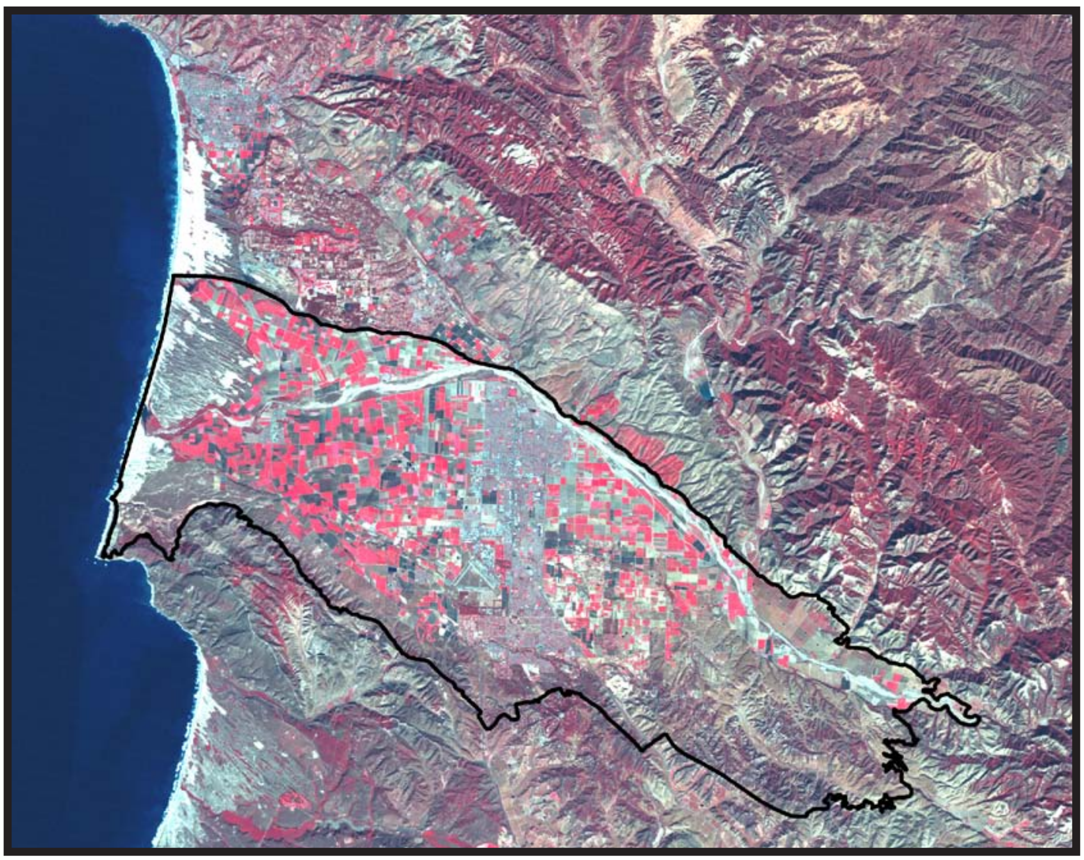
2011 Annual Report of Hydrogeologic Conditions, Water Requirements, Supplies and Disposition

Santa Maria Valley Management Area



Luhdorff and Scalmanini
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April, 2012

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Water Requirements, Supplies, and Disposition

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prepared by

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Acronyms and Abbreviations

af, afy, af/ac	acre-feet, acre-feet per year, acre-feet/acre
AW	applied water
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	Nipomo Mesa Management Area
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
SWP	State Water Project
TMA	Twitchell Management Authority
UCCE	University of California Cooperative Extension
USACE	United States Army Corps of Engineers
USGS	United States Geological Survey
umho/cm	micromhos per centimeter
WRP	water reclamation plant
WWTP	waste water treatment plant

1. Introduction

This fourth annual report of conditions in the Santa Maria Valley Management Area, for calendar year 2011, 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 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.

In accordance with those specifications, 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 2011, including groundwater conditions, Twitchell Reservoir operations, and hydrologic and climatic conditions. 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 2011. 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. Overall, the organization and formatting of this report is comparable to that utilized for the previous annual reports (2008 through 2010) on conditions in the SMVMA.

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

Under the terms and conditions of 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, all available historical data on the geology and water resources of the SMVMA were first compiled into a Geographic Information System (GIS). The GIS was utilized 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 then classified based on well depth and completion information. Those wells with inconclusive depth and completion information were originally designated as unclassified wells; in 2009, 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 to reflect those minor changes to the well networks.

Assessment of the spatial distribution of monitored wells throughout the SMVMA, as well as their vertical distribution within the aquifer system, provided the basis for designation of two monitoring program well networks, one each for the shallow and deep aquifer zones. While the networks are primarily comprised of wells that are actively monitored, they include additional wells that are currently inactive (monitoring to be restarted) and some new wells (installation and monitoring to be implemented). All network wells are to be monitored for groundwater levels, with a subset of those wells to be monitored for groundwater quality, as shown in the maps and tables of the monitoring program well networks (Figures 1.3-1a and 1.3-1b; Tables 1.3-1a through 1.3-1c). The SMVMA monitoring program is included in Appendix A.

Another use of the GIS was for evaluation of actively and historically monitored surface water and climatic gauges by location and period of record, specifically for Twitchell Reservoir releases, stream discharge, precipitation, and reference evapotranspiration data. Assessment of the adequacy of coverage of the gauges throughout the SMVMA provided the basis for designation of the network of surface water and climate gauges in the monitoring program. The network includes gauges currently monitored as well as those that are inactive ("potential gauges" to potentially be reestablished). For Twitchell Reservoir, stage, storage, releases, and water quality are to be monitored; for surface streams, all current gauges are to be monitored for stage, discharge, and quality (potential gauges monitored for stage and discharge); and for climate, the current and potential stations are to be monitored for precipitation and reference evapotranspiration data, as shown in the map of the surface water and climate monitoring network (Figure 1.3-2). As described in the next chapter, work was conducted on a new climate station on the Santa Maria Valley floor during 2010, with its completion in early 2011.

In addition to the hydrologic data described above, the monitoring program for the SMVMA 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; they also include 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.

In order to complete this annual assessment of groundwater conditions, water requirements, water supplies, and water disposition in the SMVMA, the following data for 2011 were acquired from the identified sources and compiled in the GIS:

- 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 SMVWCDand Santa Barbara County Public Works Department;

- surface water discharge and quality data: the USGS;

- 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: Santa Barbara and San Luis Obispo County Agricultural Commissioner's Offices;

- 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, and the Laguna Sanitation District.

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 2011, and related to ongoing monitoring, data collection, and interpretation for future annual reporting.

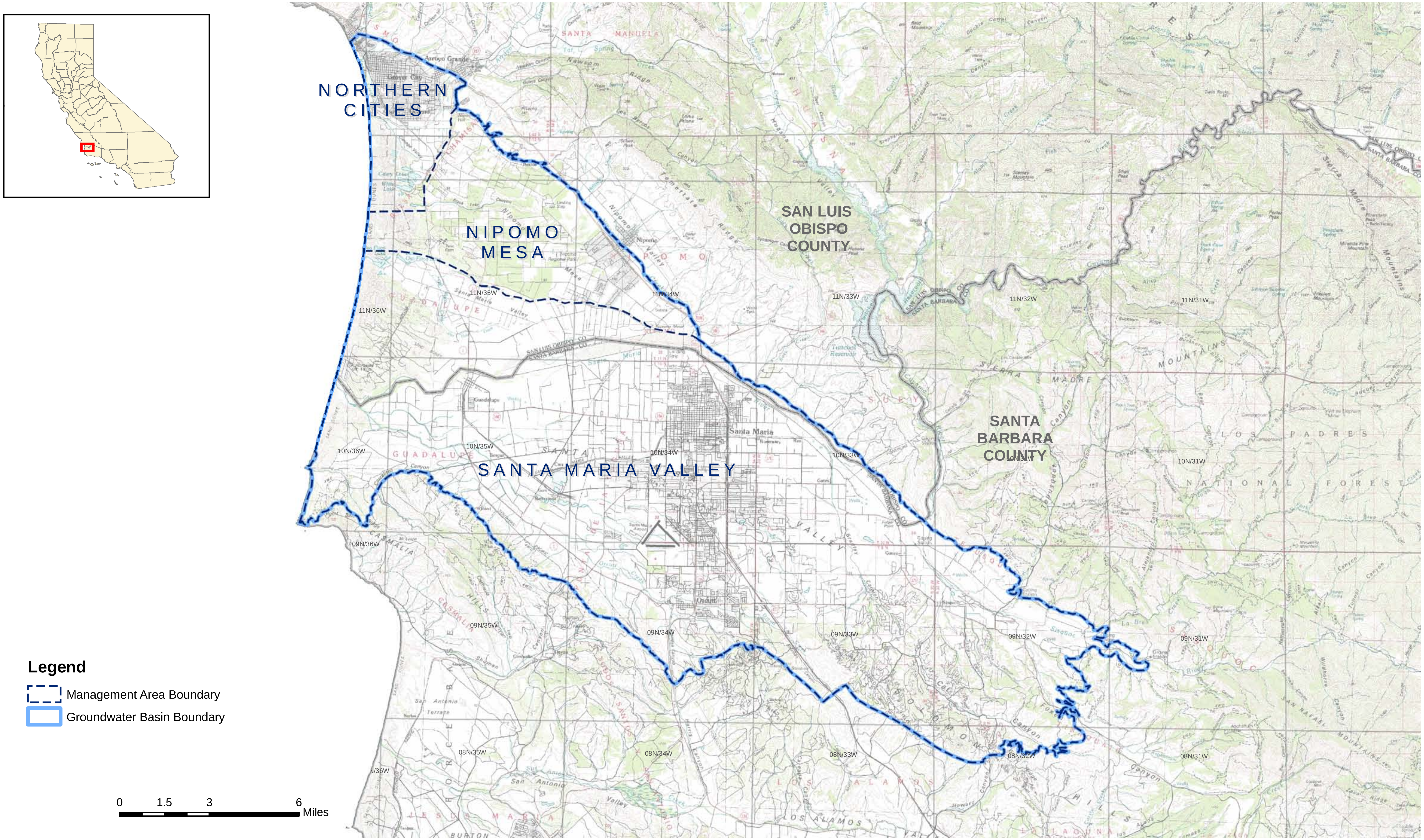

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Figure 1.1-1
Santa Maria Valley Groundwater Basin and Management Areas
Santa Maria Valley Management Area

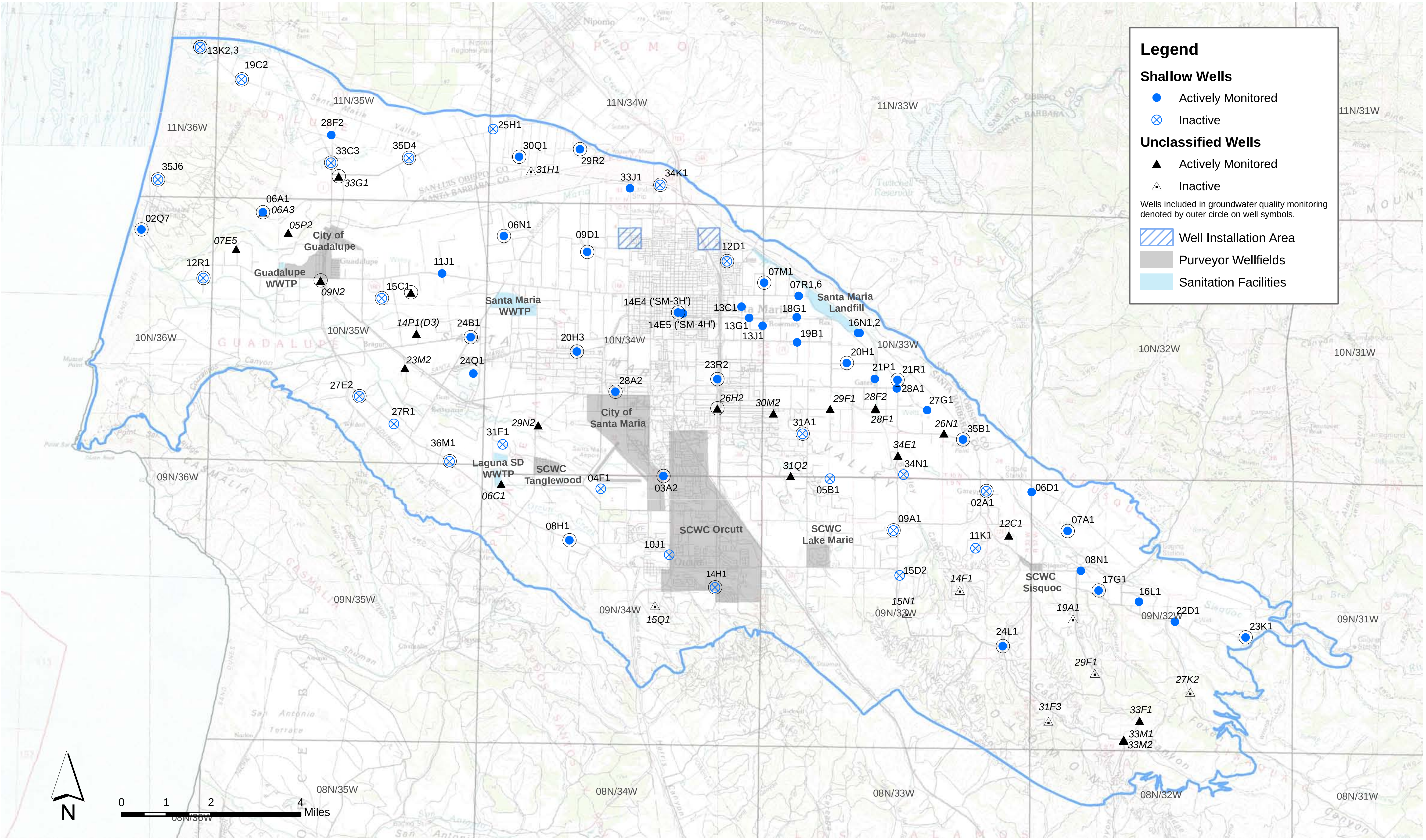

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Figure 1.3-1a
Well Network for Monitoring Shallow Groundwater
Santa Maria Valley Management Area

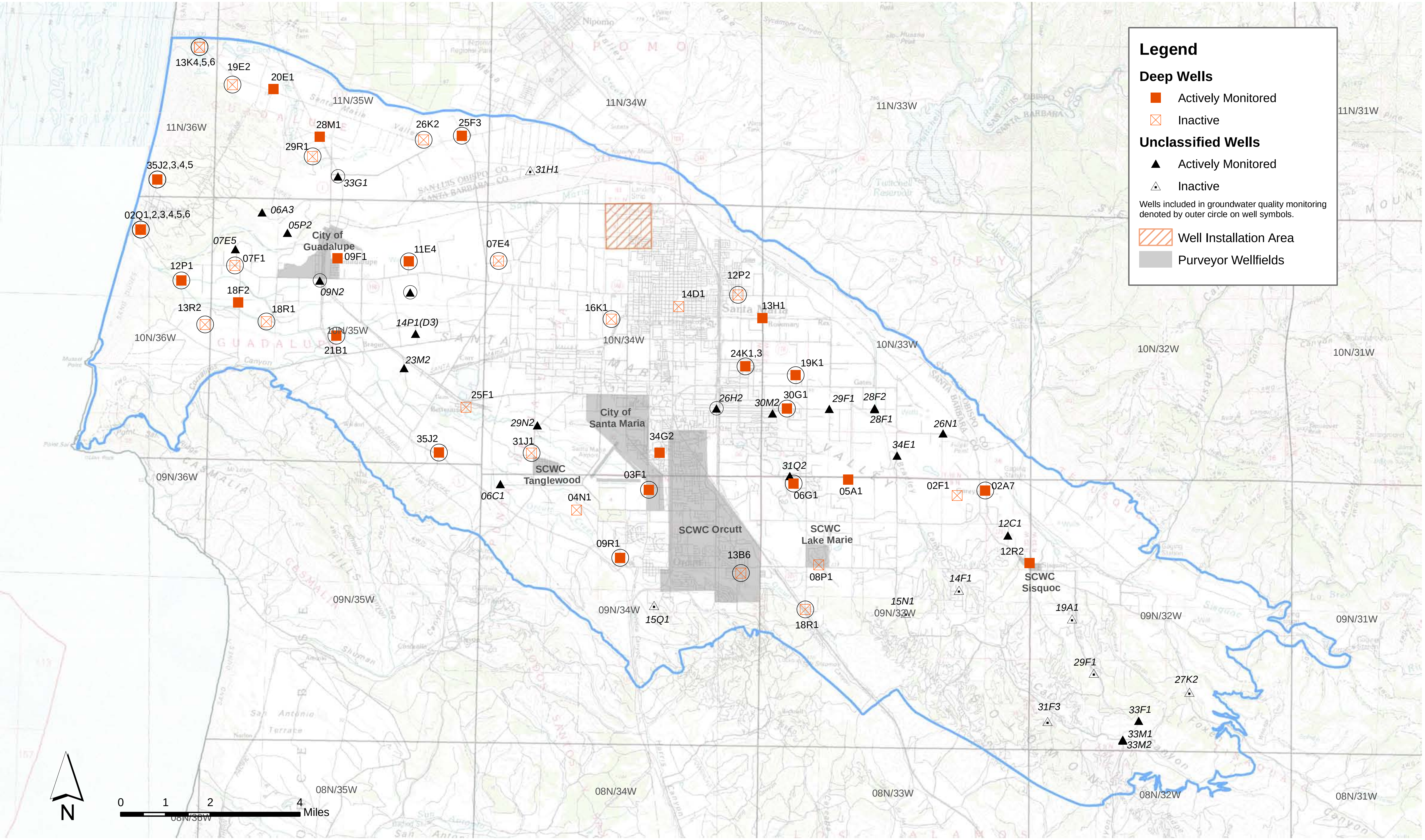

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Figure 1.3-1b
Well Network for Monitoring Deep Groundwater
Santa Maria Valley Management Area

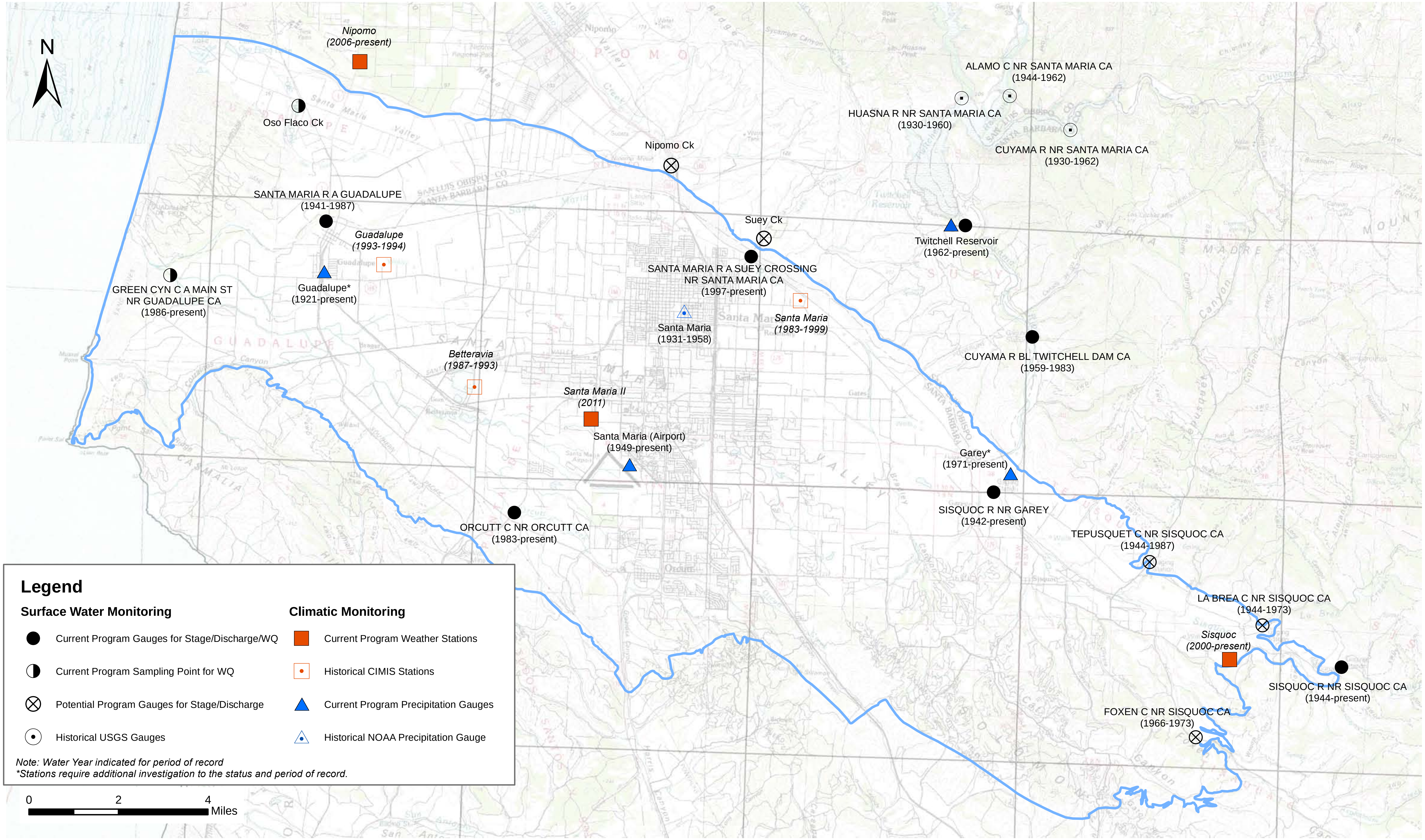

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Figure 1.3-2
Surface Water and Climatic Monitoring Network
Santa Maria Valley Management Area

Table 1.3-1a
Well Network for Monitoring Shallow Groundwater
Santa Maria Valley Management Area
(corresponds to Figure 1.3-1a)

Township/ Range	State Well Number	Well Map ID	Monitoring Agency	Actively Monitored for Water Levels	Actively Monitored for Water Quality	To Be Sampled for Water Quality
SHALLOW WELLS						
9N/32W	009N032W06D001S	06D1	USGS	A/S		
	009N032W07A001S	07A1	USGS	A/S		B
	009N032W08N001S	08N1	USGS	A/S		
	009N032W16L001S	16L1	USGS	A/S		
	009N032W17G001S	17G1	USGS	A/S		B
	009N032W22D001S	22D1	USGS	A/S		
	009N032W23K001S	23K1	USGS	A/S		B
9N/33W	009N033W02A001S	02A1	TBD			B
	009N033W05B001S	05B1	TBD			
	009N033W09A001S	09A1	TBD			B
	009N033W11K001S	11K1	TBD			
	009N033W15D002S	15D2	TBD			
	009N033W24L001S	24L1	USGS	A/S		B
9N/34W	009N034W03A002S	03A2	USGS	A/S	A	B
	009N034W04F001S	04F1	TBD			
	009N034W08H001S	08H1	USGS	A/S		B
	009N034W10J001S	10J1	TBD			
	009N034W14H001S	14H1	TBD			B
10N/33W	010N033W07M001S	07M1	USGS	A/S		B
	010N033W07R001S	07R1	USGS	A/S		
	010N033W07R006S	07R6	USGS	A/S		
	010N033W16N001S	16N1	USGS	A/S		
	010N033W16N002S	16N2	USGS	A/S		
	010N033W18G001S	18G1	SMVWCD & USGS	Qtr & S		
	010N033W19B001S	19B1	SMVWCD & USGS	Qtr & S		
	010N033W20H001S	20H1	USGS	A/S	A	B
	010N033W21P001S	21P1	SMVWCD & USGS	Qtr & S		
	010N033W21R001S	21R1	USGS	A/S		B
	010N033W27G001S	27G1	SMVWCD & USGS	Qtr & S		
	010N033W28A001S	28A1	SMVWCD & USGS	Qtr & S		
	010N033W31A001S	31A1	TBD			B
	010N033W34N001S	34N1	TBD			
	010N033W35B001S	35B1	USGS	A/S		B
10N/34W	010N034W06N001S	06N1	SMVWCD & USGS	Qtr & S		B
	010N034W09D001S	09D1	SMVWCD & USGS	Qtr & S		B
	010N034W12D001S	12D1	TBD			B
	010N034W13C001S	13C1	USGS	A/S		
	010N034W13G001S	13G1	USGS	A/S		
	010N034W13J001S	13J1	USGS	A/S		
	010N034W14E004S	14E4	SMVWCD & USGS	Qtr & S	A	B
	010N034W14E005S	14E5	USGS	A/S		
	010N034W20H003S	20H3	SMVWCD & USGS	Qtr & S		B
	010N034W23R002S	23R2	USGS	A/S		B
	010N034W28A002S	28A2	SMVWCD & USGS	Qtr & S		B
	010N034W31F001S	31F1	TBD			
10N/35W	010N035W06A001S	06A1	USGS	A/S		B
	010N035W11J001S	11J1	SMVWCD & USGS	Qtr & S		
	010N035W15C001S	15C1	TBD			B
	010N035W24B001S	24B1	SMVWCD & USGS	Qtr & S		B
	010N035W24Q001S	24Q1	USGS	A/S		
	010N035W27E002S	27E2	TBD			B
	010N035W27R001S	27R1	TBD			
	010N035W36M001S	36M1	TBD			B

Frequency Abbreviation: A/S - Annual/Semiannual; Qtr & S - Quarter & Semiannual; A - Annual; B - Biennial
Agency Abbreviation: SMVWCD - Santa Maria Valley Water Conservation District; SLODPW - San Luis Obispo Department of Public Works; USGS - United States Geological Survey; TBD - To Be Determined

Table 1.3-1a (continued)
Well Network for Monitoring Shallow Groundwater
Santa Maria Valley Management Area
(corresponds to Figure 1.3-1a)

Township/ Range	State Well Number	Well Map ID	Monitoring Agency	Actively Monitored for Water Levels	Actively Monitored for Water Quality	To Be Sampled for Water Quality
SHALLOW WELLS						
10N/36W	010N036W02Q007S	02Q7	USGS	A/S	A	B
	010N036W12R001S	12R1	TBD			B
11N/34W	011N034W29R002S	29R2	SLODPW & USGS	A/S		B
	011N034W30Q001S	30Q1	SMVWCD & USGS	Qtr & S		B
	011N034W33J001S	33J1	SMVWCD & USGS	Qtr & S		
	011N034W34K001S	34K1	TBD			B
11N/35W	011N035W19C002S	19C2	TBD			B
	011N035W25H001S	25H1	TBD			
	011N035W28F002S	28F2	SLODPW & USGS	A/S		
	011N035W33C003S	33C3	TBD			B
	011N035W35D004S	35D4	TBD			B
11N/36W	011N036W13K002S	13K2	TBD			B
	011N036W13K003S	13K3	TBD			B
	011N036W35J006S	35J6	TBD			B

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Agency Abbreviation: SMVWCD - Santa Maria Valley Water Conservation District; SLODPW - San Luis Obispo Department of Public Works; USGS - United States Geological Survey; TBD - To Be Determined

Notes on Network Modification:

09N/32W-6D1 previously unclassified; classified as shallow well (depth unknown; compared to wells of known depth, water levels similar to those from shallow wells)

09N/33W-12R2 removed; classified as deep well

10N/33W-18G1 previously unclassified; classified as shallow well (depth = 422'; compared to wells of known depth, water levels similar to those from shallow wells)

10N/35W-11J1 previously unclassified; classified as shallow well (depth = 215'; compared to wells of known depth, water levels similar to those from shallow wells)

11N/34W-33J1 previously not included; classified as shallow well (depth = 149'; water level data recently made available by the USGS)

11N/35W-28F2 previously not included; classified as shallow well (depth = 48'; water level data recently made available by NMMA Tech Comm.)

