/A	---	N/A	---	N/A	---
Chloride	mg/l	N/A	---	N/A	---	N/A	---	N/A	---	N/A	---
Nitrate-NO3	mg/l	N/A	---	N/A	---	N/A	---	ND - 45	(2)	ND-125	(2)
Bradley Canyon											
Specific Conductivity	umho/cm	N/A	---	N/A	---	N/A	---	N/A	---	500 - 1,500	(3)
Sulfate	mg/l	N/A	---	N/A	---	N/A	---	N/A	---	N/A	---
Chloride	mg/l	N/A	---	N/A	---	N/A	---	N/A	---	N/A	---
Nitrate-NO3	mg/l	N/A	---	N/A	---	N/A	---	N/A	---	20 - 110	(3)
Green Canyon											
Specific Conductivity	umho/cm	N/A	---	N/A	---	N/A	---	2,200	(2)	1,600 - 3,100	(3)
Sulfate	mg/l	N/A	---	N/A	---	N/A	---	N/A	---	N/A	---
Chloride	mg/l	N/A	---	N/A	---	N/A	---	N/A	---	N/A	---
Nitrate-NO3	mg/l	N/A	---	N/A	---	N/A	---	60 - 80	(2)	80 - 450	(3)

Time periods shown based on the period of record for the earliest historical water quality data for the Cuyama and Sisquoc Rivers (USGS, Hughes, J.L., 1977).

Data Sources are as follows: (1) Hughes, 1977; (2) USGS NWIS; (3) CCRWQCB CCAMP

N/A Data not available

Table 2.4-1
Precipitation Data, 2013, Santa Maria Airport
Santa Maria Valley Management Area
(all values in inches)

Day	January	February	March	April	May	June	July	August	September	October	November	December
1	0.00	0.00	0.00	0.07	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3	0.00	0.00	T	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4	0.00	0.00	0.00	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5	0.12	0.00	0.00	0.00	T	0.00	0.00	0.00	0.00	0.00	0.00	0.00
6	0.28	0.00	0.08	0.00	0.04	0.00	0.00	0.00	0.00	0.00	0.00	T
7	0.00	0.02	0.41	0.00	T	T	0.00	0.00	0.00	0.00	0.00	0.15
8	0.00	0.79	0.17	0.02	0.00	0.00	0.00	T	0.00	0.00	0.00	0.00
9	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00
10	T	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00
11	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
14	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
15	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
16	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
17	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
18	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
19	0.00	0.20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	T	0.03
20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	T	0.00	0.00	0.05	0.00
21	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	T	0.00	T	0.00
22	0.00	0.00	0.00	0.00	0.00	0.00	T	0.00	0.00	0.00	0.00	0.00
23	T	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
24	0.19	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
25	0.01	0.00	0.00	0.00	0.00	0.00	T	0.00	0.00	0.00	0.00	0.00
26	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
27	T	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
28	0.00	0.00	T	0.00	0.00	0.00	0.00	0.00	0.00	0.17	0.00	0.00
29	0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.08	0.00
30	0.00		T	T	0.00	0.00	T	0.00	0.00	0.00	0.00	0.00
31	0.00		0.04		0.00		0.00	0.00		0.00		0.00
Total	**0.63**	**1.01**	**0.70**	**0.11**	**0.04**	**0.00**	**0.01**	**0.00**	**0.00**	**0.18**	**0.13**	**0.18**
	T = Trace amount										**Total Precipitation (in)**	**2.99**

Table 2.4-2
Reference Evapotranspiration and Precipitation Data, 2013
Santa Maria Valley Management Area CIMIS Stations

Reference Evapotranspiration (in inches)

	January			February			March			April			May			June		
Day	Sisquoc	Santa Maria II	Nipomo	Sisquoc	Santa Maria II	Nipomo	Sisquoc	Santa Maria II	Nipomo	Sisquoc	Santa Maria II	Nipomo	Sisquoc	Santa Maria II	Nipomo	Sisquoc	Santa Maria II	Nipomo
1	0.05	0.03	0.04	0.10	0.07	0.07	0.17	0.14	0.16	0.12	0.06	0.09	0.20	0.18	0.18	0.26	0.21	0.18
2	0.07	0.06	0.08	0.03	0.03	0.03	0.17	0.13	0.12	0.16	0.15	0.15	0.24	0.21	0.20	0.21	0.13	0.14
3	0.07	0.07	0.07	0.06	0.06	0.06	0.11	0.10	0.10	0.16	0.14	0.11	0.26	0.24	0.24	0.14	0.08	0.10
4	0.07	0.07	0.07	0.09	0.08	0.08	0.11	0.10	0.10	0.15	0.15	0.15	0.21	0.17	0.13	0.19	0.15	0.14
5	0.05	0.05	0.05	0.01	0.01	0.01	0.02	0.04	0.05	0.14	0.14	0.14	0.18	0.13	0.13	0.20	0.18	0.18
6	0.01	0.03	0.04	0.10	0.10	0.09	0.05	0.05	0.07	0.18	0.17	0.16	0.09	0.17	0.13	0.18	0.15	0.09
7	0.07	0.06	0.06	0.08	0.08	0.08	0.09	0.09	0.07	0.18	0.16	0.17	0.15	0.15	0.16	0.20	0.17	0.15
8	0.07	0.07	0.08	0.04	0.03	0.05	0.07	0.07	0.06	0.15	0.17	0.16	0.17	0.18	0.15	0.20	0.18	0.11
9	0.05	0.04	0.04	0.09	0.08	0.09	0.13	0.13	0.12	0.19	0.17	0.18	0.19	0.17	0.18	0.21	0.10	0.07
10	0.06	0.06	0.07	0.09	0.08	0.09	0.13	0.13	0.12	0.22	0.19	0.20	0.20	0.18	0.19	0.21	0.19	0.18
11	0.07	0.06	0.07	0.09	0.09	0.09	0.14	0.13	0.12	0.15	0.14	0.14	0.23	0.19	0.16	0.22	0.20	0.19
12	0.07	0.06	0.07	0.11	0.09	0.10	0.15	0.13	0.11	0.17	0.15	0.15	0.24	0.20	0.19	0.21	0.19	0.12
13	0.06	0.07	0.08	0.10	0.09	0.10	0.16	0.13	0.11	0.16	0.14	0.14	0.21	0.17	0.15	0.22	0.21	0.21
14	0.07	0.06	0.07	0.11	0.10	0.10	0.12	0.12	0.09	0.17	0.16	0.16	0.20	0.16	0.15	0.23	0.22	0.19
15	0.07	0.07	0.07	0.13	0.11	0.14	0.15	0.13	0.13	0.14	0.15	0.15	0.20	0.18	0.18	0.19	0.12	0.12
16	0.09	0.07	0.08	0.14	0.12	0.13	0.14	0.13	0.13	0.19	0.18	0.18	0.14	0.11	0.11	0.23	0.20	0.20
17	0.09	0.08	0.08	0.10	0.09	0.10	0.16	0.15	0.14	0.20	0.19	0.19	0.21	0.19	0.19	0.22	0.21	0.20
18	0.11	0.08	0.09	0.02	0.01	0.02	0.10	0.09	0.08	0.22	0.19	0.20	0.22	0.20	0.20	0.19	0.20	0.20
19	0.12	0.08	0.10	0.05	0.05	0.05	0.14	0.13	0.12	0.22	0.20	0.20	0.24	0.21	0.21	0.26	0.24	0.23
20	0.12	0.09	0.10	0.10	0.10	0.10	0.11	0.10	0.08	0.22	0.21	0.20	0.25	0.21	0.20	0.25	0.22	0.22
21	0.12	0.09	0.11	0.10	0.11	0.10	0.15	0.15	0.13	0.23	0.20	0.19	0.21	0.20	0.18	0.23	0.21	0.20
22	0.12	0.09	0.10	0.12	0.11	0.11	0.19	0.17	0.15	0.20	0.17	0.11	0.22	0.21	0.21	0.24	0.20	0.19
23	0.05	0.03	0.04	0.14	0.11	0.11	0.17	0.19	0.15	0.15	0.13	0.12	0.21	0.20	0.20	0.17	0.13	0.12
24	0.02	0.02	0.02	0.13	0.13	0.12	0.17	0.15	0.14	0.01	0.01	0.01	0.22	0.19	0.19	0.08	0.12	0.15
25	0.02	0.02	0.04	0.12	0.11	0.11	0.12	0.11	0.10	0.19	0.18	0.17	0.21	0.19	0.19	0.23	0.19	0.17
26	0.08	0.08	0.08	0.16	0.16	0.15	0.14	0.13	0.11	0.19	0.17	0.18	0.22	0.20	0.20	0.24	0.21	0.20
27	0.09	0.08	0.09	0.15	0.14	0.15	0.14	0.13	0.11	0.19	0.16	0.17	0.21	0.19	0.18	0.26	0.23	0.20
28	0.08	0.08	0.08	0.14	0.14	0.14	0.09	0.08	0.08	0.19	0.15	0.14	0.22	0.20	0.20	0.25	0.22	0.20
29	0.10	0.08	0.08				0.15	0.14	0.11	0.20	0.18	0.09	0.23	0.21	0.21	0.25	0.24	0.23
30	0.10	0.09	0.10				0.15	0.14	0.13	0.15	0.13	0.11	0.24	0.21	0.21	0.23	0.20	0.19
31	0.10	0.09	0.09				0.07	0.13	0.13				0.26	0.22	0.22			
Total	**2.32**	**2.01**	**2.24**	**2.70**	**2.48**	**2.57**	**3.96**	**3.74**	**3.42**	**5.19**	**4.69**	**4.51**	**6.48**	**5.82**	**5.62**	**6.40**	**5.50**	**5.07**

Reference Evapotranspiration (in inches)

	July			August			September			October			November			December		
Day	Sisquoc	Santa Maria II	Nipomo	Sisquoc	Santa Maria II	Nipomo	Sisquoc	Santa Maria II	Nipomo	Sisquoc	Santa Maria II	Nipomo	Sisquoc	Santa Maria II	Nipomo	Sisquoc	Santa Maria II	Nipomo
1	0.19	0.15	0.15	0.21	0.20	0.19	0.15	0.17	0.16	0.14	0.13	0.12	0.15	0.12	0.12	0.10	0.08	0.10
2	0.24	0.22	0.20	0.21	0.18	0.16	0.18	0.17	0.16	0.14	0.11	0.11	0.12	0.10	0.10	0.08	0.07	0.08
3	0.23	0.20	0.18	0.19	0.16	0.11	0.18	0.17	0.17	0.15	0.15	0.13	0.09	0.09	0.09	0.06	0.07	0.07
4	0.23	0.20	0.18	0.20	0.16	0.13	0.18	0.17	0.16	0.15	0.15	0.15	0.13	0.13	0.12	0.07	0.07	0.08
5	0.20	0.17	0.13	0.19	0.15	0.11	0.18	0.17	0.16	0.18	0.17	0.18	0.11	0.11	0.12	0.08	0.07	0.09
6	0.20	0.17	0.15	0.15	0.11	0.10	0.19	0.17	0.15	0.20	0.18	0.19	0.13	0.11	0.12	0.07	0.06	0.07
7	0.21	0.16	0.15	0.17	0.16	0.15	0.19	0.16	0.13	0.15	0.13	0.11	0.12	0.08	0.08	0.06	0.06	0.06
8	0.24	0.21	0.19	0.18	0.16	0.16	0.17	0.14	0.11	0.12	0.10	0.07	0.12	0.09	0.09	0.06	0.06	0.07
9	0.23	0.18	0.17	0.19	0.16	0.15	0.16	0.14	0.10	0.05	0.05	0.06	0.11	0.09	0.09	0.07	0.06	0.08
10	0.11	0.11	0.10	0.19	0.15	0.11	0.13	0.13	0.12	0.13	0.11	0.11	0.09	0.07	0.07	0.07	0.06	0.08
11	0.20	0.19	0.17	0.17	0.14	0.13	0.12	0.11	0.08	0.12	0.11	0.10	0.10	0.08	0.08	0.10	0.07	0.08
12	0.22	0.18	0.16	0.18	0.16	0.13	0.15	0.13	0.13	0.12	0.11	0.09	0.06	0.04	0.05	0.09	0.07	0.08
13	0.22	0.17	0.15	0.20	0.17	0.12	0.15	0.14	0.13	0.12	0.10	0.10	0.12	0.14	0.12	0.06	0.06	0.08
14	0.23	0.19	0.18	0.22	0.19	0.16	0.15	0.15	0.13	0.14	0.13	0.13	0.09	0.07	0.08	0.10	0.07	0.09
15	0.20	0.16	0.17	0.22	0.20	0.18	0.17	0.15	0.13	0.18	0.15	0.15	0.07	0.07	0.07	0.10	0.07	0.09
16	0.20	0.18	0.18	0.22	0.19	0.16	0.16	0.14	0.11	0.18	0.15	0.15	0.07	0.06	0.07	0.12	0.07	0.11
17	0.21	0.17	0.17	0.19	0.17	0.12	0.14	0.15	0.14	0.17	0.14	0.13	0.08	0.07	0.07	0.12	0.07	0.09
18	0.20	0.18	0.19	0.19	0.16	0.12	0.17	0.18	0.15	0.15	0.13	0.13	0.06	0.06	0.06	0.03	0.02	0.01
19	0.19	0.17	0.17	0.19	0.17	0.12	0.18	0.16	0.13	0.14	0.10	0.09	0.06	0.05	0.05	0.05	0.05	0.05
20	0.20	0.17	0.15	0.19	0.16	0.15	0.15	0.11	0.09	0.10	0.08	0.07	0.04	0.04	0.05	0.08	0.09	0.09
21	0.20	0.19	0.17	0.18	0.15	0.13	0.10	0.10	0.09	0.10	0.09	0.09	0.01	0.03	0.05	0.07	0.07	0.07
22	0.15	0.16	0.14	0.20	0.19	0.19	0.18	0.16	0.14	0.10	0.10	0.09	0.07	0.09	0.10	0.07	0.06	0.07
23	0.21	0.20	0.14	0.18	0.15	0.15	0.19	0.23	0.18	0.04	0.05	0.04	0.06	0.07	0.08	0.09	0.06	0.07
24	0.18	0.16	0.12	0.20	0.18	0.16	0.18	0.16	0.13	0.08	0.06	0.05	0.08	0.08	0.07	0.09	0.07	0.10
25	0.19	0.17	0.12	0.19	0.17	0.15	0.17	0.16	0.14	0.09	0.07	0.07	0.09	0.08	0.08	0.12	0.08	0.10
26	0.17	0.15	0.11	0.19	0.16	0.16	0.16	0.15	0.13	0.11	0.09	0.08	0.07	0.06	0.08	0.11	0.08	0.11
27	0.18	0.16	0.13	0.19	0.17	0.12	0.18	0.17	0.15	0.06	0.02	0.02	0.09	0.09	0.07	0.13	0.09	0.10
28	0.21	0.17	0.14	0.18	0.16	0.13	0.20	0.16	0.16	0.03	0.05	0.04	0.07	0.06	0.05	0.08	0.07	0.08
29	0.20	0.14	0.11	0.18	0.16	0.16	0.18	0.15	0.13	0.09	0.09	0.09	0.05	0.05	0.04	0.11	0.07	0.09
30	0.19	0.13	0.10	0.20	0.19	0.17	0.16	0.15	0.13	0.10	0.10	0.10	0.08	0.07	0.08	0.11	0.09	0.10
31	0.17	0.11	0.10	0.18	0.15	0.15				0.12	0.11	0.11				0.09	0.08	0.09
Total	**6.20**	**5.27**	**4.67**	**5.92**	**5.13**	**4.43**	**4.95**	**4.60**	**4.02**	**3.75**	**3.31**	**3.15**	**2.59**	**2.35**	**2.40**	**2.64**	**2.12**	**2.53**

Total Evapotranspiration (in) SMVMA CIMIS Stations		
	Sisquoc[1]	**53.10**
	Santa Maria II[2]	**47.02**
	Nipomo[3]	**44.63**

Table 2.4-2 (cont.)
Reference Evapotranspiration and Precipitation Data, 2013
Santa Maria Valley Management Area CIMIS Stations

Precipitation (in inches)

Day	January			February			March			April			May			June		
	Sisquoc	Santa Maria II	Nipomo	Sisquoc	Santa Maria II	Nipomo	Sisquoc	Santa Maria II	Nipomo	Sisquoc	Santa Maria II	Nipomo	Sisquoc	Santa Maria II	Nipomo	Sisquoc	Santa Maria II	Nipomo
1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.16	0.13	0.00	0.00	0.02	0.00	0.00	0.03
2	0.00	0.03	0.00	0.00	0.00	0.03	0.00	0.00	0.02	0.00	0.00	0.00	0.00	0.00	0.02	0.00	0.00	0.02
3	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.03	0.00	0.00	0.01	0.01	0.01	0.03
4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.04	0.00	0.00	0.01	0.00	0.00	0.03
5	0.19	0.13	0.17	0.00	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.02	0.00	0.00	0.00	0.00	0.00	0.02
6	0.36	0.48	0.41	0.00	0.00	0.00	0.08	0.09	0.04	0.00	0.00	0.02	0.09	0.02	0.18	0.00	0.00	0.02
7	0.00	0.00	0.00	0.00	0.01	0.00	0.48	0.39	0.40	0.00	0.00	0.02	0.00	0.00	0.03	0.00	0.00	0.01
8	0.00	0.00	0.00	0.48	0.61	0.32	0.30	0.15	0.09	0.02	0.01	0.06	0.00	0.00	0.02	0.00	0.00	0.02
9	0.02	0.02	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.03	0.00	0.00	0.02	0.00	0.00	0.04
10	0.26	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.04	0.12	0.00	0.00
11	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.03	0.00	0.00	0.03	2.04	0.00	0.02
12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.03	0.00	0.00	0.04	0.00	0.00	0.03	0.81	0.00	0.02
13	0.00	0.00	0.00	0.00	0.01	0.03	0.00	0.01	0.03	0.00	0.00	0.00	0.75	0.00	0.00	0.00	0.00	0.03
14	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.04	0.32	0.00	0.03	0.00	0.00	0.02
15	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.00	0.00	0.01	0.00	0.00	0.02	0.00	0.00	0.02
16	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.02	0.00	0.00	0.00
17	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.04	0.00	0.00	0.02	0.00	0.00	0.02	0.00	0.00	0.01
18	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.02
19	0.00	0.00	0.00	0.22	0.23	0.13	0.00	0.00	0.00	0.00	0.00	0.03	0.00	0.00	0.03	0.00	0.00	0.02
20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.00	0.00	0.03	0.00	0.00	0.02	0.00	0.00	0.02
21	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.03	0.00	0.00	0.03	0.00	0.00	0.02
22	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.02	0.00	0.00	0.01
23	0.00	0.00	0.02	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.02	0.00	0.00	0.03	0.00	0.00	0.00
24	0.13	0.23	0.21	0.00	0.00	0.01	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.02	0.00	0.00	0.00
25	0.10	0.01	0.06	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.03	0.00	0.00	0.03	0.00	0.00	0.03
26	0.02	0.00	0.00	0.00	0.00	0.02	0.00	0.00	0.00	0.00	0.00	0.02	0.00	0.00	0.02	0.00	0.01	0.04
27	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.00	0.00	0.02	0.00	0.00	0.02	0.00	0.00	0.03
28	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.02	0.00	0.00	0.02	0.00	0.00	0.02	0.94	0.00	0.02
29	0.00	0.00	0.00				0.00	0.00	0.03	0.00	0.00	0.02	0.00	0.00	0.05	0.94	0.00	0.03
30	0.00	0.00	0.00				0.00	0.00	0.01	0.00	0.00	0.01	0.00	0.00	0.03	0.44	0.00	0.03
31	0.00	0.00	0.00				0.10	0.03	0.02				0.00	0.00	0.04			
Total	**1.08**	**0.90**	**0.88**	**0.70**	**0.87**	**0.58**	**0.96**	**0.67**	**0.87**	**0.02**	**0.18**	**0.74**	**1.16**	**0.02**	**0.86**	**5.30**	**0.02**	**0.61**

Precipitation (in inches)