11N/36W-35J5 removed; classified as deep well

Table 1.3-1b
Well Network for Monitoring Deep Groundwater
Santa Maria Valley Management Area
(corresponds to Figure 1.3-1b)

Township/ Range	State Well Number	Well Map ID	Monitoring Agency	Actively Monitored for Water Levels	Actively Monitored for Water Quality	To Be Sampled for Water Quality
DEEP WELLS						
9N/33W	009N033W02A007S	02A7	SMVWCD & USGS	Qtr & S	A	B
	009N033W02F001S	02F1	TBD			
	009N033W05A001S	05A1	USGS	A/S		
	009N033W06G001S	06G1	USGS	A/S		B
	009N033W08P001S	08P1	TBD			
	009N033W12R002S	12R2	SMVWCD & USGS	Qtr & S		
	009N033W18R001S	18R1	TBD			B
9N/34W	009N034W03F001S	03F1	USGS	A/S		B
	009N034W04N001S	04N1	TBD			
	009N034W09R001S	09R1	USGS	A/S		B
	009N034W13B006S	13B6	TBD			B
10N/33W	010N033W19K001S	19K1	USGS	A/S		B
	010N033W30G001S	30G1	SMVWCD & USGS	Qtr & S	A	B
10N/34W	010N034W07E004S	07E4	TBD			B
	010N034W12P002S	12P2	TBD			B
	010N034W13H001S	13H1	USGS	A/S		
	010N034W14D001S	14D1	TBD			
	010N034W16K001S	16K1	TBD			B
	010N034W24K001S	24K1	SMVWCD & USGS	Qtr & S		
	010N034W24K003S	24K3	SMVWCD & USGS	Qtr & S		B
	010N034W31J001S	31J1	TBD			B
	010N034W34G002S	34G2	SMVWCD & USGS	Qtr & S		
10N/35W	010N035W07F001S	07F1	TBD			B
	010N035W09F001S	09F1	USGS	A/S		
	010N035W11E004S	11E4	SMVWCD & USGS	Qtr & S		B
	010N035W18F002S	18F2	USGS	A/S		
	010N035W18R001S	18R1	TBD			B
	010N035W21B001S	21B1	SMVWCD & USGS	Qtr & S		B
	010N035W25F001S	25F1	TBD			
	010N035W35J002S	35J2	USGS	A/S		B
10N/36W	010N036W02Q001S	02Q1	USGS	A/S	A	B
	010N036W02Q002S	02Q2	TBD			B
	010N036W02Q003S	02Q3	USGS	A/S	A	B
	010N036W02Q004S	02Q4	USGS	A/S	A	B
	010N036W02Q005S	02Q5	TBD			B
	010N036W02Q006S	02Q6	TBD			B
	010N036W12P001S	12P1	USGS	A/S		B
	010N036W13R002S	13R2	TBD			B
11N/35W	011N035W19E002S	19E2	TBD			B
	011N035W20E001S	20E1	SMVWCD & USGS	Qtr & S		
	011N035W25F003S	25F3	SMVWCD & USGS	Qtr & S		B
	011N035W26K002S	26K2	TBD			B
	011N035W28M001S	28M1	SMVWCD & USGS	Qtr & S		
	011N035W29R001S	29R1	TBD			B
11N/36W	011N036W13K004S	13K4	TBD			B
	011N036W13K005S	13K5	TBD			B
	011N036W13K006S	13K6	TBD			B
	011N036W35J002S	35J2	USGS	A/S	A	B
	011N036W35J003S	35J3	USGS	A/S	A	B
	011N036W35J004S	35J4	USGS	A/S	A	B
	011N036W35J005S	35J5	USGS	A/S	A	B

Frequency Abbreviation: A/S - Annual/Semiannual; Qtr & S - Quarter & Semiannual; A - Annual; B - Biennial
Agency Abbreviation: SMVWCD - Santa Maria Valley Water Conservation District; USGS - United States Geological Survey; TBD - To Be Determined

Notes on Network Modification:

09N/33W-2A7 previously not included; classified as deep well (depth = 512'; water level data recently made available by the USGS)
09N/33W-12R2 previously classified as shallow well; classified as deep well (depth = 640'; compared to wells of known depth, water levels similar to those from deep wells)
10N/35W-9F1 previously unclassified; classified as deep well (depth = 240'; compared to wells of known depth, water levels similar to those from deep wells)
10N/35W-18F2 previously unclassified; classified as deep well (depth = 251'; compared to wells of known depth, water levels similar to those from deep wells)
10N/35W-21B1 previously unclassified; classified as deep well (depth = 300'; compared to wells of known depth, water levels similar to those from deep wells)
11N/35W-20E1 previously unclassified; classified as deep well (depth = 444'; compared to wells of known depth, water levels similar to those from deep wells)
11N/35W-25F3 previously unclassified; classified as deep well (depth unknown; compared to wells of known depth, water levels similar to those from deep wells)
11N/35W-28M1 previously unclassified; classified as deep well (depth = 376'; compared to wells of known depth, water levels similar to those from deep wells)
11N/36W-35J5 previously classified as shallow well; classified as deep well (depth = 135'; compared to wells of known depth, water levels and quality similar to those from deep coastal network wells)

Table 1.3-1c
Unclassified Wells for Groundwater Monitoring
Santa Maria Valley Management Area
(shown on Figures 1.3-1a and 1.3-1b)

Township/ Range	State Well Number	Well Map ID	Monitoring Agency	Actively Monitored for Water Levels	Actively Monitored for Water Quality	To Be Sampled for Water Quality
UNCLASSIFIED WELLS						
9N/32W	009N032W19A001S	19A1	TBD			
	009N032W27K002S	27K2	TBD			
	009N032W29F001S	29F1	TBD			
	009N032W31F003S	31F3	TBD			
	009N032W33F001S	33F1	USGS	A/S		
	009N032W33M001S	33M1	USGS	A/S		
	009N032W33M002S	33M2	USGS	A/S		
9N/33W	009N033W12C001S	12C1	USGS	A/S		
	009N033W14F001S	14F1	TBD			
	009N033W15N001S	15N1	TBD			
9N/34W	009N034W06C001S	06C1	USGS	A/S		
	009N034W15Q001S	15Q1	TBD			
10N/33W	010N033W26N001S	26N1	USGS	A/S		
	010N033W28F001S	28F1	USGS	A/S		
	010N033W28F002S	28F2	USGS	A/S		
	010N033W29F001S	29F1	USGS	A/S		
	010N033W30M002S	30M2	USGS	A/S		
	010N033W31Q002S	31Q2	USGS	A/S		
	010N033W34E001S	34E1	USGS	A/S		
10N/34W	010N034W26H002S	26H2	USGS	A/S		B
	010N034W29N002S	29N2	USGS	A/S		
10N/35W	010N035W05P002S	05P2	USGS	A/S		
	010N035W06A003S	06A3	USGS	A/S		
	010N035W07E005S	07E5	USGS	A/S		
	010N035W09N002S	09N2	USGS	A/S		B
	010N035W14P001S	14P1 (D3)[1]	USGS	A/S	(A)	(A)
	010N035W23M002S	23M2	USGS	A/S		
11N/34W	011N034W31H001S	31H1	TBD			
11N/35W	011N035W33G001S	33G1	SMVWCD & USGS	Qtr & S		B

[1]14P1 actively monitored for levels but not quality. 14D3 actively monitored for quality but not levels.

Frequency Abbreviation: A/S - Annual/Semiannual; Qtr & S - Quarter & Semiannual; A - Annual; B - Biennial
Agency Abbreviation: SMVWCD - Santa Maria Valley Water Conservation District; USGS - United States Geological Survey; TBD - To Be Determined

Notes on Network Modification:

09N/32W-6D1 removed; classified as shallow well
10N/33W-18G1 removed; classified as shallow well
10N/35W-9F1 removed; classified as deep well
10N/35W-11J1 removed; classified as shallow well
10N/35W-18F2 removed; classified as deep well
10N/35W-21B1 removed; classified as deep well
11N/35W-20E1 removed; classified as deep well
11N/35W-25F3 removed; classified as deep well
11N/35W-28M1 removed; classified as deep well

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 during winter 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 areas along the Santa Maria River, groundwater level fluctuations are greater in the shallow aquifer zone than the deep (see Twitchell Recharge Area, Central Agricultural Area, and Oso Flaco 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, at least partially in response to above average releases from Twitchell Reservoir following above average rainfall in December 2011 and early 2011. Importantly, 2011 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 2011 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 2011 as illustrated by contour maps of equal groundwater elevation for the shallow and deep aquifer zones (Figures 2.1-3a through 2.1-3f). One notable feature in the contour maps regarding hydrologic conditions in 2011 is the widening of groundwater level contours beneath the central-south and western portions of the SMVMA. This indicates a reduced (flatter) groundwater gradient, tending slightly toward a local pumping depression, 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 and municipal water supply wells of the City of Santa Maria and the Golden State Water Company are operated, although municipal pumping in 2011 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 greater flattening of the gradient in the deep aquifer 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 is the overall seasonal difference in shallow and deep zone water levels across the SMVMA from early spring through the fall period. Some decline was observed between February and April (early and late spring contour maps, respectively) with additional decline through late October in areas distant from the Santa Maria River, presumably reflecting groundwater pumping during the year. In areas near the River however, groundwater levels rose between spring and fall 2011, likely due to substantial recharge from Twitchell Reservoir releases and Sisquoc River discharge beginning as early as February and continuing through the year.

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.

Lastly, with support from the TMA and through the efforts of the SMVWCD in 2011, groundwater levels were measured in almost 20 additional shallow and deep wells during the fall period. The groundwater level data from those wells, which are typically measured by the USGS in spring but not fall, provided greater areal coverage of fall groundwater level contours (generally equivalent to spring period coverage) across the SMVMA (see Figures 2.1-3c and 3f).

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 in 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 2011, 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 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 2011 for the SMVMA are extremely sparse (recommendations for water quality monitoring are addressed in Chapter 5), assessment of those data indicates that, during 2011, 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 (less than 1,100 umho/cm in groundwater deeper than 600 feet). No specific conductance data were available in 2011 for the deep zone in the Sisquoc Valley. 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 some cases, the increase has been to the point where municipal purveyors have had to reduce or cease pumping from water supply wells with shallow zone completions, or install a packer to isolate production from the deep zone, in order to comply with drinking water standards. In 2011, nitrate-as-nitrate (NO3-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 appeared slightly higher in 2011 than 2010, but with a great increase reported for well 10N/33W-20H1, from 90 to almost 110 mg/l (see Figure 2.1-4). Perhaps more indicative of some localized farming activity, nitrate concentrations in this well have substantially fluctuated over the last decade, from less than 20 mg/l in 2002 to 110 mg/l in 2005, down to 40 mg/l by 2008, before the latest increasing trend through 2011. Nitrate concentrations 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 groundwaterremained 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. Exceptions to this have been two deeper wells in the south-southeast part of the Valley (9N/33W-02A7 and 9N/34W-03F2), with nitrate concentrations between 30 and 35 mg/l, and some coastal deep monitoring wells with nitrate levels exceeding 75 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 2011, 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.

Since the commencement of coastal groundwater quality monitoring, including in 2011, coastal groundwater has continued to show elevated but largely unchanging specific conductance values. Shallow groundwater at the southerly monitoring well set (10N/36W-02Q, shallow well 02Q7, Figure 2.1-4) had values of about 1,500 umho/cm in 2011, substantially lower than the 2,200 umho/cm value reported in 2010. Deep groundwater values (wells 02Q1, 02Q3, and 02Q4) have been lower, between 900 and 1,000 umho/cm over the last 30 years. Groundwater at the more northerly monitoring well set (11N/36W-35J) shows more variation in specific conductance values with depth, from 1,100 umho/cm in the deepest well (35J2), increasing to 1,500 umho/cm in the next deepest well (35J3), to 1,900 umho/cm in the next deepest well (35J4). Specific conductance values in the shallowest well (35J5) have gradually risen throughout the monitoring period through 2011 from about 1,400 to 1,700 umho/cm.

Some coastal groundwaters, specifically in 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 (as nitrate) concentrations have steadily risen from a range of 5 to 10 mg/l in the 1980’s to between 37 and 77 mg/l in 2011 (see Figure 2.1-4). In contrast, groundwaters in all aquifer zones near the southerly monitoring well set (10N/36W-02Q) have consistently shown very low concentrations of nitrate through the present (historical water quality graphs for these wells are provided in Appendix C). 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 2011. 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 2011 indicate general mineral quality conditions remain stable across the SMVMA and in particular along the coast, with no indication of sea water intrusion. Specific conductance values remain elevated in groundwater in all areas, to levels generally ranging between 900 and 1,600 umho/cm. In contrast, degradation from nitrate remains in shallow groundwater across the SMVMA, with concentrations in some areas well above the primary drinking water standard of 45 mg/l. A long-term gradual increase in nitrate concentrations continues in deep groundwater at the northerly portion of the coast, to between 37 and 77 mg/l, while they remained less than 10 mg/l in deep groundwater at the municipal wellfield.

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 2011, 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, 1968-2011). 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 and 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 in April, with releases commencing in February and continuing through December.

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 2011 is 52,800 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.

As described in the SMVMA 2010 annual report, project work was completed at the Twitchell Dam in late 2009 and early 2010 that included removal of sediment from 1,100 feet of tunnel and gate chamber, effectively restoring the dam outlet works, service gates, and stilling basin to full operational status. Also in 2010, additional project work was completed including sediment removal from the dam outlet tunnel, stilling basin, keyhole, and 1,600 linear feet of the Cuyama River immediately downstream of the dam (T. Gibbons, personal communication). This project work restored the conservation release function of the Twitchell project and provided for enhanced flood control immediately downstream of the dam and groundwater recharge in the Santa Maria Valley during 2011.

2.2.3 Instream Steelhead Fisheries Study

An instream steelhead fisheries study was recently completed for the Santa Maria, Sisquoc, and Cuyama Rivers watershed (Stillwater Sciences, April 2012), and discussion of the study, primarily its recommendations, is provided herein. The stated purpose of the study was "to characterize the historical and current conditions of instream flow in the Santa Maria River and to determine what, if any, modifications to the current flow regime would improve upstream passage for adult steelhead, through the mainstem into the upper watershed, and downstream passage of juvenile steelhead through the mainstem to the estuary and ocean."

The basic premise of the study is that a return to the pre-Twitchell Dam flow regime, through some modification of Twitchell Reservoir releases, would be sufficient to improve steelhead migration into the future. Thus, the study objectives were to characterize differences in pre- and post-Twitchell Dam flow regimes, including discharge rates, flow durations, frequency of steelhead passage events upstream and downstream, and infiltration losses along a 5-mile "critical passage" reach of the Santa Maria River near Bonita School Crossing. Steelhead passage criteria, both hydraulic and temporal, were estimated, and studies to determine the flow regime supporting those criteria were conducted by varied methods, including:

- analyses of historical discharge records in the Sisquoc, Cuyama (including Twitchell Reservoir releases), and Santa Maria Rivers;
- calculation by Manning's Equation of stream water width, depth, and velocity associated with varying discharge rate at numerous channel transects in the "critical passage" reach of the Santa Maria River;
- field measurement of stream water width, depth, and velocity during varying flow events at channel transects in the "critical passage" reach; and
- simulation by a simplified coupled surface water:groundwater model of stream discharge and infiltration losses along the Sisquoc and Santa Maria Rivers from Garey to the estuary.

Of note from the study results is a finding that the post-Twitchell Dam flow regime has resulted in slightly less frequent steelhead passage events compared to the pre-Twitchell period; further, infiltration losses along the migration length of the Sisquoc and Santa Maria Rivers were simply estimated to range between 300 and 450 cfs.

A summary of study assumptions regarding minimum stream discharge rates and durations supportive of the hydraulic criteria (i.e., water depth and width) for steelhead passage include:

- Initiation of upstream migration of adult steelhead would be coincident with flows of 250 cfs in the “critical passage” reach of the mainstem Santa Maria River.

- Upstream adult steelhead passage would require at least three days of flow greater than or equal to 250 cfs the “critical passage” reach of the mainstem Santa Maria River, as measured in the vicinity of the Bonita School Road and Highway 1 crossings. Flows of at least 150 cfs would be required in the lower Sisquoc River to achieve passage through that reach.

- Downstream juvenile passage would require at least one day of flow greater than or equal to 150 cfs through the “critical passage” reach of the mainstem Santa Maria River, with at least two preceding days of passable flows in the upstream Sisquoc River.

Study recommendations comprise a “strategy” to increase flow in the Cuyama River when the Sisquoc River is flowing at a rate that, historically (pre-Twitchell), would have resulted in potentially suitable steelhead-passage conditions in the mainstem Santa Maria River. As stated in the report, recommendations include:

- Flow augmentation from releases at Twitchell Dam to improve steelhead passage windows should occur in accord with the following rules during the months of December-April.

- Flow augmentation (releases) should occur when average daily flows in the lower Sisquoc River, as measured at the Garey gage, are between 350 and 550 cfs and have already remained at or above that level for at least two previous days. Once started, the releases should occur if/as needed to ensure passage flows in the mainstem Santa Maria River for at least three days.

- Flow augmentation (releases) should be sufficient to maintain flows in the critical reach of the mainstem Santa Maria River at 250 cfs; absent direct measurement of flow, this is assumed to be achieved with combined discharge from the Sisquoc and Cuyama Rivers of 600 cfs (i.e., transmission losses are 350 cfs unless observations show otherwise).

- Flow augmentation (releases) to support steelhead passage should not occur, or should stop once started, if (a) discharges fall below 150 cfs in the lower Sisquoc River, or (b) twelve or more days of adult steelhead-passable conditions have been achieved during the current water year.

It is estimated in the study that implementation of these recommendations would result in an average volume between 1,000 to 1,500 afy of augmentation releases from Twitchell Reservoir; that is, releases for the purpose of augmenting streamflow for steelhead migration that would therefore not be available for recharging the groundwater basin.

A number of points can be made regarding the study and recommendations, perhaps most importantly that:

1) no description is provided of steelhead populations in the Santa Maria and Sisquoc Rivers, either observed in the pre-Twitchell Dam period or predicted with implementation of the study recommendations, so it is unknown what improvement in steelhead fisheries can be anticipated for such an "investment" of basin water supply;

2) diversion of Twitchell water supply to augment streamflows that are ultimately lost from the basin constitutes a permanent, long-term reduction in recharge to the groundwater basin, when no surplus condition or alternate water supply has been identified in the basin to support this diversion;

3) no simulation or prediction was made of potential effects on groundwater levels and quality in the basin from implementation of the recommendations, namely the reduced recharge to the basin;

4) while the reason for conducting the study was to fulfill requirements of the California Department of Fish and Game, it remains to be clarified whether there is any compelling basis for implementing the study recommendations; and

5) related to the previous point is the need to resolve any conflict between said compelling basis, should it exist, and the 2005 Stipulation for the groundwater basin resulting from the basin adjudication, that specifies among other things directives for managing the basin, including Twitchell recharge operations, and awards rights to recover return flows from the importation of SWP water.

Discussion of these points is provided in the Recommendations section of this annual report.

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 Figure 1.3-2). 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 52,800 afy from 1967 through 2011. 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, to a high of almost 250,000 af during 1998. Stream discharge in 2011 from Twitchell releases was almost 90,000 af, well above the 1967-2011 average of 52,800 afy.

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 38,000 (absent data from years 1999-2007) and 39,500 afy, respectively, over the historical period of record. 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 2011 annual discharge into the SMVMA was well above average, approximately 160,000 af. 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 Figure 1.3-2). 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, 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. The discharge data for 2009 through 2011 remain problematic due to uncertainties in streamflow rating curves; 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 1,500 afy, ranging from essentially no streamflow during several years to just over 10,000 af in 1995; in 2011, stream discharge was above average, approximately 2,500 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 slightly 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 a lower amount 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 is summarized in Table 2.3-1. More recent water quality data for the River were unavailable for review for this report.

Table 2.3-1

Selected General Mineral Constituent Concentrations
Cuyama River below Twitchell Reservoir
(USGS, Hughes, J.L., 1977)

Constituent	Years 1906 and 1941	Years 1958 - 1966	Years 1967 - 1975
Specific Conductance (umho/cm)	1,700 - 4,500	1,300 - 2,400	750 - 2,100
Sulfate (mg/l)	700 - 1,700	450 - 700	190 - 550
Chloride (mg/l)	90 - 140	50 - 100	25 -85

Water quality in the Sisquoc River likely has remained relatively unchanged since 1906 although much fewer historical data are available than for the Cuyama River. The water quality concentrations measured between 1940 and 1975 are lower than observed in the Cuyama River during any of the above periods of time, with approximately 1,100 umho/cm specific conductance, 350 mg/l sulfate, and 20 mg/l chloride (USGS, Hughes, J.L., 1977). Review of more recent water quality data indicate that specific conductance values have remained essentially unchanged, ranging from 900 to 1,200 umho/cm, from 1975 through to the present, as seen in a graph of Sisquoc River water quality (Figure 2.3-2a). The latter data have been collected essentially monthly, and a slight seasonal variation in specific conductance is visible in most years, with values increasing as discharge decreases. The Sisquoc River has also been monitored for nitrate since 1975 on an annual basis, with NO_3-NO_3 concentrations at or below reporting limits.

The Sisquoc River data described above were collected at the upstream gauge (near Sisquoc) at the point where the river enters the Sisquoc plain and, thus, do not fully describe the quality of flows entering the Santa Maria Valley further downstream near Garey. Limited historical water quality data for the Sisquoc River near Sisquoc and near Garey, and for its tributary streams, indicate that the quality of streamflows entering the Sisquoc plain are slightly improved by tributary inflows (USGS, Hughes, J.L., 1977).

In contrast to the quality of streamflows in the Cuyama and Sisquoc Rivers, the quality of Orcutt Creek flows is highly degraded, with specific conductance values typically fluctuating between 1,100 and 3,500 umho/cm, with values exceeding 5,500 umho/cm in 2005 and 2006. Subsequently, specific conductance values have declined to the previous range, as seen in a graph of Orcutt Creek historical water quality (Figure 2.3-2b). Orcutt Creek flows also became highly degraded by nitrate, with NO_3-NO_3 concentrations remaining above the health-based standard of 45 mg/l since 2005, exceeded 125 mg/l in 2007 through 2009, and declined to about 70 mg/l in 2011.

An additional surface water monitoring point is on Green Canyon, a drainage canal that courses from south of Guadalupe westward and, with other small drainages, joins the Santa Maria River. Specific conductance values were 2,200 umho/cm in the late 1980’s, after which they have greatly fluctuated between 900 and 3,100 umho/cm. Nitrate (as nitrate) concentrations ranged from 60 to 80 mg/l in the late 1980’s and have since substantially increased to range between 100 and 200 mg/l. However, no water quality data have been available since 2009.

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 are or have been located in the SMVMA, specifically at Guadalupe, Santa Maria (currently at the Airport and previously downtown), and Garey (see Figure 1.3-2). The average annual rainfall measured at the Santa Maria Airport gauge, the most centrally located of the three gauges, is 12.99 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 and, while over nine inches of rain occurred in December 2010, total rainfall in calendar year 2011 was close to the average at 13.47 inches with almost six inches falling in March alone, 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. 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. Although the total rainfall in 2010 greatly exceeded the long-term average, a large portion of rainfall occurred in December following the measurement of fall groundwater levels. The rise in groundwater levels observed through 2011 in much of the SMVMA is attributed in large part to the recharge of runoff generated from the December 2010 rainfall and subsequent above average rainfall in early 2011 along the Sisquoc, Cuyama, and Santa Maria Rivers.

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 Figure 1.3-2). 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. These five 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 2011 from the Nipomo and Sisquoc stations are listed in Table 2.4-2, which shows that annual ETo and precipitation amounts were 43.58 and 16.54 inches, respectively, at Nipomo and 47.54 and 30.36 inches, respectively, at Sisquoc. As reported in the 2010 annual report, a CIMIS climate station located on the floor of the Santa Maria Valley ("Santa Maria II" near the Santa Maria airport, see Figure 1.3-2) was reestablished in April 2011. The reference ETo and precipitation data collected at this new station from April through December are provided in Table 2.4-2; however, lacking January through March data, the annual amounts are unknown.

Evapotranspiration was highest during the months of April through August at all three stations. The 2011 precipitation recorded at the Nipomo station, 16.54 inches, was the most similar to the amount observed at the Santa Maria Airport precipitation gauge, 13.47 inches. In contrast, the precipitation recorded at the Sisquoc station, 30.36 inches, greatly exceeded that observed at the Airport gauge. For this reason, and as described in the next chapter, the 2011 precipitation data from the Airport gauge, the average of the ETo data recorded at the Nipomo and Sisquoc stations for the months of January through March, and the average of the ETo data from all three CIMIS stations for the months of April through December were utilized in the estimation of agricultural water requirements for the SMVMA in 2011.

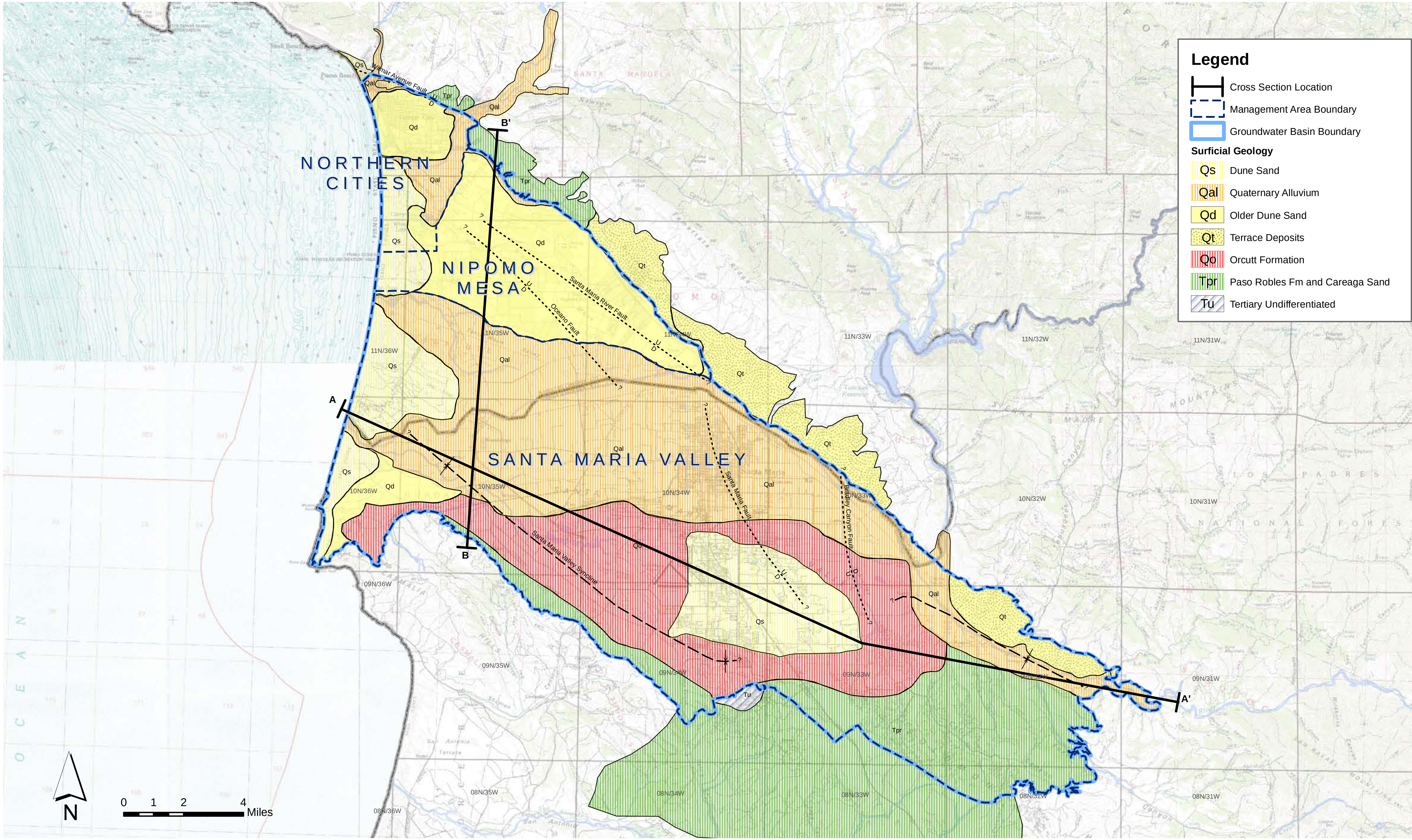

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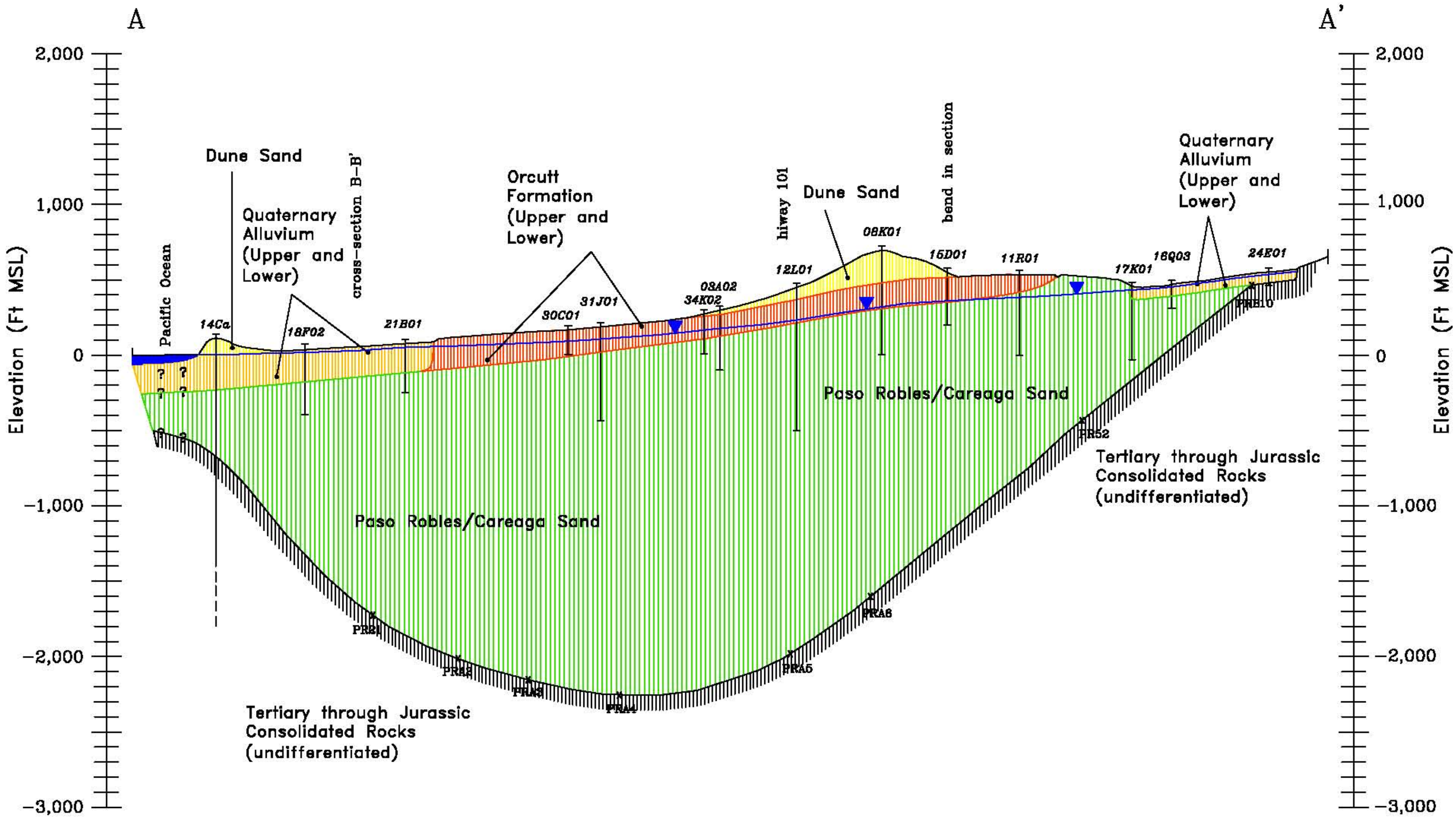
Figure 2.1-1a
Generalized Geologic Map with Cross Section Locations
Santa Maria Valley Management Area