Day	July			August			September			October			November			December		
	Sisquoc	Santa Maria II	Nipomo	Sisquoc	Santa Maria II	Nipomo	Sisquoc	Santa Maria II	Nipomo	Sisquoc	Santa Maria II	Nipomo	Sisquoc	Santa Maria II	Nipomo	Sisquoc	Santa Maria II	Nipomo
1	0.00	0.00	0.02	0.00	0.00	0.01	0.00	0.00	0.01	0.00	0.00	0.03	0.00	0.00	0.00	0.00	0.00	0.00
2	0.00	0.00	0.02	0.00	0.00	0.02	0.00	0.00	0.02	0.00	0.00	0.01	0.00	0.00	0.01	0.00	0.00	0.00
3	0.00	0.00	0.03	0.00	0.00	0.02	0.00	0.17	0.02	0.00	0.00	0.02	0.00	0.00	0.00	0.00	0.00	0.00
4	0.00	0.00	0.03	0.00	0.00	0.00	0.00	0.00	0.02	0.00	0.00	0.01	0.00	0.00	0.02	0.00	0.00	0.00
5	0.00	0.00	0.03	1.22	0.00	0.00	0.00	0.00	0.02	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00
6	0.00	0.00	0.02	0.75	0.07	0.01	0.00	0.00	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
7	0.00	0.00	0.01	0.00	0.00	0.03	0.00	0.00	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.37	0.13	0.18
8	0.00	0.00	0.02	0.00	0.00	0.00	0.00	0.00	0.02	0.00	0.00	0.02	0.00	0.00	0.01	0.00	0.00	0.00
9	0.00	0.12	0.03	0.00	0.00	0.02	0.00	0.00	0.01	0.00	0.02	0.01	0.00	0.00	0.00	0.00	0.00	0.00
10	0.00	0.32	0.04	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.01	0.00	0.00	0.01
11	0.00	0.00	0.01	0.00	0.00	0.02	0.00	0.00	0.03	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00
12	0.00	0.00	0.03	0.00	0.00	0.02	0.00	0.00	0.03	0.00	0.00	0.00	0.00	0.00	0.02	0.00	0.00	0.00
13	0.00	0.00	0.02	0.00	0.00	0.00	0.00	0.00	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
14	0.00	0.00	0.02	0.00	0.00	0.04	0.00	0.00	0.02	0.00	0.00	0.00	0.00	0.00	0.02	0.00	0.00	0.00
15	0.00	0.01	0.03	0.00	0.00	0.01	0.00	0.00	0.02	0.00	0.00	0.00	0.00	0.01	0.01	0.00	0.00	0.00
16	1.06	0.00	0.02	0.00	0.00	0.03	0.00	0.00	0.02	0.00	0.00	0.00	0.00	0.00	0.02	0.00	0.00	0.00
17	1.00	0.00	0.02	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00
18	0.25	0.00	0.03	0.00	0.00	0.02	0.00	0.00	0.02	0.00	0.00	0.02	0.00	0.00	0.01	0.00	0.00	0.00
19	0.00	0.00	0.02	0.00	0.00	0.01	0.00	0.00	0.02	0.00	0.00	0.02	0.00	0.00	0.00	0.09	0.02	0.02
20	0.00	0.00	0.01	0.00	0.00	0.02	0.00	0.00	0.01	0.00	0.00	0.02	0.12	0.09	0.09	0.00	0.00	0.00
21	0.00	0.00	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.07	0.00	0.01	0.00	0.00	0.00
22	0.00	0.00	0.02	0.00	0.00	0.04	0.00	0.00	0.02	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00
23	0.00	0.00	0.02	0.00	0.00	0.03	0.00	0.00	0.02	0.00	0.00	0.02	0.00	0.00	0.00	0.00	0.01	0.00
24	0.00	0.03	0.01	0.00	0.00	0.02	0.00	0.00	0.02	0.00	0.00	0.00	0.00	0.00	0.02	0.00	0.01	0.01
25	0.00	0.00	0.01	0.00	0.00	0.02	0.00	0.00	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
26	0.00	0.00	0.00	0.00	0.00	0.03	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00
27	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.02	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00
28	0.00	0.00	0.02	0.00	0.00	0.02	0.00	0.00	0.02	0.13	0.15	0.16	0.00	0.00	0.00	0.00	0.00	0.00
29	0.00	0.00	0.03	0.00	0.00	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.13	0.06	0.02	0.00	0.00	0.00
30	0.00	0.00	0.02	0.00	0.00	0.02	0.00	0.00	0.03	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00
31	0.00	0.00	0.02	0.00	0.00	0.02				0.00	0.00	0.00				0.00	0.00	0.00
Total	**2.31**	**0.48**	**0.64**	**1.97**	**0.07**	**0.52**	**0.00**	**0.17**	**0.51**	**0.13**	**0.19**	**0.38**	**0.32**	**0.16**	**0.29**	**0.46**	**0.17**	**0.22**

Total Precipitation (in)	**Sisquoc[4]**	**14.41**
SMVMA CIMIS Stations	**Santa Maria II**	**3.90**
	Nipomo	**7.10**

1) Sisquoc station ETo data from March, April, May, August, September, and December are flagged by Calif. DWR
2) Santa Maria II station ETo data from January, March, April, and June are flagged by Calif. DWR
3) Nipomo station ETo data from October are flagged by Calif. DWR
4) Sisquoc station precipitation data from June are flagged by Calif. DWR

3. Water Requirements and Water Supplies

Current water requirements and water supplies in the SMVMA, including discussion of agricultural land use and crop water requirements, which were the basis for estimation of agricultural water requirements and groundwater supply in 2013, are described in the following sections of this Chapter. Municipal water requirements and the components of water supply to meet those requirements, including groundwater and imported water from the State Water Project (SWP), are also described in the following sections.

3.1 Agricultural Water Requirements and Supplies

All agricultural water requirements in the SMVMA are supplied by local groundwater pumping, essentially all of which is neither directly metered nor otherwise indirectly measured. Consequently, agricultural water requirements, which represent by far the largest part of overall water requirements in the SMVMA, need to be indirectly estimated. Historically, and for this annual report, agricultural water requirements are estimated by quantifying land use (crop types and acreages), computing applied water requirements for each crop type, and summing total water requirements for the aggregate of various crops throughout the SMVMA. Reflected in this annual report are previously reported estimates of historical agricultural land use and water requirements through 1995 (LSCE, 2000) and from 1998 through 2012 (LSCE, 2009 - 2013), as well as the current estimate of land use and water requirements for 2013 made as part of the overall preparation of this annual report.

3.1.1 Land Use

An assessment was made of crop acreages in 2013 from the review of Pesticide Use Report (PUR) databases, including mapped agricultural parcels permitted for pesticide application, maintained by the Santa Barbara and San Luis Obispo County Agricultural Commissioner's Offices. The mapped parcels were identified by the respective Counties under the following crop types: 1) Rotational Vegetable, 2) Strawberry, 3) Wine Grape, 4) Pasture, 5) Grain, 6) Nursery, and 7) Orchard (Citrus and Deciduous). Also in 2013, the acreage of hydroponic crops, primarily tomatoes, was accounted. Review of the PUR records indicated that "Rotational Vegetable" primarily consisted of lettuce, celery, broccoli, cauliflower, and spinach crops. Verification of agricultural cropland distribution in the SMVMA was conducted through review of 2013 satellite images and high-resolution aerial photographs, an inventory of which is provided in Appendix C of this report. The distribution of irrigated acreage for 2013, by crop type identified by the Counties as well as by crop category utilized by the California DWR in its periodic land use studies, is listed in Table 3.1-1a. The crop parcel locations in 2013 are shown in a map of agricultural land use throughout the SMVMA (Figure 3.1-1a) and the distribution of historical irrigated acreage, including DWR land use study years and LSCE assessment years through 2013, is listed in Table 3.1-1b (USGS, Worts, G.F., 1951; California DWR, 1959, 1968, 1977, 1985, and 1995; LSCE, 2000 and 2009 - 2013).

In 2013, about 51,565 acres in the Santa Maria Valley were irrigated cropland, with the great majority (88 percent) in truck crops, specifically Rotational Vegetables (33,795 acres), Strawberries (11,465 acres), and Hydroponic (135 acres). Vineyard comprised the next largest category (4,790 acres), with Pasture, Nursery, Grain, and Orchard in descending order of acreage (445, 225, 160, and 30 acres, respectively). Fallow cropland was estimated to be approximately 520 acres. Cropland occupies large portions of the Santa Maria Valley floor, Orcutt Upland, Oso Flaco area, and Sisquoc plain and terraces.

The total irrigated acreage of about 51,565 acres in 2013 is within and near the upper end of the reported historical range of roughly 34,000 acres in 1945 to 53,000 acres in 1995 (see Table 3.1-1b). The 2013 cropland locations continue the historical trend of agricultural expansion onto portions of the Orcutt Upland, Sisquoc Valley, and, most recently, Graciosa Canyon, as urban land use expands into former cropland near the central portions of the Santa Maria Valley and Orcutt Upland. Further, the crop type distribution continues the historical trend of increased truck crop acreage and decline in pasture (including alfalfa), field, and orchard acreages, as illustrated by the bar chart of historical crop type distribution from DWR land use study years and for 2013 (Figure 3.1-1b). In order to provide consistency with the historical land use data, the crop acreages reported here are “land” acreages; i.e., the land area used for growing crops regardless of whether it is used for single or multiple cropping throughout any given year. Multiple cropping of land, and associated annual water requirements, is accommodated in the calculation of applied crop water requirements below.

3.1.2 Applied Crop Water Requirements

Applied crop water requirements were developed for the crop categories described above, and the approach used in their development depended on information available for each individual category. In the case of Rotational Vegetables (primarily lettuce, celery, broccoli, cauliflower, and spinach; and including cane and bush berries), Strawberries, and Pasture, values for their evapotranspiration of applied water (ETaw) were developed using a CIMIS-based approach where reference evapotranspiration data (ETo) were coupled with crop coefficients (Kc) to first estimate the evapotranspirative water requirements of the crops (ETc). Those requirements were then factored to consider any effective precipitation in 2013 that would have reduced the need for applied water to meet the respective evapotranspirative water requirements, which in turn provided the ETaw values for those three categories.

For the remaining crop categories (except hydroponic), for which information was insufficient to utilize a CIMIS-based approach, reported values of ETaw were used (California DWR, 1975). Specifically, these were values measured and developed for different rainfall zones in the central California coastal valleys, and a review of the reported values indicated that they accommodated multiple cropping. The values in turn had previously been used to develop a relationship between ETaw values and the annual rainfall amounts within the Santa Maria Valley groundwater basin by crop type (LSCE, 2000). With a rainfall total of about 3 inches in 2013 in the Valley, the previously developed ETaw values corresponding to that amount of precipitation were used for this assessment. For hydroponic tomatoes, an applied crop water duty was estimated from hydroponic crop research articles and notes (Selina, et. al., April 2002; Resh, 2005; and Jones, 2012).

For the three crop categories utilizing the CIMIS-based approach, the ETo data for 2013 from the Santa Maria II CIMIS station were used in conjunction with Kc values from the following sources to develop ETc values. The Rotational Vegetable value was based on reported values for lettuce derived from an agricultural leaflet for estimating ETc for vegetable crops (Univ. of California Cooperative Extension, 1994); the Strawberry values were derived from a paper reporting the results of a study on drip irrigation of strawberries in the Santa Maria Valley (Hanson, B., and Bendixen, W., 2004); and the Pasture values were directly based on ETo values measured on the reference surface (grass) at the Santa Maria II station. The resulting ETc values for the three crop categories are shown in Table 3.1-1c.

Effective precipitation (P_E) during 2013 was then subtracted from the ETc values to estimate crop ETaw values. The P_E amounts that contributed to meeting the ETc of the crops, and thus reduced applied water requirements, were based on review of the precipitation data for 2013, during which rain primarily occurred in January and March. During those months, the ETc for all crops was largely or entirely met by precipitation; it was assumed for the hydroponic crops that no component of precipitation was effective. The calculated ETaw values for Rotational Vegetables, Strawberries, and Pasture, as well as the developed values for the remaining crop categories (and the value for Nursery from NMMA TG), are shown in Table 3.1-1c.

Values of ETaw were then used to estimate applied crop water requirements (AW) by considering estimated irrigation system distribution uniformity (DU) values for each crop. For Strawberries grown in the Santa Maria Valley, DU values have been reported to range from 80 and 94 percent (Hanson, B., and Bendixen, W., 2004), and an intermediate DU value of 85 percent was selected for this assessment. For the remaining crops, DU values have not been specifically reported for the Santa Maria Valley; for this assessment, values of 80 percent (Rotational Vegetables, Truck, Grain, and Pasture), 85 percent (Citrus), and 95 percent (Vineyard and Nursery) were utilized. For the hydroponic tomato crops, all of which are grown in a highly controlled greenhouse environment, the DU value was assumed to be 100 percent. The resulting AW values for each of the crop categories are shown in Table 3.1-1c; they range from the highest applied water rate of 3.9 af/ac for pasture, to intermediate rates of 2.4 af/ac for rotational vegetables and 2.0 af/ac for hydroponic tomatoes, to the lowest rates of 1.3 af/ac for strawberries and vineyard and less than one-half af/ac for grain. The AW values calculated for crops grown in the SMVMA are similar to those previously reported for crops grown in the NMMA (NMMA TG, 2009 through 2013). Between the two adjacent management areas, crops in common are Rotational Vegetables, Strawberries, Pasture, Citrus, Nursery, and Deciduous.

3.1.3 Total Agricultural Water Requirements

The AW values for each SMVMA crop category were coupled with their respective crop acreages from 2013 to produce estimates of the individual crop and total agricultural water requirements for 2013, as shown in Table 3.1-1c. The resultant estimated total water requirement was almost 116,000 af, with Rotational Vegetables comprising by far the greatest component, about 88,575 af, primarily because about 66 percent of the total acreage was dedicated to those crops. Strawberries comprised the next largest crop acreage and had an associated water requirement over 17,790 af. Vineyard had a water requirement of about 6,550 af, and all remaining crop types had water requirements at or below 2,000 af.

In the context of historical estimates of total agricultural water requirements, the estimated 2013 agricultural water use is in the range of applied water requirements over the last four decades, as illustrated in a graph of historical irrigated acreage and agricultural groundwater pumping (the sole source of irrigation water in the Valley and, thus, equal to total agricultural water requirements) (Figure 3.1-1c). For reference, agricultural water requirements were previously estimated to be around 80,000 afy during the 1940's and 1950's, gradually increasing to over 100,000 afy by the 1970's; since then, agricultural water requirements have fluctuated from year to year, as a function of weather variability, but water requirements have generally remained within a broad but fairly constant range (LSCE, 2000, 2009 - 2013). Since the 1970's, maximum and minimum agricultural water requirements, respectively, were about 132,000 af in 1997 and about 77,000 af in 1998, with estimated agricultural water requirements in 2013 well within and near the upper end of that range.

3.1.4 Agricultural Groundwater Pumping

As noted above, the sole source of water for agricultural irrigation in the SMVMA is groundwater, so groundwater pumping for agricultural irrigation in 2013 is estimated to be the same as the total estimated agricultural water requirement of almost 116,000 af. This amount is also, of course, within the historical range of estimated groundwater pumping for agricultural irrigation in the Valley over the last four decades. Proportions of groundwater pumping from the shallow and deep aquifer zones of the SMVMA are not known because a comprehensive investigation of individual irrigation well depths and completion intervals has not been completed.

3.2 Municipal Water Requirements and Supplies

Prior to the late 1990's, all municipal water requirements in the SMVMA were met by local groundwater pumping. Since the beginning of State Water Project (SWP) availability in 1997, deliveries of SWP water have replaced some of the local groundwater pumping for municipal supply. All municipal pumping and imported (SWP) water deliveries in the SMVMA are metered; consequently, the following summaries of municipal water requirement and supplies derive from those measured data.

3.2.1 Municipal Groundwater Pumping

Municipal purveyors in the SMVMA include the Cities of Santa Maria and Guadalupe and the Golden State Water Company (GSWC, formerly Southern California Water Company). The latter provides water to suburban areas in the southern portion of the SMVMA, specifically the towns of Orcutt and Sisquoc and the Lake Marie and Tanglewood developments. With the exception of small pumping in Guadalupe and Sisquoc, municipal pumping is from numerous water supply wells in individual wellfields located between the Santa Maria Airport and the town of Orcutt. The municipal water supply wells are completed in the shallow and/or deep aquifer zones with, in general, newer wells having been constructed to produce from deeper portions of the aquifer system with better water quality. Monthly and total annual groundwater pumping amounts for 2013 are tabulated by individual well, by purveyor, and for each water system in Table 3.2-1a.

In 2013, 14,220 af of groundwater were pumped for municipal water supply in the SMVMA. GSWC pumping was the largest, about 8,335 af, of which the great majority (7,950 af) was for the GSWC Orcutt system and less than 400 af was for all three of the other GSWC systems combined. The City of Santa Maria pumped 5,215 af and the City of Guadalupe pumped about 670 af.

Compared to historical municipal pumping, pumping for municipal supply in 2013 was substantially less than 17 years ago, immediately prior to the initial deliveries of supplemental imported SWP water in 1997, as shown in a graph of historical municipal groundwater pumpage for the SMVMA (Figure 3.2-1a). Most notably, the City of Santa Maria has substantially reduced pumping since the importation of SWP water began, from 12,800 af in 1996 to 5,215 af in 2013. In fact, during an intervening period of high availability of SWP water (1998 through 2007), groundwater pumping by Santa Maria was even lower, an average of about 1,000 afy. Equally notable is that, over the entire period since SWP was made available, total municipal pumping has ranged between 8,900 afy and 18,100 afy, and has averaged about 11,800 afy, which represents an approximate 50 percent reduction in municipal pumping from immediately prior to SWP water availability (23,500 af in 1996).

3.2.2 Imported Water

The three municipal purveyors in the SMVMA have entitlements to imported water from the State Water Project (SWP) through the Central Coast Water Authority (CCWA). Each purveyor's total entitlement is comprised of their basic entitlement plus a "drought buffer" equal to 10 percent of their basic entitlement. By purveyor, their respective total entitlements are as follows: City of Santa Maria, 17,820 af (16,200 af basic entitlement plus 1,620 af drought buffer); City of Guadalupe, 605 af (550 af basic plus 55 af drought buffer); and GSWC, 550 af (500 af plus 50 af drought buffer). The drought buffer is intended to provide a way to stabilize annual fluctuations in SWP water deliveries to the purveyors due to annual fluctuations in SWP water availability, in essence firming up the overall reliability of the purveyors' SWP entitlements. As such, during years when SWP water availability exceeds purveyor demand, the drought buffer amounts (and unused entitlement allocations) could be stored either directly into a groundwater basin or in an in-lieu manner (i.e., by taking delivery of drought buffer water to meet demand in order to reduce groundwater pumping by that amount). Conversely, during years when SWP water availability is less than purveyor demand, the stored drought buffer water (and stored entitlement water) is meant to be available to augment SWP deliveries (Santa Barbara County DPD, 2008). The total entitlements of the Cities of Santa Maria and Guadalupe and the GSWC (SCWC) are listed in Exhibit F to the Stipulation as follows: Santa Maria, 17,800 af; Guadalupe, 610 af; and SCWC (GSWC), 550 af. The amounts listed for Santa Maria and Guadalupe appear to be the actual entitlements described above but "rounded off." Such as the Stipulation also specifies certain minimum importation of SWP water, as a function of its availability in any given year and also as a function of individual purveyor entitlement, the following assessment of imported water use in 2013 is related to those total entitlements.

In 2013, total deliveries of SWP water to the SMVMA were 9,031 af. The majority of those deliveries, 8,504 af, were to the City of Santa Maria; a small portion of the Santa Maria deliveries, 87 af, were transferred to GSWC, which also took delivery of 156 af of its own entitlement. The City of Guadalupe took 284 af of SWP water in 2013. The monthly and total annual deliveries of SWP water to the SMVMA in 2013 are summarized in Table 3.2-1b.

Municipal deliveries commenced in 1997 with approximately 4,500 af going to the City of Santa Maria. The following year, the City's delivery more than doubled to nearly 10,700 af and GSWC took about 80 af (the City of Guadalupe delivery records prior to 2004 are unavailable). From then through 2007, total annual SWP water deliveries ranged between about 10,400 and 13,800 afy. Then, due to decreased SWP water availability in 2008 and 2009 (35 and 40 percent, respectively), SWP water deliveries in those years were reduced to about 8,000 afy. With improved SWP water availability in 2010, 2011, and 2012 (50, 80, and 65 percent, respectively), water deliveries increased during those years to between 10,450 and 12,135 af. With the decrease in SWP water availability to 35 percent in 2013, water deliveries were again reduced (to about 9,030 af), as shown in a graph of the historical deliveries of SWP water to the SMVMA (Figure 3.2-1b).

The Stipulation designates minimum amounts of SWP water to be imported and used in the SMVMA in any year as a function of individual entitlement and SWP availability. Santa Maria is to import and use not less than 10,000 afy of available SWP water, or the full amount of available SWP water when it is less than 10,000 af. Guadalupe is to import and use a minimum of 75 percent of its available SWP water; and GSWC is to import and use all its available SWP water. In 2013, overall SWP water availability was 35 percent of entitlements. For municipal purveyors in the SMVMA, that availability converts to the following individual availability of SWP water: Santa Maria, 6,230 af; GSWC, 190 af; and Guadalupe, 210 af (75 percent of which, or 155 af, as a minimum was to be imported). Actual imports of SWP water by all three municipal purveyors (including transfers from Santa Maria to GSWC), were as follows: Santa Maria, 8,504 af; GSWC, 243 af; and Guadalupe, 284 af (see Table 3.2-1b). Comparison of these figures indicates Santa Maria, GSWC, and Guadalupe each imported more than their respective minimum amounts in 2013, thus satisfying the specification in the Stipulation for importation and use of SWP water in the SMVMA.

3.2.3 Total Municipal Water Requirements

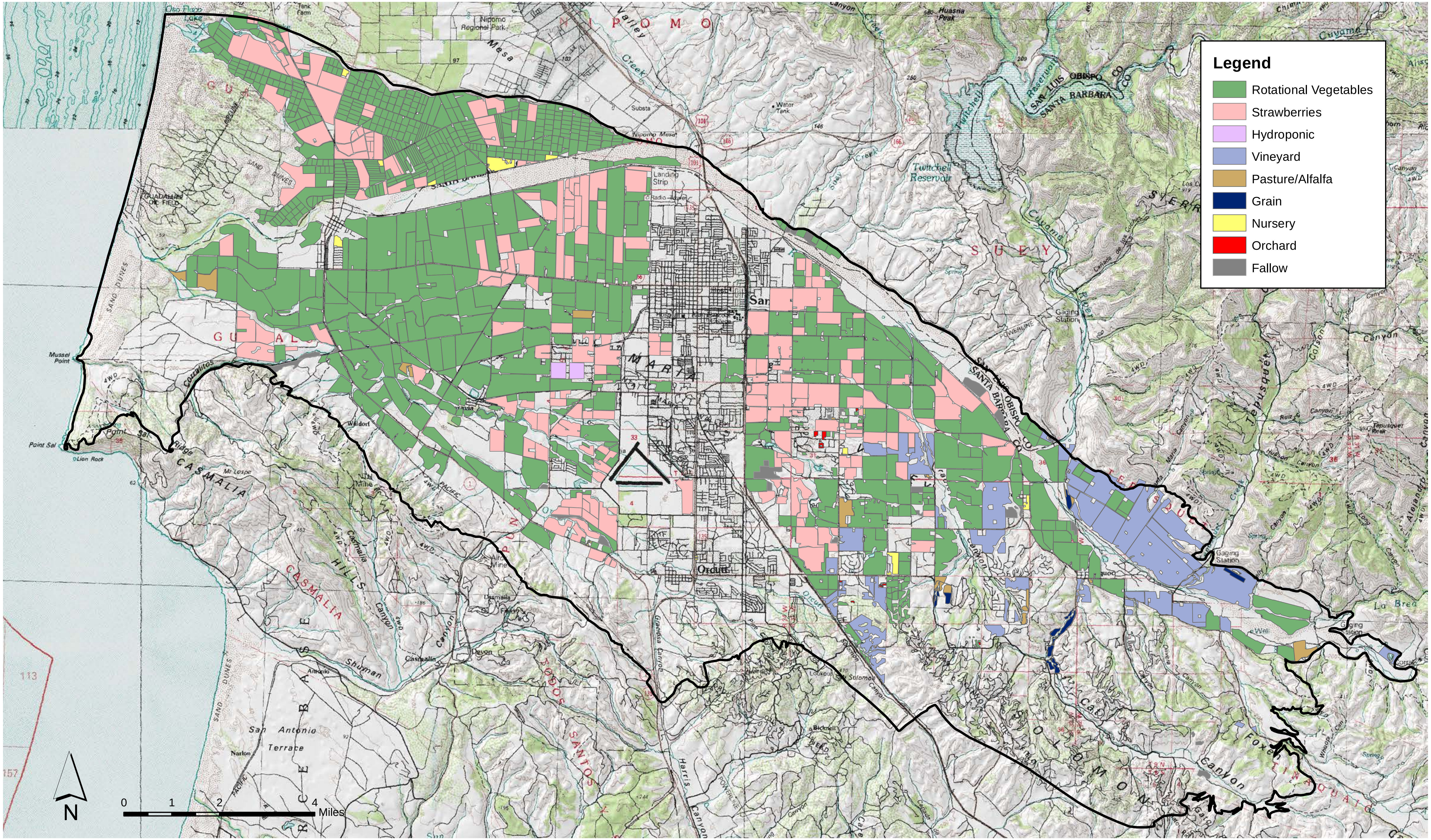
Total municipal water requirements in 2013 were 23,250 af, slightly more than in 2012 (22,260 af). While the 2013 total reflects a decrease since the highest historical municipal water use, 25,500 af in 2007, it continues a long-term general trend of increasing municipal water requirements that have essentially doubled since the mid-1970's. In fact, municipal water requirements have followed a roughly linear increase over the historical period of record, although more recently with an overall decline in municipal water use in 2008 through 2012. The overall history of municipal water use in the SMVMA is detailed in Table 3.2-1c and illustrated in a graph of annual municipal requirements (Figure 3.2-1c).

3.3 Total Water Requirements and Supplies

Total water requirement for 2013 in the SMVMA, the combination of agricultural and municipal water requirements, was approximately 139,220 af. That total demand was predominately met by about 130,190 af of groundwater pumping. The balance, 9,030 af, was met by delivery of imported water from the State Water Project as seen in Table 3.3-1a. Groundwater met 100 percent of the agricultural water requirement (115,970 af), 61 percent of the municipal water requirements (23,250 af), and 93 percent of the total water requirements in the SMVMA (139,220 af).

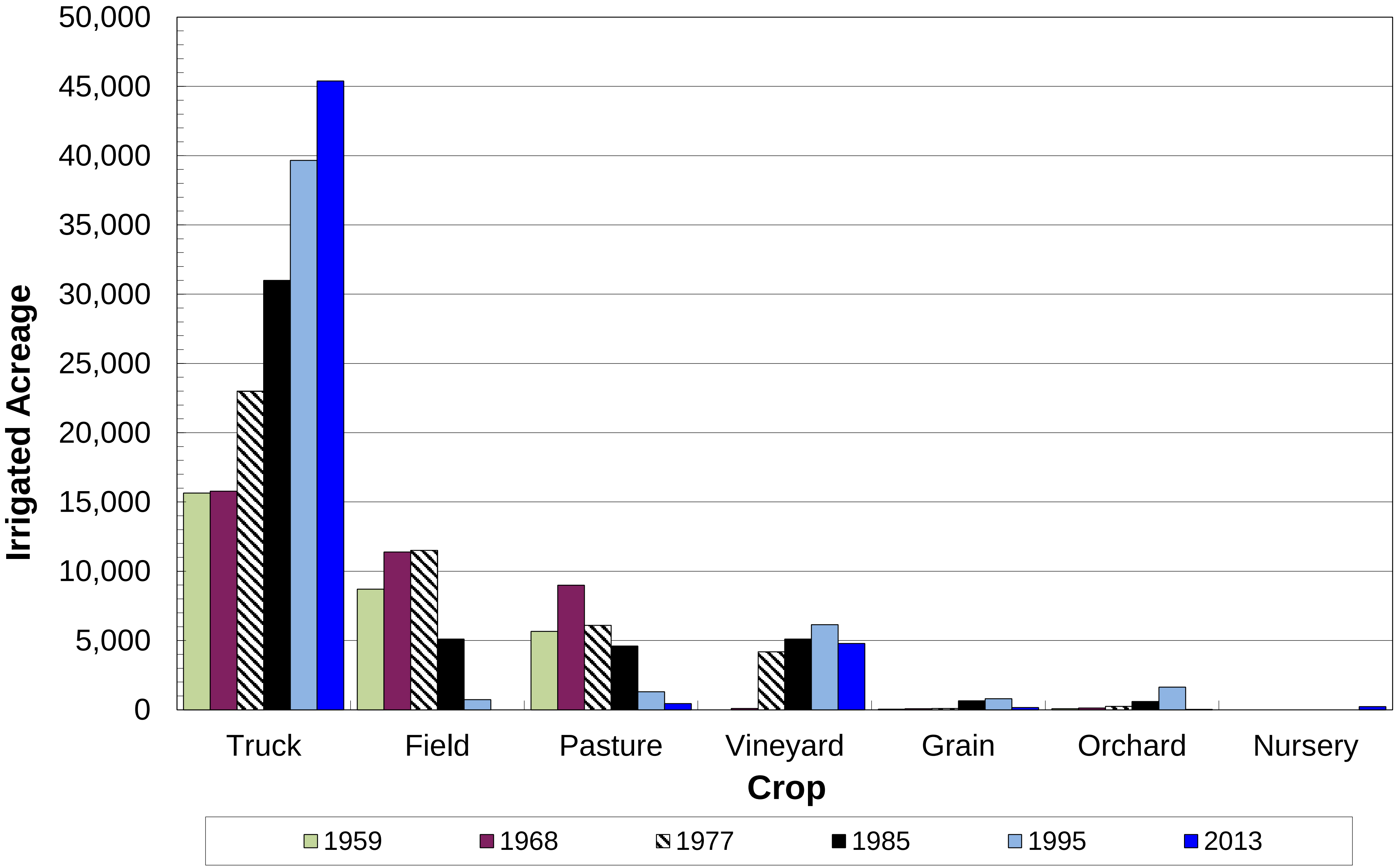
Historical total water requirements in the SMVMA have increased from about 80,000 af in 1950 to about 150,000 af by 1990, and have fluctuated in a broad but relatively constant range between about 100,000 and 150,000 afy, as shown in a graph of historical total water requirements (Figure 3.3-1). Total water requirements in 2013 remained within that range.

Historical water supplies in the SMVMA were solely derived from groundwater pumping until 1997, when the City of Santa Maria commenced importation of SWP water. While groundwater has always met 100 percent of agricultural water requirements (and through 1996 also met 100 percent of municipal water requirements), groundwater pumping has since met from 35 to 80 percent of the municipal water requirements and from 87 to 97 percent of the total water requirements in the SMVMA, as shown in Table 3.3-1b.



LUHDORFF & SCALMANINI CONSULTING ENGINEERS

Figure 3.1-1a
Agricultural Land Use, 2013
Santa Maria Valley Management Area



LUHDORFF & SCALMANINI CONSULTING ENGINEERS

Figure 3.1-1b
Historical Distribution of Irrigated Acreage by Crop Category
Santa Maria Valley Management Area

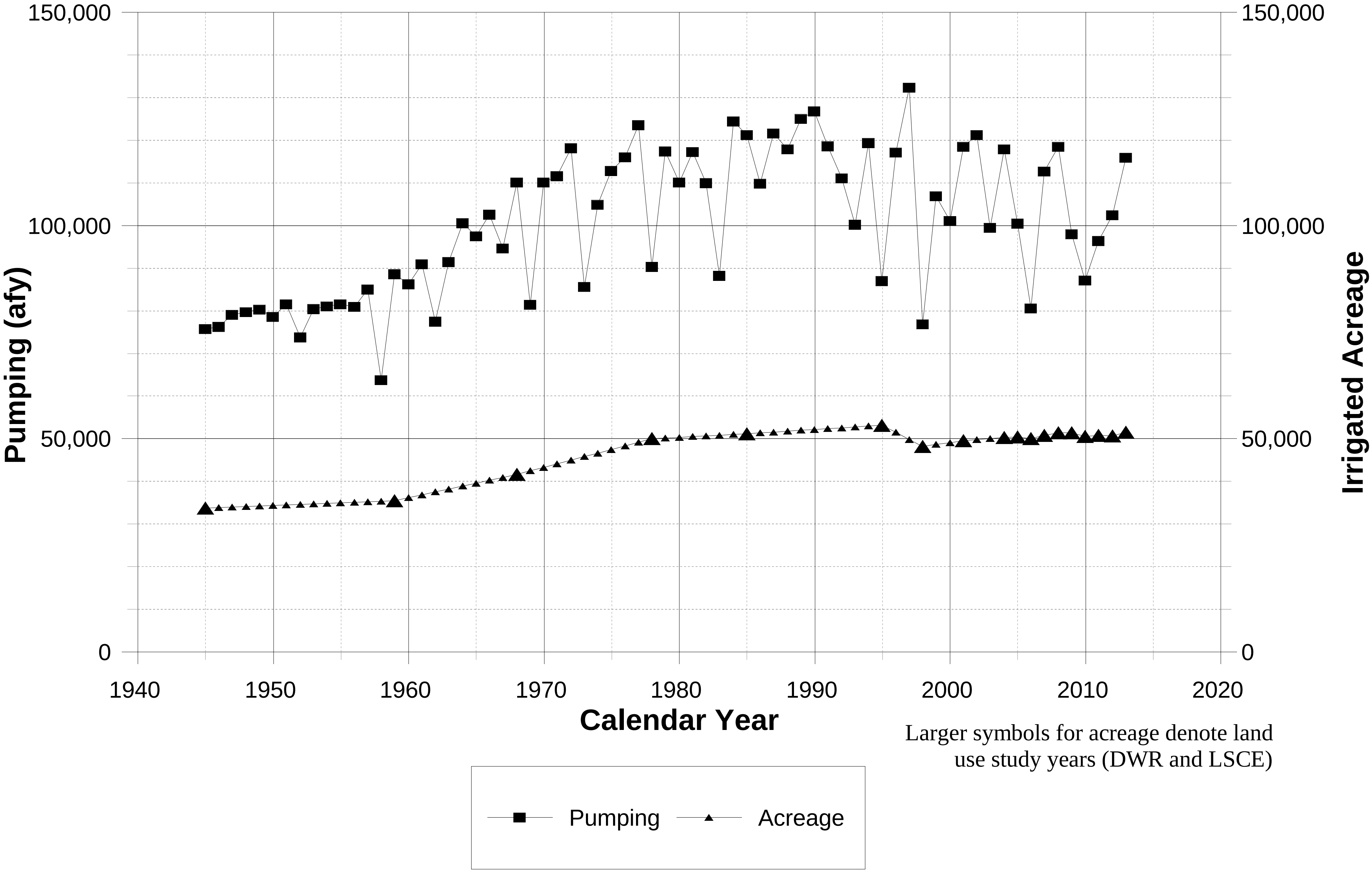


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Figure 3.1-1c
Historical Agricultural Acreage and Groundwater Pumping
Santa Maria Valley Management Area

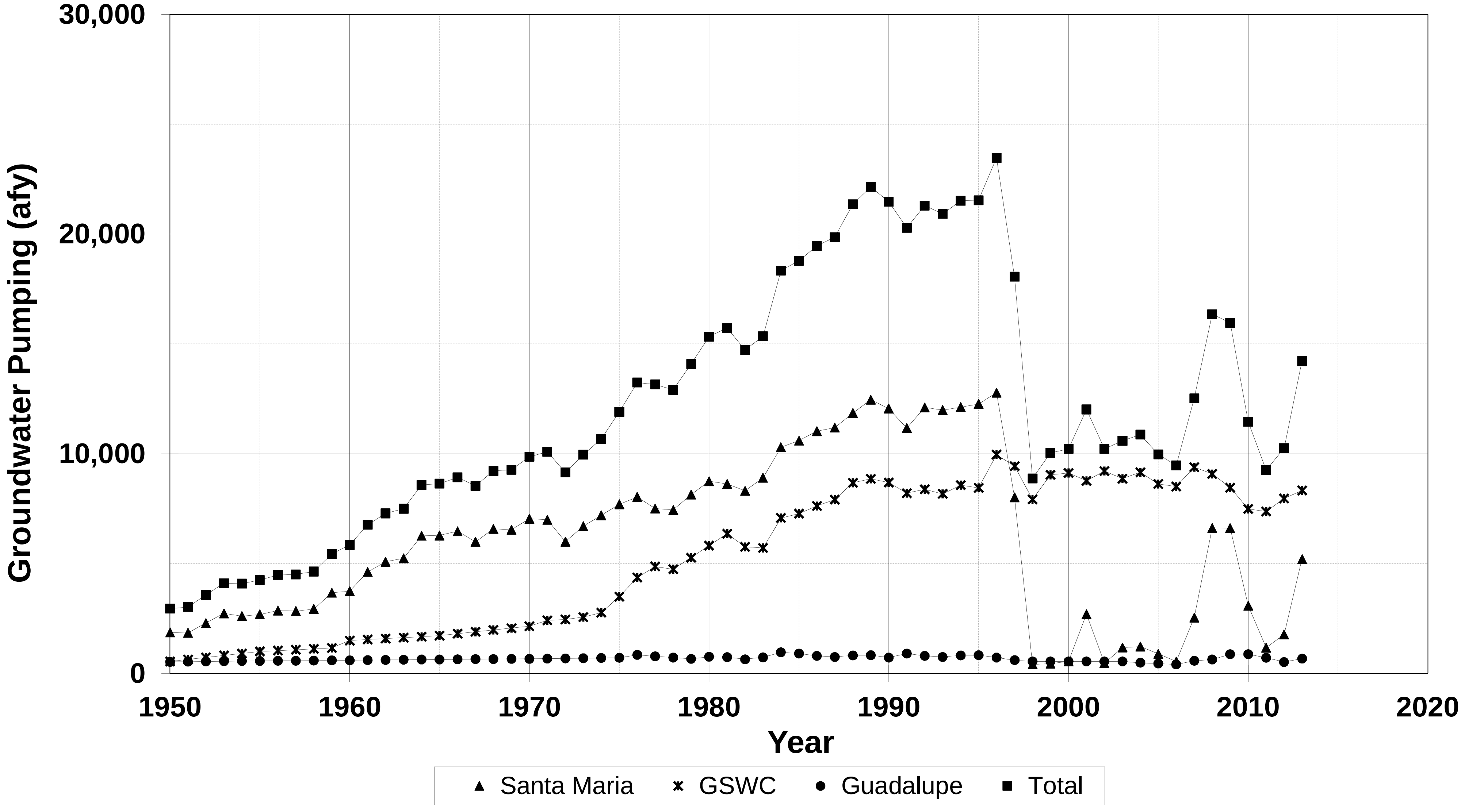

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Figure 3.2-1a
Historical Municipal Groundwater Pumping
Santa Maria Valley Management Area