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

Vertical Exaggeration = x20

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

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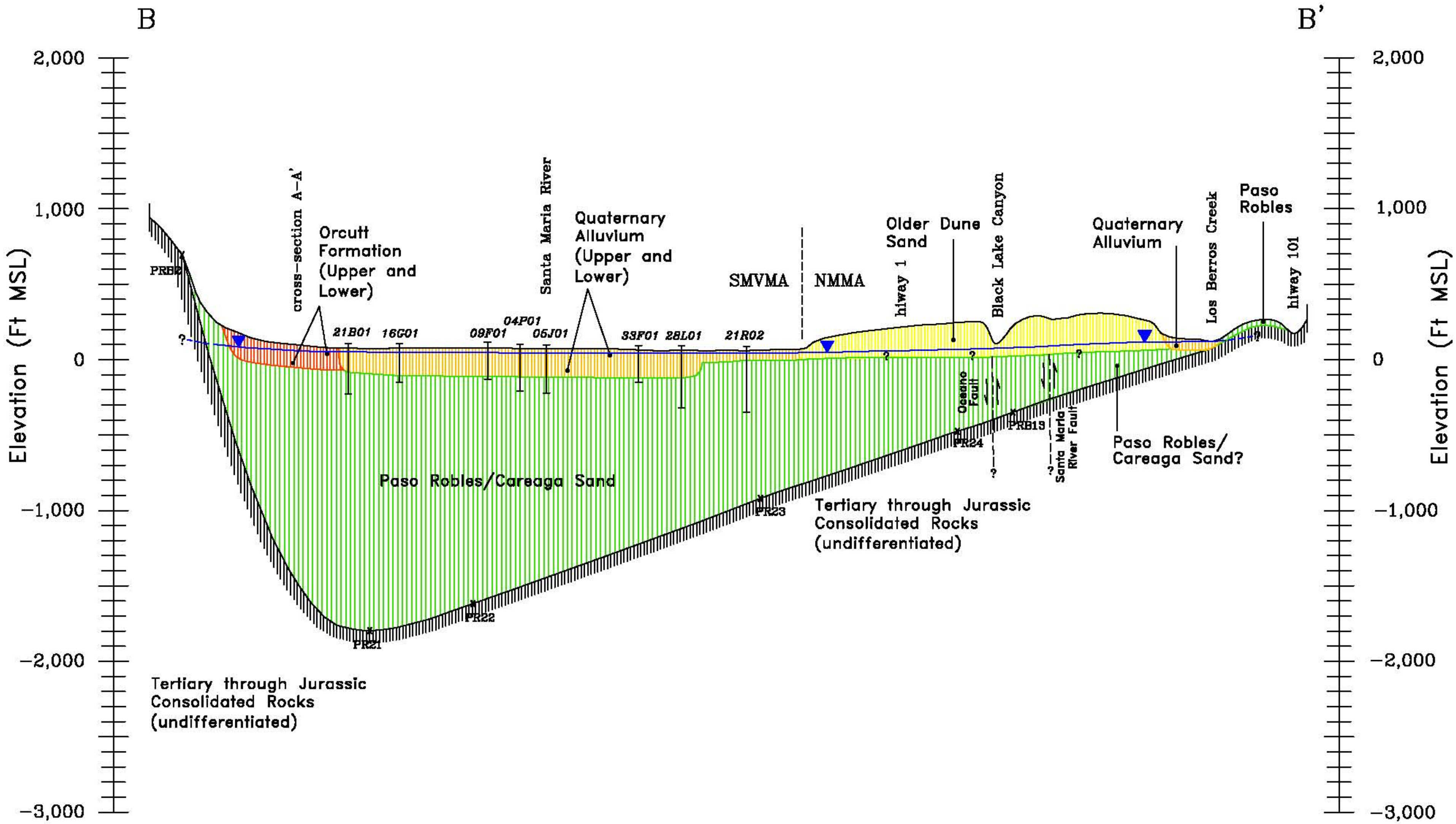
Figure 2.1-1b
Longitudinal Geologic Cross Section, A-A'
Santa Maria Valley Management Area



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

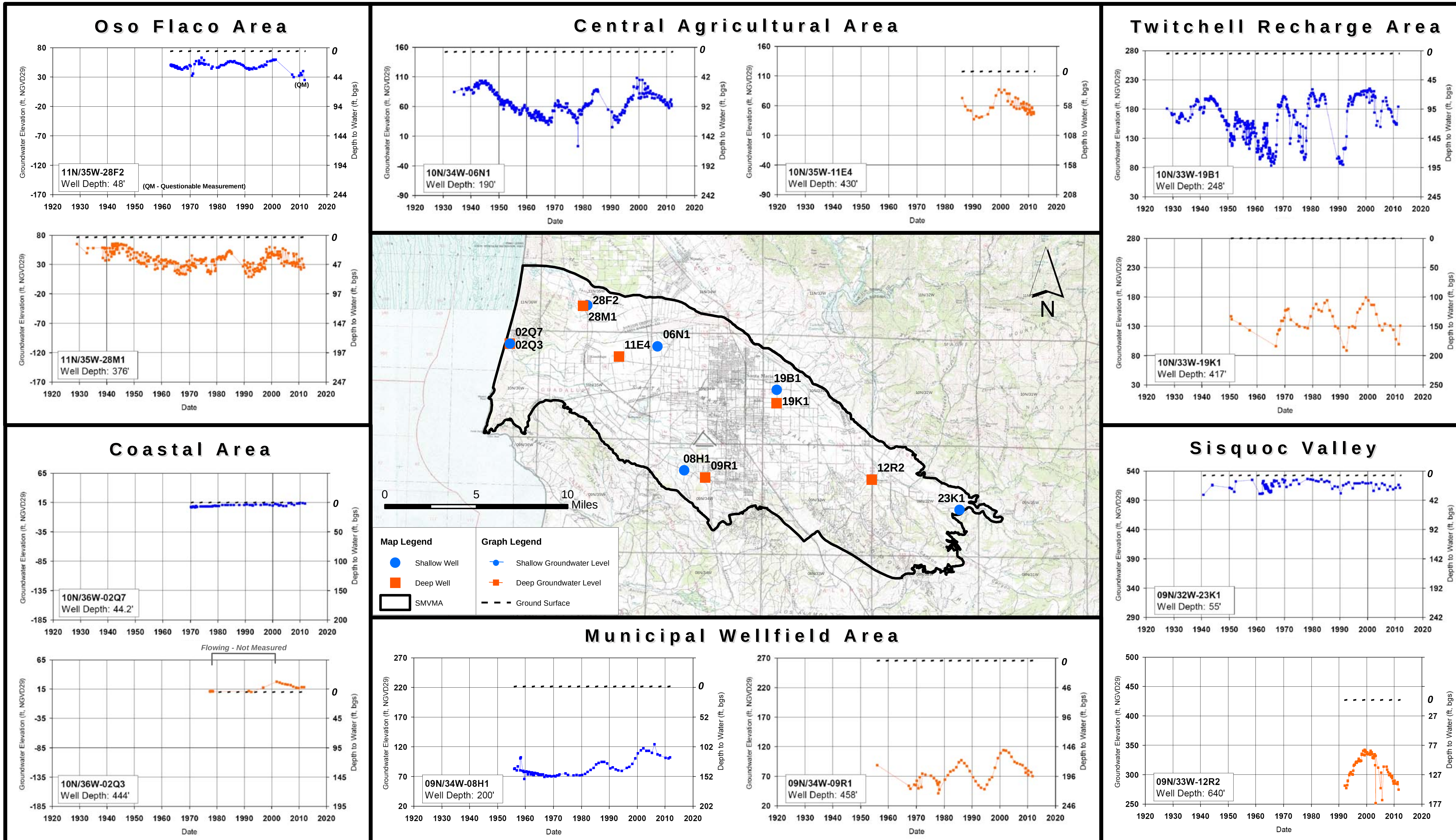

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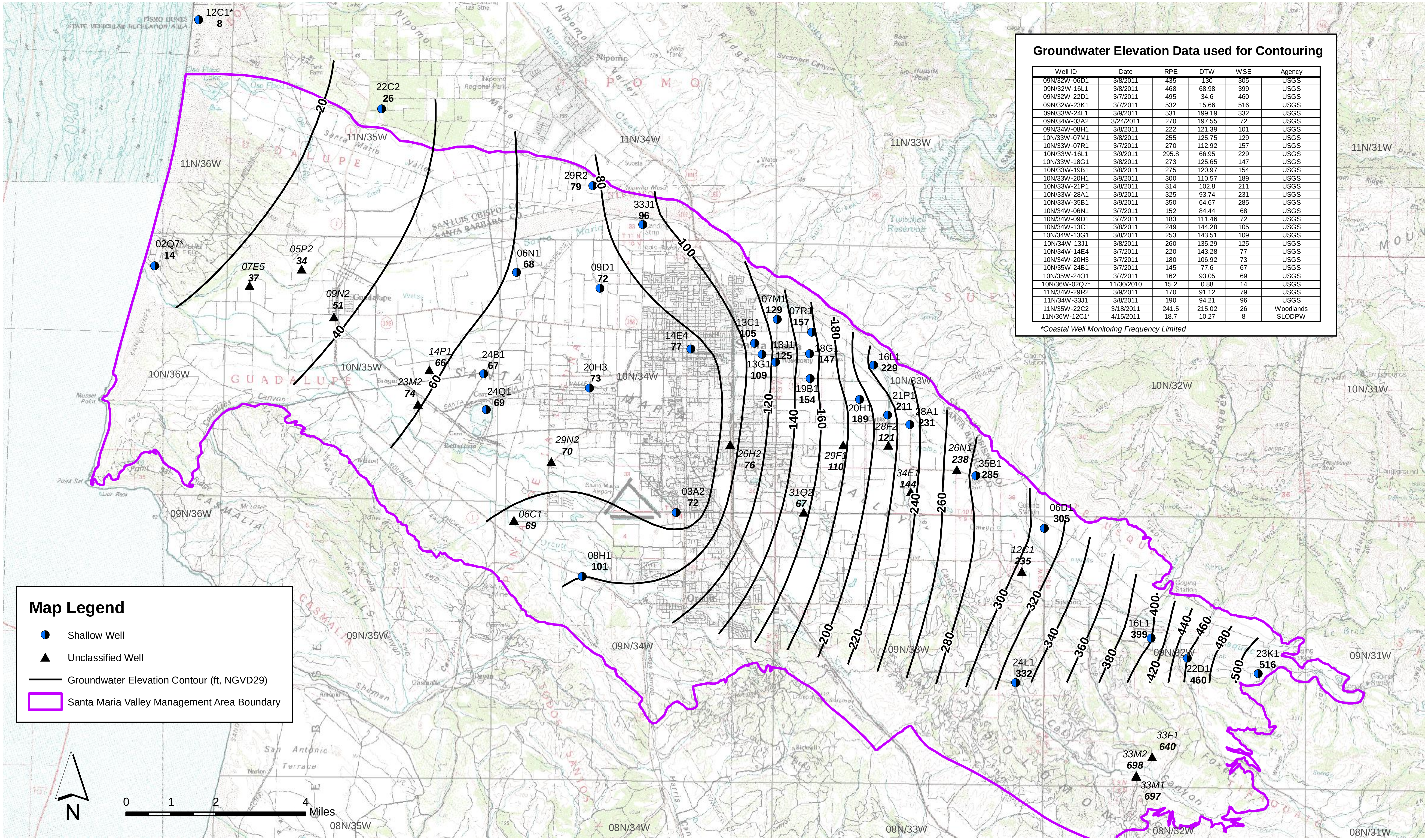
Figure 2.1-2
Historical Groundwater Levels
Santa Maria Valley Management Area



Groundwater Elevation Data used for Contouring

Well ID	Date	RPE	DTW	WSE	Agency
09N/32W-06D1	3/8/2011	435	130	305	USGS
09N/32W-16L1	3/8/2011	468	68.98	399	USGS
09N/32W-22D1	3/7/2011	495	34.6	460	USGS
09N/32W-23K1	3/7/2011	532	15.66	516	USGS
09N/33W-24L1	3/9/2011	531	199.19	332	USGS
09N/34W-03A2	3/24/2011	270	197.55	72	USGS
09N/34W-08H1	3/8/2011	222	121.39	101	USGS
10N/33W-07M1	3/8/2011	255	125.75	129	USGS
10N/33W-07R1	3/7/2011	270	112.92	157	USGS
10N/33W-16L1	3/9/2011	295.8	66.95	229	USGS
10N/33W-18G1	3/8/2011	273	125.65	147	USGS
10N/33W-19B1	3/8/2011	275	120.97	154	USGS
10N/33W-20H1	3/9/2011	300	110.57	189	USGS
10N/33W-21P1	3/8/2011	314	102.8	211	USGS
10N/33W-28A1	3/9/2011	325	93.74	231	USGS
10N/33W-35B1	3/9/2011	350	64.67	285	USGS
10N/34W-06N1	3/7/2011	152	84.44	68	USGS
10N/34W-09D1	3/7/2011	183	111.46	72	USGS
10N/34W-13C1	3/8/2011	249	144.28	105	USGS
10N/34W-13G1	3/8/2011	253	143.51	109	USGS
10N/34W-13J1	3/8/2011	260	135.29	125	USGS
10N/34W-14E4	3/7/2011	220	143.28	77	USGS
10N/34W-20H3	3/7/2011	180	106.92	73	USGS
10N/35W-24B1	3/7/2011	145	77.6	67	USGS
10N/35W-24Q1	3/7/2011	162	93.05	69	USGS
10N/36W-02Q7*	11/30/2010	15.2	0.88	14	USGS
11N/34W-29R2	3/9/2011	170	91.12	79	USGS
11N/34W-33J1	3/8/2011	190	94.21	96	USGS
11N/35W-22C2	3/18/2011	241.5	215.02	26	Woodlands
11N/36W-12C1*	4/15/2011	18.7	10.27	8	SLODPW

*Coastal Well Monitoring Frequency Limited

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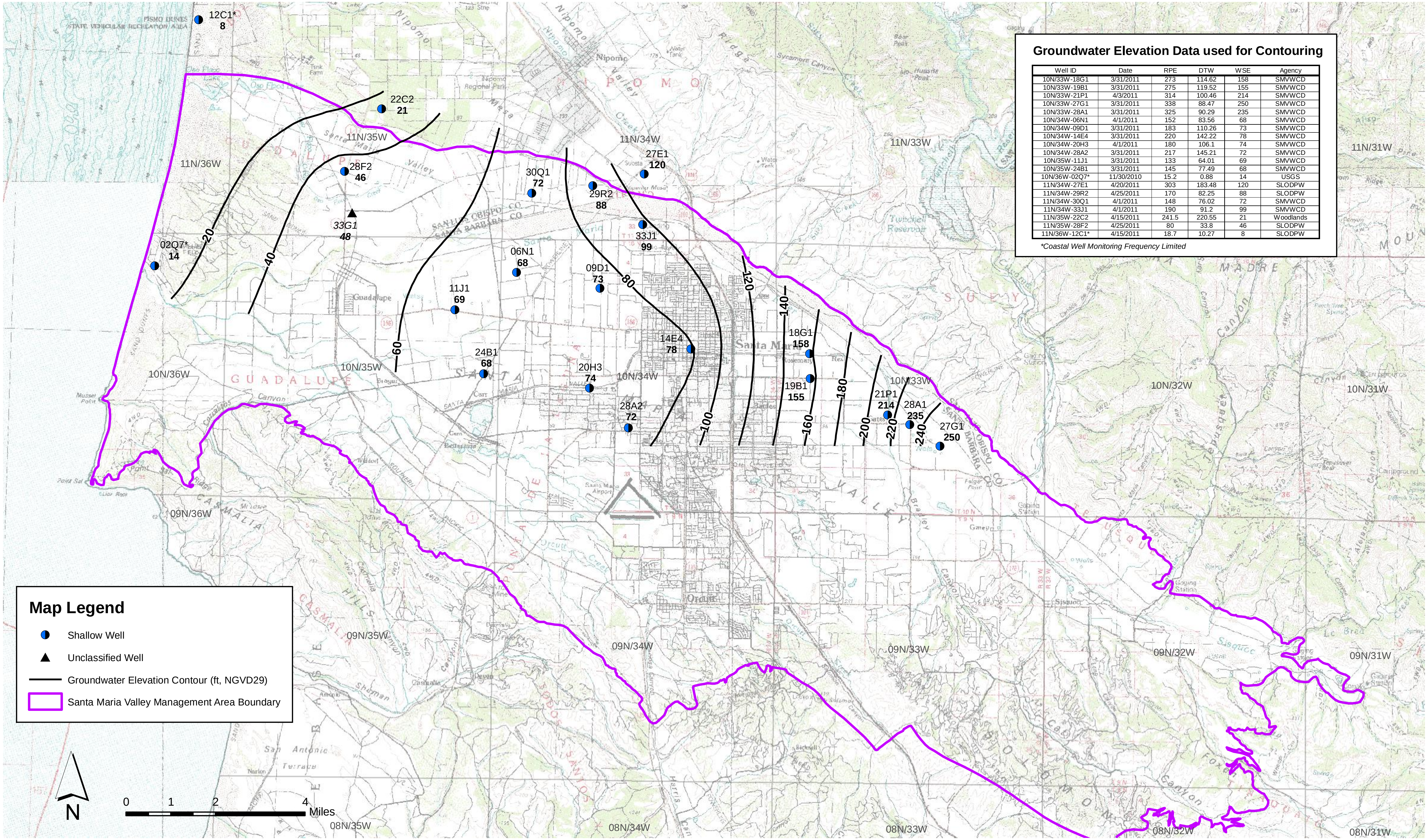
Figure 2.1-3a
Contours of Equal Groundwater Elevation, Shallow Zone, Early Spring (March 7 - 24) 2011
Santa Maria Valley Management Area



Groundwater Elevation Data used for Contouring

Well ID	Date	RPE	DTW	WSE	Agency
10N/33W-18G1	3/31/2011	273	114.62	158	SMVWCD
10N/33W-19B1	3/31/2011	275	119.52	155	SMVWCD
10N/33W-21P1	4/3/2011	314	100.46	214	SMVWCD
10N/33W-27G1	3/31/2011	338	88.47	250	SMVWCD
10N/33W-28A1	3/31/2011	325	90.29	235	SMVWCD
10N/34W-06N1	4/1/2011	152	83.56	68	SMVWCD
10N/34W-09D1	3/31/2011	183	110.26	73	SMVWCD
10N/34W-14E4	3/31/2011	220	142.22	78	SMVWCD
10N/34W-20H3	4/1/2011	180	106.1	74	SMVWCD
10N/34W-28A2	3/31/2011	217	145.21	72	SMVWCD
10N/35W-11J1	3/31/2011	133	64.01	69	SMVWCD
10N/35W-24B1	3/31/2011	145	77.49	68	SMVWCD
10N/36W-02Q7*	11/30/2010	15.2	0.88	14	USGS
11N/34W-27E1	4/20/2011	303	183.48	120	SLODPW
11N/34W-29R2	4/25/2011	170	82.25	88	SLODPW
11N/34W-30Q1	4/1/2011	148	76.02	72	SMVWCD
11N/34W-33J1	4/1/2011	190	91.2	99	SMVWCD
11N/35W-22C2	4/15/2011	241.5	220.55	21	Woodlands
11N/35W-28F2	4/25/2011	80	33.8	46	SLODPW
11N/36W-12C1*	4/15/2011	18.7	10.27	8	SLODPW

**Coastal Well Monitoring Frequency Limited*

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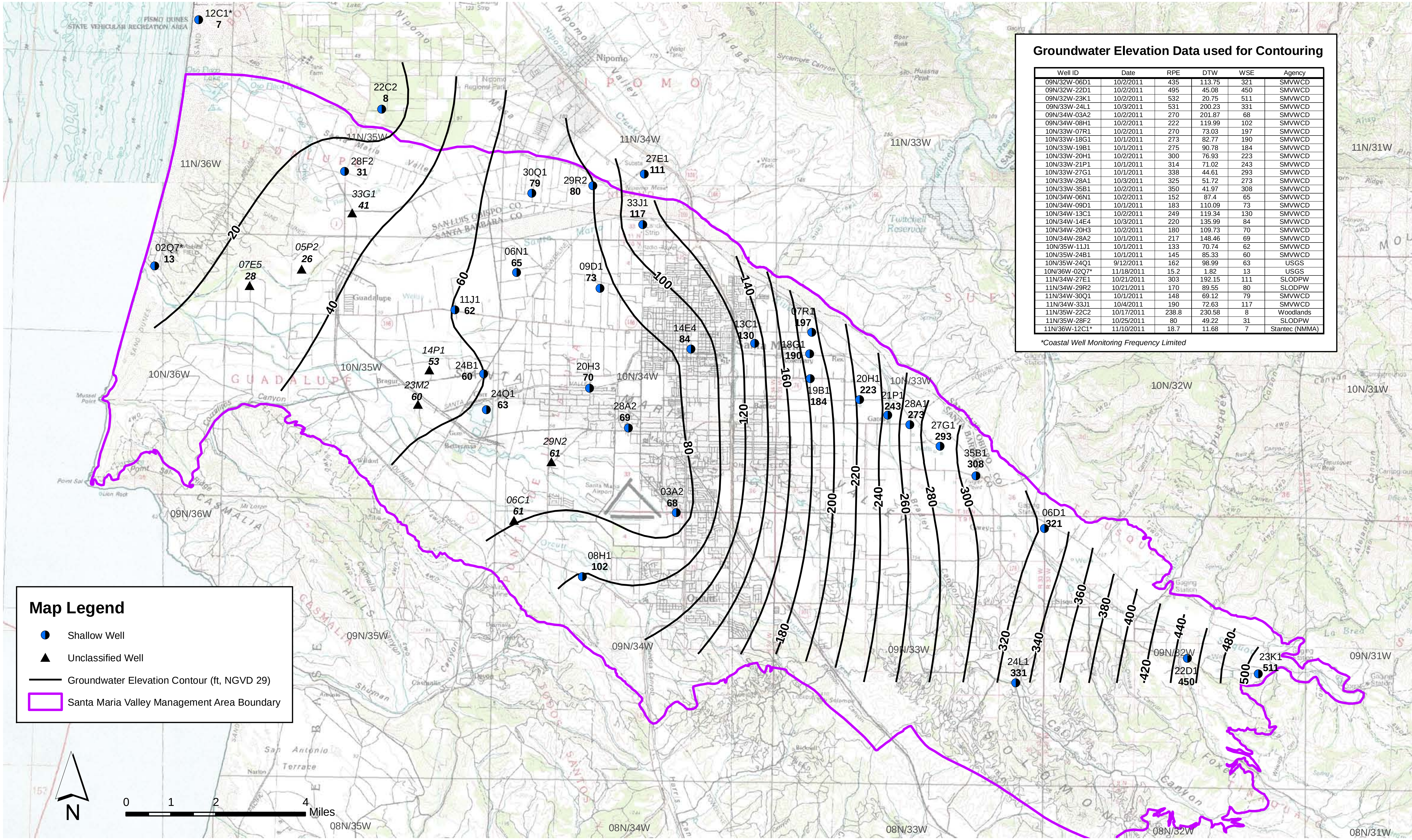
Figure 2.1-3b
Contours of Equal Groundwater Elevation, Shallow Zone, Late Spring (March 31 - April 25) 2011
Santa Maria Valley Management Area



Groundwater Elevation Data used for Contouring

Well ID	Date	RPE	DTW	WSE	Agency
09N/32W-06D1	10/2/2011	435	113.75	321	SMVWCD
09N/32W-22D1	10/2/2011	495	45.08	450	SMVWCD
09N/32W-23K1	10/2/2011	532	20.75	511	SMVWCD
09N/33W-24L1	10/3/2011	531	200.23	331	SMVWCD
09N/34W-03A2	10/2/2011	270	201.87	68	SMVWCD
09N/34W-08H1	10/2/2011	222	119.99	102	SMVWCD
10N/33W-07R1	10/2/2011	270	73.03	197	SMVWCD
10N/33W-18G1	10/1/2011	273	82.77	190	SMVWCD
10N/33W-19B1	10/1/2011	275	90.78	184	SMVWCD
10N/33W-20H1	10/2/2011	300	76.93	223	SMVWCD
10N/33W-21P1	10/1/2011	314	71.02	243	SMVWCD
10N/33W-27G1	10/1/2011	338	44.61	293	SMVWCD
10N/33W-28A1	10/3/2011	325	51.72	273	SMVWCD
10N/33W-35B1	10/2/2011	350	41.97	308	SMVWCD
10N/34W-06N1	10/2/2011	152	87.4	65	SMVWCD
10N/34W-09D1	10/1/2011	183	110.09	73	SMVWCD
10N/34W-13C1	10/2/2011	249	119.34	130	SMVWCD
10N/34W-14E4	10/3/2011	220	135.99	84	SMVWCD
10N/34W-20H3	10/2/2011	180	109.73	70	SMVWCD
10N/34W-28A2	10/1/2011	217	148.46	69	SMVWCD
10N/35W-11J1	10/1/2011	133	70.74	62	SMVWCD
10N/35W-24B1	10/1/2011	145	85.33	60	SMVWCD
10N/35W-24Q1	9/12/2011	162	98.99	63	USGS
10N/36W-02Q7*	11/18/2011	15.2	1.82	13	USGS
11N/34W-27E1	10/21/2011	303	192.15	111	SLODPW
11N/34W-29R2	10/21/2011	170	89.55	80	SLODPW
11N/34W-30Q1	10/1/2011	148	69.12	79	SMVWCD
11N/34W-33J1	10/4/2011	190	72.63	117	SMVWCD
11N/35W-22C2	10/17/2011	238.8	230.58	8	Woodlands
11N/35W-28F2	10/25/2011	80	49.22	31	SLODPW
11N/36W-12C1*	11/10/2011	18.7	11.68	7	Stantec (NMMA)

*Coastal Well Monitoring Frequency Limited

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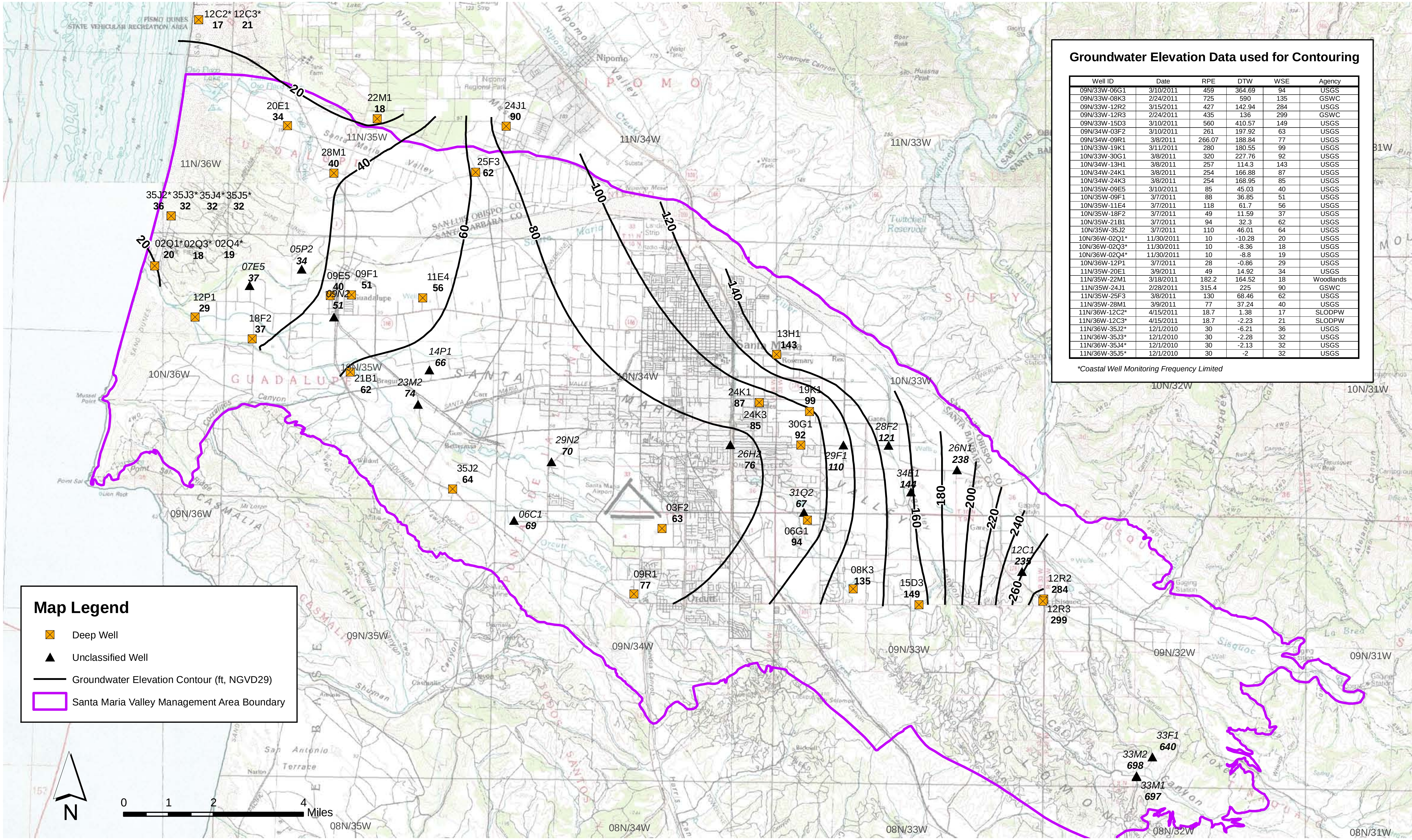
Figure 2.1-3c

Contours of Equal Groundwater Elevation, Shallow Zone, Fall (September 12 - October 25) 2011

Santa Maria Valley Management Area



Groundwater Elevation Data used for Contouring

Well ID	Date	RPE	DTW	WSE	Agency
09N/33W-06G1	3/10/2011	459	364.69	94	USGS
09N/33W-08K3	2/24/2011	725	590	135	GSWC
09N/33W-12R2	3/15/2011	427	142.94	284	USGS
09N/33W-12R3	2/24/2011	435	136	299	GSWC
09N/33W-15D3	3/10/2011	560	410.57	149	USGS
09N/34W-03F2	3/10/2011	261	197.92	63	USGS
09N/34W-09R1	3/8/2011	266.07	188.84	77	USGS
10N/33W-19K1	3/11/2011	280	180.55	99	USGS
10N/33W-30G1	3/8/2011	320	227.76	92	USGS
10N/34W-13H1	3/8/2011	257	114.3	143	USGS
10N/34W-24K1	3/8/2011	254	166.88	87	USGS
10N/34W-24K3	3/8/2011	254	168.95	85	USGS
10N/35W-09E5	3/10/2011	85	45.03	40	USGS
10N/35W-09F1	3/7/2011	88	36.85	51	USGS
10N/35W-11E4	3/7/2011	118	61.7	56	USGS
10N/35W-18F2	3/7/2011	49	11.59	37	USGS
10N/35W-21B1	3/7/2011	94	32.3	62	USGS
10N/35W-35J2	3/7/2011	110	46.01	64	USGS
10N/36W-02Q1*	11/30/2011	10	-10.28	20	USGS
10N/36W-02Q3*	11/30/2011	10	-8.36	18	USGS
10N/36W-02Q4*	11/30/2011	10	-8.8	19	USGS
10N/36W-12P1	3/7/2011	28	-0.86	29	USGS
11N/35W-20E1	3/9/2011	49	14.92	34	USGS
11N/35W-22M1	3/18/2011	182.2	164.52	18	Woodlands
11N/35W-24J1	2/28/2011	315.4	225	90	GSWC
11N/35W-25F3	3/8/2011	130	68.46	62	USGS
11N/35W-28M1	3/9/2011	77	37.24	40	USGS
11N/36W-12C2*	4/15/2011	18.7	1.38	17	SLODPW
11N/36W-12C3*	4/15/2011	18.7	-2.23	21	SLODPW
11N/36W-35J2*	12/1/2010	30	-6.21	36	USGS
11N/36W-35J3*	12/1/2010	30	-2.28	32	USGS
11N/36W-35J4*	12/1/2010	30	-2.13	32	USGS
11N/36W-35J5*	12/1/2010	30	-2	32	USGS

**Coastal Well Monitoring Frequency Limited*

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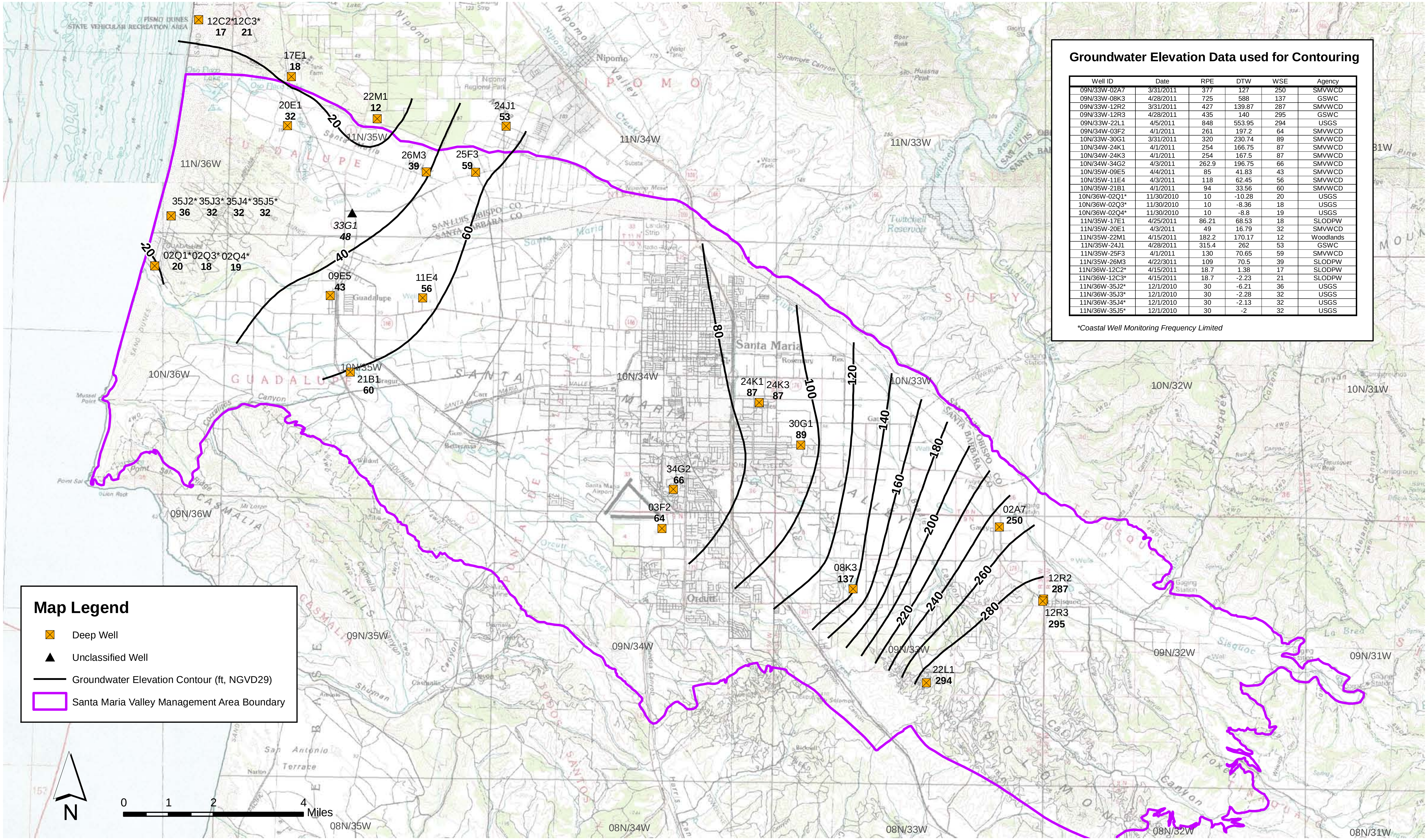
Figure 2.1-3d

Contours of Equal Groundwater Elevation, Deep Zone, Early Spring (February 24 - March 18) 2011

Santa Maria Valley Management Area



Groundwater Elevation Data used for Contouring

Well ID	Date	RPE	DTW	WSE	Agency
09N/33W-02A7	3/31/2011	377	127	250	SMVWCD
09N/33W-08K3	4/28/2011	725	588	137	GSWC
09N/33W-12R2	3/31/2011	427	139.87	287	SMVWCD
09N/33W-12R3	4/28/2011	435	140	295	GSWC
09N/33W-22L1	4/5/2011	848	553.95	294	USGS
09N/34W-03F2	4/1/2011	261	197.2	64	SMVWCD
10N/33W-30G1	3/31/2011	320	230.74	89	SMVWCD
10N/34W-24K1	4/1/2011	254	166.75	87	SMVWCD
10N/34W-24K3	4/1/2011	254	167.5	87	SMVWCD
10N/34W-34G2	4/3/2011	262.9	196.75	66	SMVWCD
10N/35W-09E5	4/4/2011	85	41.83	43	SMVWCD
10N/35W-11E4	4/3/2011	118	62.45	56	SMVWCD
10N/35W-21B1	4/1/2011	94	33.56	60	SMVWCD
10N/36W-02Q1*	11/30/2010	10	-10.28	20	USGS
10N/36W-02Q3*	11/30/2010	10	-8.36	18	USGS
10N/36W-02Q4*	11/30/2010	10	-8.8	19	USGS
11N/35W-17E1	4/25/2011	86.21	68.53	18	SLODPW
11N/35W-20E1	4/3/2011	49	16.79	32	SMVWCD
11N/35W-22M1	4/15/2011	182.2	170.17	12	Woodlands
11N/35W-24J1	4/28/2011	315.4	262	53	GSWC
11N/35W-25F3	4/1/2011	130	70.65	59	SMVWCD
11N/35W-26M3	4/22/3011	109	70.5	39	SLODPW
11N/36W-12C2*	4/15/2011	18.7	1.38	17	SLODPW
11N/36W-12C3*	4/15/2011	18.7	-2.23	21	SLODPW
11N/36W-35J2*	12/1/2010	30	-6.21	36	USGS
11N/36W-35J3*	12/1/2010	30	-2.28	32	USGS
11N/36W-35J4*	12/1/2010	30	-2.13	32	USGS
11N/36W-35J5*	12/1/2010	30	-2	32	USGS

*Coastal Well Monitoring Frequency Limited

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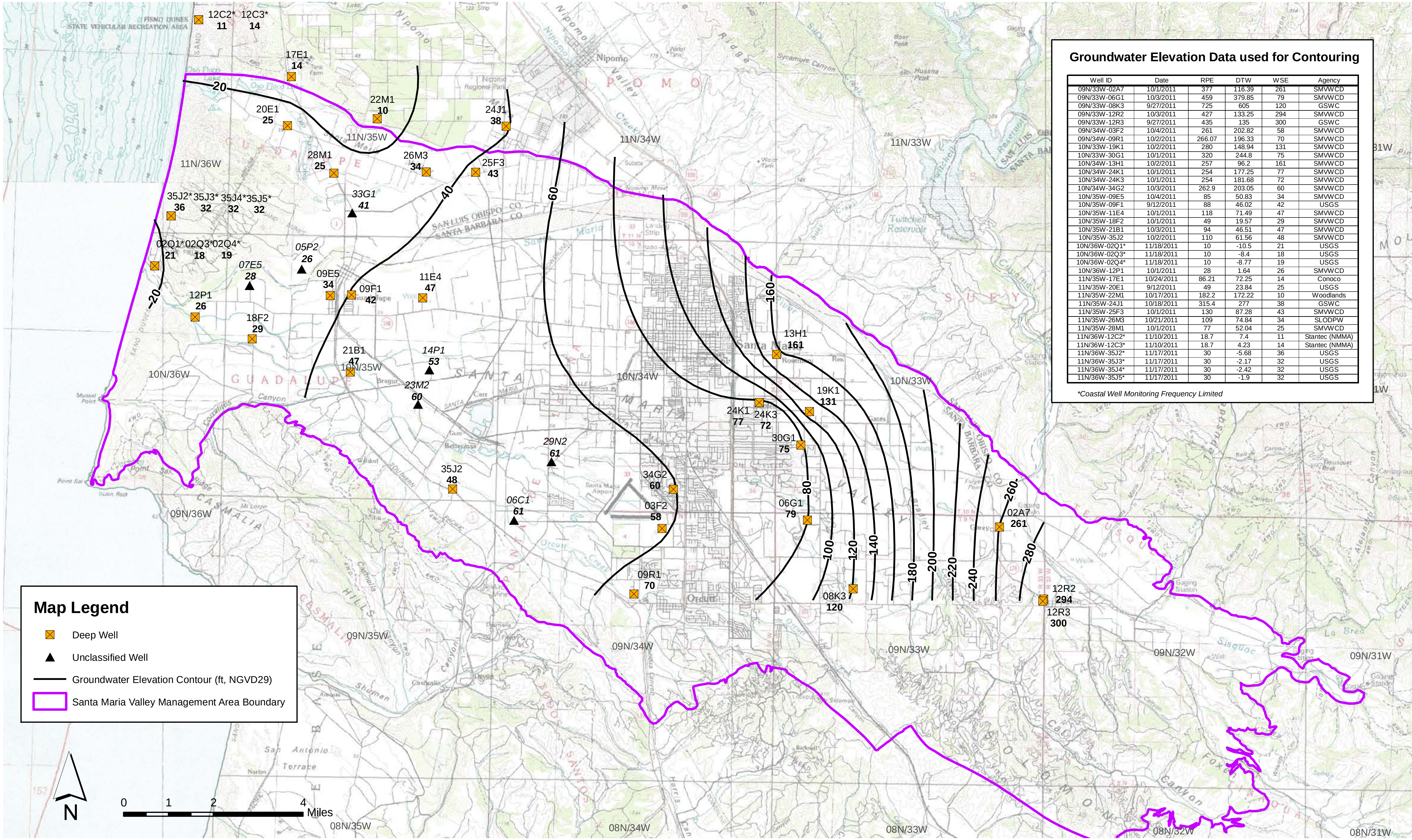
Figure 2.1-3e
Contours of Equal Groundwater Elevation, Deep Zone, Late Spring (March 31 - April 28) 2011
Santa Maria Valley Management Area



Groundwater Elevation Data used for Contouring

Well ID	Date	RPE	DTW	WSE	Agency
09N/33W-02A7	10/1/2011	377	116.39	261	SMVWCD
09N/33W-06G1	10/3/2011	459	379.85	79	SMVWCD
09N/33W-08K3	9/27/2011	725	605	120	GSWC
09N/33W-12R2	10/3/2011	427	133.25	294	SMVWCD
09N/33W-12R3	9/27/2011	435	135	300	GSWC
09N/34W-03F2	10/4/2011	261	202.82	58	SMVWCD
09N/34W-09R1	10/2/2011	266.07	196.33	70	SMVWCD
10N/33W-19K1	10/2/2011	280	148.94	131	SMVWCD
10N/33W-30G1	10/1/2011	320	244.8	75	SMVWCD
10N/34W-13H1	10/2/2011	257	96.2	161	SMVWCD
10N/34W-24K1	10/1/2011	254	177.25	77	SMVWCD
10N/34W-24K3	10/1/2011	254	181.68	72	SMVWCD
10N/34W-34G2	10/3/2011	262.9	203.05	60	SMVWCD
10N/35W-09E5	10/4/2011	85	50.83	34	SMVWCD
10N/35W-09F1	9/12/2011	88	46.02	42	USGS
10N/35W-11E4	10/1/2011	118	71.49	47	SMVWCD
10N/35W-18F2	10/1/2011	49	19.57	29	SMVWCD
10N/35W-21B1	10/3/2011	94	46.51	47	SMVWCD
10N/35W-35J2	10/2/2011	110	61.56	48	SMVWCD
10N/36W-02Q1*	11/18/2011	10	-10.5	21	USGS
10N/36W-02Q3*	11/18/2011	10	-8.4	18	USGS
10N/36W-02Q4*	11/18/2011	10	-8.77	19	USGS
10N/36W-12P1	10/1/2011	28	1.64	26	SMVWCD
11N/35W-17E1	10/24/2011	86.21	72.25	14	Conoco
11N/35W-20E1	9/12/2011	49	23.84	25	USGS
11N/35W-22M1	10/17/2011	182.2	172.22	10	Woodlands
11N/35W-24J1	10/18/2011	315.4	277	38	GSWC
11N/35W-25F3	10/1/2011	130	87.28	43	SMVWCD
11N/35W-26M3	10/21/2011	109	74.84	34	SLODPW
11N/35W-28M1	10/1/2011	77	52.04	25	SMVWCD
11N/36W-12C2*	11/10/2011	18.7	7.4	11	Stantec (NMMA)
11N/36W-12C3*	11/10/2011	18.7	4.23	14	Stantec (NMMA)
11N/36W-35J2*	11/17/2011	30	-5.68	36	USGS
11N/36W-35J3*	11/17/2011	30	-2.17	32	USGS
11N/36W-35J4*	11/17/2011	30	-2.42	32	USGS
11N/36W-35J5*	11/17/2011	30	-1.9	32	USGS

*Coastal Well Monitoring Frequency Limited

Map Legend

- Deep Well
- Unclassified Well
- Groundwater Elevation Contour (ft, NGVD29)
- Santa Maria Valley Management Area Boundary

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Figure 2.1-3f

Contours of Equal Groundwater Elevation, Deep Zone, Fall (September 12 - October 24) 2011

Santa Maria Valley Management Area

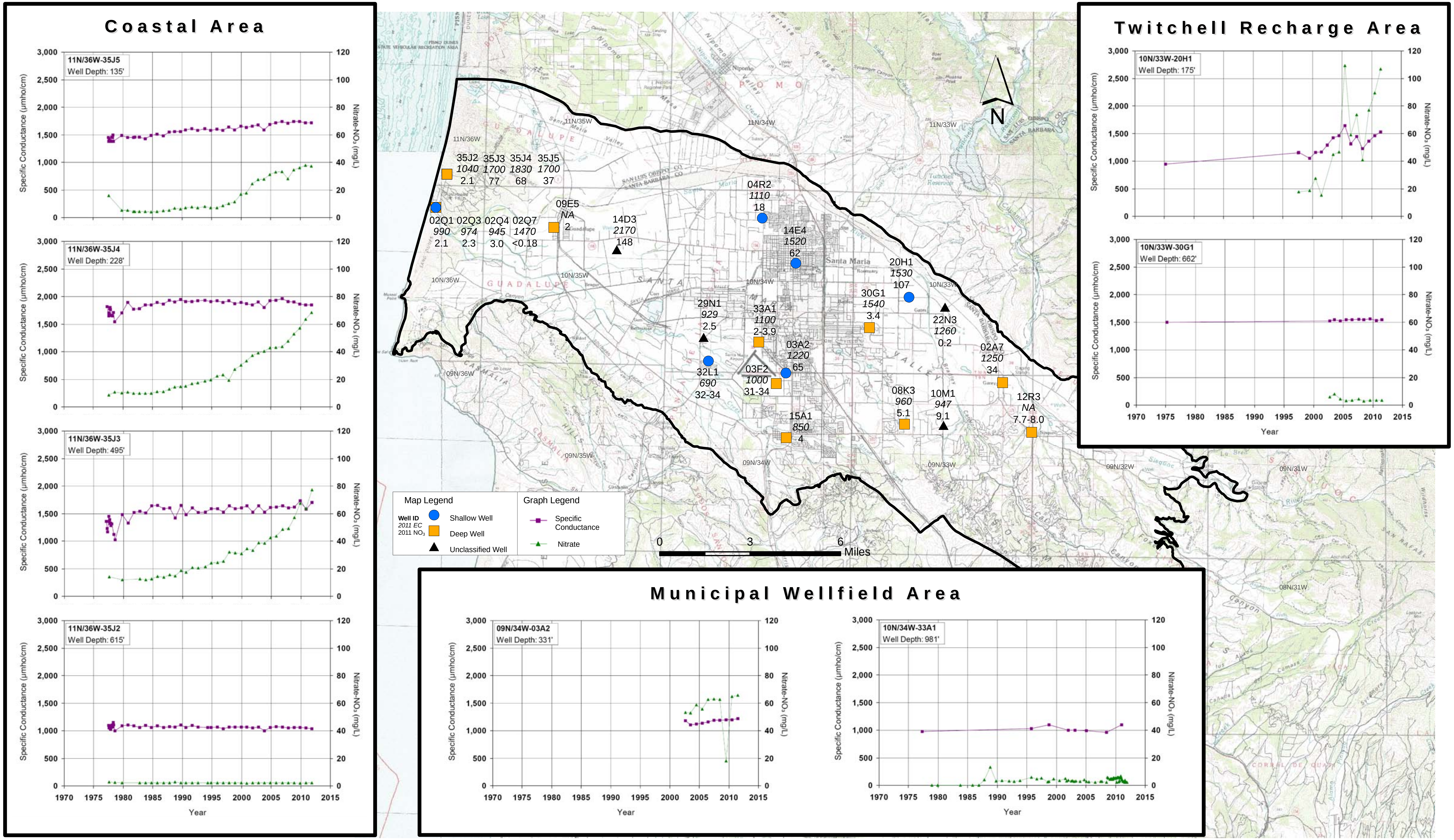

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Figure 2.1-4
Historical Groundwater Quality
Santa Maria Valley Management Area

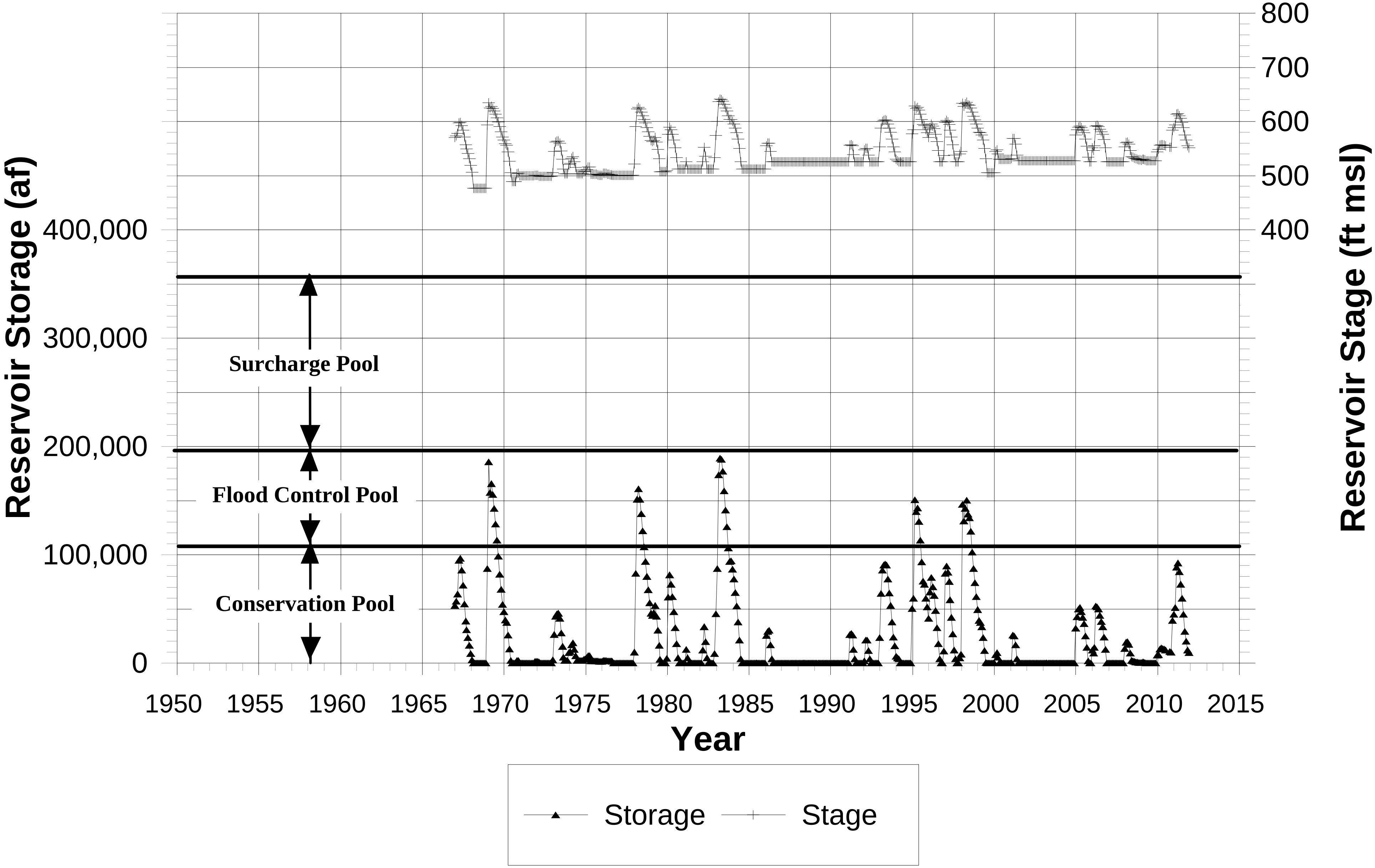

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Figure 2.2-1a
Historical Stage and Storage, Twitchell Reservoir
Santa Maria Valley Management Area

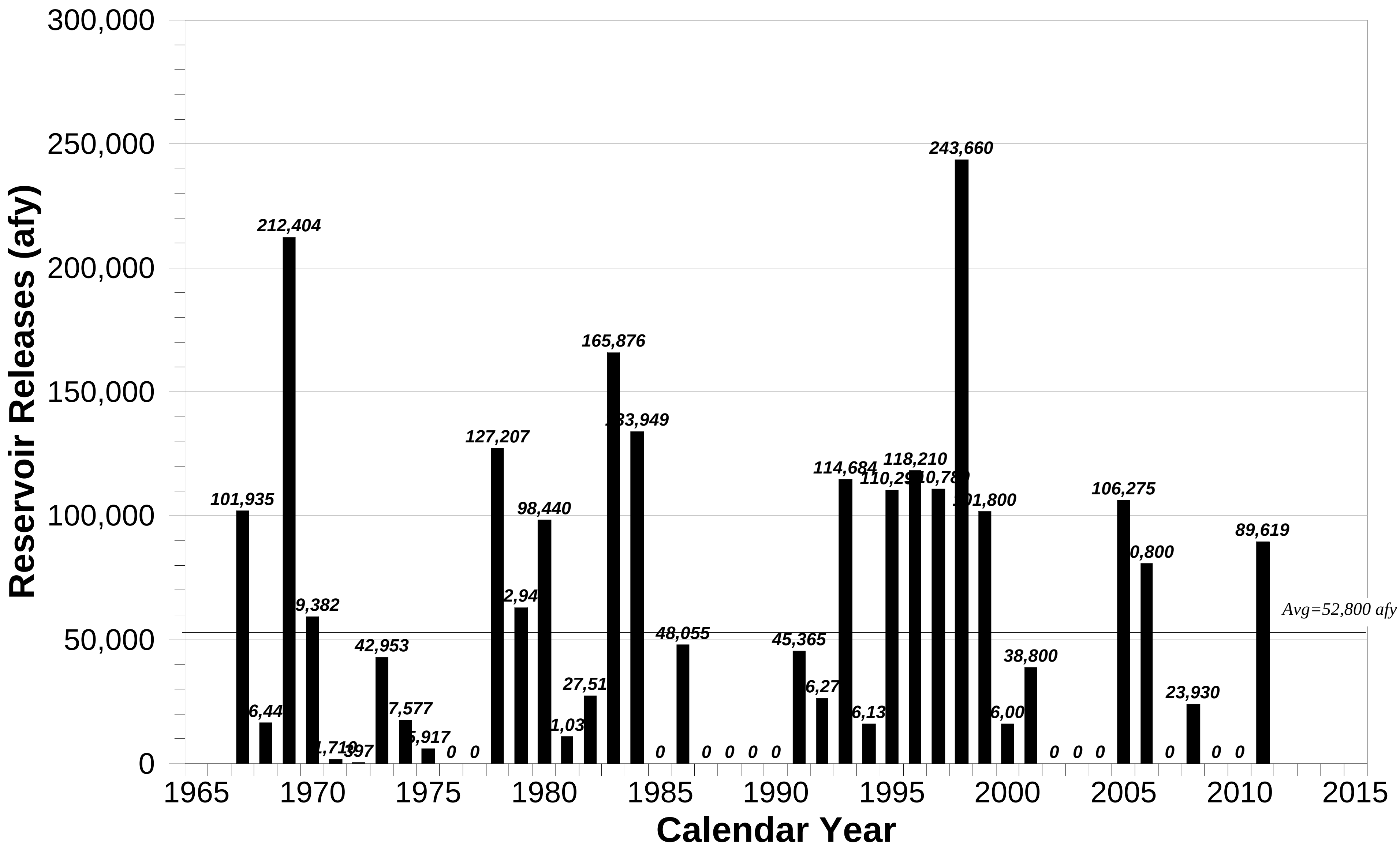

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Figure 2.2-1b
Historical Releases, Twitchell Reservoir
Santa Maria Valley Management Area

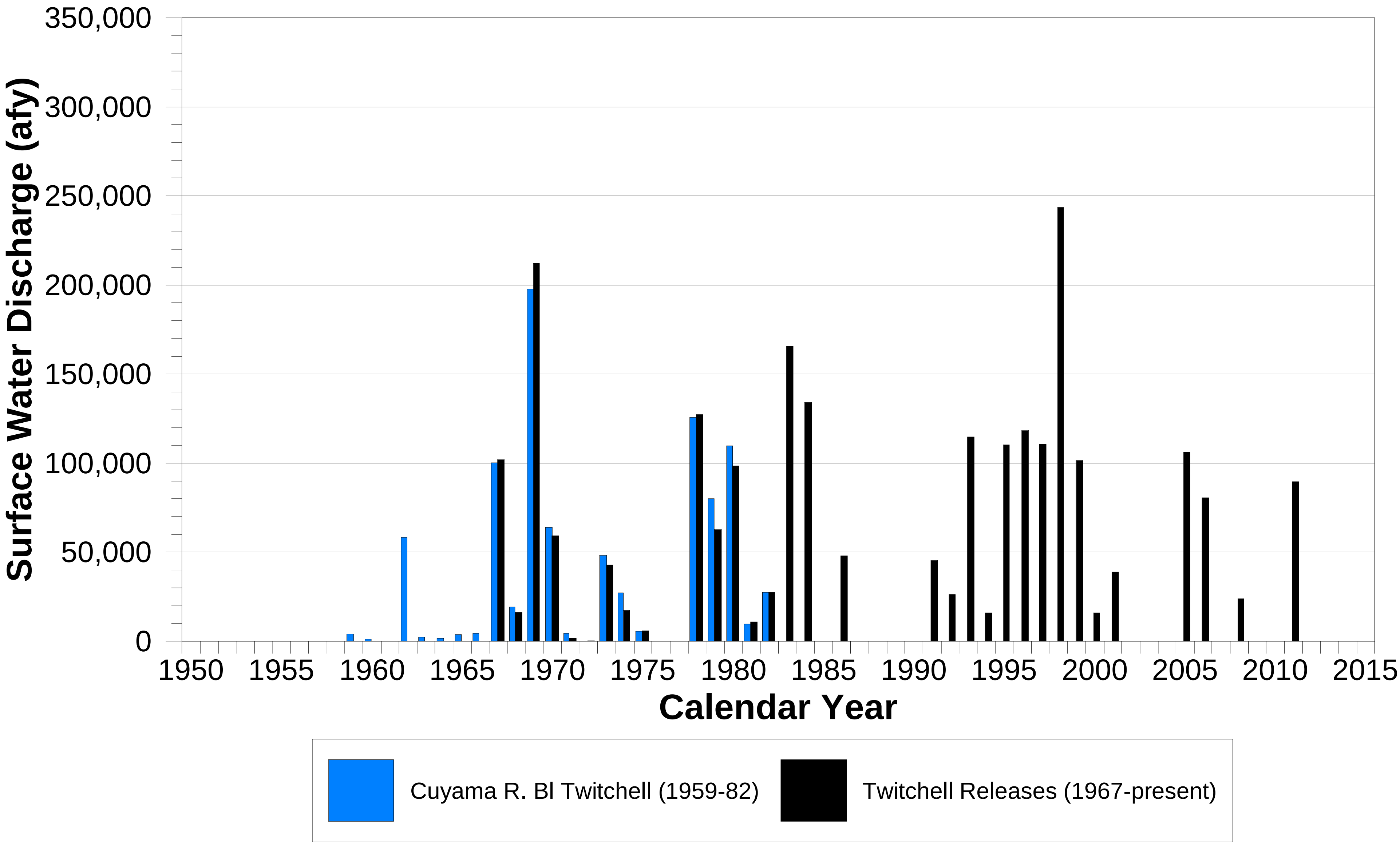

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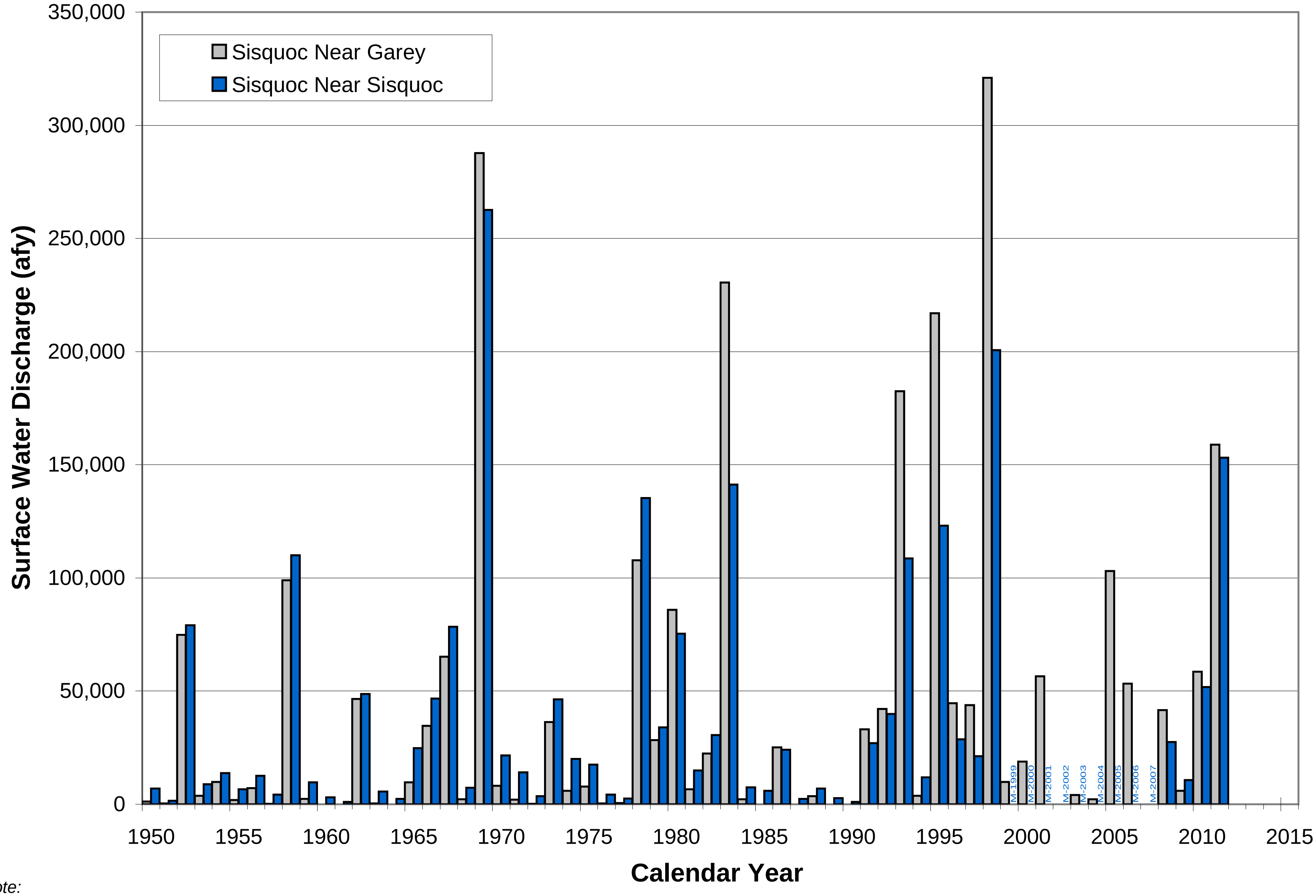
Figure 2.3-1a
Historical Discharge, Cuyama River, and Twitchell Reservoir Releases
Santa Maria Valley Management Area