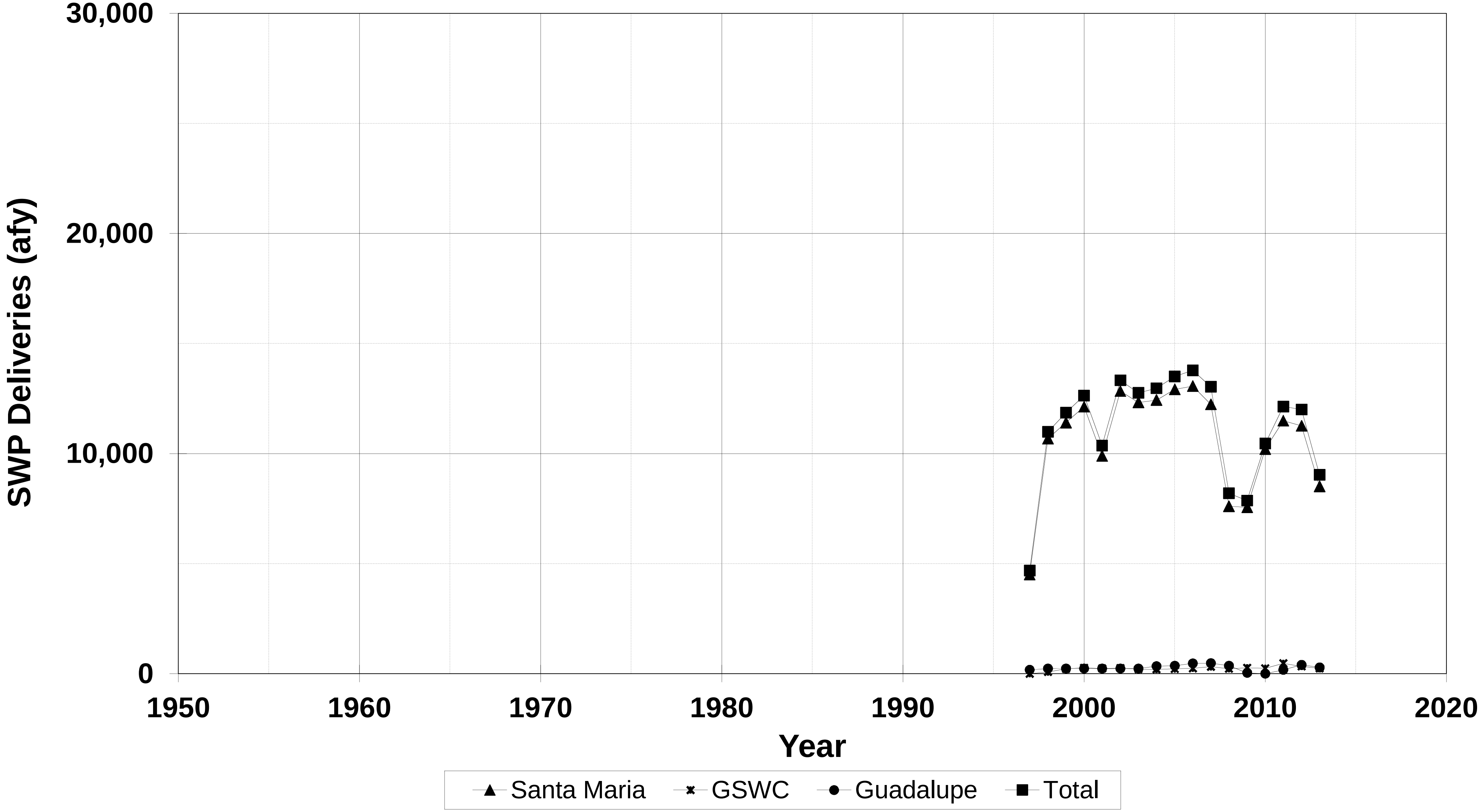

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Figure 3.2-1b
Historical State Water Project Deliveries
Santa Maria Valley Management Area

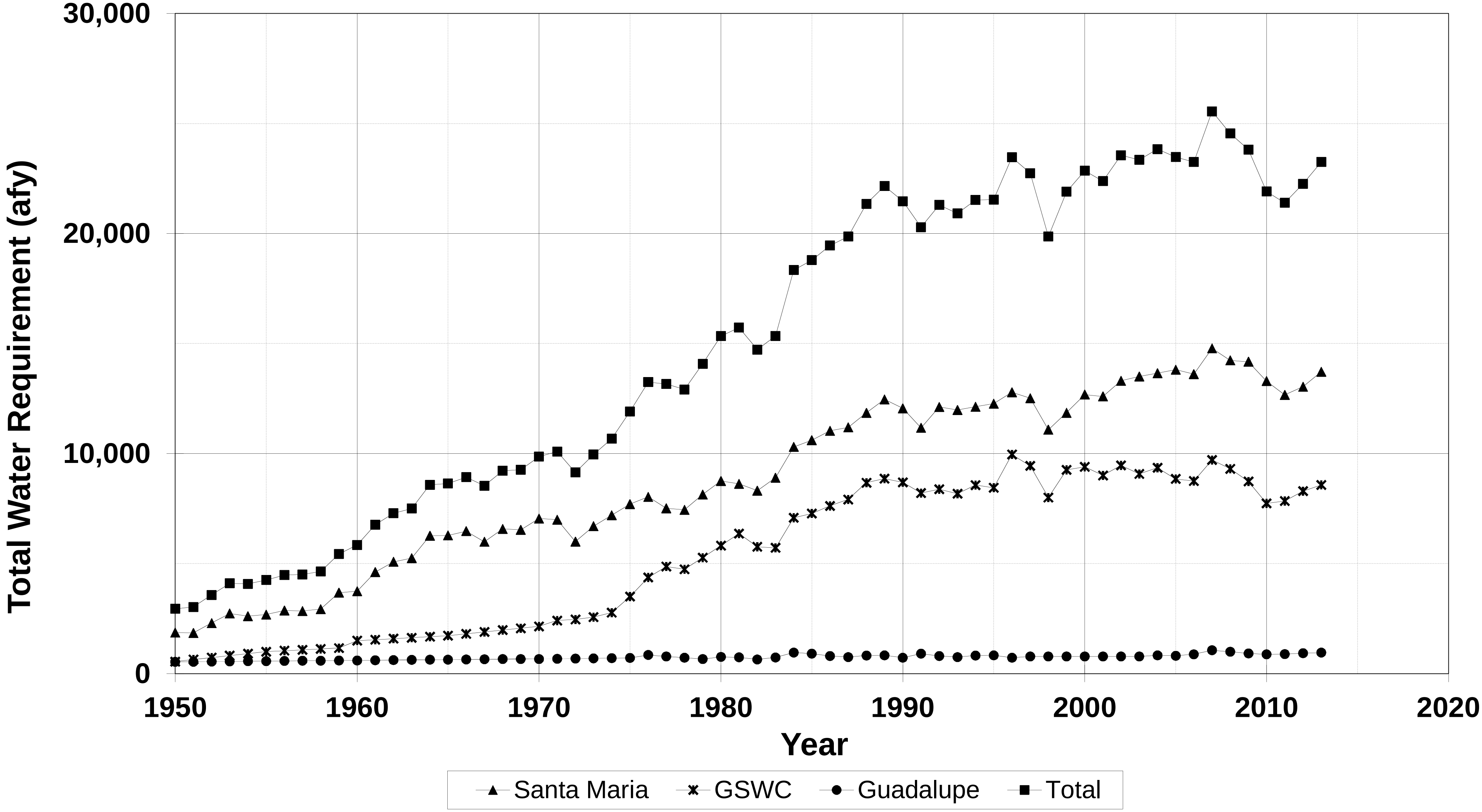

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Figure 3.2-1c
Historical Municipal Water Requirements
Santa Maria Valley Management Area

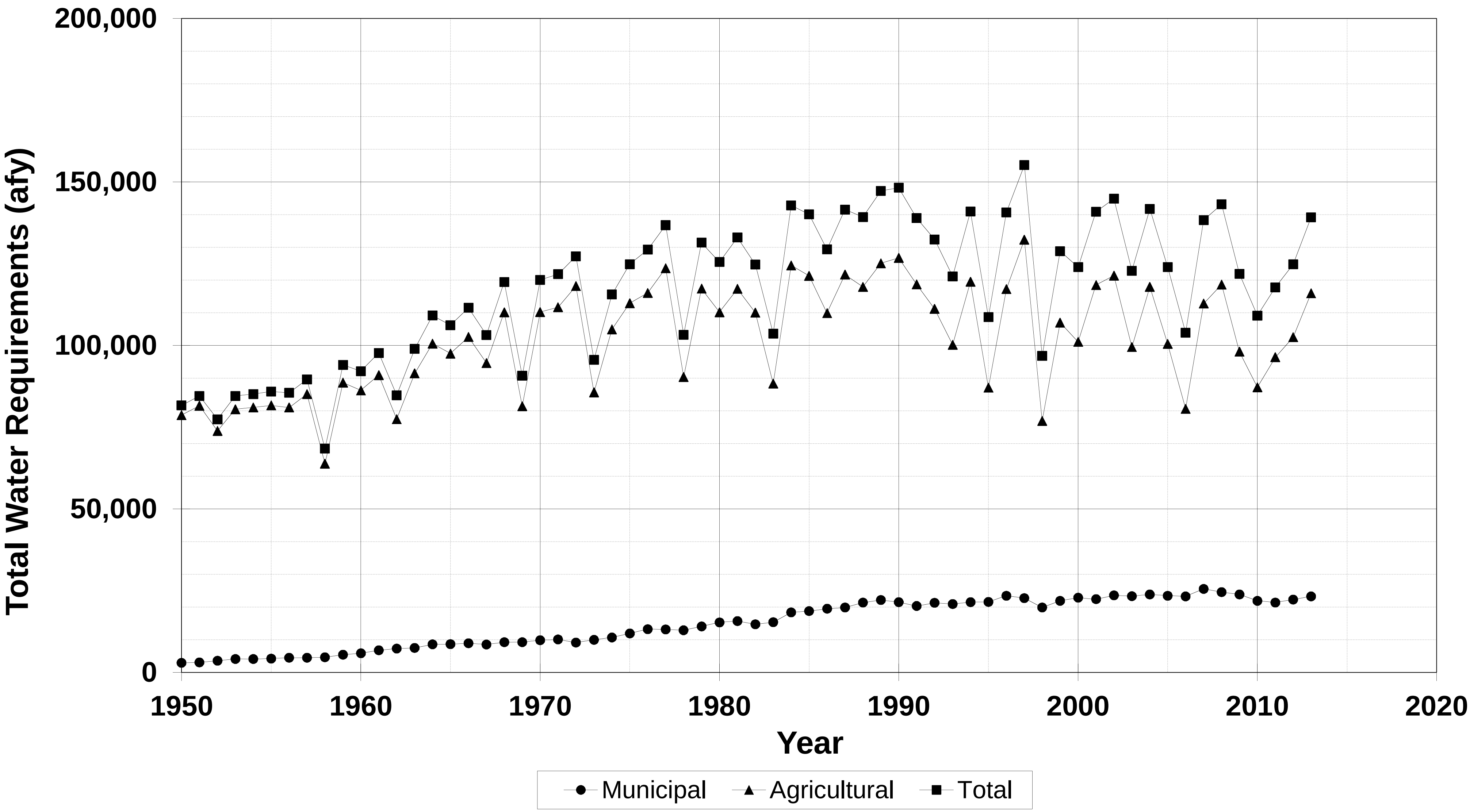

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Figure 3.3-1
Historical Total Water Requirements
Santa Maria Valley Management Area

Table 3.1-1a
Distribution of Irrigated Acreage, 2013
Santa Maria Valley Management Area

Crop Category	Acreages	
	Individual	Total
Truck Crops		
Rotational Vegetables[1]	33,796	
Strawberries	11,464	
Hydroponic[2]	135	45,395
Vineyard		
Wine Grapes	4,788	4,788
Pasture		
Pasture, Alfalfa	446	446
Grain		
Barley, Oat, "Grain"	158	158
Nursery		
Nursery, Outdoor Container and Transplants	227	227
Orchard		
Deciduous	10	
Citrus, Avocado	20	30
Fallow		
Fallow	519	519
Total		**51,563**

1) Rotational Vegetables include lettuce, broccoli, cauliflower, celery, spinach, cut flowers, peas, squash, beans, tomatillos, and others; cane and bush berry acreages are included due to similar crop water requirements.

2) Hydroponic includes primarily tomatoes with minor cucumber, peppers, and other vegetables (Windset Farms facility)

Table 3.1-1b
Historical Distribution of Irrigated Acreage
Land Use Study Years (DWR and LSCE)
Santa Maria Valley Management Area

	Year																	
Crop Categories	**1945**	**1959**	**1968**	**1977**	**1985**	**1995**	**1998**	**2001**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**
Rotational Vegetables	-----	-----	-----	-----	-----	-----	37,264	38,329	37,645	38,097	36,189	37,015	35,132	33,737	33,850	34,243	34,920	33,796
Strawberries	-----	-----	-----	-----	-----	-----	3,516	2,731	5,968	5,958	7,553	7,388	9,139	10,375	10,010	9,938	9,323	11,464
Hydroponic	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	135
Total Truck	20,000	15,640	15,770	23,000	31,000	39,665	40,780	41,060	43,613	44,055	43,742	44,403	44,271	44,112	43,860	44,181	44,243	45,395
Vineyard	0	0	95	4,200	5,100	6,148	5,180	5,241	4,311	4,219	4,400	4,492	4,968	4,765	4,675	4,561	4,573	4,788
Alfalfa	2,200	2,820	5,660	1,500	1,400	0	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Pasture	1,000	2,830	3,330	4,600	3,200	1,295	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Total Pasture	3,200	5,650	8,990	6,100	4,600	1,295	629	911	457	516	447	322	368	441	321	320	362	446
Field	5,000	8,710	11,390	11,500	5,100	734	0	0	0	0	0	0	0	0	0	0	0	0
Grain	1,200	40	80	100	640	789	546	947	760	877	837	420	382	580	993	1,028	588	158
Nursery	0	0	0	0	0	0	203	215	235	238	219	222	243	239	215	229	201	227
Deciduous	50	70	20	50	50	66	-----	-----	-----	15	13	13	13	13	10	10	10	10
Citrus	0	0	110	200	550	1,561	-----	-----	-----	18	18	23	23	23	24	24	20	20
Total Orchard	50	70	130	250	600	1,627	108	21	24	33	31	36	36	36	34	34	30	30
Fallow	4,400	5,430	5,220	4,900	4,200	2,973	790	1,211	932	507	408	900	1,136	1,244	557	528	711	519
Total Acreage	**33,850**	**35,540**	**41,675**	**50,050**	**51,240**	**53,231**	**48,236**	**49,606**	**50,332**	**50,445**	**50,084**	**50,795**	**51,404**	**51,417**	**50,655**	**50,881**	**50,708**	**51,563**

Table 3.1-1c

Applied Crop Water Requirements and Total Agricultural Water Requirements, 2013

Santa Maria Valley Management Area

Crop Category	Evapotranspiration of Crop ETc (in)	Effective Precipitation P_E (in)	Evapotranspiration of Applied Water ETaw (in)	Evapotranspiration of Applied Water ETaw (af/ac)	Distribution Uniformity DU (%)	Applied Water AW (af/ac)	Crop Acreage	Estimated Water Requirements (af)
Rotational Vegetables[1]	25.54	0.38	25.16	2.10	80	2.62	33,796	88,574
Strawberries[1]	17.76	1.93	15.83	1.32	85	1.55	11,464	17,792
Hydroponic[2]	---	---	---	---	---	2.0	135	270
Vineyard[3]	---	---	15.6	1.3	95	1.4	4,788	6,552
Pasture[1]	47.02	2.34	44.68	3.72	80	4.65	446	2,076
Grain[3]	---	---	9.6	0.8	80	1.0	158	158
Nursery[4]	---	---	---	---	---	2.0	227	454
Deciduous[3]	---	---	33.6	2.8	85	3.3	10	33
Avocado[3]	---	---	32.4	2.7	85	3.2	20	64
Fallow[5]	---	---	---	---	---	---	519	---
Total							**51,563**	**115,972**

1) CIMIS-based applied crop water duties

2) Research-based applied crop water duty

3) Reported ETaw-based applied crop water duties

4) NMMA applied crop water duty; DU assumed as 80%

5) No applied water

Table 3.2-1a
Municipal Groundwater Pumpage in 2013
Santa Maria Valley Management Area
(in acre-feet)

Well	January	February	March	April	May	June	July	August	September	October	November	December	Total
City of Santa Maria													
9S	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0
10S	0.0	0.0	0.0	3.7	38.2	87.0	90.8	92.5	129.3	112.4	121.1	64.4	739
11S	0.0	0.0	0.1	0.0	0.3	0.6	0.0	0.0	26.7	10.3	65.0	15.5	119
12S	25.6	55.5	45.9	13.3	0.0	313.6	339.5	340.4	245.6	228.8	233.4	180.6	2,022
13S	67.5	56.4	65.8	308.0	331.2	11.2	0.0	0.0	261.8	322.7	296.4	281.4	2,002
14S	0.0	0.0	0.0	0.9	7.9	0.0	0.0	0.0	4.9	9.4	268.4	41.1	333
Purveyor Total	**93.1**	**111.8**	**111.8**	**325.9**	**377.7**	**412.5**	**430.4**	**432.9**	**668.3**	**683.5**	**984.4**	**583.0**	**5,215**
Golden State Water Company													
Orcutt System													
Crescent #1	85.9	88.5	103.4	101.0	103.4	95.3	94.9	97.6	101.8	102.8	96.8	98.6	1,170
Kenneth #1	53.2	54.6	83.9	125.5	131.8	113.4	131.8	130.9	106.1	82.2	108.5	101.3	1,223
Mira Flores #1	20.9	20.4	26.1	33.1	28.0	34.1	37.7	40.6	44.1	39.7	31.0	29.8	386
Mira Flores #2	12.4	22.6	42.4	58.7	61.4	54.3	57.9	59.3	51.1	53.1	81.5	91.8	647
Mira Flores #4	38.4	3.1	1.6	2.9	27.9	72.7	75.7	79.1	77.5	80.0	76.4	64.4	600
Mira Flores #5	8.9	7.8	15.1	26.0	17.9	16.2	23.0	57.4	24.7	68.5	20.5	5.6	292
Mira Flores #6	3.1	8.1	1.9	17.8	99.0	54.3	65.7	18.1	109.7	24.9	7.5	0.4	411
Mira Flores #7	59.3	91.8	117.3	110.3	110.8	104.6	89.1	80.5	37.7	37.5	25.2	15.9	880
Oak	0.5	1.7	20.9	35.7	40.3	49.2	50.9	46.8	14.6	0.0	0.0	1.3	262
Orcutt	6.9	9.6	13.8	29.8	36.5	41.6	51.6	58.4	62.8	56.4	43.7	34.5	446
Woodmere #1	24.9	35.6	89.3	106.0	53.4	103.0	102.4	71.0	73.7	91.0	1.1	0.9	752
Woodmere #2	74.5	61.3	34.6	37.0	91.5	81.8	86.0	85.5	81.2	83.4	82.5	84.9	884
System Total	388.9	405.2	550.2	683.7	802.0	820.4	866.6	825.3	785.0	719.6	574.9	529.5	7,951
Lake Marie System													
Vineyard #5	1.3	1.8	3.7	3.2	1.1	0.9	1.7	0.4	5.3	0.4	0.8	0.5	21
Vineyard #6	7.6	9.7	15.1	19.5	28.8	30.3	32.6	32.5	22.5	28.6	18.9	20.2	266
System Total	9.0	11.6	18.8	22.7	29.9	31.2	34.4	32.8	27.9	28.9	19.7	20.7	288
Tanglewood System													
Tanglewood #1	0.0	0.0	0.0	0.0	0.0	0.0	0.6	1.0	0.2	0.0	0.0	0.0	2
Tanglewood #3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.6	12.1	14.2	13.0	42
System Total	0.0	0.0	0.0	0.0	0.0	0.0	0.6	1.0	2.8	12.1	14.2	13.0	44
Sisquoc System													
Foxen Cyn #4	2.3	1.5	3.0	4.4	7.0	6.7	5.8	4.7	5.2	4.5	2.6	2.2	50
System Total	2.3	1.5	3.0	4.4	7.0	6.7	5.8	4.7	5.2	4.5	2.6	2.2	50
Purveyor Total	**400.2**	**418.3**	**572.0**	**710.9**	**839.0**	**858.3**	**907.4**	**863.8**	**820.9**	**765.1**	**611.3**	**565.4**	**8,333**
City of Guadalupe													
Obispo	28.3	27.8	37.7	43.1	52.6	52.7	56.7	80.1	68.3	76.5	76.6	71.5	672
Purveyor Total	**28.3**	**27.8**	**37.7**	**43.1**	**52.6**	**52.7**	**56.7**	**80.1**	**68.3**	**76.5**	**76.6**	**71.5**	**672**
												Total Municipal Pumpage	**14,220**