Note:
The annual total discharge is comprised of daily data for the respective 'Near Sisquoc' and 'Near Garey' Gauges; these daily data have been approved by the USGS through Sep 2010 and remain in provisional status Oct 2010 through Dec 2011.
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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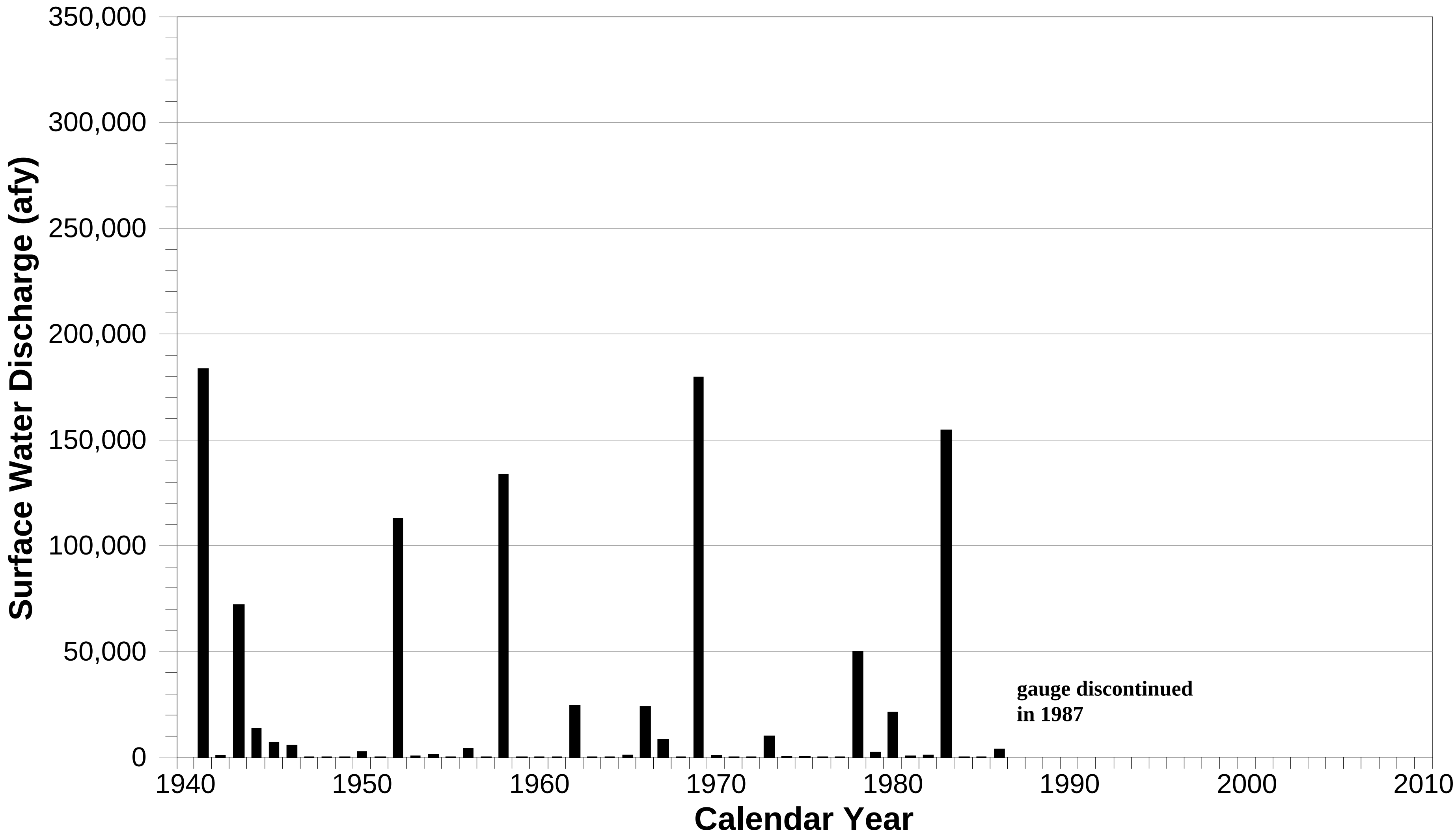
Figure 2.3-1b
Historical Stream Discharge, Sisquoc River
Santa Maria Valley Management Area



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

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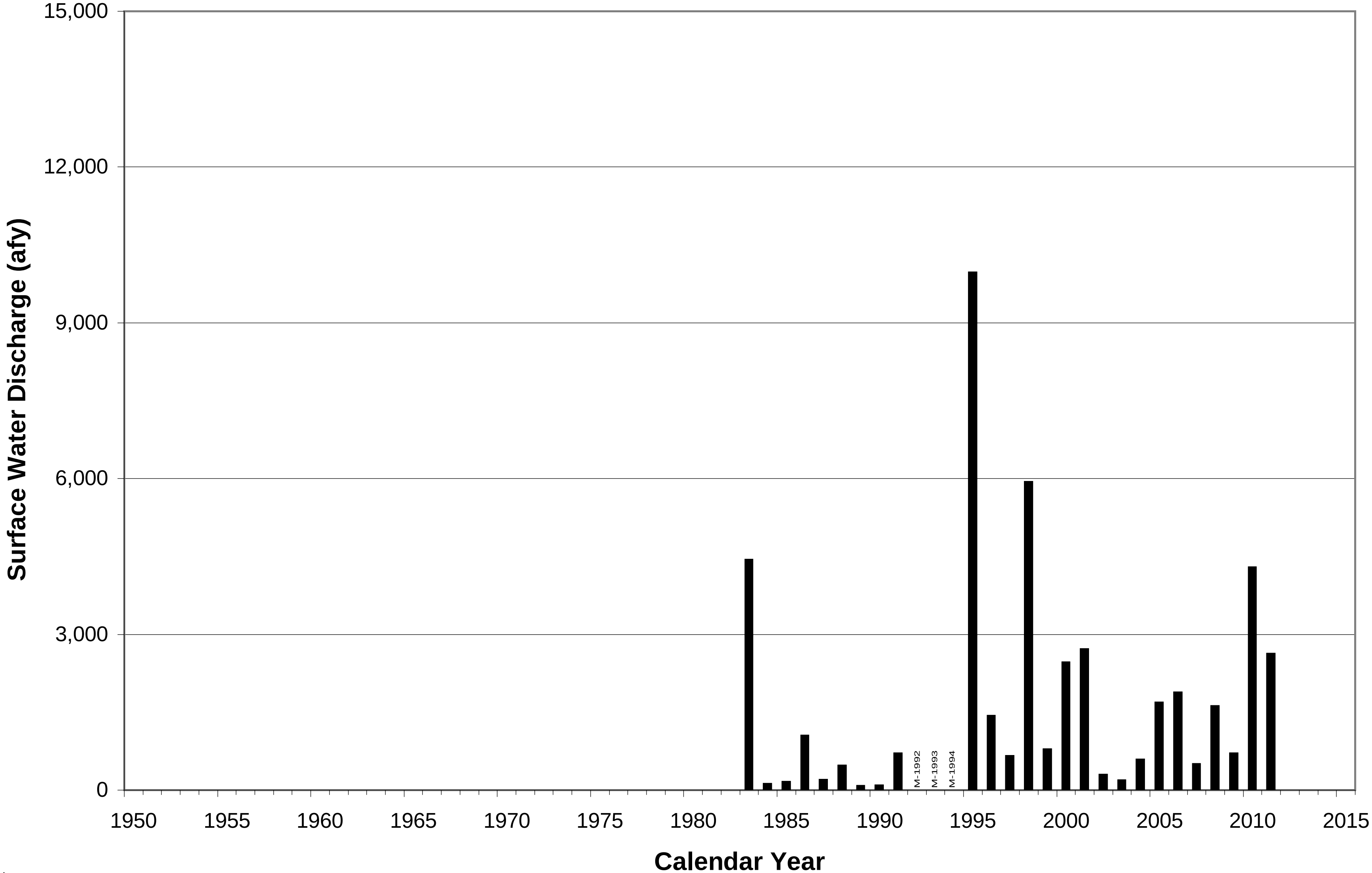
Figure 2.3-1c
Historical Surface Water Discharge, Santa Maria River at Guadalupe
Santa Maria Valley Management Area



Note:
The annual total discharge is comprised of daily data; these daily data have been approved by the USGS through Sep 2010 and remain in provisional status Oct 2010 through Dec 2011.
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

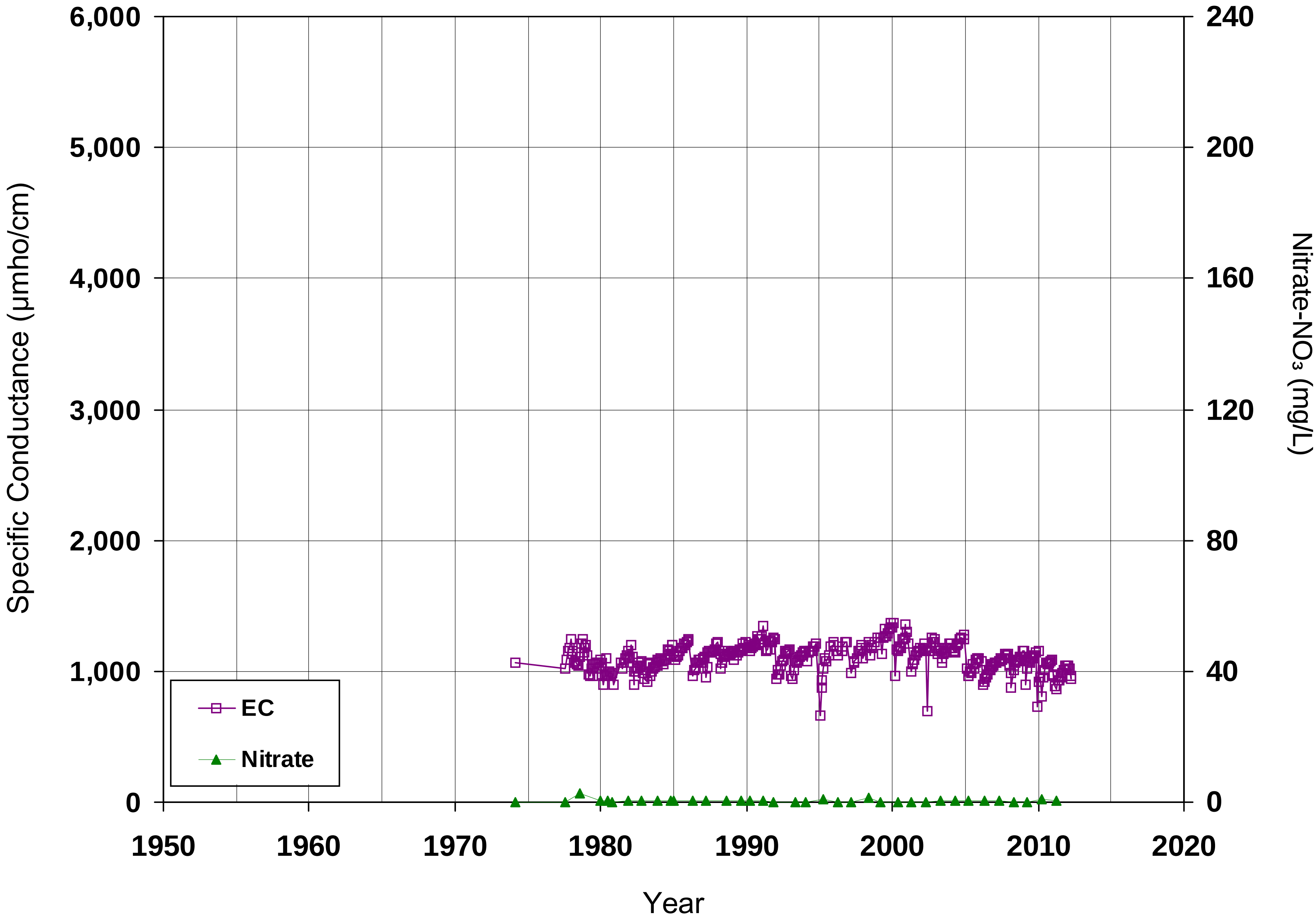

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Figure 2.3-2a
Historical Surface Water Quality, Sisquoc River
Santa Maria Valley Management Area

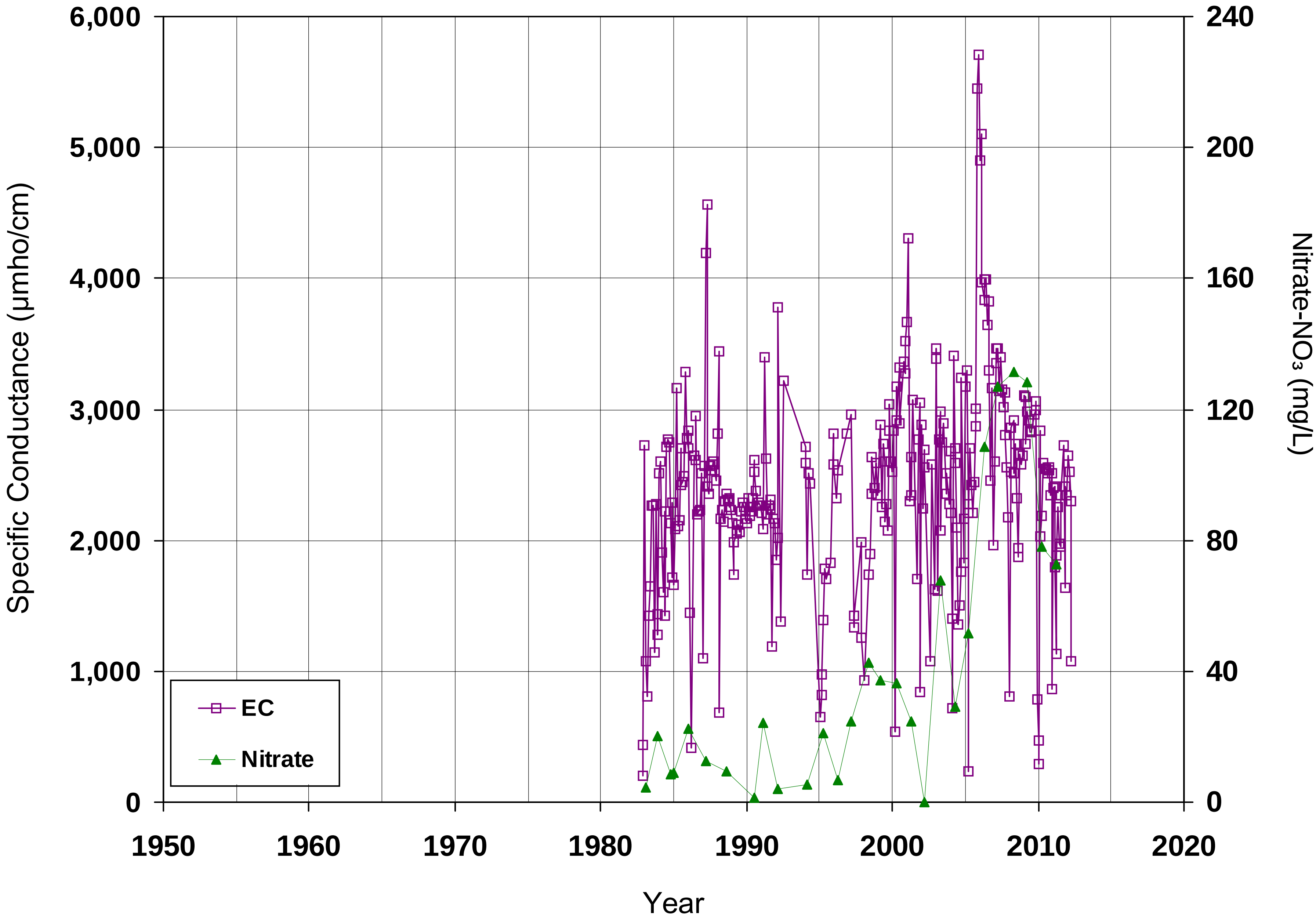

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Figure 2.3-2b
Historical Surface Water Quality, Orcutt Creek
Santa Maria Valley Management Area

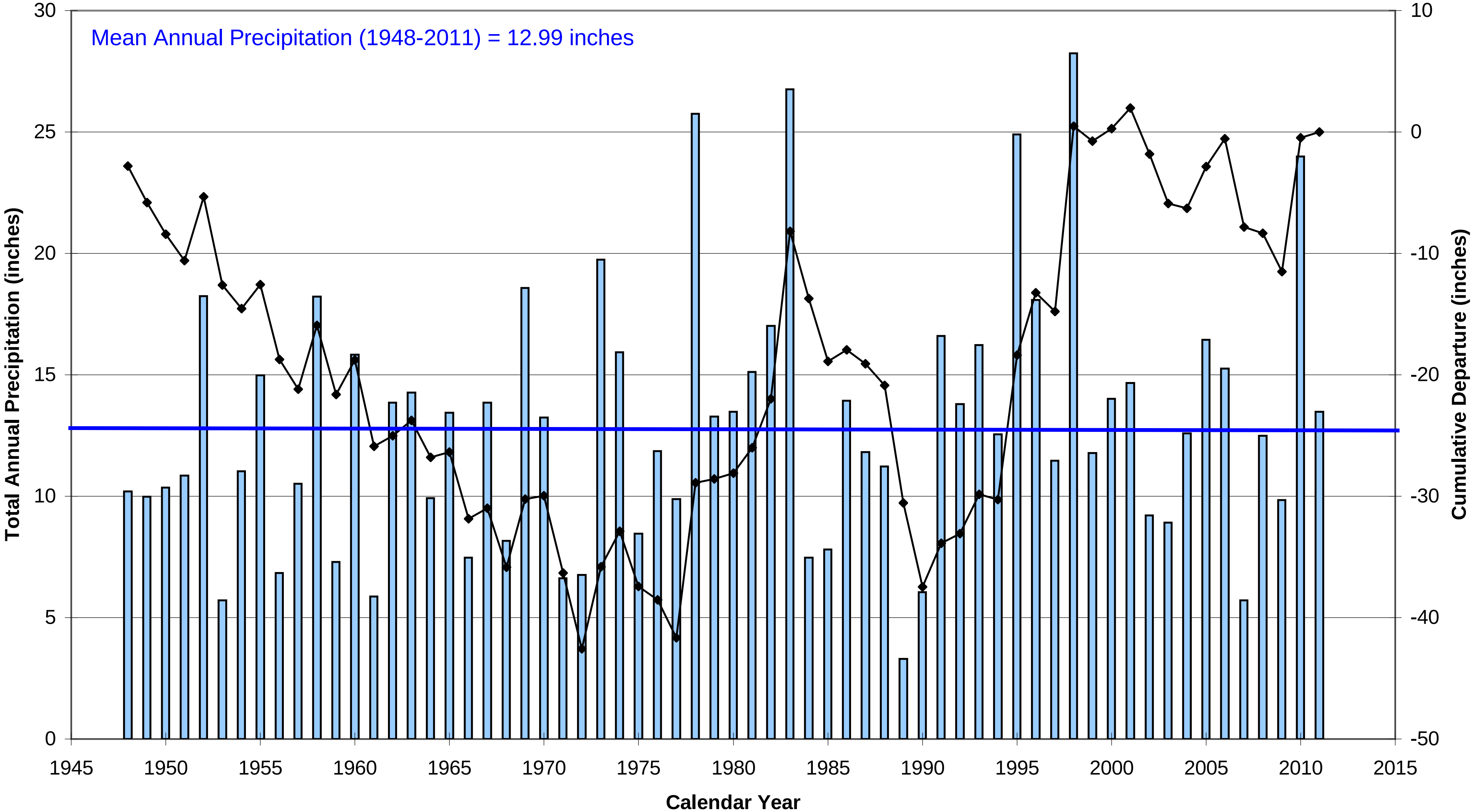

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Figure 2.4-1
Historical Precipitation, Santa Maria Airport
Santa Maria Valley Management Area

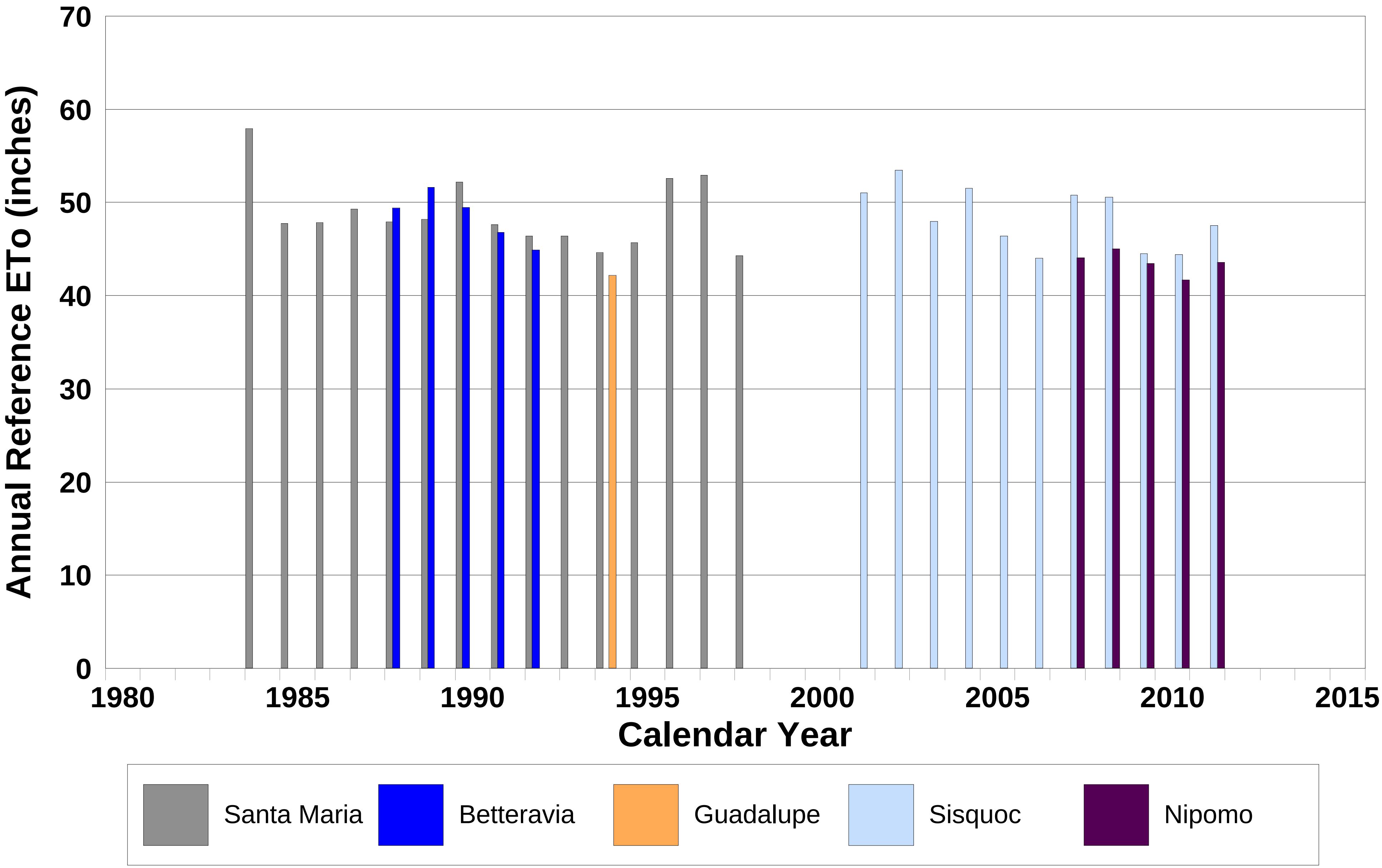

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Figure 2.4-2
Historical Reference Evapotranspiration, CIMIS Stations
Santa Maria Valley Management Area

Table 2.4-1
Precipitation Data, 2011, 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	T	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2	0.72	0.00	0.05	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.04	0.02	0.00
4	0.00	0.00	0.00	0.00	0.00	0.05	0.00	0.00	0.00	0.06	0.05	0.00
5	0.00	0.00	0.00	0.00	0.00	0.15	0.00	0.00	0.00	0.64	0.00	0.00
6	0.00	0.00	0.05	0.00	0.00	0.38	0.00	0.00	0.00	0.01	0.16	0.00
7	0.00	0.00	0.05	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
8	0.00	0.00	0.00	0.01	T	0.00	0.00	0.00	0.00	0.00	0.00	0.00
9	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.09	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	0.43	0.00
12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.14
13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	T
14	0.00	T	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00
15	0.00	0.00	0.00	0.00	0.09	0.00	0.00	0.00	0.00	0.00	0.00	0.02
16	0.00	0.31	0.00	0.00	0.07	0.00	0.00	0.00	0.00	0.00	0.00	0.00
17	0.00	T	0.00	0.00	0.12	0.00	0.00	0.00	0.00	0.00	0.00	0.00
18	0.00	1.77	0.21	0.00	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00
19	0.00	0.42	0.80	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
20	0.00	0.03	3.46	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.83	0.00
21	0.00	0.00	0.05	0.06	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
22	0.00	0.00	T	T	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
23	0.00	0.00	0.49	0.00	0.00	T	0.00	0.00	0.00	0.00	0.00	0.00
24	0.00	0.00	0.32	0.06	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
25	0.00	0.45	0.06	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
26	0.00	0.02	0.22	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
27	0.00	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	0.00	0.00	0.05	0.00	0.00	0.00	0.00	0.00	0.00	0.00
29	0.10		0.00	0.00	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00
30	0.26		0.00	0.00	0.00	0.00	T	0.00	0.00	0.00	0.00	0.00
31	0.00		0.00		0.00		0.00	0.00		0.00		0.00
Total	**1.08**	**3.00**	**5.77**	**0.15**	**0.38**	**0.59**	**0.00**	**0.00**	**0.09**	**0.75**	**1.50**	**0.16**

T = Trace amount

Total Precipitation (in) 13.47

Table 2.4-2
Reference Evapotranspiration and Precipitation Data, 2011
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	0.10		0.09	0.09		0.09	0.20	0.17	0.17	0.22	0.23	0.22	0.20	0.20	0.20
2	0.03		0.02	0.09		0.09	0.04		0.03	0.01	0.01	0.02	0.24	0.23	0.21	0.21	0.21	0.21
3	0.03		0.05	0.09		0.09	0.09		0.10	0.11	0.11	0.13	0.21	0.19	0.20	0.18	0.16	0.15
4	0.06		0.05	0.09		0.08	0.12		0.12	0.18	0.16	0.17	0.24	0.24	0.24	0.06	0.05	0.03
5	0.05		0.06	0.13		0.12	0.13		0.11	0.17	0.15	0.16	0.23	0.22	0.21	0.07	0.10	0.07
6	0.06		0.06	0.12		0.12	0.04		0.03	0.15	0.15	0.15	0.20	0.09	0.16	0.20	0.18	0.18
7	0.05		0.07	0.12		0.10	0.12		0.11	0.07	0.08	0.10	0.15	0.15	0.15	0.18	0.19	0.20
8	0.05		0.06	0.12		0.12	0.14		0.10	0.06	0.13	0.14	0.13	0.18	0.18	0.14	0.14	0.15
9	0.05		0.07	0.13		0.13	0.14		0.13	0.15	0.15	0.16	0.18	0.17	0.19	0.15	0.16	0.17
10	0.05		0.07	0.12		0.13	0.12		0.11	0.16	0.15	0.16	0.19	0.17	0.17	0.13	0.12	0.13
11	0.03		0.03	0.13		0.12	0.09		0.12	0.14	0.14	0.15	0.17	0.14	0.16	0.17	0.16	0.17
12	0.07		0.07	0.14		0.13	0.11		0.11	0.15	0.15	0.16	0.19	0.18	0.18	0.18	0.13	0.13
13	0.09		0.08	0.10		0.09	0.12		0.11	0.16	0.16	0.17	0.18	0.17	0.17	0.19	0.17	0.15
14	0.09		0.10	0.03		0.02	0.12		0.11	0.19	0.19	0.19	0.12	0.18	0.18	0.20	0.18	0.12
15	0.11		0.11	0.06		0.09	0.14		0.12	0.22	0.22	0.21	0.11	0.16	0.18	0.20	0.18	0.18
16	0.12		0.09	0.05		0.08	0.12		0.11	0.22	0.19	0.20	0.10	0.10	0.11	0.10	0.07	0.05
17	0.14		0.09	0.08		0.07	0.16		0.14	0.18	0.15	0.18	0.06	0.10	0.10	0.18	0.18	0.18
18	0.10		0.10	0.04		0.03	0.11		0.10	0.13	0.12	0.14	0.08	0.17	0.17	0.17	0.15	0.14
19	0.09		0.08	0.03		0.02	0.03		0.03	0.10	0.11	0.10	0.19	0.18	0.18	0.15	0.15	0.14
20	0.09		0.09	0.10		0.09	0.00		0.01	0.13	0.13	0.14	0.19	0.18	0.18	0.22	0.19	0.17
21	0.09		0.09	0.08		0.10	0.06		0.12	0.15	0.13	0.15	0.17	0.18	0.18	0.21	0.18	0.16
22	0.09		0.08	0.10		0.11	0.12		0.13	0.14	0.13	0.15	0.15	0.16	0.16	0.21	0.18	0.16
23	0.11		0.09	0.08		0.10	0.07		0.03	0.16	0.14	0.15	0.20	0.20	0.19	0.20	0.17	0.17
24	0.09		0.11	0.10		0.10	0.10		0.08	0.12	0.11	0.14	0.20	0.19	0.19	0.20	0.16	0.14
25	0.12		0.10	0.01		0.01	0.13		0.13	0.17	0.17	0.19	0.19	0.17	0.17	0.18	0.16	0.16
26	0.13		0.11	0.10		0.10	0.04		0.02	0.21	0.20	0.19	0.22	0.22	0.20	0.19	0.18	0.19
27	0.11		0.10	0.11		0.11	0.13		0.13	0.20	0.20	0.20	0.22	0.22	0.21	0.20	0.18	0.15
28	0.09		0.09	0.11		0.11	0.15		0.14	0.19	0.18	0.19	0.21	0.20	0.20	0.20	0.17	0.14
29	0.05		0.04				0.19		0.15	0.24	0.23	0.20	0.20	0.20	0.20	0.18	0.19	0.17
30	0.03		0.06				0.18		0.19	0.23	0.24	0.23	0.19	0.20	0.19	0.24	0.24	0.23
31	0.09		0.08				0.21		0.20				0.20	0.19	0.20			
Total	**2.41**	**N/A**	**2.33**	**2.56**	**N/A**	**2.55**	**3.41**	**N/A**	**3.21**	**4.69**	**4.55**	**4.79**	**5.53**	**5.56**	**5.63**	**5.29**	**4.88**	**4.59**