Table 3.2-1b
Municipal State Water Project Deliveries in 2013
Santa Maria Valley Management Area
(in acre-feet)

City of Santa Maria

	January	February	March	April	May	June	July	August	September	October	November	December	Total
SWP Deliveries	668.6	649.2	879.3	799.6	952.5	963.1	1,020.3	956.3	664.4	584.0	62.1	391.7	8,591
Transfers to GSWC	0.6	4.4	9.1	11.4	22.7	9.9	13.2	7.9	3.7	2.1	1.7	0.4	87
Purveyor Total	**668.0**	**644.8**	**870.3**	**788.2**	**929.8**	**953.3**	**1,007.0**	**948.4**	**660.7**	**581.8**	**60.4**	**391.3**	**8,504**

Golden State Water Company

	January	February	March	April	May	June	July	August	September	October	November	December	Total
Orcutt System													
Transfers from Santa Maria	0.6	4.4	9.1	11.4	22.7	9.9	13.2	7.9	3.7	2.1	1.7	0.4	87
System Total	0.6	4.4	9.1	11.4	22.7	9.9	13.2	7.9	3.7	2.1	1.7	0.4	87
Tanglewood System													
SWP Deliveries	12.2	11.8	14.8	16.3	19.1	20.1	20.2	19.0	16.2	5.0	0.7	0.6	156
System Total	12.2	11.8	14.8	16.3	19.1	20.1	20.2	19.0	16.2	5.0	0.7	0.6	156
Purveyor Total	**12.7**	**16.2**	**23.9**	**27.7**	**41.8**	**29.9**	**33.5**	**26.9**	**19.9**	**7.1**	**2.3**	**0.9**	**243**

City of Guadalupe

	January	February	March	April	May	June	July	August	September	October	November	December	Total
SWP Deliveries	34.8	32.3	36.1	34.0	35.5	34.1	34.7	12.6	14.0	9.6	0.2	6.0	284
Purveyor Total	**34.8**	**32.3**	**36.1**	**34.0**	**35.5**	**34.1**	**34.7**	**12.6**	**14.0**	**9.6**	**0.2**	**6.0**	**284**

Total Municipal Deliveries 9,031

Table 3.2-1c
Historical Municipal Water Requirements and Supplies
Santa Maria Valley Management Area

	Groundwater Pumping (afy)				State Water Project Deliveries (afy)								Total Municipal Water Supplies (afy)			
					City of Santa Maria			Golden State Water Company								
Year	City of Santa Maria	Golden State Water Company	City of Guadalupe	Total	SWP Deliveries to City of Santa Maria	Transfers to Golden State Water Company	Net Total	SWP Deliveries to Golden State Water Company	Transfers from City of Santa Maria	Net Total	City of Guadalupe	Total	City of Santa Maria	Golden State Water Company	City of Guadalupe	Total
1950	1,866	550	533	**2,949**	-----	-----	-----	-----	-----	-----	-----	**0**	1,866	550	533	**2,949**
1951	1,847	640	540	**3,027**	-----	-----	-----	-----	-----	-----	-----	**0**	1,847	640	540	**3,027**
1952	2,298	730	548	**3,576**	-----	-----	-----	-----	-----	-----	-----	**0**	2,298	730	548	**3,576**
1953	2,732	820	556	**4,108**	-----	-----	-----	-----	-----	-----	-----	**0**	2,732	820	556	**4,108**
1954	2,610	910	563	**4,083**	-----	-----	-----	-----	-----	-----	-----	**0**	2,610	910	563	**4,083**
1955	2,688	1,000	566	**4,254**	-----	-----	-----	-----	-----	-----	-----	**0**	2,688	1,000	566	**4,254**
1956	2,866	1,040	574	**4,480**	-----	-----	-----	-----	-----	-----	-----	**0**	2,866	1,040	574	**4,480**
1957	2,845	1,080	582	**4,507**	-----	-----	-----	-----	-----	-----	-----	**0**	2,845	1,080	582	**4,507**
1958	2,930	1,120	590	**4,640**	-----	-----	-----	-----	-----	-----	-----	**0**	2,930	1,120	590	**4,640**
1959	3,676	1,160	598	**5,434**	-----	-----	-----	-----	-----	-----	-----	**0**	3,676	1,160	598	**5,434**
1960	3,749	1,500	600	**5,849**	-----	-----	-----	-----	-----	-----	-----	**0**	3,749	1,500	600	**5,849**
1961	4,618	1,544	608	**6,771**	-----	-----	-----	-----	-----	-----	-----	**0**	4,618	1,544	608	**6,771**
1962	5,083	1,588	617	**7,288**	-----	-----	-----	-----	-----	-----	-----	**0**	5,083	1,588	617	**7,288**
1963	5,245	1,633	626	**7,503**	-----	-----	-----	-----	-----	-----	-----	**0**	5,245	1,633	626	**7,503**
1964	6,267	1,677	634	**8,578**	-----	-----	-----	-----	-----	-----	-----	**0**	6,267	1,677	634	**8,578**
1965	6,282	1,725	633	**8,640**	-----	-----	-----	-----	-----	-----	-----	**0**	6,282	1,725	633	**8,640**
1966	6,476	1,810	642	**8,927**	-----	-----	-----	-----	-----	-----	-----	**0**	6,476	1,810	642	**8,927**
1967	5,993	1,894	651	**8,538**	-----	-----	-----	-----	-----	-----	-----	**0**	5,993	1,894	651	**8,538**
1968	6,580	1,979	660	**9,219**	-----	-----	-----	-----	-----	-----	-----	**0**	6,580	1,979	660	**9,219**
1969	6,538	2,064	669	**9,271**	-----	-----	-----	-----	-----	-----	-----	**0**	6,538	2,064	669	**9,271**
1970	7,047	2,150	666	**9,863**	-----	-----	-----	-----	-----	-----	-----	**0**	7,047	2,150	666	**9,863**
1971	7,000	2,415	675	**10,090**	-----	-----	-----	-----	-----	-----	-----	**0**	7,000	2,415	675	**10,090**
1972	6,000	2,460	685	**9,145**	-----	-----	-----	-----	-----	-----	-----	**0**	6,000	2,460	685	**9,145**
1973	6,700	2,565	694	**9,959**	-----	-----	-----	-----	-----	-----	-----	**0**	6,700	2,565	694	**9,959**
1974	7,200	2,770	704	**10,674**	-----	-----	-----	-----	-----	-----	-----	**0**	7,200	2,770	704	**10,674**
1975	7,700	3,500	714	**11,914**	-----	-----	-----	-----	-----	-----	-----	**0**	7,700	3,500	714	**11,914**
1976	8,033	4,367	845	**13,245**	-----	-----	-----	-----	-----	-----	-----	**0**	8,033	4,367	845	**13,245**
1977	7,509	4,868	781	**13,158**	-----	-----	-----	-----	-----	-----	-----	**0**	7,509	4,868	781	**13,158**
1978	7,446	4,743	722	**12,911**	-----	-----	-----	-----	-----	-----	-----	**0**	7,446	4,743	722	**12,911**
1979	8,142	5,274	666	**14,082**	-----	-----	-----	-----	-----	-----	-----	**0**	8,142	5,274	666	**14,082**
1980	8,754	5,820	762	**15,336**	-----	-----	-----	-----	-----	-----	-----	**0**	8,754	5,820	762	**15,336**
1981	8,621	6,366	738	**15,725**	-----	-----	-----	-----	-----	-----	-----	**0**	8,621	6,366	738	**15,725**
1982	8,313	5,765	648	**14,726**	-----	-----	-----	-----	-----	-----	-----	**0**	8,313	5,765	648	**14,726**
1983	8,903	5,714	733	**15,350**	-----	-----	-----	-----	-----	-----	-----	**0**	8,903	5,714	733	**15,350**
1984	10,299	7,079	961	**18,339**	-----	-----	-----	-----	-----	-----	-----	**0**	10,299	7,079	961	**18,339**
1985	10,605	7,276	908	**18,789**	-----	-----	-----	-----	-----	-----	-----	**0**	10,605	7,276	908	**18,789**
1986	11,033	7,625	798	**19,456**	-----	-----	-----	-----	-----	-----	-----	**0**	11,033	7,625	798	**19,456**
1987	11,191	7,916	757	**19,864**	-----	-----	-----	-----	-----	-----	-----	**0**	11,191	7,916	757	**19,864**
1988	11,849	8,678	823	**21,350**	-----	-----	-----	-----	-----	-----	-----	**0**	11,849	8,678	823	**21,350**
1989	12,464	8,860	828	**22,152**	-----	-----	-----	-----	-----	-----	-----	**0**	12,464	8,860	828	**22,152**
1990	12,052	8,691	724	**21,467**	-----	-----	-----	-----	-----	-----	-----	**0**	12,052	8,691	724	**21,467**
1991	11,170	8,210	908	**20,288**	-----	-----	-----	-----	-----	-----	-----	**0**	11,170	8,210	908	**20,288**
1992	12,116	8,381	798	**21,295**	-----	-----	-----	-----	-----	-----	-----	**0**	12,116	8,381	798	**21,295**
1993	11,984	8,174	757	**20,915**	-----	-----	-----	-----	-----	-----	-----	**0**	11,984	8,174	757	**20,915**
1994	12,129	8,571	823	**21,523**	-----	-----	-----	-----	-----	-----	-----	**0**	12,129	8,571	823	**21,523**
1995	12,267	8,447	828	**21,542**	-----	-----	-----	-----	-----	-----	-----	**0**	12,267	8,447	828	**21,542**
1996	12,780	9,960	724	**23,464**	-----	-----	-----	-----	-----	-----	-----	**0**	12,780	9,960	724	**23,464**
1997	8,016	9,441	603	**18,060**	4,506	0	4,506	0	0	0	175	**4,681**	12,522	9,441	778	**22,741**
1998	411	7,922	545	**8,878**	10,674	0	10,674	79	0	79	233	**10,986**	11,085	8,001	778	**19,865**
1999	454	9,044	545	**10,043**	11,405	0	11,405	219	0	219	233	**11,857**	11,859	9,263	778	**21,900**
2000	548	9,131	545	**10,224**	12,174	42	12,132	226	42	268	233	**12,633**	12,679	9,399	778	**22,856**
2001	2,699	8,772	545	**12,016**	9,914	20	9,894	217	20	237	233	**10,364**	12,594	9,009	778	**22,380**
2002	468	9,211	545	**10,224**	12,879	35	12,844	220	35	255	233	**13,332**	13,312	9,466	778	**23,556**
2003	1,178	8,866	545	**10,589**	12,325	4	12,321	201	4	205	233	**12,759**	13,499	9,071	778	**23,349**
2004	1,223	9,159	487	**10,869**	12,427	0	12,427	197	0	197	345	**12,969**	13,650	9,356	832	**23,838**
2005	897	8,626	452	**9,975**	12,960	43	12,917	177	43	220	362	**13,499**	13,814	8,846	814	**23,474**
2006	543	8,511	412	**9,466**	13,128	61	13,067	182	61	243	471	**13,781**	13,610	8,754	883	**23,247**
2007	2,550	9,393	580	**12,523**	12,352	120	12,232	197	120	317	483	**13,032**	14,782	9,710	1,063	**25,555**
2008	6,631	9,083	636	**16,350**	7,652	48	7,604	180	48	228	361	**8,193**	14,235	9,311	997	**24,543**
2009	6,615	8,463	879	**15,957**	7,641	84	7,557	182	84	266	38	**7,861**	14,172	8,729	917	**23,818**
2010	3,087	7,487	880	**11,454**	10,279	72	10,207	176	72	248	0	**10,455**	13,294	7,735	880	**21,909**
2011	1,170	7,375	713	**9,258**	11,785	290	11,495	179	290	469	172	**12,136**	12,665	7,844	885	**21,394**
2012	1,775	7,966	521	**10,262**	11,407	144	11,263	185	144	330	404	**11,996**	13,038	8,296	924	**22,258**
2013	5,215	8,333	672	**14,220**	8,591	87	8,504	156	87	243	284	**9,031**	13,719	8,576	956	**23,251**

estimated

731 af were reported for 2000
(unknown whether total use or total groundwater)

Table 3.3-1a
Total Water Requirements and Supplies 2013
Santa Maria Valley Management Area
(acre-feet)

Water Use Category	Water Requirements	Water Supplies			
		Groundwater	SWP imported	SWP transfer[1]	Net SWP
Agricultural					
Total	**115,972**	**115,972**	**--**	**--**	**--**
Municipal					
City of Santa Maria	13,719	5,215	8,591	-87	8,504
Golden State Water Company	8,576	8,333	156	87	243
City of Guadalupe	956	672	284	--	284
Total	**23,251**	**14,220**	**9,031**	**--**	**9,031**
SMVMA Total	**139,223**	**130,192**			**9,031**

[1]Transfer within SMVMA from Santa Maria to Golden State Water Company

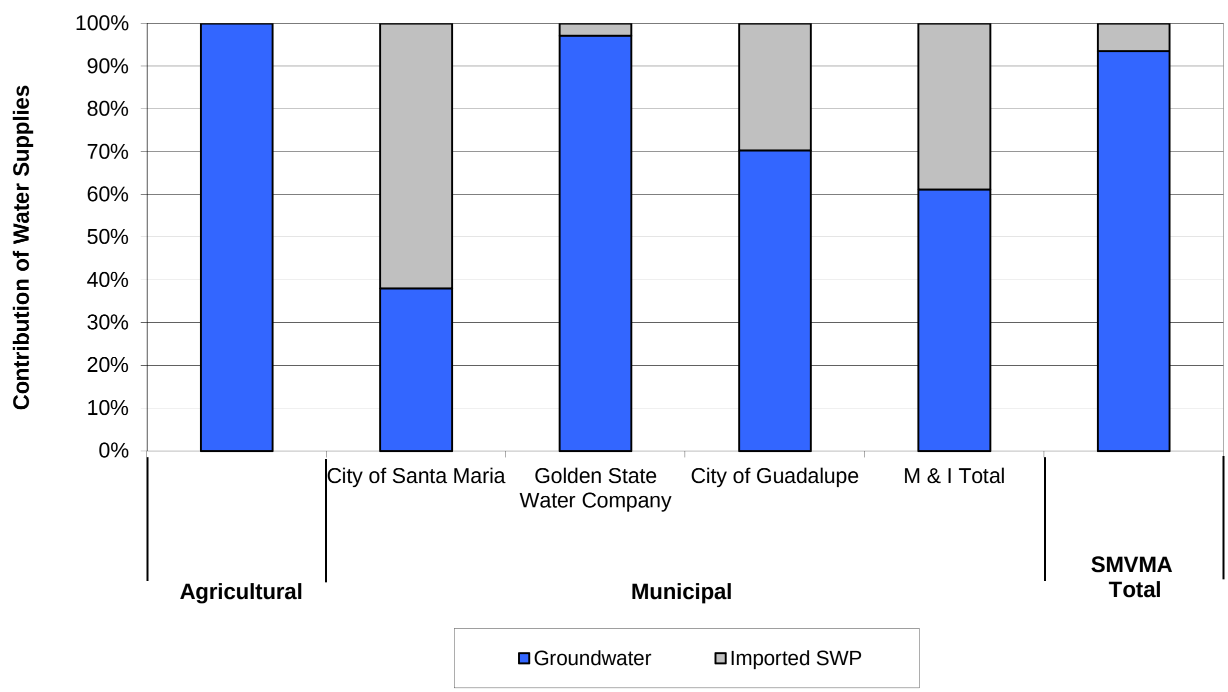
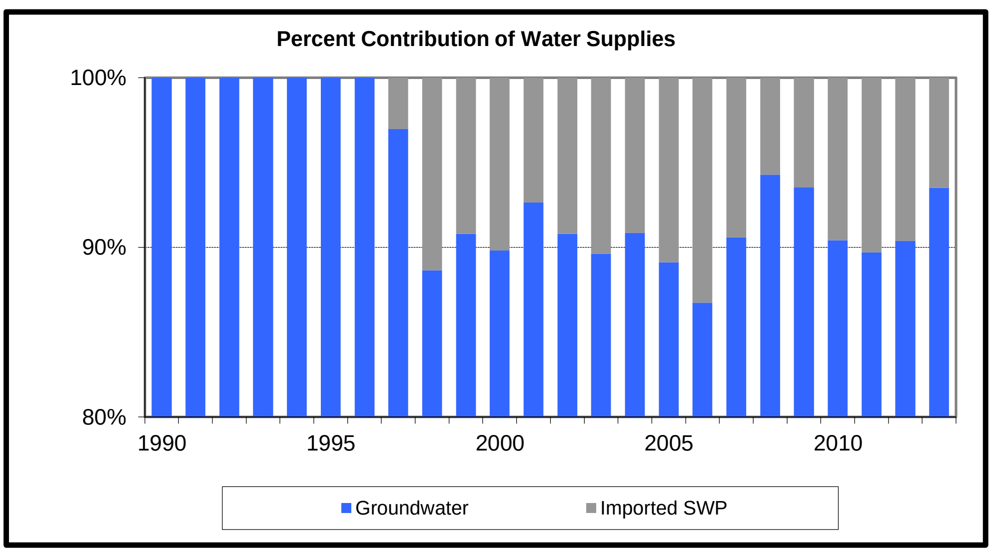


Table 3.3-1b
Recent Historical Total Water Supplies
Santa Maria Valley Management Area
(Acre-feet)

Year	*Total Groundwater*	*Total Imported SWP Water*	**Total Water Supply**
1990	148,254	0	**148,254**
1991	138,963	0	**138,963**
1992	132,461	0	**132,461**
1993	121,124	0	**121,124**
1994	140,956	0	**140,956**
1995	108,640	0	**108,640**
1996	140,691	0	**140,691**
1997	150,451	4,681	**155,132**
1998	85,778	10,986	**96,765**
1999	117,013	11,857	**128,870**
2000	111,306	12,633	**123,938**
2001	130,532	10,364	**140,896**
2002	131,557	13,332	**144,889**
2003	110,099	12,759	**122,859**
2004	128,799	12,969	**141,768**
2005	110,469	13,499	**123,968**
2006	90,130	13,781	**103,911**
2007	125,318	13,032	**138,350**
2008	134,962	8,193	**143,155**
2009	114,042	7,861	**121,903**
2010	98,668	10,455	**109,123**
2011	105,645	12,136	**117,781**
2012	112,779	11,996	**124,775**
2013	130,192	9,031	**139,223**



4. Water Disposition

The Stipulation directs that there be an annual accounting of the disposition of water supplies in the SMVMA. The primary uses of water in the SMVMA are for agricultural irrigation and for domestic and related municipal uses, as detailed in Chapter 3, where most of the water is consumptively used. The balance of water supplies primarily flow, or are disposed, back to the groundwater basin via deep percolation of applied irrigation that exceeds agricultural crop water requirements, via deep percolation of landscape or other non-agricultural irrigation, and via purposeful infiltration of treated municipal waste water. Other disposition of water in the SMVMA includes purposeful consumptive use of treated municipal waste water via spray irrigation for disposal (evapotranspiration), injection of brine derived from reverse osmosis treatment, and industrial use. Additional disposition of water is minor agricultural drainage in localized areas of low surface elevation and high shallow groundwater levels and, potentially, purposeful export of water to another management area. This chapter quantitatively addresses the two largest of the preceding components of water disposition, deep percolation of applied agricultural irrigation and discharge of treated municipal waste water. It also includes estimated return flows from landscape irrigation. Limited information is available with regard to agricultural drainage, so there is no quantitative discussion of that component of disposition herein. With regard to other aspects of water supply and disposition, the Stipulation includes provisions for future intra-basin export of water from the SMVMA to the adjacent NMMA; the planned water sales from the City of Santa Maria to the Nipomo Community Services District (Nipomo CSD) and associated technical concerns (expressed in previous SMVMA annual reports) are further discussed below.

4.1 Agricultural Return Flows

The largest component of overall return flows in the SMVMA originates as applied water for agricultural irrigation. Except for local areas near the Santa Maria River toward the western end of the SMVMA where subsurface drainage removes shallow groundwater beneath irrigated lands, applied irrigation in excess of crop water requirements is considered to deep percolate beyond crop rooting depths and result in return flows to groundwater. The estimation of agricultural water requirements and associated groundwater pumping, as described in Section 3.1, is based on crop areas, respective crop water requirements, and estimated performance of various irrigation systems. For the range of crops and irrigation systems in the SMVMA, most crops are considered to consumptively use about 80 to 85 percent of the water applied to them, resulting in an estimated 15 to 20 percent of applied water exceeding crop consumption and deep percolating as return flow to the underlying aquifer system. Exceptions to the preceding ranges are wine grapes and hydroponic tomatoes, where 95% and 100% of applied water are estimated to be consumptively used, respectively (resulting in return flow from only the vineyards, specifically 5% of applied water).

For the full range of crop categories in the SMVMA, return flow rates in 2013 are estimated to range from less than 0.1 af/ac for Vineyard, to about 0.5 af/ac for the predominant Rotational Vegetables and Orchard in the Valley to a maximum of about 0.9 af/ac for Pasture. The respective estimated agricultural return flow rates are detailed in Table 4.1-1. When combined with their respective individual crop acreages, it is estimated that about 21,260 af of applied agricultural irrigation deep percolated to groundwater as return flows in the SMVMA in 2013.

4.2 Treated Municipal Waste Water Discharge

There are three municipal waste water treatment plants in the SMVMA: the City of Santa Maria plant located west of the City; the Laguna Sanitation District plant west of the Santa Maria Airport; and the City of Guadalupe plant west of Guadalupe (see Appendix A, Figure 2a). At the City of Santa Maria WWTP, influent volumes are metered and recorded, and all treated water is discharged to percolation ponds near Green Canyon adjacent to the plant facilities. At the Laguna Sanitation District (Laguna SD) WWTP, influent volumes are metered and recorded, and the large majority of treated water (94%) is discharged to permanent spray fields north and west of the plant facilities and to Santa Maria airport lands for irrigation. Of the remaining effluent, a small amount (4%) is brine derived from reverse osmosis treatment of part of the total waste water flow; that brine is discharged to a deep injection well (a converted oil well, completed below the base of fresh groundwater). The balance of effluent (2%) is conveyed to an oil lease near Orcutt for industrial use. At the City of Guadalupe WWTP, influent volumes are recorded and all treated water is discharged to permanent spray fields north of the plant facilities, across the Santa Maria River (with storage pond north of the facility).

Monthly influent data from 2013 are shown by facility and method of disposal in Table 4.2-1. For all three plants, effluent volumes are estimated to be 90 percent of the metered influent, with the remainder assumed to be lost (consumed) during treatment. In 2013, an estimated 11,120 af of treated municipal waste water were discharged in the SMVMA. About 76 percent (8,470 af) of that total was discharged to the percolation ponds of the City of Santa Maria WWTP. Just over 1,900 af of treated water were discharged to spray irrigation of permanent pasture of the Laguna SD WWTP and of Santa Maria airport lands. Approximately 80 af of brine were discharged by deep well injection and 60 af of treated water were utilized for industrial purposes on an oil lease near Orcutt. Just over 600 af of treated water were discharged to spray irrigation by the City of Guadalupe.

The Stipulation has provisions for each of the municipal water purveyors in the SMVMA to have rights to recover return flows that derive from their respective importations of water from the SWP. Those rights are to specific fractions of SWP water use in the preceding year; they are limited in time to recovery in the following year, and thus do not carry over or otherwise accumulate in the basin. The respective fractions for the three municipal purveyors are 65 percent for Santa Maria and 45 percent each for Southern California Water Company (now GSWC) and for Guadalupe. The Stipulation is silent as to the basis for the respective fractions; logically, however, they would have some basis in the fate of imported SWP water, i.e. what fraction ends up being "disposed" as a "return flow" to the groundwater basin.

Since the SMVMA water supply is a commingled combination of groundwater and SWP water, the "return flow" fraction attributable to SWP water would be the same as that for the commingled supply. An accounting of waste stream volumes from the different sources as influent to the three WWTPs and the calculated return flows generated from the WWTP discharge for years 1997 through 2013 are provided in Table 4.2-2. Return flows derived from landscape irrigation within the Valley urban areas (water applied beyond the consumptive use of landscape plantings) is also included in Table 4.2-2. The supporting calculations of return flows from WWTP discharge (for 1997 through 2013) and landscape irrigation (2008 through 2013) are provided in Appendices D and E, respectively.

While the volume of influent is recorded at each of the three WWTPs, the amount of water toward landscape irrigation is necessarily estimated. The base indoor water usage (during winter months) is analyzed and water use in excess of that base amount for all other months is calculated as landscape irrigation. The results of these calculations provide an indication of the fate of water used by the cities of Santa Maria and Guadalupe and the GSWC, specifically the average percentages (for the 2008 – 2013 period) of each of the purveyors' respective water supplies that ultimately become WWTP influent, urban landscape irrigation, and the consumptive use and conveyance loss, as follows:

- WWTP total influent/water supply: Santa Maria, 65%; GSWC, 33%; Guadalupe, 72%
- Landscape irrigation/water supply: Santa Maria, 33%; GSWC, 46%; Guadalupe, 20%
- Residential consumption and conveyance loss/water supply: Santa Maria, 2%; GSWC, 21%; Guadalupe, 8%

Interpretation of the municipal water supplies and waste water processes in 2013, as well as the estimated return flows from WWTPs and landscape irrigation in the SMVMA, suggests the 65 percent "return flow" fraction specified in the Stipulation for Santa Maria is representative of the amount of Santa Maria water supply providing return flow to the SMVMA. This is primarily the case because the great majority of waste water generated in Santa Maria is conveyed to the City's WWTP (with some small amount conveyed to the Laguna SD WWTP) where effluent discharge is to percolation ponds for purposeful infiltration (and generation of return flows) to the groundwater basin.

Interpretation of the Guadalupe and GSWC/Laguna SD water supplies and waste water processes in 2013, as well as the estimated return flows from WWTPs and landscape irrigation in the SMVMA, suggests the 45 percent "return flow" fraction specified in the Stipulation for Guadalupe and GSWC is not representative of the amount of their respective water supplies providing return flow to the SMVMA. This is primarily the case because the great majority of waste water generated in Guadalupe is conveyed to the City's WWTP and the great majority of waste water generated in the GSWC service areas is conveyed to the Laguna SD WWTP (with some small amount conveyed to the Santa Maria WWTP). At both plants, effluent discharge is primarily to permanent spray fields for evapotranspiration (and only minor generation of return flows) to the groundwater basin.

Regarding Guadalupe return flows, and ignoring the fact that the Guadalupe spray field is located over an area where the deeper part of the aquifer system is confined, constraining the effectiveness of recharge via application at the ground surface, a reasonable estimate of any deep percolation beneath the Guadalupe spray field would be in the range of about 10 to 15 percent of its water supply. Addition of return flows from landscape irrigation may increase the overall percentage to around 15 to 18 percent, far less than the stipulated 45 percent. Regarding GSWC return flows, an estimate of deep percolation beneath the Laguna SD spray field and Santa Maria airport lands would be about 20 percent of the effluent, equivalent to about 5 percent of the GSWC water supplies to their Orcutt, Lake Marie, and Tanglewood service areas; addition of recharge from waters intercepted to the Santa Maria plant for discharge to percolation ponds, would be about 9 percent of total GSWC water supplies. Further addition of estimated recharge that derives from landscape irrigation in the GSWC service areas may increase the total return flow fraction to almost 20 percent, also far less than the stipulated 45 percent (see Table 4.2-2).

Analysis of municipal return flows since 1997, when SWP water importation commenced, shows that the percentages of total water supply as return flow for each purveyor in 2013 are similar to those over the recent historical period, as seen in Table 4.2-2. With a combination of return flows from WWTP effluent, after accounting for varying disposal methods, and return flows from landscape irrigation, the percentages of total water supply for Santa Maria, GSWC, and Guadalupe averaged 65, 19, and 16 percent, respectively for the period 1997 – 2013.

In summary, as long as the existing waste water treatment and disposal processes remain in place at the City of Guadalupe and Laguna SD WWTPs, there is no technical support for the 45 percent fractions that were included in the Stipulation for Guadalupe and GSWC (in the case of Laguna SD) to recover return flows from their respective use of SWP water. Any “recovery” of those amounts of water by groundwater pumping would actually be pumping of a much smaller fraction (one-half or less of the 45 percent) of “return flow,” with the balance being groundwater unrelated to imported water use by either entity.

4.3 Exported Water

No water was exported from the SMVMA in 2013. However, planning continues for future delivery of water from the SMVMA to the NMMA, specifically from the City of Santa Maria to the Nipomo CSD. The Stipulation includes provisions specific to the NMMA for implementation of a Memorandum of Understanding (MOU) between the City and Nipomo CSD that would provide for the sale of a minimum of 2,500 af of “supplemental water” per year by Santa Maria to Nipomo; that sale would be equivalent to an intra-basin export from one management area (the SMVMA) to another (the NMMA). Notable actions completed in support of that potential sale include: 1) certification of the environmental documentation for the pipeline interconnection (“Waterline Intertie” Project) between the City of Santa Maria and the Nipomo CSD (Douglas Wood & Associates, March 2009), 2) completion of a Wholesale Water Supply Agreement (successor to the MOU) between the City and Nipomo CSD in January 2010 (updated in May 2013), 3) approval by the Nipomo CSD of a financing plan for construction of a Phase I waterline project in May 2013, and 4) commencement of planned project construction activities in mid- to late 2013.

Both the environmental documentation and the January 2010 Wholesale Water Supply Agreement describe a potentially phased delivery of supplemental water from Santa Maria whereby Nipomo CSD would purchase minimum quantities of 2,000 afy for the first ten years of the Agreement, 2,500 afy for the next nine years, and 3,000 afy for the balance of the term of the Agreement (through 2085). Deliveries under that Agreement were specified to begin in the first year after completion of the Waterline Intertie Project (the focus of the certified environmental documentation). The environmental documentation and 2010 Wholesale Water Supply

Agreement also describe provisions whereby Nipomo CSD may request delivery of additional supplemental water, up to an additional 3,200 afy, for a total delivery of 6,200 afy, with the latter going beyond the provisions in the Stipulation for the sale of water.

Most recently, investigation was made by the Nipomo CSD of alternatives for acquiring supplemental water for the Nipomo Mesa. The alternatives include the certified or "full" waterline intertie project, with the phased delivery of as much as 3,000 afy of water from the City (and potentially as much as 6,200 afy), and a reduced "Phase I only" project with a reduced infrastructure and capacity, from 500 to 1,000 afy (NCSD, March 2013). Nipomo CSD goals for supplemental water acquisition included the initial delivery of up to 1,000 af of water by June 2015, with long-term delivery of an uninterrupted supply of 3,000 afy of water (with the capability to increase deliveries to 6,200 afy). Toward those goals, the Nipomo CSD approved a financing plan for the "Phase I only" project (500 to 1,000 afy capacity) and the City and Nipomo CSD approved an updated Wholesale Water Supply Agreement in April-May 2013. While the updated agreement remains essentially unchanged from the January 2010 agreement, it reflects the reduced capacity of the Phase I only project while accommodating future project expansion. Phased minimum deliveries of supplemental water from the City to Nipomo CSD were to be as follows: 645 af in year one; 800 afy in years 2 through 5; 1,000 afy in years 6 through 10, and 2,500 afy in years 11 through the term of the agreement (2085). A provision remains for the Nipomo CSD to be able to request delivery of an additional 3,200 afy in excess of these minimum quantities (potential total delivery of 5,700 afy).

Supplemental water deliveries from the City to the Nipomo CSD by way of the Phase I only project and updated Wholesale Water Supply Agreement, although initially reduced compared to the original project and agreement, would still constitute intra-basin export of water from one management area to another. Should project capacity be expanded in the future, and with provisions of the updated agreement accommodating the sale of a minimum of 2,500 afy of supplemental water (with a possible additional 3,200 afy or total of 5,700 afy), three technical concerns remain about a waterline intertie project. Those concerns, expressed in the annual reports for the SMVMA, include the following:

1) There has been no analysis to identify the existence of any surplus water in the SMVMA (for export to the NMMA), nor to evaluate impacts to water supplies in the SMVMA that might derive from such export as described in the MOU;

2) The MOU specifies that water delivered by Santa Maria shall be of the same quality that it delivers to its customers (a mix of groundwater and SWP water). In most years, this would require Santa Maria to pump additional groundwater beyond its own demand; however, there has been no analysis of the source(s), pumping locations, or potential impacts of such groundwater pumping for export from the SMVMA.

3) Most importantly, there remains an apparent conflict between the Stipulation and the MOU with regard to the importation and use of SWP water. The Stipulation specifies that the City of Santa Maria is to import and use within the SMVMA at least 10,000 afy of SWP water unless SWP availability is limited and precludes the importation of the full 10,000 af; in those years, Santa Maria is to import and use its full available SWP supply in the SMVMA. However,

should Santa Maria export water in accordance with the MOU in years when its SWP supply was less than 10,000 af (i.e. in years when overall SWP reliability is less than about 60 percent), Santa Maria would be out of compliance with the Stipulation, leading to more groundwater pumping for municipal supply in the SMVMA than envisioned by the Stipulation.

While no new technical work on the preceding issues was completed in 2013, Santa Maria has made efforts to address them as follows. On the first concern, the City has listed a combination of water supplies that, in the quantities listed by the City, notably exceed its existing and currently projected water requirements. Those water supplies include appropriative rights to groundwater in the SMVMA, reportedly quantified in the Judgment; a portion of the yield from Twitchell Reservoir operations; SWP supplies; and return flows from SWP use by the City. While those aggregate supplies exceed the City's water requirements, relative to either the original or currently planned intertie project, there remains no analysis to identify whether there are sufficient supplies in the overall SMVMA whereby there is a "surplus" available for intra-basin transfer without causing a shortage in the SMVMA. Through its Utilities Department, the City has maintained a willingness and intent to analyze that issue as part of a larger effort that will include securing additional SWP allocation on a schedule that coincides with the request from Nipomo CSD for water deliveries from the City. In addition, the City has continued the pursuit of additional SWP allocation toward offsetting projected reductions in reliability of SWP water deliveries (personal communication, R. Sweet, City of Santa Maria, May 15, 2013).

On the second concern, the City's blended fractions of SWP water and local groundwater in 2013 differed from those during the year preceding the signing of the MOU: 62 percent SWP water and 38 percent local groundwater in 2013, compared to 87 and 13 percent, respectively, prior to the MOU. Had the original Water Sales Agreement been operational with SWP availability as it was in 2013 (35%), the fractional use of SWP water to a combination of City customers and the Nipomo CSD would have decreased to about 37 percent; SWP water use in the SMVMA would have decreased from full availability (6,230 af) to about 5,112 af; and the total groundwater pumping by the City would have increased from the 5,215 af actually pumped to about 8,608 af. While the updated agreement accommodates a smaller Nipomo CSD water requirement (ultimately 2,500 afy instead of 3,000 afy), groundwater pumping by the City would still increase from the 5,215 af actually pumped to about 8,450 af. Again, there has been no analysis of the source(s), pumping locations, or potential impacts of such an increase in groundwater pumping on the SMVMA. As with the first concern discussed above, however, the Santa Maria Utilities Department has maintained a willingness and intent to analyze this second issue in the same manner although on a schedule dependent upon future water transfer planning on the Nipomo Mesa.

On the third concern, the preceding discussion is a good illustration of the potential conflict between the Stipulation and the original and updated Water Sales Agreements. Had the original Sales Agreement been operational with SWP availability as it was in 2013 (35%), and with the City's SWP Table A amount as it now is (17,800 af), the City would not have been able to fully satisfy both the Sales Agreement and the Stipulation. SWP availability to Santa Maria in 2013 was 6,230 af, but the Sales Agreement would have called for the export of 1,118 af of SWP water to the NMMA, with a balance of only 5,112 af of SWP water available for use in the SMVMA, less than the minimum specified in the Stipulation. Without access to additional SWP water, the City would have been required by the Stipulation to dedicate the full 6,230 af of SWP allocation to the SMVMA with no delivery of SWP water to the Nipomo CSD. Similarly, under the updated Water Sales Agreement, and given the SWP availability of 2013 and the City's current SWP Table A amount, this potential conflict with the Stipulation remains. In 2013, the updated agreement would have called for the export of 960 af of SWP water to the NMMA with a balance of only 5,270 af of SWP water available for use in the SMVMA, again less than the minimum specified in the Stipulation. Without access to additional SWP water, the City would have been required by the Stipulation to dedicate the full 6,230 af of SWP allocation to the SMVMA with no delivery of SWP water to the Nipomo CSD. Thus, neither the original nor updated water sales agreement could be satisfied with SWP availability as it was in 2013 (35%).

For reference, Table 4.3-1a is a summary of two scenarios to examine the amounts of SWP water and SMVMA groundwater that would comparatively be delivered to Santa Maria alone (without any Water Sales Agreement) or to Santa Maria and Nipomo CSD (with the original Water Sales Agreement). Corresponding Table 4.3-1b summarizes the same two scenarios but with the provisions of the updated Water Sales Agreement. The Table 4.3-1a scenarios (original agreement, January 2010) include water availability and deliveries at various rates of SWP allocation, with the first scenario reflecting "current" conditions (2013 City water demand) and 3,000 afy delivery to Nipomo CSD, and the other scenario reflecting projected "future" conditions (buildout City water demand and 6,200 afy delivery to Nipomo CSD). The Table 4.3-1b scenarios (updated agreement, May 2013) reflect "current" conditions (2013 City water demand) and 2,500 afy delivery to Nipomo CSD and projected "future" conditions (buildout City water demand and 5,700 afy delivery to Nipomo CSD).

In summary regarding any future intra-basin water export, the City recognizes all the preceding issues and, based on ongoing communication with its Utilities Department, continues work on their resolution. Primarily, the City is maintaining its efforts to increase its SWP Table A water supply, but on a schedule that recognizes the practical realities that remain to be addressed before the Nipomo CSD can request delivery of water under the current Water Supply Sales Agreement. While those practicalities are to be addressed in the NMMA, Santa Maria continues work toward ultimately securing up to 10,000 afy of additional SWP allocation, possibly from some combination of suspended SWP Table A allocation in Santa Barbara County and unused SWP Table A allocation in San Luis Obispo County. The City's original intention was to secure the additional SWP supplies to enable deliveries under the Water Sales Agreement and also satisfy provisions of the Stipulation, while also attempting to limit its financial commitment to purchase additional SWP supplies until they are certainly needed, until the Nipomo CSD completes all its requirements to request water deliveries from Santa Maria. Regardless of events described above related to the waterline intertie project, the City remains committed to pursuing additional SWP allocation to offset projected reductions in SWP water supply reliability.