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	0.24	0.21	0.21	0.22	0.21	0.20	0.16	0.12	0.11	0.14	0.14	0.13	0.11	0.09	0.10	0.12	0.13	0.13
2	0.24	0.20	0.19	0.21	0.20	0.20	0.16	0.14	0.09	0.14	0.13	0.12	0.12	0.11	0.11	0.09	0.08	0.09
3	0.24	0.21	0.20	0.17	0.15	0.15	0.17	0.14	0.11	0.12	0.13	0.12	0.10	0.11	0.10	0.08	0.07	0.08
4	0.23	0.21	0.20	0.19	0.19	0.19	0.16	0.13	0.14	0.04	0.09	0.10	0.05	0.08	0.08	0.08	0.07	0.07
5	0.22	0.21	0.21	0.16	0.14	0.09	0.15	0.14	0.15	0.08	0.09	0.10	0.08	0.08	0.08	0.07	0.07	0.07
6	0.22	0.20	0.21	0.18	0.15	0.13	0.18	0.16	0.14	0.13	0.12	0.10	0.07	0.09	0.08	0.08	0.07	0.08
7	0.23	0.20	0.20	0.17	0.15	0.13	0.20	0.18	0.17	0.14	0.14	0.13	0.09	0.10	0.09	0.08	0.04	0.07
8	0.22	0.18	0.17	0.18	0.16	0.07	0.17	0.14	0.12	0.14	0.13	0.13	0.10	0.09	0.09	0.07	0.06	0.07
9	0.19	0.14	0.13	0.19	0.17	0.12	0.14	0.13	0.11	0.13	0.13	0.11	0.11	0.09	0.09	0.07	0.07	0.07
10	0.18	0.16	0.16	0.17	0.15	0.11	0.05	0.05	0.04	0.12	0.11	0.11	0.04	0.04	0.05	0.07	0.06	0.07
11	0.19	0.16	0.11	0.15	0.11	0.08	0.11	0.10	0.10	0.15	0.16	0.14	0.07	0.05	0.03	0.04	0.04	0.05
12	0.16	0.13	0.14	0.18	0.14	0.10	0.16	0.15	0.14	0.17	0.23	0.19	0.06	0.06	0.06	0.01	0.02	0.02
13	0.19	0.17	0.12	0.19	0.18	0.15	0.16	0.15	0.10	0.20	0.17	0.16	0.08	0.07	0.08	0.06	0.06	0.06
14	0.19	0.19	0.19	0.20	0.18	0.15	0.13	0.12	0.07	0.15	0.13	0.13	0.03	0.03	0.04	0.06	0.06	0.07
15	0.17	0.15	0.15	0.22	0.20	0.19	0.10	0.11	0.09	0.09	0.09	0.06	0.08	0.08	0.08	0.04	0.04	0.04
16	0.18	0.14	0.14	0.19	0.16	0.11	0.11	0.12	0.11	0.11	0.11	0.11	0.08	0.08	0.09	0.06	0.07	0.07
17	0.20	0.18	0.18	0.18	0.16	0.17	0.13	0.14	0.13	0.12	0.10	0.09	0.08	0.08	0.08	0.05	0.07	0.07
18	0.21	0.20	0.20	0.17	0.16	0.16	0.17	0.16	0.13	0.09	0.06	0.10	0.05	0.06	0.06	0.06	0.06	0.06
19	0.21	0.18	0.17	0.14	0.15	0.14	0.16	0.15	0.12	0.09	0.11	0.11	0.07	0.07	0.07	0.03	0.05	0.05
20	0.21	0.19	0.15	0.14	0.14	0.13	0.14	0.12	0.08	0.10	0.10	0.06	0.01	0.03	0.02	0.02	0.06	0.07
21	0.17	0.15	0.09	0.18	0.15	0.15	0.13	0.11	0.12	0.09	0.08	0.09	0.07	0.06	0.07	0.06	0.06	0.06
22	0.18	0.15	0.14	0.16	0.13	0.13	0.14	0.13	0.13	0.13	0.12	0.11	0.07	0.06	0.07	0.07	0.06	0.07
23	0.17	0.14	0.12	0.19	0.18	0.15	0.09	0.11	0.13	0.15	0.12	0.10	0.06	0.06	0.06	0.07	0.07	0.07
24	0.19	0.15	0.15	0.18	0.18	0.14	0.09	0.08	0.11	0.07	0.05	0.04	0.05	0.05	0.06	0.09	0.07	0.08
25	0.19	0.15	0.16	0.18	0.16	0.16	0.10	0.13	0.13	0.02	0.03	0.04	0.09	0.09	0.09	0.09	0.07	0.07
26	0.21	0.18	0.17	0.12	0.12	0.16	0.15	0.15	0.13	0.10	0.10	0.10	0.09	0.08	0.09	0.07	0.06	0.07
27	0.19	0.19	0.16	0.17	0.15	0.14	0.16	0.15	0.13	0.14	0.12	0.12	0.10	0.08	0.08	0.06	0.06	0.07
28	0.20	0.18	0.15	0.17	0.14	0.16	0.15	0.12	0.09	0.14	0.12	0.12	0.07	0.06	0.07	0.08	0.08	0.10
29	0.18	0.15	0.09	0.17	0.15	0.17	0.10	0.10	0.08	0.13	0.13	0.15	0.06	0.06	0.07	0.09	0.09	0.08
30	0.16	0.13	0.10	0.16	0.13	0.13	0.13	0.12	0.11	0.12	0.11	0.12	0.10	0.10	0.09	0.06	0.06	0.06
31	0.15	0.14	0.13	0.16	0.14	0.12				0.10	0.09	0.08				0.09	0.12	0.11
Total	**6.11**	**5.32**	**4.89**	**5.44**	**4.88**	**4.38**	**4.15**	**3.85**	**3.41**	**3.64**	**3.54**	**3.37**	**2.24**	**2.19**	**2.23**	**2.07**	**2.05**	**2.20**

Total Evapotranspiration (in)	**Sisquoc**	**47.54**
SMVMA CIMIS Stations	**Santa Maria[1]**	**36.82**
	Nipomo	**43.58**

1) Partial year total, Santa Maria II station came on line in April 2011

Table 2.4-2 (cont.)
Reference Evapotranspiration and Precipitation Data, 2011
Santa Maria Valley Management Area CIMIS Stations

Precipitation (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	0.00		0.20	0.00		0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.20	0.28	0.00
2	0.77		0.53	0.00		0.00	0.09		0.13	0.00	0.00	0.03	0.00	0.00	0.00	0.50	0.00	0.04
3	0.02		0.00	0.00		0.00	0.06		0.00	0.00	0.00	0.00	0.00	0.00	0.04	0.00	0.00	0.00
4	0.00		0.00	0.00		0.01	0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.09	0.07	0.15
5	0.00		0.00	0.00		0.00	0.00		0.00	0.00	0.00	0.03	0.00	0.00	0.00	0.01	0.15	0.35
6	0.00		0.00	0.00		0.00	0.11		0.05	0.00	0.00	0.00	0.00	0.00	0.02	0.16	0.30	0.37
7	0.00		0.00	0.00		0.00	0.12		0.03	0.03	0.02	0.02	0.00	0.00	0.04	0.00	0.00	0.00
8	0.00		0.00	0.00		0.00	0.00		0.00	0.12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.04
9	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	0.00
10	0.00		0.00	0.00		0.01	0.00		0.04	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.04
11	0.00		0.00	0.00		0.00	0.00		0.01	0.00	0.00	0.08	0.00	0.00	0.05	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	0.00	0.00	0.00
13	0.00		0.00	0.00		0.00	0.00		0.00	0.00	0.00	0.04	0.00	0.00	0.04	0.00	0.00	0.00
14	0.00		0.00	0.00		0.02	0.00		0.04	0.00	0.00	0.00	0.02	0.00	0.00	0.00	0.00	0.03
15	0.00		0.00	0.02		0.00	0.01		0.00	0.00	0.00	0.05	0.15	0.06	0.17	0.78	0.00	0.00
16	0.00		0.00	0.30		0.26	0.00		0.00	0.00	0.00	0.00	0.04	0.06	0.12	0.06	0.00	0.02
17	0.00		0.00	0.00		0.00	0.00		0.04	0.00	0.00	0.00	0.09	0.10	0.16	0.03	0.00	0.00
18	0.00		0.00	1.62		1.35	0.50		0.16	0.01	0.00	0.00	0.09	0.05	0.05	0.03	0.00	0.03
19	0.00		0.00	0.37		0.56	0.56		0.82	0.00	0.00	0.00	0.00	0.00	0.04	0.19	0.00	0.00
20	0.00		0.00	0.02		0.00	3.80		2.36	0.01	0.00	0.00	0.00	0.00	0.00	0.12	0.00	0.04
21	0.00		0.00	0.00		0.00	0.07		0.06	0.04	0.07	0.15	0.00	0.00	0.03	1.83	0.00	0.00
22	0.00		0.02	0.00		0.05	0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.03
23	0.00		0.00	0.00		0.02	0.27		0.40	0.00	0.00	0.05	0.00	0.00	0.03	0.00	0.00	0.02
24	0.00		0.02	0.00		0.05	0.26		0.35	0.01	0.02	0.02	0.00	0.00	0.00	0.00	0.00	0.01
25	0.00		0.00	0.56		0.56	0.06		0.06	0.00	0.00	0.04	0.00	0.00	0.04	0.00	0.00	0.00
26	0.00		0.00	0.01		0.00	0.08		0.35	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.05
27	0.00		0.02	0.00		0.00	0.00		0.00	0.00	0.00	0.05	0.00	0.00	0.04	0.00	0.00	0.00
28	0.00		0.00	0.00		0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.04	0.06	0.00	0.00	0.02
29	0.03		0.03				0.00		0.00	0.00	0.00	0.00	0.02	0.00	0.04	0.01	0.01	0.04
30	0.25		0.10				0.00		0.02	0.00	0.00	0.00	2.07	0.00	0.00	0.00	0.00	0.04
31	0.00		0.00				0.00		0.00				0.54	0.19	0.05			
Total	**1.07**	**N/A**	**0.92**	**2.90**	**N/A**	**2.89**	**5.99**	**N/A**	**4.92**	**0.22**	**0.11**	**0.58**	**3.02**	**0.50**	**1.03**	**6.01**	**0.81**	**1.32**

Precipitation (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	0.00	0.00	0.02	0.00	0.00	0.04	1.93	0.00	0.00	0.00	0.00	0.05	0.00	0.01	0.00	0.00	0.00	0.01
2	0.00	0.00	0.04	0.00	0.00	0.00	2.00	0.00	0.05	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3	0.00	0.00	0.00	0.00	0.00	0.04	1.10	0.00	0.00	0.00	0.04	0.09	0.08	0.03	0.02	0.00	0.00	0.00
4	0.00	0.00	0.03	0.92	0.00	0.00	0.00	0.00	0.04	0.01	0.05	0.05	0.06	0.04	0.17	0.00	0.00	0.00
5	0.00	0.00	0.01	0.84	0.00	0.02	0.25	0.00	0.00	0.33	0.55	0.63	0.11	0.00	0.00	0.06	0.00	0.00
6	0.00	0.00	0.04	0.17	0.00	0.00	0.15	0.12	0.06	0.06	0.01	0.02	0.09	0.18	0.08	0.00	0.00	0.00
7	0.00	0.00	0.00	0.06	0.00	0.05	0.12	0.00	0.00	0.02	0.00	0.03	0.00	0.00	0.00	0.00	0.00	0.01
8	0.00	0.00	0.04	0.00	0.00	0.00	0.07	0.00	0.05	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
9	0.00	0.00	0.01	0.00	0.00	0.00	0.07	0.00	0.00	0.00	0.00	0.03	0.00	0.00	0.00	0.00	0.00	0.00
10	0.00	0.00	0.05	0.00	0.00	0.03	0.11	0.11	0.10	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00
11	0.00	0.00	0.00	0.00	0.00	0.05	0.13	0.00	0.00	0.00	0.00	0.02	0.04	0.43	0.46	0.00	0.00	0.00
12	0.00	0.00	0.04	0.00	0.00	0.00	0.13	0.40	0.04	0.00	0.00	0.00	0.05	0.03	0.01	0.06	0.18	0.20
13	0.00	0.00	0.00	0.00	0.00	0.04	0.04	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	0.04	0.00	0.00	0.00	0.02	0.00	0.06	0.00	0.00	0.02	0.00	0.00	0.00	0.00	0.00	0.01
15	0.00	0.00	0.00	0.00	0.00	0.04	0.01	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.02	0.02
16	0.00	0.00	0.04	0.00	0.00	0.01	0.01	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	0.02	0.00	0.00	0.04	0.00	0.00	0.04	0.00	0.00	0.00	0.00	0.00	0.00
18	0.24	0.00	0.04	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.01	0.00	0.01	0.00	0.00	0.00	0.00
19	0.09	0.00	0.00	0.00	0.00	0.04	0.02	0.00	0.05	0.00	0.00	0.04	0.00	0.00	0.00	0.00	0.00	0.00
20	0.07	0.00	0.02	0.00	0.00	0.00	0.02	0.01	0.01	0.00	0.00	0.01	0.00	0.61	0.80	0.00	0.00	0.00
21	0.03	0.00	0.00	0.00	0.00	0.04	0.02	0.00	0.04	0.00	0.00	0.03	0.00	0.00	0.00	0.00	0.00	0.00
22	0.02	0.00	0.03	0.00	0.00	0.00	0.05	0.00	0.01	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.01	0.00
23	0.01	0.00	0.00	0.00	0.00	0.05	0.02	0.00	0.03	0.00	0.00	0.02	0.00	0.00	0.00	0.00	0.00	0.00
24	0.00	0.00	0.05	0.00	0.00	0.00	0.02	0.00	0.01	0.01	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00
25	0.00	0.00	0.00	0.00	0.00	0.05	0.01	0.00	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
26	0.00	0.00	0.01	0.00	0.00	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
27	0.00	0.00	0.00	0.00	0.00	0.05	0.00	0.00	0.04	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01
28	0.00	0.00	0.04	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	0.00
29	0.00	0.00	0.00	0.87	0.51	0.02	0.00	0.00	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
30	0.00	0.00	0.01	0.51	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.03	0.00	0.01	0.01	0.00	0.00	0.00
31	0.00	0.00	0.00	0.00	0.00	0.03				0.00	0.01	0.01				0.00	0.00	0.00
Total	**0.46**	**0.00**	**0.56**	**3.37**	**0.51**	**0.63**	**6.32**	**0.64**	**0.69**	**0.43**	**0.66**	**1.17**	**0.45**	**1.35**	**1.57**	**0.12**	**0.22**	**0.26**

Total Precipitation (in)	**Sisquoc[1]**	**30.36**
SMVMA CIMIS Stations	**Santa Maria[2]**	**4.80**
	Nipomo	**16.54**

1) Sisquoc station data from June through December are flagged by Cal. DWR
2) Partial year total, Santa Maria II station came on line in April 2011

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 (evapotranspiration) via spray irrigation for disposal of some treated municipal waste water, injection of brine derived from reverse osmosis treatment, 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 irrigation and discharge of treated municipal waste water. It also includes estimated return flows from landscape irrigation. No data are 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; potential water sales from the City of Santa Maria to the Nipomo Community Services District (Nipomo CSD), and the technical concerns regarding that planned sale initially expressed in the 2008 SMVMA Annual Report, 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 (the one exception to the preceding ranges is wine grapes, where 95% of applied water is estimated to be consumptively used, resulting in return flow of only 5% of applied water).

For the full range of crop categories in the SMVMA, return flow rates in 2011 are estimated to range from less than 0.1 af/ac for Vineyard, to about 0.4 af/ac for the predominant Rotational Vegetables in the Valley, to a maximum of about 0.7 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 just under 18,000 af of applied agricultural irrigation deep percolated to groundwater as return flows in the SMVMA in 2011.

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 the City (see Figure 1.3-1a). 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 WWTP, influent volumes are metered and recorded, and the large majority of treated water (95%) 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 (3%) 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 2011 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. During January through May of 2011, the Guadalupe Plant flow meter was nonoperational, precluding the collection of influent data. Metering of plant influent resumed in June. Since the City of Guadalupe's total water requirements in 2010 and 2011 differed only slightly from 2009 (approx. 5 percent), and for purposes of accounting 2011 return flows from the plant, the metered influent data from January through May 2009 were utilized in this report, along with the metered influent data from June through December 2011 as shown in Table 4.2-1.

In 2011, an estimated 10,820 af of treated municipal waste water were discharged in the SMVMA. About 75 percent (8,100 af) of that total was discharged to the percolation ponds of the City of Santa Maria WWTP. About 2,000 af of treated water were discharged to spray irrigation of permanent pasture of the Laguna Sanitation District WWTP and irrigation of Santa Maria airport lands. Approximately 70 af of brine were discharged by deep well injection and 40 af of treated water were utilized for industrial purposes on an oil lease near Orcutt. Slightly less than 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.

Interpretation of the municipal water supplies and waste water processes in the SMVMA in 2011 suggests that the 65 percent "return flow" fraction for Santa Maria is approximately representative of the relative amount of overall Santa Maria water supply that primarily ends up as effluent discharged to spreading basins for infiltration to the groundwater basin. While the 8,100 af of estimated effluent in Table 4.2.1 is mostly reflective of water that originates as Santa Maria water supply, it is slightly inflated by the net interception of some waste water, by the Santa Maria sewer system, from Orcutt (originally from GSWC water supply). On the other hand, effluent from the Santa Maria WWTP does not account for "return flows" that derive from landscape irrigation with municipal water supply. Deduction of the former and addition of the latter suggest that, depending on how much actually infiltrates from the spreading basins, the net "return flow" to groundwater from the Santa Maria municipal water supply system could be as high as 65 percent of its total water supply. Since the Santa Maria 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 Santa Maria WWTP (Santa Maria and GSWC) and supporting calculations of the different types of return flows (WWTP and landscape irrigation) for 2011 is provided in Table 4.2-2.

Interpretation of the GSWC/Laguna Sanitation District and Guadalupe water supplies and waste water processes in 2011 suggests that the 45 percent return flow fractions in the Stipulation are not representative of relative amounts of those respective water supplies that end up as groundwater recharge which, in turn, would be recoverable by pumping from the basin. In the case of Guadalupe, metered influent to the treatment plant represents approximately 75 percent of its water supply, and estimated effluent is equal to about 68 percent of its water supply. While both fractions exceed the 45 percent return flow fraction in the Stipulation, the disposal method (spray irrigation) is not conducive to groundwater recharge but is, conversely, conducive to consumption of the effluent by evapotranspiration. 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 20 to 22 percent, far less than the stipulated 45 percent.

While the overall sewer and waste water treatment system at the Laguna Sanitation District is more difficult to analyze, the combination of treated volumes and disposal method suggests that far less than the stipulated 45 percent of water supply ends up as groundwater recharge. The metered influent to the Laguna plant represents only about 30 percent of the GSWC water supply to its Orcutt, Lake Marie and Tanglewood systems; estimated effluent represents only about 27 percent of those water supplies. With credit for the net sewer fraction that is intercepted to the Santa Maria plant, those fractions increase to about 37 and 34 percent, respectively. Beyond those low fractions, the spray irrigation disposal method is, as with Guadalupe, not conducive to groundwater recharge. A reasonable estimate of deep percolation to groundwater recharge beneath the Laguna spray field and airport lands would be about 20 percent of the estimated effluent, equivalent to only about 5 percent of the GSWC water supplies. Addition of recharge from waters intercepted to the Santa Maria plant would increase the estimate of return flows to about 7 percent of total GSWC water supplies. Further addition of estimated recharge that derives from landscape irrigation in the GSWC service area would increase the total return flow fraction to about 18 percent. All the preceding fractions are far less than the stipulated 45 percent. The treated volumes and disposal methods for waters supplied do not support the credit for return flows of SWP water designated for GSWC in the Stipulation.

As long as the existing waste water treatment and disposal processes remain in place at the Laguna Sanitation District and City of Guadalupe WWTPs, there is no technical support for the 45 percent fractions that were included in the Stipulation for GSWC (in the case of Laguna Sanitation District) and Guadalupe 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.

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 2011 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 66, 18, and 20 percent, respectively since 1997. A detailed analysis of influent amounts, accounting for intercepted waste streams from the GSWC systems to the Santa Maria WWTP and from the City of Santa Maria area to the Laguna Sanitation District WWTP, and disposition of effluent for the three WWTPs since 1997 is included in Appendix D.

4.3 Exported Water

No water was exported from the SMVMA in 2011. However, planning continued in 2011 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 provides for the sale of up to 3,000 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 now completed on that potential sale include certification of environmental documentation and completion of a Wholesale Water Supply Agreement (successor to the MOU) between the City of Santa Maria and the Nipomo CSD.

Both the environmental documentation and the 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 the Agreement are specified to begin in the first year after completion of pipeline interconnection between Santa Maria and Nipomo CSD; that interconnection was the focus of the certified environmental documentation on the Nipomo CSD "Waterline Intertie" project. Both the environmental documentation and the Wholesale 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; the latter goes beyond the provisions in the Stipulation for the sale of up to 3,000 afy.

Since the Wholesale Agreement and the environmental documentation on the Waterline Intertie project reflect planned intra-basin export of water from one management area to another, three technical concerns about the planned project were expressed in the initial (2008) annual report for the SMVMA; as included in that report, those technical concerns were:

- "First, while there has apparently been extensive analysis of the need for supplemental water in the NMMA, prior to and through a recently certified EIR on the project, the Nipomo CSD "Waterline Intertie", there has been no analysis to identify the existence of any surplus water in the SMVMA. There has similarly been no analysis of any impacts to water supplies in the SMVMA that might derive from an export as described in the MOU."

- "Second, the MOU includes provisions that the water delivered by Santa Maria shall be of the same quality that the City delivers to its customers; the project EIR notes that the water will be a mix of City groundwater and SWP water. In the year prior to the signing of the MOU, the City delivered an average blend of 87 percent SWP water and 13 percent local groundwater to its customers. In 2008, those respective fractions were 53 percent and 47 percent. Using both sets of fractions for illustration purposes only, the delivery of "supplemental" water to the NMMA could represent about 1,600 to 2,600 afy of SWP water and about 400 to 1,400 afy of groundwater pumped from the SMVMA. There has been no analysis of the source(s), pumping locations, or potential impacts of such groundwater pumping for export from the SMVMA."

- "Finally, and perhaps of greatest concern, there is an apparent conflict with regard to importation and use of SWP water between the Stipulation and the MOU. In the Stipulation provisions specific to the SMVMA, the City of Santa Maria is to import and use within the SMVMA at least 10,000 afy of SWP water. The only exception to that amount of importation and use is in years when SWP availability to Santa Maria is less than 10,000 af; in those years, Santa Maria is to import and use all its available SWP supply in the SMVMA. However, if Santa Maria were to 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 in all those years, 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 2011, Santa Maria has initiated efforts to address them as follows. On the first item, 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, 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 Nipomo CSD being ready to actually request water deliveries from the City. Regarding the latter, the formation of an assessment district to fund the Waterline Intertie project was rejected by Nipomo Mesa property owners on May 9, 2012. The City anticipates considering various options for conducting intra-basin water transfers in the future, either by the original project or by some modified project. The pursuit by the City of additional SWP water allocation will continue for the purpose of at least offsetting projected reductions in reliability of SWP water deliveries, specifically to a projected 60 percent (personal communication, R. Sweet, City of Santa Maria, May 11, 2012).

On the second concern expressed in the 2008 report, the City's blended fractions of SWP water and local groundwater in 2011 were similar to those during the year preceding the signing of the MOU: 91 percent SWP water and 9 percent local groundwater in 2011, compared to 87 and 13 percent, respectively, prior to the MOU. Had the Water Sales Agreement been operational with SWP availability as it was in 2011 (80%), the fractional use of SWP water to a combination of City customers and the Nipomo CSD would have remained constant at about 91 percent; SWP water use in the SMVMA would have decreased from full availability (14,240 af) to about 11,500 af, which was roughly the amount actually imported by the City in 2011. The total groundwater pumping by the City would have increased from about 1,170 af to 1,460 af. As indicated in the 2008 annual report, there has been no analysis of the source(s), pumping locations, or potential impacts of such an increase in groundwater pumping on the SMVMA. While an additional 300 af of groundwater pumping is small relative to the total pumping of just over 105,000 af in 2011, the additional pumping that would have been necessary to meet the obligations of the agreement were much larger in 2008, 2009, and 2010 (LSCE, 2009, 2010, and 2011). 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 last concern expressed in the 2008 report, the preceding discussion is a good illustration of the potential conflict between the Stipulation and the Water Sales Agreement (the MOU when included in the Stipulation). Had the Water Sales Agreement been operational with SWP availability as it was in 2011 (80%), and with the City's SWP Table A Amount as it now is (17,800 af), the City would have been able to satisfy both the Water Sales Agreement and the Stipulation. However, this would not have been the case in the previous three years when SWP availability to Santa Maria was less than 10,000 af. Without access to additional SWP water during the previous years, the City could not dedicate all its SWP allocation to the SMVMA (as required by the Stipulation when that allocation is less than 10,000 af) and also deliver any to the Nipomo CSD. In fact, if the Water Sales Agreement were operational, such would be the case in all year-types when SWP allocations are less than about 70 percent.

For reference, Table 4.3-1 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 the Water Sales Agreement) or to Santa Maria and Nipomo CSD (with the Water Sales Agreement). Both scenarios include water availability and deliveries at various rates of SWP allocation, with one scenario to reflect "current" conditions (2011 City water demand) and 3,000 afy delivery to Nipomo CSD), and the other scenario to reflect projected "future" conditions (buildout City water demand and 6,200 afy delivery to Nipomo CSD).