Table 4.1-1
Applied Crop Water Requirements, Total Agricultural Water Requirements and Return Flows, 2013
Santa Maria Valley Management Area

Crop Category	Evapotranspiration of Crop ETc (in)	Effective Precipitation P_E (in)	Evapotranspiration of Applied Water ETaw (in)	Evapotranspiration of Applied Water ETaw (af/ac)	Distribution Uniformity DU (%)	Applied Water AW (af/ac)	Crop Acreage	Estimated Water Requirements (af)	Applied Water above ETaw AW-ETaw (in)	Applied Water above ETaw AW-ETaw (ft)	Agricultural Return Flow (af)
Rotational Vegetables[1]	25.54	0.38	25.16	2.10	80	2.62	33,796	88,574	6.3	0.52	17,715
Strawberries[1]	17.76	1.93	15.83	1.32	85	1.55	11,464	17,792	2.8	0.23	2,669
Hydroponic[2]	---	---	---	---	---	2.00	135	270	0.0	0.00	0
Vineyard[3]	---	---	15.6	1.3	95	1.4	4,788	6,552	0.8	0.07	328
Pasture[1]	47.02	2.34	44.68	3.72	80	4.65	446	2,076	11.2	0.93	415
Grain[3]	---	---	9.6	0.8	80	1.0	158	158	2.4	0.20	32
Nursery[4]	---	---	---	---	---	2.0	227	454	4.8	0.40	91
Deciduous[3]	---	---	33.6	2.8	85	3.3	10	33	5.9	0.49	5
Avocado[3]	---	---	32.4	2.7	85	3.2	20	64	5.7	0.48	10
Fallow[5]	---	---	---	---	---	---	519	---	---	---	---
Total							**51,563**	**115,972**			**21,263**

1) CIMIS-based applied crop water duties

2) Research-based applied crop water duty

3) Reported ETaw-based applied crop water duties

4) NMMA applied crop water duty; DU assumed as 80%

5) No applied water

Table 4.2-1
Treated Municipal Waste Water Discharge in 2013
Santa Maria Valley Management Area
(all amounts in acre-feet)

	City of Santa Maria[1]		Laguna Sanitation District WWTP[2]					City of Guadalupe[3]		Total Municipal Waste Water Discharge					
	Metered Influent	Estimated Effluent	Metered Influent	Estimated Effluent				Metered Influent	Estimated Effluent	Influent	Effluent				
Month	Total	Total	Total	irrigation[4]	injection	industrial use[5]	Total	Total	Total	Total	ponds	irrigation	injection	industrial use	Total
January	705	635	198	171	7.3	0.1	178	58	52	962	635	223	7.3	0.1	865
February	646	581	183	154	6.1	5.0	165	53	48	883	581	202	6.1	5.0	794
March	774	697	196	165	6.9	4.2	176	55	49	1,025	697	215	6.9	4.2	922
April	833	750	186	155	6.5	5.5	167	60	54	1,079	750	210	6.5	5.5	971
May	865	779	193	161	6.7	6.3	174	63	57	1,122	779	218	6.7	6.3	1,010
June	846	761	181	150	6.5	6.2	163	59	53	1,086	761	203	6.5	6.2	977
July	809	728	184	154	6.8	4.6	165	58	52	1,050	728	206	6.8	4.6	945
August	766	690	186	156	6.0	5.3	167	54	49	1,006	690	205	6.0	5.3	906
September	725	653	182	153	6.0	4.9	164	52	47	960	653	200	6.0	4.9	864
October	809	728	190	159	6.7	5.9	171	57	51	1,056	728	210	6.7	5.9	951
November	813	732	189	158	6.3	5.3	170	54	49	1,056	732	207	6.3	5.3	951
December	819	737	198	167	6.4	5.0	178	58	52	1,075	737	219	6.4	5.0	967
Annual Totals	**9,411**	**8,470**	**2,267**	1,903	78	58	**2,040**	**682**	**614**	**12,360**	8,470	2,517	78	58	**11,124**

1) Total effluent estimated as 90% of metered influent (assumed loss of 10% during treatment); all effluent discharged to ponds.
2) Total effluent estimated as 90% of metered influent; brine discharged to deep injection well and treated water for industrial use is metered, with the balance of discharge for irrigation.
3) Total effluent estimated as 90% of metered influent; all effluent discharged to spray fields.
4) Includes spray irrigation on Laguna San fields and irrigation on Santa Maria airport lands.
5) For industrial use on oil lease near Orcutt.

Table 4.2-2
Estimated Recent Historical Return Flows from WWTPs and Landscape Irrigation
Santa Maria Valley Management Area
(all units in afy unless otherwise noted)

	Total Water Use				Effluent Available for Return Flows					Estimated Landscape Irrigation			Return Flows													
					Santa Maria		GSWC		Guadalupe				Santa Maria					Golden State Water Company					Guadalupe			
Year	SM	GSWC	GSWC[1]	Guad	from SM WWTP	from LSD WWTP	from SM WWTP	from LSD WWTP	from Guad WWTP	Santa Maria[2]	GSWC[3]	Guadalupe[4]	from SM WWTP[5]	from LSD WWTP[6]	from landscape irrigation[7]	Total	% of Water Use	from SM WWTP[5]	from LSD WWTP[6]	from landscape irrigation[7]	Total	% of Water Use	from Guad WWTP[6]	from landscape irrigation[7]	Total	% of Water Use
1997	12,522	9,441	9,387	778	7,279	83	296	2,269	420	4,383	4,626	163	7,279	17	877	8,172	65	296	454	925	1,675	17.8	84	33	117	15
1998	11,085	8,001	7,960	778	6,434	82	302	1,874	420	3,880	3,921	163	6,434	16	776	7,226	65	302	375	784	1,461	18.4	84	33	117	15
1999	11,859	9,263	9,193	778	6,899	82	298	2,215	420	4,151	4,539	163	6,899	16	830	7,745	65	298	443	908	1,649	17.9	84	33	117	15
2000	12,679	9,399	9,342	778	7,223	83	309	2,459	420	4,438	4,606	163	7,223	17	888	8,127	64	309	492	921	1,722	18.4	84	33	117	15
2001	12,594	9,009	8,950	778	7,538	83	323	2,500	420	4,408	4,414	163	7,538	17	882	8,436	67	323	500	883	1,706	19.1	84	33	117	15
2002	13,312	9,466	9,409	778	7,661	83	320	2,287	420	4,659	4,638	163	7,661	17	932	8,610	65	320	457	928	1,705	18.1	84	33	117	15
2003	13,499	9,071	9,023	778	7,766	83	431	2,281	420	4,725	4,445	163	7,766	17	945	8,728	65	431	456	889	1,776	19.7	84	33	117	15
2004	13,650	9,356	9,302	832	8,201	83	399	2,240	449	4,778	4,585	175	8,201	17	956	9,173	67	399	448	917	1,764	19.0	90	35	125	15
2005	13,814	8,846	8,802	814	8,374	82	317	1,990	439	4,835	4,334	171	8,374	16	967	9,358	68	317	398	867	1,582	18.0	88	34	122	15
2006	13,610	8,754	8,700	883	8,251	81	288	1,724	477	4,764	4,289	185	8,251	16	953	9,220	68	288	345	858	1,491	17.1	95	37	132	15
2007	14,782	9,710	9,652	1,063	8,074	81	368	1,854	574	5,174	4,758	223	8,074	16	1,035	9,125	62	368	371	952	1,690	17.5	115	45	159	15
2008	14,235	9,311	9,255	997	8,123	81	444	1,963	570	4,952	4,282	211	8,123	16	990	9,130	64	444	393	856	1,693	18.3	114	42	156	16
2009	14,172	8,729	8,668	917	8,057	81	467	1,932	598	5,392	4,228	216	8,057	16	1,078	9,152	65	467	386	846	1,699	19.6	120	43	163	18
2010	13,294	7,735	7,681	880	7,360	80	489	1,888	598	4,176	4,052	201	7,360	16	835	8,211	62	489	378	810	1,677	21.8	120	40	160	18
2011	12,665	7,844	7,794	885	7,598	81	506	1,933	589	3,377	3,005	124	7,598	16	675	8,290	65	506	387	601	1,494	19.2	118	25	143	16
2012	13,038	8,296	8,241	924	8,028	84	490	1,861	613	4,247	3,710	180	8,028	17	849	8,895	68	490	372	742	1,604	19.5	123	36	159	17
2013	13,719	8,576	8,526	956	8,094	84	376	1,819	614	4,639	3,598	235	8,094	17	928	9,038	66	376	364	720	1,460	17.1	123	47	170	18
																avg %	65				avg %	19			avg %	16

Estimated (shaded)

SM City of Santa Maria
GSWC Golden State Water Company
Guad City of Guadalupe
LSD Laguna Sanitation District

1) Excludes Sisquoc System water use (for effluent return flow calculations).
2) Percent range of SM total water supply used for landscape irrigation estimated from monthly water use data for 2008-2013 = 27-38%.
3) Percent range of GSWC total water supply used for landscape irrigation estimated from monthly water use data for 2008-2013 = 39-53%.
4) Percent range of Guad total water supply used for landscape irrigation estimated from monthly water use data for 2008-2013 = 14-25%.
5) All effluent from Santa Maria WWTP percolation ponds assumed as return flows.
6) 20 percent of effluent from Laguna San and Guadalupe WWTP irrigation assumed as return flows.
7) 20 percent of landscape irrigation assumed as return flows.

Table 4.3-1a
Water Requirements, Supplies, and Amounts Delivered under Current and Projected Conditions
Wholesale Water Supply Agreement, January 5, 2010
Santa Maria Valley Management Area
(State Water Project water availability in 2013, 35 percent)

Current Conditions

SWP		**Water Requirements**			**City Water Supply**					**City Water Delivered****			
		In 2013	=	13,720						SMVMA		NCSD	
Allocation (%)	**Supply to City** (af)	City (af)	NCSD (af)	Total (af)	SWP (af)	(%)*	Groundwater (af)	(%)*	Total (af)	SWP (af)	Groundwater (af)	SWP (af)	Total (af)
100	17,800	13,720	3,000	16,720	16,720	100	0	0	16,720	13,720	0	3,000	3,000
90	16,020	13,720	3,000	16,720	16,020	96	700	4	16,720	13,146	574	2,874	3,000
80	14,240	13,720	3,000	16,720	14,240	85	2,480	15	16,720	11,685	2,035	2,555	3,000
75	13,350	13,720	3,000	16,720	13,350	80	3,370	20	16,720	10,955	2,765	2,395	3,000
70	12,460	13,720	3,000	16,720	12,460	75	4,260	25	16,720	10,224	3,496	2,236	3,000
65	11,570	13,720	3,000	16,720	11,570	69	5,150	31	16,720	9,494	4,226	2,076	3,000
60	10,680	13,720	3,000	16,720	10,680	64	6,040	36	16,720	8,764	4,956	1,916	3,000
50	8,900	13,720	3,000	16,720	8,900	53	7,820	47	16,720	7,303	6,417	1,597	3,000
40	7,120	13,720	3,000	16,720	7,120	43	9,600	57	16,720	5,842	7,878	1,278	3,000
35	**6,230**	**13,720**	**3,000**	**16,720**	**6,230**	**37**	**10,490**	**63**	**16,720**	**5,112**	**8,608**	**1,118**	**3,000**
30	5,340	13,720	3,000	16,720	5,340	32	11,380	68	16,720	4,382	9,338	958	3,000
20	3,560	13,720	3,000	16,720	3,560	21	13,160	79	16,720	2,921	10,799	639	3,000
10	1,780	13,720	3,000	16,720	1,780	11	14,940	89	16,720	1,461	12,259	319	3,000

Given:

City Table A (af) = 17,800
City Water Req (af) = 14,235
NCSD Water Req (af) = 3,000

* % of total water requirements by source

** provides for water delivered to be of equal quality

Projected Conditions[1]

SWP		**Water Requirements**			**City Water Supply**					**City Water Delivered****			
										SMVMA		NCSD	
Allocation (%)	**Supply to City** (af)	City (af)	NCSD (af)	Total (af)	SWP (af)	(%)*	Groundwater (af)	(%)*	Total (af)	SWP (af)	GW (af)	SWP (af)	Total (af)
100	17,800	19,000	6,200	25,200	17,800	71	7,400	29	25,200	13,421	5,579	4,379	6,200
90	16,020	19,000	6,200	25,200	16,020	64	9,180	36	25,200	12,079	6,921	3,941	6,200
80	14,240	19,000	6,200	25,200	14,240	57	10,960	43	25,200	10,737	8,263	3,503	6,200
70	12,460	19,000	6,200	25,200	12,460	49	12,740	51	25,200	9,394	9,606	3,066	6,200
65	11,570	19,000	6,200	25,200	11,570	46	13,630	54	25,200	8,723	10,277	2,847	6,200
60	10,680	19,000	6,200	25,200	10,680	42	14,520	58	25,200	8,052	10,948	2,628	6,200
50	8,900	19,000	6,200	25,200	8,900	35	16,300	65	25,200	6,710	12,290	2,190	6,200
40	7,120	19,000	6,200	25,200	7,120	28	18,080	72	25,200	5,368	13,632	1,752	6,200
35	**6,230**	**19,000**	**6,200**	**25,200**	**6,230**	**25**	**18,970**	**75**	**25,200**	**4,697**	**14,303**	**1,533**	**6,200**
30	5,340	19,000	6,200	25,200	5,340	21	19,860	79	25,200	4,026	14,974	1,314	6,200
20	3,560	19,000	6,200	25,200	3,560	14	21,640	86	25,200	2,684	16,316	876	6,200
10	1,780	19,000	6,200	25,200	1,780	7	23,420	93	25,200	1,342	17,658	438	6,200

Given:

City Table A (af) = 17,800
City Water Req (af) = 19,000
NCSD Water Req (af) = 6,200

* % of total water requirements by source

** provides for water delivered to be of equal quality

1) City projected demand at build-out in 2022; NCSD projected deliveries from City by 2085 per Jan 5, 2010, Agreement

Table 4.3-1b
Water Requirements, Supplies, and Amounts Delivered under Current and Projected Conditions
Wholesale Water Supply Agreement, May 7, 2013
Santa Maria Valley Management Area
(State Water Project water availability in 2013, 35 percent)

Current Conditions

SWP		**Water Requirements**			**City Water Supply**					**City Water Delivered****					
		In 2013	=	13,720						SMVMA			NCSD		
Allocation (%)	**Supply to City** (af)	City (af)	NCSD (af)	Total (af)	SWP (af)	(%)*	Groundwater (af)	(%)*	Total (af)	SWP (af)	Groundwater (af)	Total (af)	SWP (af)	Groundwater (af)	Total (af)
100	17,800	13,720	2,500	16,220	16,220	100	0	0	16,220	13,720	0	13,720	2,500	0	2,500
90	16,020	13,720	2,500	16,220	16,020	99	200	1	16,220	13,551	169	13,720	2,469	31	2,500
80	14,240	13,720	2,500	16,220	14,240	88	1,980	12	16,220	12,045	1,675	13,720	2,195	305	2,500
75	13,350	13,720	2,500	16,220	13,350	82	2,870	18	16,220	11,292	2,428	13,720	2,058	442	2,500
70	12,460	13,720	2,500	16,220	12,460	77	3,760	23	16,220	10,540	3,180	13,720	1,920	580	2,500
65	11,570	13,720	2,500	16,220	11,570	71	4,650	29	16,220	9,787	3,933	13,720	1,783	717	2,500
60	10,680	13,720	2,500	16,220	10,680	66	5,540	34	16,220	9,034	4,686	13,720	1,646	854	2,500
50	8,900	13,720	2,500	16,220	8,900	55	7,320	45	16,220	7,528	6,192	13,720	1,372	1,128	2,500
40	7,120	13,720	2,500	16,220	7,120	44	9,100	56	16,220	6,023	7,697	13,720	1,097	1,403	2,500
35	**6,230**	**13,720**	**2,500**	**16,220**	**6,230**	**38**	**9,990**	**62**	**16,220**	**5,270**	**8,450**	**13,720**	**960**	**1,540**	**2,500**
30	5,340	13,720	2,500	16,220	5,340	33	10,880	67	16,220	4,517	9,203	13,720	823	1,677	2,500
20	3,560	13,720	2,500	16,220	3,560	22	12,660	78	16,220	3,011	10,709	13,720	549	1,951	2,500
10	1,780	13,720	2,500	16,220	1,780	11	14,440	89	16,220	1,506	12,214	13,720	274	2,226	2,500

Given:
* % of total water requirements by source
** provides for water delivered to be of equal quality

City Table A (af) = 17,800
City Water Req (af) = 14,235
NCSD Water Req (af) = 2,500

Projected Conditions[1]

SWP		**Water Requirements**			**City Water Supply**					**City Water Delivered****					
										SMVMA			NCSD		
Allocation (%)	**Supply to City** (af)	City (af)	NCSD (af)	Total (af)	SWP (af)	(%)*	Groundwater (af)	(%)*	Total (af)	SWP (af)	GW (af)	Total (af)	SWP (af)	GW (af)	Total (af)
100	17,800	19,000	5,700	24,700	17,800	72	6,900	28	24,700	13,692	5,308	19,000	4,108	1,592	5,700
90	16,020	19,000	5,700	24,700	16,020	65	8,680	35	24,700	12,323	6,677	19,000	3,697	2,003	5,700
80	14,240	19,000	5,700	24,700	14,240	58	10,460	42	24,700	10,954	8,046	19,000	3,286	2,414	5,700
70	12,460	19,000	5,700	24,700	12,460	50	12,240	50	24,700	9,585	9,415	19,000	2,875	2,825	5,700
65	11,570	19,000	5,700	24,700	11,570	47	13,130	53	24,700	8,900	10,100	19,000	2,670	3,030	5,700
60	10,680	19,000	5,700	24,700	10,680	43	14,020	57	24,700	8,215	10,785	19,000	2,465	3,235	5,700
50	8,900	19,000	5,700	24,700	8,900	36	15,800	64	24,700	6,846	12,154	19,000	2,054	3,646	5,700
40	7,120	19,000	5,700	24,700	7,120	29	17,580	71	24,700	5,477	13,523	19,000	1,643	4,057	5,700
35	**6,230**	**19,000**	**5,700**	**24,700**	**6,230**	**25**	**18,470**	**75**	**24,700**	**4,792**	**14,208**	**19,000**	**1,438**	**4,262**	**5,700**
30	5,340	19,000	5,700	24,700	5,340	22	19,360	78	24,700	4,108	14,892	19,000	1,232	4,468	5,700
20	3,560	19,000	5,700	24,700	3,560	14	21,140	86	24,700	2,738	16,262	19,000	822	4,878	5,700
10	1,780	19,000	5,700	24,700	1,780	7	22,920	93	24,700	1,369	17,631	19,000	411	5,289	5,700

Given:
* % of total water requirements by source
** provides for water delivered to be of equal quality

City Table A (af) = 17,800
City Water Req (af) = 19,000
NCSD Water Req (af) = 5,700

1) City projected demand at build-out in 2022; NCSD projected deliveries from City by 2085 per May 7, 2013, Agreement

5. Conclusions and Recommendations

Conclusions drawn from assessment of the hydrogeologic conditions and the water requirements, supplies, and disposition in the SMVMA in 2013 are discussed in the following section, which is in turn followed by recommendations for ongoing data collection, basin management, and future analysis.

5.1 Conclusions

5.1.1 Hydrogeologic Conditions

Assessment of hydrogeologic conditions in 2013 showed that groundwater levels slightly declined from 2012, but the water levels and general mineral quality in the shallow and deep aquifer zones remain within historical ranges for the SMVMA. As has historically been the case for several decades, the prevailing gradients for groundwater flow in both zones was reduced (flattened) in the vicinity of local pumping near the Santa Maria Airport, but groundwater flow continued through the area toward the coast where groundwater levels remained above sea level. Concentrations of nitrate in groundwater remained near or below detection limits in the deep aquifer zone, but continued to increase in the shallow zone near Orcutt. Nitrate concentrations also continued to gradually increase in portions of the aquifer along the coast.

Operation of Twitchell Reservoir has, overall, continued to provide conservation of runoff for subsequent release for groundwater recharge in the SMVMA, despite sedimentation that has now filled the former dead pool storage below the conservation pool of the Reservoir. However, with total precipitation greatly below mean amounts in both 2012 and 2013, no releases were made from Twitchell reservoir and stream discharge in the Sisquoc River was well below average in 2013. Twitchell reservoir storage was instead further depleted in 2013 through evaporation. The slight decline in groundwater levels observed across the SMVMA in 2013 was at least partially due to the lack of Twitchell releases and greatly reduced Sisquoc River discharge.

General mineral and nitrate concentrations remain higher in streams in the western and southern portion of the SMVMA, including the Santa Maria River, Oso Flaco Creek, and Green Canyon near Guadalupe, as well as Orcutt Creek and Bradley Canyon on the Orcutt Upland. In particular, the streams are degraded with elevated concentrations of dissolved salts, measured as specific conductance, and nitrate. In comparison, the Cuyama, Sisquoc, and Santa Maria Rivers in or flowing into the eastern portion of the SMVMA have only slightly elevated salt levels and very low levels of nitrate. In the case of all the main streams, the reported constituent concentrations in 2013 were within their respective historical ranges.

5.1.2 Water Requirements, Supplies, and Disposition

Water requirements, water supplies to meet those requirements, and disposition of water supplies in the SMVMA in 2013 can be summarized as follows. Total water requirements were greater than in 2012, at 139,223 af, comprised of 115,972 af for agricultural irrigation and 23,251 af for municipal supply. Groundwater was the primary water supply, 130,192 af, to meet most of the total water demand; the balance of total water requirements was met by 9,031 af of imported water from the State Water Project. Disposition of the agricultural water supply was to evapotranspiration by crops, 94,709 af, and return flows to the basin, 21,263 af. Municipal water supply was consumed or disposed in the service areas and WWTPs, 13,085 af, and produced return flows to the basin, 10,166 af. A tabular summary of total water requirements, supplies, and disposition for the SMVMA in 2013 is provided in Table 5.1-1.

Table 5.1-1
Summary of 2013 Total Water Requirements, Supplies and Disposition
Santa Maria Valley Management Area
(in acre-feet)

<table>
<tr><th colspan="3">Water Requirements</th><th colspan="3">Water Supplies</th></tr>
<tr><th>Agricultural</th><th>Municipal</th><th>Total</th><th>Groundwater</th><th>Imported SWP Water</th><th>Total</th></tr>
<tr><td>115,972</td><td>23,251</td><td>139,223</td><td>130,192</td><td>9,031</td><td>139,223</td></tr>
</table>

<table>
<tr><th colspan="11">Water Disposition</th></tr>
<tr><th colspan="2">Agricultural</th><th colspan="9">Municipal</th></tr>
<tr><th>Consumption</th><th>Return Flows</th><th colspan="3">Service Area Use</th><th colspan="4">Waste Water</th><th colspan="2">Total</th></tr>
<tr><td>94,709</td><td>21,263</td><td colspan="3">10,891</td><td colspan="4">12,360</td><td colspan="2">23,251</td></tr>
<tr><td colspan="2" rowspan="3"></td><th colspan="2">Consumption</th><th>Return Flows</th><th colspan="3">Consumption/Disposal</th><th>Return Flows</th><th>Consumption</th><th>Return Flows</th></tr>
<tr><th>In-Home</th><th>Landscape Irrigation</th><th>Landscape Irrigation</th><th>Treatment</th><th>Spray Irrigation</th><th>Injection/ Industial Use</th><th>Pond/Spray Field</th><td rowspan="2">13,085</td><td rowspan="2">10,166</td></tr>
<tr><td>721</td><td>8,475</td><td>1,695</td><td>1,236</td><td>2,517</td><td>136</td><td>8,471</td></tr>
</table>

Regarding agricultural land use and water requirements, supplies, and disposition, the reported total irrigated acreage and crop distribution in 2013 was about 51,565 acres devoted primarily to truck crops, and the associated applied water requirement was about 115,972 af. The 2013 acreages and water requirements are consistent with the generally constant trend in agricultural land use and water requirements in the SMVMA over the last 20 years. Total irrigated cropland has been generally stable between 48,000 and 52,000 acres, with increased truck crop acreage and a decline in pasture, field, and citrus acreages. The associated applied water requirements had also been generally stable, in the broad range of 80,000 to 120,000 afy, where that range is largely driven by year-to-year weather conditions. The sole source of water supply for agricultural irrigation continues to be groundwater, and thus groundwater pumping for agricultural purposes in 2013 was an estimated 115,972 af. Disposition of agricultural water supply was primarily to evapotranspiration by crops, which consumptively used about 94,709 af of the applied water; the balance of applied irrigation, at 21,263 af, returned to the groundwater basin as deep percolation of applied water not consumptively used by crops.

Regarding municipal water requirements and supplies, the recorded municipal water supplies in 2013 were about 14,220 af groundwater and 9,031 af imported SWP water to meet a total municipal water requirement of 23,251 af. The total municipal demand in 2013 was consistent with the long-term trend of gradually increasing municipal water demand, although less than the peak historical municipal demand of 25,600 af in 2007. Groundwater pumping for municipal water supply in 2013 is less than 50 percent of the amount 17 years ago when groundwater pumping met the entire municipal water requirement of approximately 23,000 afy. Of course, this decrease in municipal groundwater pumping, to about 11,800 afy on average (1997 – 2013) is attributed to the importation and use of SWP water beginning in 1997. In 2013, those importations exceeded the minimum annual amount specified in the Stipulation for the Cities of Santa Maria and Guadalupe as well as the GSWC.

Disposition of municipal water supply in 2013 was very similar to the last 10 to 15 years. Slightly less than one-half of the total municipal water supply, about 10,891 af, was utilized in municipal service areas, with the remainder of municipal supply, about 12,360 af, processed at WWTPs. Within the service areas, it is estimated that 1,695 af of water became return flow to the basin through landscape irrigation, with the balance consumed by in-home use and landscaping. At the WWTPs, it is estimated that 8,471 af of treated water became return flow primarily through surface spreading in infiltration basins and much less through spray irrigation. The balance of water was consumed during plant treatment (1,236 af) and disposed by evaporation of spray irrigation (2,517 af) and by brine injection and industrial use (136 af).

5.1.3 Stipulation

With regard to provisions in the Stipulation for each of the municipal purveyors in the SMVMA to have rights to return flows that derive from their respective importations of SWP water, the existing systems for waste water treatment and disposal are such that only the City of Santa Maria actually discharges in a manner that supports the 65 percent return flow fraction in the Stipulation for the City. Waste water treatment and disposal of waters supplied by GSWC and the City of Guadalupe are such that they do not support the 45 percent return flow fraction for either of those purveyors.

The November 21, 2012, California Court of Appeal decision preserved the Stipulation provisions awarding these rights to return flows derived from imported SWP water. Appellants did not challenge the respective percentages and, accordingly, the decision does not address their validity. However, until there is some substantial change in the GSWC and City of Guadalupe respective treatment and disposal schemes, the Stipulation provision that entitles recovery of 45 percent of SWP water to both purveyors lacks technical support and should be decreased to a maximum of 20 percent.

Finally, the Stipulation delineates four specific criteria that, when all are met in any given year, define a condition of severe water shortage in the SMVMA; those four criteria are:

- chronic decline in groundwater levels (over period of not less than 5 years);
- groundwater level decline not caused by drought;
- material increase in groundwater use during the five year period; and
- groundwater levels below lowest recorded levels.

While groundwater levels in the SMVMA have gradually declined overall since about 2000 (with substantial recovery in 2011), they remain in 2013 above the lowest recorded levels in the SMVMA. Recognizing that generally drier conditions have prevailed over that time, notably resulting in no releases from Twitchell Reservoir in 2002-2004, 2007, 2009, and 2010, limited releases in 2012, and no releases in 2013, the recent gradual decline in groundwater levels is most likely attributable to climatological conditions. The total groundwater use in 2013, at 130,192 af, was comparable to use during the last 15 years, which has ranged between 90,000 and 135,000 afy. In summary, conditions in the SMVMA do not satisfy any of the criteria delineated in the Stipulation to define a severe water shortage; as a result, it is concluded that there is no severe water shortage in the SMVMA as of 2013.

5.2 Recommendations

In light of basin conditions related to water requirements and supplies, and related to local water resources, there are no major needs to change things related to those conditions. However, there are a few items that warrant discussion, and they are embedded in these recommendations. Such as data not currently being collected impede various aspects of reporting on conditions in the SMVMA, recommendations regarding collection of those data are included in the monitoring program prepared for the TMA in 2009 and revised in 2010 (Appendix A of this report). While implementation of the entire monitoring program will logically be over a period of time, as recognized in the monitoring program itself, progress toward implementation will allow progressively expanded reporting on conditions in the SMVMA in future annual reports. Examples of continued or expanded monitoring include:

- measurement of groundwater levels on a semi-annual basis in all designated wells (specifically, with fall measurements in additional wells made under some formal long-term arrangement);

- groundwater quality monitoring, general minerals and nitrate, on a biennial basis in the designated water quality wells;

- installation of at least one deep monitoring well north of the City of Santa Maria for inclusion in the monitoring program well networks;

- reactivation of stream gauges, in order of priority: 1) Cuyama River (below Twitchell) and Santa Maria River (near Guadalupe), 2) Sisquoc River tributaries (Foxen, La Brea, and Tepusquet Creeks), and 3) Santa Maria River tributaries (Nipomo and Suey Creeks);

- reporting of stream stage with discharge; and

- surface water quality monitoring, general minerals and nitrate, from Twitchell Reservoir and streams on a biennial basis.

One key aspect of expanded monitoring that remains is coordination of data collection efforts to facilitate consistent interpretation of groundwater flow conditions in the vicinity of the boundary between the SMVMA and the NMMA. Comments on the initial (2008) annual reports for both management areas called attention to differing interpretations and associated indications of the existence or absence of subsurface flow from the SMVMA toward the NMMA. In response to the comments, it was recommended to the TMA that a locally expanded network of wells be developed with an increased frequency (monthly) of groundwater level data collection near that boundary, with the intent to maximize the use of currently monitored wells in coordination with the NMMA TG.

Water level measurements made on a monthly basis in a few private water supply wells located near the boundary (GSWC, Woodlands, Conoco Phillips) have been helpful toward describing seasonal flow conditions along the boundary, although additional areal well coverage is still needed. Until such time as adequate data are available, and as was done in past annual reports on the SMVMA, expanded interpretation of spring groundwater conditions near the boundary are provided in this annual report with the groundwater level contour maps for the early and late spring periods, specifically in Figures 2.1-3a, b, d, and e. The maps typically show the lowering of static groundwater levels that occurs in both management areas between early and late spring with the commencement of the annual irrigation season. The importance remains of utilizing only groundwater level data from a focused time period, no longer than one or two weeks, in the construction of a spring groundwater level contour map covering the area.

Still apparent from the focused spring contour maps are the limitations in existing monitoring data sets that affect the area of coverage for contouring and, thus, description of groundwater flow conditions between and within the management areas. As described in the previous SMVMA annual reports, spring groundwater level measurements are made in late February or early March in the SMVMA (by USGS) but not in the NMMA, thus extremely limiting the ability to contour groundwater levels in the SMVMA to its boundary with the NMMA (Figure 2.1-3a). In contrast, spring measurements are made in mid- to late April in the NMMA (by SLODPW) and in the SMVWCD portion of the SMVMA (by SMVWCD) but not in the southern half of the SMVMA, thus precluding contouring of groundwater levels to its southern boundary (Figure 2.1-3b). While the latter map describes flow conditions at the management area boundary, importantly showing no subsurface flow from the SMVMA toward the NMMA, the contouring is based on a sparse density of wells for a time period in late spring after static groundwater levels have declined tens of feet in response to area pumping for irrigation. Again, contouring efforts currently rely on monthly groundwater level data (e.g. February, March, and April) provided by private entities from their own water supply wells.

In order to address some of these data limitations, and as described earlier in this report, the TMA has initiated in 2013 a project to install and commence operation of transducers in selected wells, as available, near the SMVMA/NMMA boundary. In December 2013, transducers were installed in two shallow monitoring wells owned by the SLODPW, one in the SMVMA northeast of Guadalupe on Division Street and the second in the southern NMMA on Eucalyptus Road. This focused monitoring effort should provide data with which to better understand seasonal fluctuations in groundwater levels and flow conditions along the boundary. Depending on the availability and condition of wells in that area, the installation of monitoring well(s) near the boundary may be needed in order to provide adequate water level data, by either dedicated transducer or frequent manual measurements.

Regarding the existing monitoring program for the SMVMA, it is recommended that the groundwater and surface water monitoring components continue to be updated in 2013 by the Area Engineer. The update would include assessing network wells for groundwater level and quality monitoring, locations for monitoring well installation, and options for reestablishment of network stream gauges. Assessment work would be in coordination with USGS, Santa Barbara County, and San Luis Obispo County staff, as well as the SMVWCD and TMA. Coordination would also occur with agencies and/or committees currently tasked with developing monitoring programs specifically for salt and nutrient management such as for the SNMP, TMDLs, and the Ag Order. An additional point not otherwise included in the monitoring program but important in future analysis and reporting on the SMVMA is the surveying of wellhead reference point elevations at wells utilized for groundwater level monitoring.

Beyond components of the overall monitoring program, the most notable recommendation for additional investigation is that the City of Santa Maria continue with its efforts to secure additional SWP entitlement, certainly depending on consideration of future options for intra-basin water transfer with Nipomo Mesa but in a timely manner consistent with any progress as it occurs in its Water Sales Agreement with the Nipomo CSD. The recommended investigation would facilitate the City's compliance with the provisions of the Stipulation regarding importation and use of SWP water in the SMVMA when the Water Sales Agreement becomes operational. Santa Maria should then complete its analysis of the availability of surplus water in the SMVMA (surplus to all the needs in the SMVMA), logically from the additional SWP entitlement, whereby some can be exported beyond the SMVMA. Coincident with the preceding, Santa Maria should also complete its analysis of the sources, locations, and potential impacts of any additional pumping of groundwater for export beyond the SMVMA.

6. References

California DWR (Department of Public Works, Division of Water Resources), 1933.
Ventura County Investigation, DWR Bull. 46, pp. 82 - 90.

California DWR, 1959, 1968, 1977, 1985, and 1995.
Land Use Surveys, Santa Barbara and San Luis Obispo Counties.

California DWR, 1970.
Sea-Water Intrusion: Pismo-Guadalupe Area, DWR Bull. 63-3.

California DWR, 1975.
Vegetative Water Use in California, 1974, DWR Bull. 113-3.

California DWR, 1999.
Water Resources of the Arroyo Grande – Nipomo Mesa Area.

California CCRWQCB, 1995.
Assessment of Nitrate Contamination in Ground Water Basins of the Central Coast Region, Preliminary Working Draft.

California CCRWQCB, 2013.
CCAMP Surface Water Quality Data Summaries, Santa Maria Valley, CA, 2000 - 2013. Accessed 2014.
http://www.ccamp.org

California SWRCB, February 2014, and CCRWQCB, May 2013.
TMDL for Nutrients, Santa Maria River Watershed.
Accessed 2014
http://www.waterboards.ca.gov/centralcoast/water_issues/programs/tmdl/docs/santa_maria/nutrients/2014_0204_sb_signed_resoln.pdf; and
http://www.waterboards.ca.gov/centralcoast/water_issues/programs/tmdl/docs/santa_maria/nutrients/sm_nut_tmdl_att1_resoln.pdf

City of Santa Maria and Nipomo Community Services District, September 7, 2004.
Memorandum of Understanding by and Between the City of Santa Maria and Nipomo Community Services District.

Douglas Wood & Associates, Inc., March 2009.
Nipomo Community Services District Waterline Intertie, Final Environmental Impact Report (State Clearinghouse No. 2005071114), prepared for Nipomo Community Services District.

Hanson, B., and Bendixen, W., 2004.
Drip Irrigation Evaluated in Santa Maria Valley Strawberries, California Agriculture, v. 58, no. 1.

Lippincott, J.B., 1931.
Report on Water Conservation and Flood Control of the Santa Maria River in Santa Barbara and San Luis Obispo Counties, prepared for Santa Barbara County Board of Supervisors.

Luhdorff and Scalmanini, Consulting Engineers, March 2000.
Development of a Numerical Ground-Water Flow Model and Assessment of Ground-Water Basin Yield, Santa Maria Valley Ground-Water Basin, prepared for Santa Maria Valley Water Conservation District.

Luhdorff and Scalmanini, Consulting Engineers, October 2008.
Monitoring Program for the Santa Maria Valley Management Area, prepared for Superior Court of California, County of Santa Clara, and Twitchell Management Authority.

Luhdorff and Scalmanini, Consulting Engineers, April 2009.
2008 Annual Report of Hydrogeologic Conditions, Water Requirements, Supplies, and Disposition, prepared for Superior Court of California, County of Santa Clara, and Twitchell Management Authority.

Luhdorff and Scalmanini, Consulting Engineers, April 2010.
2009 Annual Report of Hydrogeologic Conditions, Water Requirements, Supplies, and Disposition, prepared for Superior Court of California, County of Santa Clara, and Twitchell Management Authority.

Luhdorff and Scalmanini, Consulting Engineers, April 2011.
2010 Annual Report of Hydrogeologic Conditions, Water Requirements, Supplies, and Disposition, prepared for Superior Court of California, County of Santa Clara, and Twitchell Management Authority.

Luhdorff and Scalmanini, Consulting Engineers, April 2012.
2011 Annual Report of Hydrogeologic Conditions, Water Requirements, Supplies, and Disposition, prepared for Superior Court of California, County of Santa Clara, and Twitchell Management Authority.

Luhdorff and Scalmanini, Consulting Engineers, April 2013.
2012 Annual Report of Hydrogeologic Conditions, Water Requirements, Supplies, and Disposition, prepared for Superior Court of California, County of Santa Clara, and Twitchell Management Authority.

NCSD, Supplemental Water Alternatives Evaluation Committee, March 2013.
Alternative Evaluation Final Report.

NMMA Technical Group, April 2009.
Nipomo Mesa Management Area First Annual Report, Calendar Year 2008, prepared for Superior Court of California, County of Santa Clara.

NMMA Technical Group, April 2010.
Nipomo Mesa Management Area Second Annual Report, Calendar Year 2009, prepared for Superior Court of California, County of Santa Clara.

NMMA Technical Group, April 2011.
Nipomo Mesa Management Area Third Annual Report, Calendar Year 2010, prepared for Superior Court of California, County of Santa Clara.

NMMA Technical Group, April 2012.
Nipomo Mesa Management Area Fourth Annual Report, Calendar Year 2011, prepared for Superior Court of California, County of Santa Clara.

NMMA Technical Group, April 2013.
Nipomo Mesa Management Area Fifth Annual Report, Calendar Year 2012, prepared for Superior Court of California, County of Santa Clara.

Santa Barbara County Agricultural Commissioner's Office, 2006 - 2013.
Shapefile of cropland boundaries in Santa Barbara County for years 2006-2013. Published and accessed 2013.
http://www.countyofsb.org/itd/gis/default.aspx?id=2802

Santa Barbara County Department of Planning and Development, June 2008.
Santa Barbara Ranch Project Water Management Plan.

Santa Barbara County Water Agency, 1994.
Santa Maria Valley Water Resources Report.

Santa Barbara County Water Agency, 1996.
Santa Barbara County 1996 Ground-Water Resources Report.

San Luis Obispo County Agricultural Commissioner's Office, 2005 - 2013.
Shapefile of cropland boundaries in San Luis County for 2005-2013.
Published and accessed 2012.
http://lib.calpoly.edu/collections/gis/slodatafinder/

SMVWCD, 1968-2013.
Reports of monthly Twitchell Reservoir conditions.

Superior Court of the State of California, County of Santa Clara, June 30, 2005.
Stipulation in the Santa Maria Groundwater Litigation, Lead Case No. CV 770214.

Sweet, R., City of Santa Maria, May 15, 2013. Personal communication.

Toups Corporation, July 1976.
Santa Maria Valley Water Resources Study, prepared for City of Santa Maria.

UCCE, 1994.
Using Reference Evapotranspiration (ETo) and Crop Coefficients to Estimate Crop Evapotranspiration (ETc) for Agronomic Crops, Grasses, and Vegetable Crops, Leaflet 21427.

USGS, Worts, G.F., Jr., 1951.
Geology and Ground-Water Resources of the Santa Maria Valley Area, California, USGS WSP 1000.

USGS, Thomasson, H.G., Jr., 1951.
Surface Water Resources, in **Geology and Ground-Water Resources of the Santa Maria Valley Area, California**, USGS WSP 1000.

USGS, Miller, G.A., and Evenson, R.E., 1966.
Utilization of Groundwater in the Santa Maria Valley Area, California, USGS WSP 1819-A.

USGS, Hughes, J.L., 1977.
Evaluation of Ground-Water Quality in the Santa Maria Valley, California, USGS WRI Report 76-128.

Jones, Benton J., 2012.
Growing Tomatoes, http://www.growtomatoes.com/water-requirement/

Selina, Paul, and Bledsoe, Michael E., April 2002
U.S. Greenhouse/Hothouse Hydroponic Tomato Timeline, NSF Center for Integrated Pest Management, http://www.cipm.info/croptimelines/pdf/USgreenhousetomato.PDF

Resh, Howard, 2005.
Hydroponic Culture of Tomatoes, http://www.howardresh.com/Hydroponic-Culture-of-tomatoes.html