The City recognizes all the preceding issues and, based on ongoing communication with its Utilities Department, continues work on their resolution, primarily by maintaining 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 will be in a position to request delivery of water under the current or some future modified Sales Agreement. Certainly notable among those practicalities are a yet-to-be completed MOU among water purveyors in the NMMA; however, with the recent rejection by Nipomo Mesa property owners of funding the Waterline Intertie project, more important will be the considerations of future options for any intra-basin water tranfers. 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 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 in order to enable deliveries under the Water Sales Agreement and also satisfy the provisions of the Stipulation, while also attempting to limit its financial commitment to purchase additional SWP supplies until they are certainly needed, i.e. if and when the Nipomo CSD completes all its requirements to actually request water deliveries from Santa Maria. Even with the recent events on the Nipomo Mesa described above, the City intends to continue the pursuit of 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, 2011
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]	24.00	2.36	21.64	1.80	80	2.25	34,243	77,186	5.4	0.45	15,437
Strawberries[1]	17.15	3.67	13.01	1.08	85	1.28	9,938	12,674	2.3	0.19	1,901
Vineyard[2]	---	---	12.0	1.0	95	1.1	4,561	4,801	0.6	0.05	240
Pasture[1]	45.39	10.17	35.23	2.94	80	3.67	320	1,174	8.8	0.73	235
Grain[2]	---	---	0.0	0.0	80	0.0	1,028	0	0.0	0.00	0
Nursery[3]	---	---	---	---	---	2.0	229	458	4.8	0.40	92
Deciduous[2]	---	---	26.4	2.2	85	2.6	10	26	4.7	0.39	4
Avocado[2]	---	---	28.8	2.4	85	2.8	24	68	5.1	0.42	10
Fallow[4]	---	---	---	---	---	---	528	---	---	---	---
Total							**50,881**	**96,387**			**17,919**

1) CIMIS-based applied crop water duties
2) Reported ETaw-based applied crop water duties
3) NMMA applied crop water duty; DU assumed as 80%
4) No applied water

Table 4.2-1
Treated Municipal Waste Water Discharge in 2011
Santa Maria Valley Management Area
(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 (af)	Total (af)	Total (af)	irrigation[4] (af)	injection[5] (af)	industrial use[6] (af)	Total (af)	Total (af)	Total (af)	Total (af)	ponds (af)	irrigation (af)	injection (af)	industrial use (af)	Total (af)
January	684	615	209	179	6	3	188	*53*	48	946	615	227	6	3	851
February	695	625	187	160	6	3	169	*48*	43	930	625	203	6	3	837
March	683	614	215	187	6	1	194	*54*	48	951	614	235	6	1	856
April	659	593	198	172	6	0	178	*54*	49	911	593	221	6	0	820
May	700	630	201	174	6	1	181	*55*	50	956	630	224	6	1	860
June	803	723	191	162	6	4	172	54	49	1,049	723	211	6	4	944
July	784	706	193	162	6	6	174	56	50	1,034	706	212	6	6	930
August	722	649	193	165	6	3	174	55	50	970	649	214	6	3	873
September	799	719	187	159	6	3	168	55	50	1,041	719	209	6	3	937
October	808	727	194	164	6	4	175	57	51	1,059	727	215	6	4	953
November	803	723	193	164	6	4	173	56	50	1,052	723	214	6	4	946
December	865	779	199	166	6	7	179	58	52	1,122	779	218	6	7	1,010
Annual Totals	**9,005**	**8,104**	**2,361**	2,014	72	40	**2,125**	**654**	**589**	**12,020**	8,104	2,603	72	40	**10,818**

1) Total effluent estimated based on assumed loss of 10% during treatment (90% of metered influent); 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 discharged for irrigation.
3) Total effluent estimated as 90% of metered influent; all effluent discharged to spray fields; *January through May values from 2009/2010 due to prolonged plant flow meter malfunction*.
4) Includes spray irrigation on Laguna SD fields and irrigation on Santa Maria airport lands.
5) Annual total injection volume available; monthly average listed.
6) 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)

Year	Total Water Use: SM	Total Water Use: GSWC	Total Water Use: GSWC[1]	Total Water Use: Guad	Effluent Available for Return Flows: Santa Maria from WWTP (SM)	Effluent Available for Return Flows: Santa Maria from WWTP (LSD)	Effluent Available for Return Flows: GSWC from WWTP (SM)	Effluent Available for Return Flows: GSWC from WWTP (LSD)	Effluent Available for Return Flows: Guadalupe from WWTP (Guad)	Irrigation Available for Return Flows: Santa Maria[2]	Irrigation Available for Return Flows: GSWC[3]	Irrigation Available for Return Flows: Guadalupe[4]	Return Flows: Santa Maria from WWTP (SM)[5]	Return Flows: Santa Maria from WWTP (LSD)[6]	Return Flows: Santa Maria from landscape irrigation[7]	Return Flows: Santa Maria Total	Return Flows: Santa Maria % of Water Use	Return Flows: Golden State Water Company from WWTP (SM)[5]	Return Flows: Golden State Water Company from WWTP (LSD)[6]	Return Flows: Golden State Water Company from landscape irrigation[7]	Return Flows: Golden State Water Company Total	Return Flows: Golden State Water Company % of Water Use[8]	Return Flows: Guadalupe from WWTP (Guad)[6]	Return Flows: Guadalupe from landscape irrigation[7]	Return Flows: Guadalupe Total	Return Flows: Guadalupe % of Water Use
1997	12,522	9,441	9,387	778	7,279	83	296	2,269	420	4,758	4,248	350	7,279	17	952	8,247	66	296	454	850	1,600	16.9	84	70	154	20
1998	11,085	8,001	7,960	778	6,434	82	302	1,874	420	4,212	3,601	350	6,434	16	842	7,293	66	302	375	720	1,397	17.5	84	70	154	20
1999	11,859	9,263	9,193	778	6,899	82	298	2,215	420	4,506	4,169	350	6,899	16	901	7,816	66	298	443	834	1,574	17.0	84	70	154	20
2000	12,679	9,399	9,342	778	7,223	83	309	2,459	420	4,818	4,230	350	7,223	17	964	8,203	65	309	492	846	1,647	17.5	84	70	154	20
2001	12,594	9,009	8,950	778	7,538	83	323	2,500	420	4,786	4,054	350	7,538	17	957	8,511	68	323	500	811	1,634	18.1	84	70	154	20
2002	13,312	9,466	9,409	778	7,661	83	320	2,287	420	5,059	4,259	350	7,661	17	1,012	8,689	65	320	457	852	1,629	17.2	84	70	154	20
2003	13,499	9,071	9,023	778	7,766	83	431	2,281	420	5,130	4,082	350	7,766	17	1,026	8,809	65	431	456	816	1,704	18.8	84	70	154	20
2004	13,650	9,356	9,302	832	8,201	83	399	2,240	449	5,187	4,210	374	8,201	17	1,037	9,255	68	399	448	842	1,689	18.1	90	75	165	20
2005	13,814	8,846	8,802	814	8,374	82	317	1,990	439	5,249	3,981	366	8,374	16	1,050	9,441	68	317	398	796	1,511	17.1	88	73	161	20
2006	13,610	8,754	8,700	883	8,251	81	288	1,724	477	5,172	3,939	397	8,251	16	1,034	9,302	68	288	345	788	1,421	16.2	95	79	175	20
2007	14,782	9,710	9,652	1,063	8,074	81	368	1,854	574	5,617	4,369	478	8,074	16	1,123	9,214	62	368	371	874	1,612	16.6	115	96	210	20
2008	14,235	9,311	9,255	997	8,123	81	444	1,963	570	5,409	4,190	449	8,123	16	1,082	9,222	65	444	393	838	1,675	18.0	114	90	204	20
2009	14,172	8,729	8,668	917	8,057	81	467	1,932	598	5,385	3,928	413	8,057	16	1,077	9,150	65	467	386	786	1,639	18.8	120	83	202	22
2010	13,294	7,735	7,681	880	7,360	80	489	2,022	598	5,052	3,481	396	7,360	16	1,010	8,386	63	489	404	696	1,590	20.6	120	79	199	23
2011	12,665	7,844	7,794	885	7,598	81	506	2,044	589	4,813	3,530	398	7,598	16	963	8,577	68	506	409	706	1,621	20.7	118	80	197	22
																avg	66				avg	18			avg	20

Estimated

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) Percentage of SM total water use as landscape irrigation = 38 (35 to 38)
3) Percentage of GSWC total water use as landscape irrigation = 45 (45 to 48)
4) Percentage of Guad total water use as landscape irrigation = 45 (24 to 64)
5) All effluent from Santa Maria WWTP percolation ponds assumed as return flows.
6) 20 percent of effluent from Laguna SD and Guadalupe WWTP irrigation assumed as return flows.
7) 20 percent of landscape irrigation assumed as return flows.
8) Percentage of GSWC total water use as return flows.

Table 4.3-1
Water Requirements, Supplies, and Amounts Delivered under Current and Projected Conditions
Santa Maria Valley Management Area

Current Conditions

SWP		Water Requirements			City Water Supply					City Water Delivered**					
		2011								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	12,700	3,000	15,700	15,700	100	0	0	15,700	12,700	0	12,700	3,000	0	3,000
90	16,020	12,700	3,000	15,700	16,020	102	(320)	(2)	15,700	12,959	(259)	12,700	3,061	(61)	3,000
80	14,240	12,700	3,000	15,700	14,240	91	1,460	9	15,700	11,519	1,181	12,700	2,721	279	3,000
75	13,350	12,700	3,000	15,700	13,350	85	2,350	15	15,700	10,799	1,901	12,700	2,551	449	3,000
70	12,460	12,700	3,000	15,700	12,460	79	3,240	21	15,700	10,079	2,621	12,700	2,381	619	3,000
65	11,570	12,700	3,000	15,700	11,570	74	4,130	26	15,700	9,359	3,341	12,700	2,211	789	3,000
60	10,680	12,700	3,000	15,700	10,680	68	5,020	32	15,700	8,639	4,061	12,700	2,041	959	3,000
50	8,900	12,700	3,000	15,700	8,900	57	6,800	43	15,700	7,199	5,501	12,700	1,701	1,299	3,000
40	7,120	12,700	3,000	15,700	7,120	45	8,580	55	15,700	5,759	6,941	12,700	1,361	1,639	3,000
30	5,340	12,700	3,000	15,700	5,340	34	10,360	66	15,700	4,320	8,380	12,700	1,020	1,980	3,000
20	3,560	12,700	3,000	15,700	3,560	23	12,140	77	15,700	2,880	9,820	12,700	680	2,320	3,000
10	1,780	12,700	3,000	15,700	1,780	11	13,920	89	15,700	1,440	11,260	12,700	340	2,660	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)	Total (af)	SWP (af)	GW (af)	Total (af)
100	17,800	19,000	6,200	25,200	17,800	71	7,400	29	25,200	13,421	5,579	19,000	4,379	1,821	6,200
90	16,020	19,000	6,200	25,200	16,020	64	9,180	36	25,200	12,079	6,921	19,000	3,941	2,259	6,200
80	14,240	19,000	6,200	25,200	14,240	57	10,960	43	25,200	10,737	8,263	19,000	3,503	2,697	6,200
70	12,460	19,000	6,200	25,200	12,460	49	12,740	51	25,200	9,394	9,606	19,000	3,066	3,134	6,200
65	11,570	19,000	6,200	25,200	11,570	46	13,630	54	25,200	8,723	10,277	19,000	2,847	3,353	6,200
60	10,680	19,000	6,200	25,200	10,680	42	14,520	58	25,200	8,052	10,948	19,000	2,628	3,572	6,200
50	8,900	19,000	6,200	25,200	8,900	35	16,300	65	25,200	6,710	12,290	19,000	2,190	4,010	6,200
40	7,120	19,000	6,200	25,200	7,120	28	18,080	72	25,200	5,368	13,632	19,000	1,752	4,448	6,200
30	5,340	19,000	6,200	25,200	5,340	21	19,860	79	25,200	4,026	14,974	19,000	1,314	4,886	6,200
20	3,560	19,000	6,200	25,200	3,560	14	21,640	86	25,200	2,684	16,316	19,000	876	5,324	6,200
10	1,780	19,000	6,200	25,200	1,780	7	23,420	93	25,200	1,342	17,658	19,000	438	5,762	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

5. Conclusions and Recommendations

Conclusions drawn from analysis of hydrogeologic and water requirement and supply conditions in the SMVMA in 2011 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

Assessment of hydrogeologic conditions in 2011 showed that groundwater 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, where elevated concentrations have resulted in management actions such as the reduction or cessation of municipal pumping from shallow water supply wells. Nitrate concentrations also continued to gradually increase in portions of the aquifer along the coast.

Water requirements, water supplies to meet those requirements, and disposition of water supplies in the SMVMA in 2011 can be summarized as follows. Total water requirements were greater than in 2010, about 117,800 af, comprised of 96,400 af for agricultural irrigation and 21,400 af for municipal supply. Groundwater was the primary water supply, 105,650 af, to meet most of the total water demand; the balance of total water requirements was met by 12,150 af of imported water from the State Water Project.

Disposition of agricultural water supply was primarily to evapotranspiration by crops, which consumptively used about 78,480 af of the applied water; the balance of applied irrigation, nearly 17,920 af, returned to the groundwater basin as deep percolation of applied water not consumptively used by crops. Slightly less than one-half of the municipal supply, about 9,380 af, was consumptively used in the service areas of municipal purveyors. The remainder of total municipal supply, about 12,020 af, was processed at waste water treatment plants. About 8,110 af of treated effluent from those plants are estimated to have returned to the groundwater basin, primarily by surface spreading in infiltration basins and much less through spray irrigation. About 1,200 af are estimated to have been consumed through waste water treatment processes and about 110 af were disposed through deep well injection of waste brine product and for industrial use.

A tabular summary of total water requirements, water supplies, and disposition of water supplies for the SMVMA in 2011 is delineated in Table 5.1. The components of total water requirements remained consistent with volumes and patterns of demand over the last decade.

Table 5.1-1
Summary of 2011 Water Requirements, Water Supplies and Disposition
Santa Maria Valley Management Area
(in acre-feet)

<table>
<tr><th colspan="3">Water Requirements</th><th colspan="6">Water Supplies</th></tr>
<tr><th>Agricultural</th><th>Municipal</th><th>Total</th><th colspan="2">Groundwater</th><th colspan="2">Imported SWP Water</th><th colspan="2">Total</th></tr>
<tr><td>96,400</td><td>21,400</td><td>117,800</td><td colspan="2">105,650</td><td colspan="2">12,150</td><td colspan="2">117,800</td></tr>
<tr><th colspan="9">Disposition</th></tr>
<tr><th colspan="2">Agriculture</th><th colspan="7">Municipal</th></tr>
<tr><th>Consumption</th><th>Return Flows</th><th>Consumption</th><th colspan="6">Waste Water</th></tr>
<tr><td>78,480</td><td>17,920</td><td>9,380</td><td colspan="6">12,020</td></tr>
<tr><td colspan="2" rowspan="2"></td><td rowspan="2"></td><th>Tmt. Plant Consump.</th><th colspan="2">Return Flows</th><th colspan="2">Disposal To Irrig.</th><th>Injection/ Industrial</th></tr>
<tr><td>1,200</td><td colspan="2">8,110</td><td colspan="2">2,600</td><td>110</td></tr>
</table>

Reported total irrigated acreage and crop distribution in 2011, about 50,880 acres devoted primarily to truck crops, and the associated applied water requirement, about 96,400 af, are consistent with the generally constant trend in agricultural land use and water requirements in the SMVMA over the last decade. 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, so groundwater pumping for agricultural purposes was an estimated 96,400 af in 2011. Importantly, the newly installed climate station on the Santa Maria Valley floor provided for enhanced estimation of the 2011 agricultural water requirements in the SMVMA.

Recorded municipal water supplies in 2011 were 9,260 af of groundwater and 12,140 af of imported SWP water to meet a total municipal water requirement of 21,400 af; total municipal demand in 2011 was consistent with the long-term trend of gradually increasing municipal water demand apparent over the last decade, although less than the peak historical municipal demand of 25,600 af in 2007. Groundwater pumping for municipal water supply in 2011 was one-half that of a decade ago, when groundwater pumping met the entire municipal water requirement of approximately 23,000 afy. Also, during several of the intervening years (1998 through 2006), groundwater pumping was less than one half the peak amount. The decrease in municipal groundwater pumping has resulted from the importation and use of SWP water, which began in 1997. In 2011, those importations exceeded the minimum annual amount specified in the Stipulation for the City of Santa Maria; the GSWC used 470 af, also exceeding their specified minimum amount, and the City of Guadalupe imported 170 af, or 47 percent of their specified minimum amount due to operational problems resolved in July 2011.

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. Until there is some substantial change in either of their respective treatment and disposal schemes, the Stipulation provision that entitles recovery of 45 percent of SWP water to both purveyors should be decreased to a maximum of 20 percent for both GSWC and Guadalupe.

Despite sedimentation that has now filled the former dead pool storage below the conservation pool in Twitchell Reservoir, operation of the Reservoir has, overall, continued to provide conservation of runoff for subsequent release for groundwater recharge in the SMVMA. Sediment removal work completed at the outlet from Twitchell Reservoir and Dam in 2010 facilitated enhanced groundwater recharge in 2011. While the total precipitation in 2011 was essentially average, the nine inches of rain that fell in December 2010 and the early 2011 rainfall resulted in substantial build-up of storage in Twitchell Reservoir for continual release and recharge through all months in 2011. The December 2010 rainfall and early 2011 rainfall produced above-average streamflow in the Sisquoc River and Orcutt Creek, both of which are uncontrolled. With the large amount of Twitchell releases for groundwater recharge, almost 90,000 af or close to double the average amount, along with recharge from the Sisquoc River and Orcutt Creek, groundwater levels in most portions of the SMVMA increased during 2011. In fact, groundwater levels remained within historical fluctuating ranges and did not decline to the point of beginning to define any type of critical water shortage.

General mineral and nitrate concentrations in the Sisquoc River and Orcutt Creek, the only streams in the SMVMA for which water quality data were available, were within historical ranges. As such, Orcutt Creek quality remained degraded with highly elevated concentrations of dissolved salts and nitrate.

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 since about 2000, including between 2009 and 2010, groundwater levels rose in 2011 remained above 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, the recent gradual decline in groundwater levels is most likely attributable to climatological conditions. The total groundwater use in 2011, about 105,650 af, was comparable to use during the last decade, 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 2011.

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;
- groundwater quality sample collection and analysis for inorganic constituents (e.g., 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
- collection and analysis of surface water quality samples from Twitchell Reservoir and streams on a biennial basis.

One key aspect of expanded monitoring 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.

Until such time as these data are available, and as was done in 2009 and 2010, this 2011 annual report on the SMVMA expanded the interpretation of spring groundwater conditions near the boundary by developing groundwater level contour maps for early and late spring 2011, specifically in Figures 2.1-3a, b, d, and e. The maps 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. As such, they illustrate the importance 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.

Also 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-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 does describe 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. Further, contouring efforts still rely on monthly groundwater level data (e.g. February, March, and April) provided by private entities on the southern Nipomo Mesa (GSWC, The Woodlands, Conoco), from their own water supply wells because no data were available from the monitoring agencies mentioned above.

In order to eliminate these data limitations, it is strongly recommended that arrangements be made between the TMA and a third party agency to conduct additional groundwater monitoring in an expanded network of wells near the boundary of the two management areas. At a minimum, the agency would take measurements in a subset of wells on the adjacent portion of the NMMA at the spring (and fall) time periods coinciding with monitoring conducted in the SMVMA. It is envisioned that the Area Engineer would initially work with the third party to develop the subset of wells, coordinating with monitoring agencies and the NMMA TG to draw on area experience and utilize existing well inventories, which likely include such information as well types or uses, locations, depths and screen completions, reference point locations and elevations, owners and access, and historical water level and/or quality data. Further, it is anticipated that the TMA would provide support in agency coordination, in particular with the third party agency, to facilitate implementation of the expanded monitoring work.

Of note in fall 2011, an expanded network of wells was measured for water levels, providing essentially the same areal coverage and density of data for the fall period as is typical for the spring period. This provided improved coverage of the SMVMA for the fall contour maps of shallow and deep groundwater levels, and it is recommended that a similar effort be made for expanded fall measurements each year. Related to this, some progress was made by the Area Engineer in assessing the consistency in well reference points, measuring points, ground surface elevations, and vertical data (NGVD29 vs. NAVD88) utilized by the various measuring and reporting agencies and water purveyors for wells and water level data, in particular in the Oso Flaco and southern Nipomo Mesa areas, toward the goal of providing consistent and accurate groundwater elevation data and contour maps.

Regarding the existing monitoring program for the SMVMA, it is recommended that the groundwater and surface water monitoring components continue to be updated in 2011 by the Area Engineer. The update would include assessing the current availability of network wells for groundwater level and quality monitoring and of locations suitable for reestablishment of network stream gauges. Completion of the well network assessment would then facilitate planning to implement a groundwater quality monitoring program in the SMVMA. Assessment work would be in coordination with USGS and Santa Barbara County Water Agency staff currently or previously tasked with water resource monitoring activities in the Valley.

Additional points not otherwise included in the monitoring program but useful in future analysis and reporting on the SMVMA include:

- surveying of wellhead reference point elevations at all wells utilized for groundwater level monitoring; and

- definition of municipal water supply well locations (GSWC, Guadalupe) and well completion information (GSWC), for wells with historical groundwater level, quality, and pumpage data.

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 if 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, pumping locations, and potential impacts of additional groundwater pumping, if any, that would be exported beyond the SMVMA.

Finally, it is recommended that parties in the SMVMA potentially affected by implementation of the instream fisheries study recommendations, such as the City of Santa Maria, GSWC, the Cityof Guadalupe, and the SMVWCD, solicit legal opinion or clarification of whether any compelling basis exists for implementing said recommendations, which would result in permanent reductions in groundwater basin recharge. Related to this, resolution should be made of any conflict existing between the study recommended diversion of Twitchell Reservoir water for fisheries in the Santa Maria and Sisquoc Rivers and the 2005 Stipulation developed from the basin adjudication. It is recommended that some estimation made of the potential impacts to groundwater levels and quality in the basin from implementation of the study recommendations.

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Appendix A

SMVMA Monitoring Program

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

October 2008
(revised April 2011)

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I. INTRODUCTION

The terms and conditions of a Stipulation in the Santa Maria Valley Groundwater Basin Litigation passed down by the Superior Court of the State of California, County of Santa Clara, on June 30, 2005, are intended to "impose a physical solution establishing a legal and practical means for ensuring the Basin's long-term sustainability." Under the Stipulation, the groundwater, imported and developed water, and storage space of the Basin are to be managed in three management areas, including one for the Santa Maria Valley (SMVMA) (Figure 1). The management area is approximately 175 square miles in size encompassing the Santa Maria and Sisquoc Valleys, extending north to the Nipomo Mesa, east to the cliffs above the Santa Maria River and terraces along the Sisquoc River, south to the Casmalia and Solomon Hills, and west to the coast.

According to the Stipulation, a monitoring program is to be established for each of the three management areas to collect and analyze data regarding water supply and demand such that the following objectives are met:

1) assessment of groundwater conditions, both levels and quality;
2) determination of land use, water requirements, and water supply; and
3) accounting of amounts and methods of disposition of water utilized.

This monitoring program has been prepared to meet these objectives in the SMVMA. Also in accordance with the Stipulation, it is expected that the monitoring results will be utilized for preparation of annual reports on the SMVMA, including an assessment of whether conditions of severe water shortage are present. The monitoring program for the SMVMA, with minor revisions from October 2008, is described by individual element in the following section.

Among other components, the monitoring program includes networks of historically monitored wells, stream gauges, and climatic stations. These monitoring points were selected based on publicly available information about their locations, characteristics, and historical data records with the intent of continuing those records as much as possible. It is recognized that, as implementation of the program proceeds, the inclusion of some network wells may be determined to be impractical or impossible due to problems of access or abandonment. Further, the reestablishment of inactive (or installation of new) wells, stream gauges and climatic stations will depend on interagency coordination, permitting procedures, and budgetary constraints. Thus, it is anticipated that the overall monitoring program will be incrementally implemented as practicalities like those mentioned above dictate. Similarly, it is expected that, with time, the program will undergo modification in response to various factors (e.g. replacing network wells abandoned in the future, revising well classifications by aquifer depth zone), while maintaining the overall goal of facilitating interpretation and reporting on water requirements, water supplies, and the state of groundwater conditions in the SMVMA.

II. MONITORING PROGRAM

As a basis for designing the monitoring program, all pertinent historical data on the geology and water resources of the SMVMA were updated and compiled into a Geographic Information System (GIS). The data include the following:

- well location, reference point elevation (RPE), depth, and construction information;
- surface water gauge locations and characteristics;
- precipitation gauge and climate station locations and characteristics;
- groundwater levels and quality;
- Twitchell Reservoir releases, stream discharge and quality;
- precipitation and reference evapotranspiration (ETo) records;
- topographic, cultural, soils, and land use maps;
- geologic map and geologic structure contours;
- water purveyor wellfield areas;
- wastewater treatment plant (WWTP) locations.

The GIS was first utilized to define aquifer depth zones for groundwater monitoring purposes. In the central and major portion of the SMVMA, there is a shallow zone comprised of the Quaternary Alluvium, Orcutt formation, and uppermost Paso Robles formation and a deep zone comprised of the remaining Paso Robles formation 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 formation) are extremely fine-grained, the underlying formations (lower members of Quaternary Alluvium and Orcutt formation, Paso Robles formation, and Careaga Sand) comprise a confined aquifer.

The GIS was then used to classify a majority of wells into the shallow or deep aquifer zones based on well depth and completion information, although a number of wells could not be classified because this information is either unavailable or indicates completion across both the shallow and deep zones. An evaluation was made of the distribution of wells across the SMVMA completed in each depth zone. Wells actively or historically monitored for water levels and quality by the U.S. Geological Survey (USGS) and its cooperating local agencies[1] (Agencies) were identified, and an evaluation was made of the adequacy of coverage of the SMVMA to meet the objective in the Stipulation of assessing groundwater conditions.

It was determined that the wells actively monitored by the Agencies for groundwater levels provide extensive but somewhat incomplete coverage of the SMVMA, with areas

[1] Cooperating local agencies include Santa Barbara County, San Luis Obispo County, and the Santa Maria Valley Water Conservation District (SMVWCD).

left unmonitored in both aquifer zones. Based on this assessment, the groundwater monitoring program for the SMVMA was designed to first incorporate all of the actively monitored wells (denoted herein as "active wells"). Thus, those wells will continue to be monitored for water levels by the Agencies with the resulting data used toward assessing groundwater conditions in the SMVMA.

Secondly, in order to fill the gaps in coverage around the active wells, the groundwater monitoring program includes a number of additional wells historically monitored by the Agencies that are no longer monitored (denoted herein as "inactive wells", but intended to be actively monitored as part of this program). Thus, water level monitoring in these wells will need to be restarted in collaboration with the Agencies. This will provide the additional benefit of bringing forward the historical water level records of the inactive wells, some of which begin in the 1920s.

Regarding the active and inactive wells, those that could not be classified by aquifer depth zone (noted as "unclassified wells") are nonetheless included in the monitoring program because they contribute to completing well coverage of the SMVMA. The main revision to the October 2008 monitoring program is classification of previously unclassified wells based on additional well information, water level, and water quality data collected since the monitoring program was implemented.

Third, the groundwater monitoring program includes new monitoring wells to be installed in both the shallow and deep aquifer zones in an area north of downtown Santa Maria to fill a gap in coverage by existing wells. Arrangements will need to be made for the well installations, and monitoring will need to be implemented in collaboration with the Agencies.

This groundwater monitoring program designates a subset of wells for the purpose of monitoring groundwater quality, with well selection based on evaluation of well depths, completion information, and historical water level and quality data. It was determined that, of those wells actively monitored for groundwater levels, very few are actively monitored for groundwater quality. The subset of groundwater quality wells under this monitoring program incorporates the few active water quality wells, which will continue to be monitored by the Agencies. In addition, the subset includes wells historically (but no longer) monitored for water quality and wells historically monitored for water levels (but never for water quality) by the Agencies. Thus, water quality monitoring in these wells will need to be restarted or implemented in collaboration with the Agencies. Lastly, in order to fill a gap in coverage by existing wells, the new monitoring well to be installed in the deep aquifer zone north of downtown Santa Maria is included in the subset of groundwater quality wells.

Thus, the groundwater monitoring program designates two well networks, one each for the shallow and deep aquifer zones, primarily comprised of wells that are actively monitored. The networks include additional wells that are currently inactive (monitoring to be restarted) and some new wells (installation and monitoring to be implemented). All network wells are to be monitored for groundwater levels, with a subset of those wells to be monitored for groundwater quality, as described in detail in the subsection below.

Another use of the GIS was for the evaluation of actively and historically monitored surface water and climatic gauges by their location and period of record, specifically for Twitchell Reservoir releases, stream discharge, precipitation, and reference evapotranspiration (ETo) data, in order to assess adequacy of coverage in the SMVMA to meet monitoring objectives in the Stipulation. In this case, it was determined that the actively monitored gauges provide a substantial but incomplete accounting of surface water resources in the SMVMA, with several streams no longer monitored and the Valley floor without any climatic gauges. The SMVMA monitoring program was designed to incorporate the active gauges and reestablish inactive gauges to provide a comprehensive record of surface water and climatic data. A revision to the October 2008 monitoring program is the addition of a surface water sampling point on Green Canyon drainage, currently monitored for flow and quality.

A description of the groundwater, surface water, and climatic monitoring included in the SMVMA monitoring program is provided in the following subsection. Three monitoring program elements designate the data collection to be conducted across the area including 1) hydrologic data with which groundwater conditions, surface water conditions, and agricultural water requirements may be assessed, 2) water requirements and supply data for agricultural irrigation and municipal use; and 3) water disposition data for agricultural and municipal land uses.

2.1 Hydrologic Data

Hydrologic data include groundwater levels and quality from two well networks, one each for the shallow and deep aquifer zones. Also to be collected are data on Twitchell Reservoir releases and stream stage, discharge, and quality, from a designated set of surface water monitoring locations. The data also include precipitation and ETo data, which will be used to estimate agricultural water use in the SMVMA.

2.1.1 Groundwater Levels and Quality

Well Networks

Evaluation of historical groundwater level and quality data from the SMVMA indicates that groundwater conditions differ across the area and with depth; accordingly and as described above, the groundwater monitoring program designates both shallow and deep well networks. The monitoring networks include along the coast three sets of existing grouped monitoring wells that are completed at varying depths for the purpose of detecting conditions of saltwater intrusion. However, the networks lack coverage inland in an area north of downtown Santa Maria adjacent to the Santa Maria River, necessitating the installation of at least one shallow and one deep well.

The monitoring networks are primarily comprised of wells actively monitored by the USGS and cooperating agencies (Agencies). The networks include additional wells that are currently inactive (monitoring to be restarted) and some new wells (installation and monitoring to be implemented). The shallow well network consists of 68 wells for groundwater level monitoring with a subset of 37 wells for water quality monitoring (Table 1a and Figure 2a), including one new well to be installed north of Santa Maria and monitored for shallow groundwater levels. The deep well network consists of 52 wells for water level monitoring with a subset of 38 water quality wells (Table 1b and Figure 2b), including one new well to be monitored for groundwater levels and quality in the deep zone. In addition, 29 unclassified wells are included for groundwater level monitoring with a subset of 4 water quality wells (Table 1c); they are shown on both the shallow and deep well network maps (see Figures 2a/2b) to illustrate the areal distribution of network wells across the SMVMA.

To augment the monitoring program results, data from water supply well monitoring conducted by the Cities of Santa Maria and Guadalupe and by the Golden State Water Company to meet California Dept. of Health Services requirements will be compiled. Likewise, data from sanitation facility well monitoring conducted under their respective permit conditions will augment the monitoring program results. Finally, data collected from wells in the Nipomo Mesa Management Area (NMMA) monitoring program (not part of the SMVMA well networks) will be compiled in order to assess groundwater conditions in the area along the northern boundary of the SMVMA.

Overall, the groundwater monitoring networks for the SMVMA include:

- 149 wells for water levels (68 shallow, 52 deep, 29 unclassified), of which:

- 91 of the 149 wells are active (42 shallow, 28 deep, 21 unclassified) and will continue to be monitored for water levels by the Agencies,
- 56 wells are inactive (25 shallow, 23 deep, 8 unclassified) and will need to have water level monitoring restarted in collaboration with the Agencies,
- 2 wells are new (1 shallow and 1 deep) and will need to have arrangements made for their installation and water level monitoring implemented in collaboration with the Agencies, and

- 79 of the 149 wells are also for water quality (37 shallow, 38 deep, 4 unclassified), of which:
- 14 wells are active (4 shallow, 9 deep, 1 unclassified), and will continue to be monitored for water quality by the Agencies,
- 34 wells are inactive (17 shallow, 14 deep, 3 unclassified), and will need to have water quality monitoring restarted in collaboration with the Agencies,
- 30 wells not monitored (16 shallow, 14 deep), and will need to have water quality monitoring implemented in collaboration with the Agencies,
- 1 well is new (deep) and will need to have water quality monitoring implemented in collaboration with the Agencies.

The areal coverage of wells for groundwater levels and quality is comparable to previous groundwater resources investigations periodically conducted by the USGS. The groundwater monitoring networks are comprehensive and conservative in that they provide areal coverage of the SMVMA in two depth zones, including focused monitoring for potential saltwater intrusion along the coast. Upon implementation of the groundwater monitoring program and analysis of the initial groundwater level and quality results, an assessment will be made of whether the well network requires modification, e.g., more or less wells, while ensuring the monitoring objectives of the Stipulation are met.

Monitoring Specifications

Under the monitoring program, groundwater level measurements in each network well will be made from an established wellhead reference point to an accuracy of 0.01 foot. Groundwater quality monitoring will include general mineral constituents to facilitate description of the general groundwater chemistry throughout the SMVMA. In addition, specific inorganic constituents are included to assess effects of historical and current land uses and groundwater quality relative to potential saltwater intrusion along the coast. The initial monitoring constituents for both the shallow and deep well networks are:

General Minerals *(including Total Dissolved Solids (TDS), Electrical Conductivity (EC), pH, sodium (Na), calcium (Ca), magnesium (Mg), potassium (K), chloride (Cl), sulfate (SO4), and bicarbonate (HCO3)*
Nitrate as Nitrate *(NO3-NO3)*
Bromide *(Br)*

All sample collection, preservation, and transport will be according to accepted EPA protocol. Sample analyses are to be conducted by laboratories certified by the State of California utilizing standard EPA methodologies. Analyses for NO3-NO3 and Br are to achieve minimum reporting limits of 0.10 mg/l.

The great majority of existing wells in the SMVMA have reported reference point elevations (RPEs) that appear to have been derived from USGS 7-1/2' topographic quadrangles, with variable levels of accuracy. Therefore, a wellhead survey will need to be conducted establishing the RPE for each network well to an accuracy of less than one foot, preferably to 0.01 foot, in order to allow accurate assessment of groundwater conditions throughout the SMVMA. The wellhead survey would most easily be completed using survey-grade global positioning system (GPS) equipment. Upon evaluation of the initial monitoring results, an assessment will be made regarding the need to verify RPEs or modify the set of water quality constituents and/or reporting limits.

Monitoring Frequency

Historical groundwater level data from the SMVMA indicate that water levels typically peak between January and April and decline to the seasonal low between July and October. Accordingly, the initial frequency of groundwater level monitoring is semiannually during the spring and fall, as has typically been the practice of the USGS and some cooperating agencies.

Review of historical groundwater quality data indicates that some quality constituents, such as sulfate, nitrate, and associated TDS and EC values, can change substantially over two to three years. As a result, the initial frequency of groundwater quality sampling is every two years, and preferably during the summer to allow any necessary followup sampling. Coastal monitoring wells will be sampled twice annually, during spring and fall, to evaluate seasonal water quality changes with the seasonal fluctuation in Valley groundwater levels.

The annual groundwater level and quality monitoring results from purveyors and sanitation facility wells will be compiled with the results from the SMVMA monitoring program, at which time an assessment will be made regarding the need for additional monitoring of selected purveyor/facility wells. Regarding the SMVMA well network, following evaluation of the initial groundwater level and quality results, an assessment will be made whether monitoring frequencies need to be modified.

Data Sources, Agency Coordination, and Plan Implementation

Implementation of the groundwater monitoring program will necessitate completing several tasks augmenting the groundwater monitoring currently conducted by the Agencies. It is recommended that program implementation proceed through the following tasks in order:

1) Coordination with the Agencies (primarily the USGS) and landowners to assess site conditions at each designated program well, including field determinations of well and wellhead conditions and access (as needed), with the objective of establishing final well networks (shallow and deep) for the ongoing measurement of water levels and collection of water quality samples;

2) Installation of monitoring wells in those areas lacking coverage by the established networks;

3) Coordination with the Agencies and landowners to make arrangements for conducting groundwater level and quality monitoring, per the monitoring program, on an ongoing basis; and

4) Completion of a wellhead survey to record the reference point elevation and ground surface elevation at each network well.

On an annual basis, the designated groundwater monitoring activities for the SMVMA will need to be coordinated with the USGS and cooperating agencies to confirm their continued monitoring of network wells. During each year, groundwater level and quality data from the Agencies will be compiled with the SMVMA dataset, and an assessment will be made of the remaining data needs to fulfill the groundwater monitoring program. The annual agency coordination, planning of monitoring activities, data collection, and data compilation will be jointly conducted by LSCE and the TMA.

2.1.2 Surface Water Storage, Discharge, Stage, and Quality

Monitoring Locations

Twitchell Reservoir stage, storage, and surface water releases are recorded on a daily basis. Also, four stream gauges in the SMVMA currently provide average daily discharge data, specifically two on the Sisquoc River ("near Sisquoc" and "near Garey"), one on the Santa Maria River ("at Suey Crossing near Santa Maria"), and one on Orcutt Creek ("near Orcutt"). Together, the reservoir release data and current stream gauge measurements account for the primary components of streamflow into the Santa Maria Valley (Figure 3).

Additional data are needed for the main streams associated with the Santa Maria Valley for the purpose of assessing surface water resources and stream/aquifer interactions in the SMVMA. The main component of streamflow into the Santa Maria Valley is not measured, specifically from the Cuyama River (inactive gauge), and streamflow from the Santa Maria Valley cannot be accounted because the gauge located on the Santa Maria River at Guadalupe is inactive. Further, for all streams in the SMVMA, stage measurements are not reported and water quality monitoring is limited to the Sisquoc River ("near Sisquoc") and Orcutt Creek ("near Orcutt"). A sampling point on Green Canyon provides information on the flow and quality of drainage in the western Valley.

Accordingly, the surface water monitoring program specifies that reservoir stage, storage, and releases from the Twitchell Project continue to be recorded on a daily basis. The program also designates a set of stream gauges on the Sisquoc, Cuyama, and Santa Maria Rivers and Orcutt Creek for the determination of average daily stage and discharge (see Figure 3). Gauge locations will serve as water quality sampling points. Additional water quality sampling points (without gauge) are the current Green Canyon point and a new one to be located on Oso Flaco Creek.

The main surface water monitoring locations for the SMVMA include:

- Twitchell Project, which will continue to be monitored for reservoir stage, storage, and releases (with water quality monitoring to be implemented) by the SMVWCD;

- 6 stream gauges, of which:
  2 gauges will continue to be monitored for stream discharge and quality by the USGS:

“Sisquoc River near Sisquoc”
“Orcutt Creek near Orcutt”
2 gauges will continue to be monitored for stream discharge by the USGS (with water quality monitoring to be implemented in collaboration with the USGS):
“Sisquoc River near Garey”
“Santa Maria River at Suey Crossing near Santa Maria”
2 gauges for which stream discharge and water quality monitoring will need to be reestablished in collaboration with the USGS:
“Cuyama River below Twitchell”
“Santa Maria River at Guadalupe”; and

- Green Canyon, for which flow and quality monitoring will continue, and Oso Flaco Creek, for which water quality monitoring will need to be implemented in collaboration with the USGS.

The inactive gauges on the Cuyama River (“below Twitchell) and Santa Maria River (“at Guadalupe”) need to be reestablished, and rating curves relating stage measurements to discharge need to be redeveloped. If possible, it would be preferable to establish an alternate location for the Cuyama River gauge closer to its confluence with the Sisquoc River. At the present time, streamflow entering the Santa Maria Valley from the Cuyama River can be estimated from Twitchell Project release data (streamflow losses occur on the Cuyama River between Twitchell Dam and its confluence with the Sisquoc River). Streamflow data from the former Cuyama River gauge facilitated better estimation of streamflow entering the Valley but did not preclude estimation errors.

Operation of the Santa Maria River gauge at Suey Crossing, located in the primary recharge area of the River, will need evaluation. Currently, stream discharge data are reported only sporadically; it appears that stage data have been collected but not yet converted to discharge pending development by the USGS of appropriate rating curves. However, data collection may be being compromised by technical problems with the gauge, in which case timely resolution of the problems or consideration of an alternate gauge location in this reach of the River would be necessary.

It should be noted that, in order to provide for the most complete assessment of surface water resources of the SMVMA, data would also be needed for its tributary streams. Streamflows into the Sisquoc Valley from La Brea Ck, Tepusquet Ck, and Foxen Canyon cannot be accounted because their respective gauges are inactive. Also, streamflows into the Santa Maria Valley from Nipomo and Suey Creeks have not been monitored (see Figure 3). Thus, stream gauges for the determination of average daily stage and discharge would need to be reestablished for La Brea, Tepusquet, and Foxen Canyon Creeks and installed on Nipomo and Suey Creeks in collaboration with the USGS.

To augment the surface water monitoring program results, water quality data from stream studies periodically conducted by the Central Coast Regional Water Quality Control Board and from sanitation facility monitoring will be compiled.

Monitoring Specifications

For the Twitchell Project, reservoir stage will need to be related to storage volume. For all stream gauges, stage measurements will need to be reported relative to some known elevation datum. Under the monitoring program, initial surface water quality analyses to be performed are for the same general mineral and specific inorganic constituents as for groundwater. Reservoir and stream sample collection will be according to accepted protocol; sample preservation, transport, analyses, and reporting limits will be according to groundwater quality monitoring specifications.

Monitoring Frequency

For the Twitchell Project, daily releases and reservoir stage are to be recorded. For all streams, gauge operations will provide average daily stream stage and discharge data. Water quality monitoring will be conducted on a semi-annual basis during the period of maximum winter/spring runoff and minimum summer flows to evaluate changes in surface water quality with fluctuations in stream discharge.

Data Sources, Agency Coordination, and Plan Implementation

Implementation of the surface water monitoring program will necessitate completing several tasks augmenting the stream monitoring currently conducted by the USGS. It is recommended that program implementation proceed through the following tasks in order:

1) Coordination with the USGS to assess site suitability for stream gauges on the Cuyama River (“below Twitchell”) and Santa Maria River (“at Guadalupe”), with the objective of establishing the locations and specifications for gauge installation to conduct ongoing measurement of stream stage, discharge, and quality;

2) Coordination with the USGS to install stream gauges and develop rating curves for the Cuyama River (“below Twitchell”) and Santa Maria River (“at Guadalupe”) locations;

3) Coordination with the Agencies to make arrangements for conducting surface water monitoring, per the monitoring program, on an ongoing basis on the designated streams (USGS) and Twitchell Reservoir (SMVWCD);

4) Coordination with the USGS to assess site suitability for stream gauges on the tributaries La Brea, Tepusquet, Foxen Canyon, Suey, and Nipomo Creeks, with the objective of establishing the locations and specifications for gauge installation to conduct ongoing measurement of stream stage, discharge, and quality;

5) Coordination with the USGS to install stream gauges and develop rating curves for the La Brea, Tepusquet, Foxen Canyon, Suey, and Nipomo Creeks locations; and

6) Coordination with the Agencies to make arrangements for conducting surface water monitoring, per the monitoring program, on an ongoing basis on the designated streams and tributaries (USGS) and Twitchell Reservoir (SMVWCD).

On an annual basis, the designated surface water monitoring activities for the SMVMA will need to be coordinated with the USGS to confirm their continued operation of each monitoring program gauge. During each year, Twitchell Project data from the SMVWCD will be compiled with stream stage, discharge, and water quality data from the USGS. Annual agency coordination, planning of monitoring activities, data collection, and data compilation will be jointly conducted by LSCE and the TMA.

2.1.3 Precipitation and Reference Evapotranspiration (ETo)

Monitoring Locations

There currently are three active NCDC[2] precipitation gauges in the SMVMA providing long-term daily precipitation data through the present, specifically at Guadalupe, the Santa Maria airport (formerly downtown), and Garey. In addition, daily precipitation is recorded at four locations around the SMVMA, at the Twitchell Dam (by the SMVWCD) and three active CIMIS[3] climate stations on the Santa Maria Valley floor, near Sisquoc, and on the southern Nipomo Mesa. Daily ETo data are also currently recorded by these three CIMIS climate stations (see Figure 3).

Accordingly, the monitoring program designates the set of four active precipitation gauges (NCDC and Twitchell) and three active CIMIS climate stations for the determination of daily precipitation and ETo (see Figure 3).

The climatic monitoring stations include:

- Four precipitation gauges, which will continue to be monitored by current operators:
  Twitchell Dam (SMVWCD)
  Guadalupe (NCDC)
  Santa Maria Airport (NCDC)
  Garey (NCDC)

- Three climate stations for precipitation and ETo, which will continue to be monitored by California DWR:
  ‘Santa Maria II’
  ‘Sisquoc’
  ‘Nipomo’

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[2] NCDC: National Climatic Data Center, administered by the National Oceanic and Atmospheric Administration (NOAA).
[3] CIMIS: California Irrigation Management Information System, administered by California Department of Water Resources (California DWR).

Monitoring Specifications and Frequency

Precipitation gauges will continue to collect total daily precipitation data, and climate stations will report daily ETo values. Operation of the climate stations will be according to CIMIS standards to collect all data utilized in the calculation of ETo values (e.g., air temperature, relative humidity, air speed).

Data Sources, Agency Coordination, and Plan Implementation

On an annual basis, the designated climatic monitoring activities for the SMVMA will need to be coordinated with the NCDC, California DWR, and SMVWCD to confirm their continued operation of each gauge/station. The annual coordination with these agencies and data compilation will be jointly conducted by LSCE and the TMA.

2.2 Water Requirements and Supply Data

These data include agricultural land use derived from land use surveys as input to the estimation of applied agricultural water requirements and, thus, groundwater pumping (sole supply) in the SMVMA. Data also include municipal and private purveyor records of water supplies, which include groundwater and imported water that in total equal the municipal water requirements in the SMVMA.

2.2.1 Agricultural Land Use and Water Requirements

Under the monitoring program, land use surveys of the SMVMA will be conducted on an annual basis from analysis and field verification of aerial photography. In the event that aerial photographs of the SMVMA are unavailable from existing agricultural service companies, arrangements for the aerial photography work will need to be made.

Survey results will be utilized to determine crop distribution and acreages, which in turn will be used in conjunction with standard crop coefficient values, ETo and precipitation data, and Valley-specific irrigation efficiency values to estimate annual applied agricultural water requirements. With groundwater serving as the sole source of water supply for agricultural irrigation in the SMVMA, the estimated applied agricultural water requirements will be considered equal to the agricultural groundwater pumping in the SMVMA.

Aerial photography arrangements and analysis, field verification, determination of crop distribution and acreages, and estimation of agricultural water requirements will be jointly conducted by LSCE and the TMA.

2.2.2 Municipal Water Requirements

As part of the monitoring program, records will be compiled of groundwater pumping and imported water deliveries from the State Water Project, Central Coast Authority (SWP), to municipal and private water purveyors, including the Cities of Santa Maria and Guadalupe, and the Golden State Water Company. All data will be recorded by subsystem on a monthly basis; groundwater pumping will be by individual water supply well; and all water transfers within the SMVMA between purveyors are to be noted. Also included are data on the number of service connections, any estimates of water usage on a per capita or per connection basis, and historical and current projections of water demand.

During the first year, purveyors will also provide current service area boundaries and all available water supply well location, depth, and completion information. With groundwater pumping and imported water deliveries as the two sources of water supply for municipal water use in the SMVMA, their total will be considered equal to the municipal water requirements in the SMVMA.

During each year, water supply data from the purveyors will be compiled into the SMVMA dataset. Annual coordination with purveyors will be jointly conducted by LSCE and the TMA.

2.2.3 Groundwater Pumping

The estimated groundwater pumping for agricultural irrigation will be summed with the reported pumping for municipal use in order to calculate total annual groundwater pumping in the SMVMA.

2.2.4 Imported Water

Imported water data will be obtained to summarize SWP deliveries to municipal and private water purveyors, specifically the Cities of Santa Maria and Guadalupe and the Golden State Water Company. Those data will be summed to calculate total annual imported water supplies in the SMVMA.

2.3 Water Disposition Data

In order to provide an accounting of amounts and methods of disposition of water utilized in the SMVMA, several data are to be reported. These include treated water volumes processed and disposed at wastewater treatment plants (WWTPs); records of any water exported from the SMVMA; and estimates of agricultural drainage disposed outside the SMVMA. “Disposition” of applied irrigation not consumptively used by crops, e.g., return flows to the aquifer system, will also be accounted.

2.3.1 Treated Water Discharge

Under the monitoring program, records of influent and treated effluent volumes will be compiled for WWTPs, including the Cities of Santa Maria, Guadalupe, and Laguna Sanitation District. All data will initially be recorded on a monthly basis to assess seasonal variation in the disposition of water (e.g., percentage of water utilized that becomes WWTP influent; losses during treatment). Effluent volumes will be recorded by disposal method and location, including any reuse of recycled water.

These data will be utilized to provide an accounting of municipal water disposed in the SMVMA. During each year, water disposal data from the WWTPs will be compiled into the SMVMA dataset. Annual coordination with the WWTPs will be jointly conducted by LSCE and the TMA.

2.3.2 Exported Water

As part of the monitoring program, records will be compiled of any groundwater or imported (SWP) water that is exported from the SMVMA. All data will be recorded by subsystem on a monthly basis and the receiving entities are to be noted. During each year, the data acquisition and compilation into the SMVMA dataset will be jointly conducted by LSCE and the TMA.

2.3.3 Agricultural Drainage and Return Flows

Under the monitoring program, estimation will be made of water drained from agricultural fields (e.g., by tile drains) for disposal outside of the SMVMA. Finally, while not formally "monitored," the disposition of applied irrigation will include estimates of the fate of that fraction of water not consumptively used by crops, primarily as return flow to the aquifer system.

III. SUMMARY

The monitoring program for the SMVMA includes the collection of hydrologic data, including: groundwater levels and quality; surface water storage, stream stage, discharge, and quality; and precipitation and ETo. The program provides designated shallow and deep well networks (Tables 1a/b/c and Figures 2a/b) and a surface water and climatic monitoring network (Figure 3) for collection of these data. Also specified are water requirements and supply data to be compiled for agricultural irrigation and municipal use, the disposal data for municipal water use, data on water exported from the SMVMA, and estimates of agricultural drainage and return flows.

The monitoring program components and frequencies are summarized as follows:

- groundwater levels: 149 wells (68 shallow, 52 deep, 29 unclassified), of which:
  91 wells are actively monitored (with monitoring to continue),
  56 wells are inactive (with monitoring to be reactivated), and
  2 wells are new (with monitoring to be implemented);
  semiannual frequency.

- groundwater quality: subset of 79 wells (37 shallow, 38 deep, 4 unclassified); of which:
  14 wells are actively monitored (with monitoring to continue),
  34 wells are inactive (with monitoring to be reactivated),
  30 wells are unmonitored and
  1 well is new (with monitoring to be implemented;
  analyzed for General Minerals (incl. NO3-NO3) and Bromide;
  biennial frequency.

- Twitchell Reservoir: stage, storage, and releases, which are actively monitored (with monitoring to continue), and
  quality, which is unmonitored (with monitoring to be implemented);
  stage, storage, and releases monitored daily;
  quality analyzed for General Minerals (incl. NO3-NO3) and Bromide on a biennial frequency.

- streams: 6 designated gauges for discharge, stage, and quality, of which:
  2 gauges are actively monitored for discharge and quality (to be continued),
  2 gauges are actively monitored for discharge (to be continued) but not monitored for water quality (to be implemented), and
  2 gauges are inactive (discharge and water quality monitoring to be reestablished);
  discharge and stage monitored daily;
  quality analyzed for General Minerals (incl. NO3-NO3) and Bromide on a biennial frequency.

- stream tributaries: 5 potential gauges for daily discharge and stage, that are inactive and would need to be reestablished.

- precipitation: 4 active gauges (to be continued);
  daily frequency.

- ETo: 3 active stations (to be continued);
  daily frequency.

- land use; annually.

- municipal water requirements, supplies (groundwater pumping and SWP imported water), disposal, and exportation; monthly.

- agricultural drainage and return flow; annually.

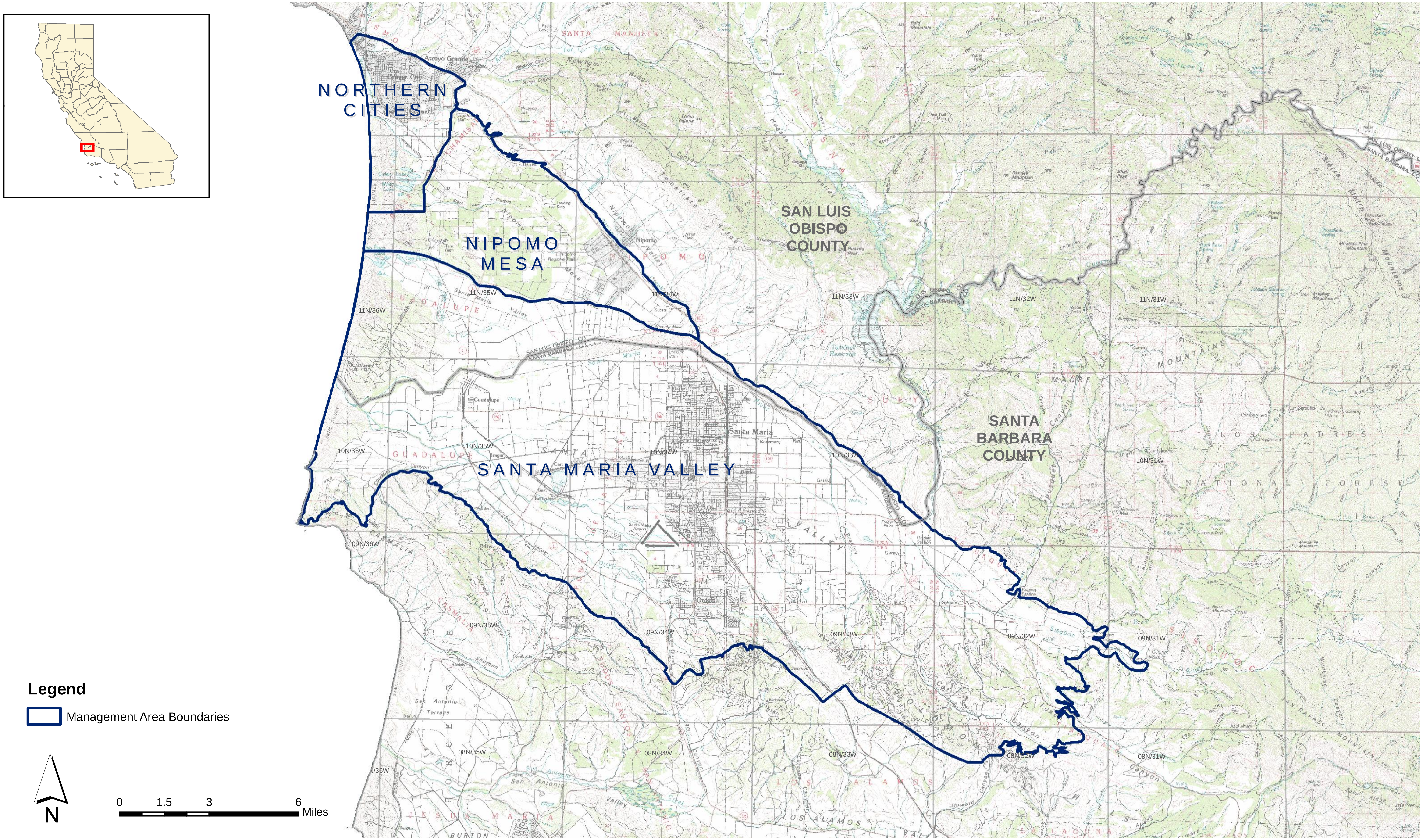

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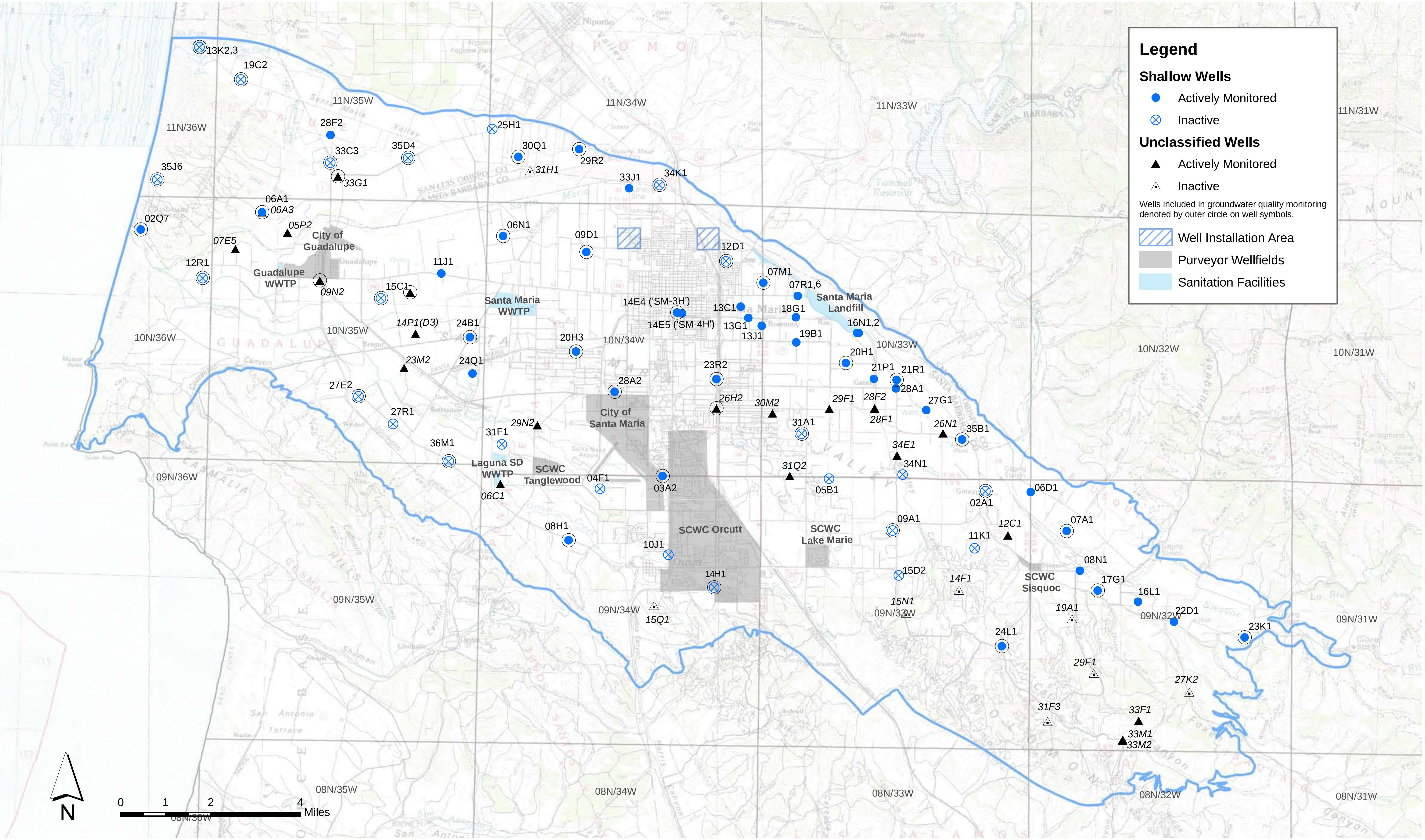
Figure 1
Santa Maria Valley Groundwater Basin and Management Areas



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Copy of document found at www.NoNewWipTax.com

Figure 2a
Well Network for Monitoring Shallow Groundwater
Santa Maria Valley Management Area

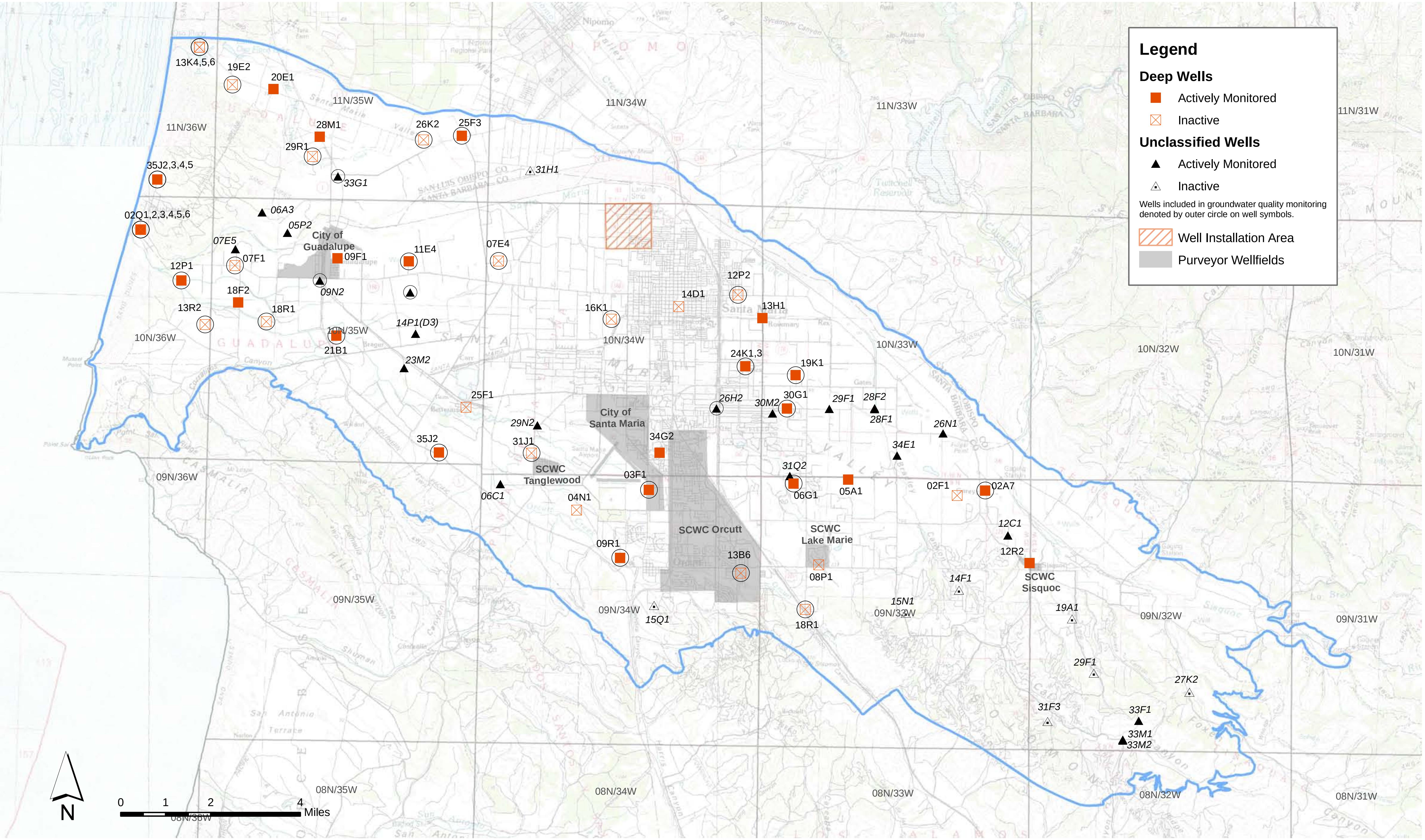

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Figure 2b
Well Network for Monitoring Deep Groundwater
Santa Maria Valley Management Area

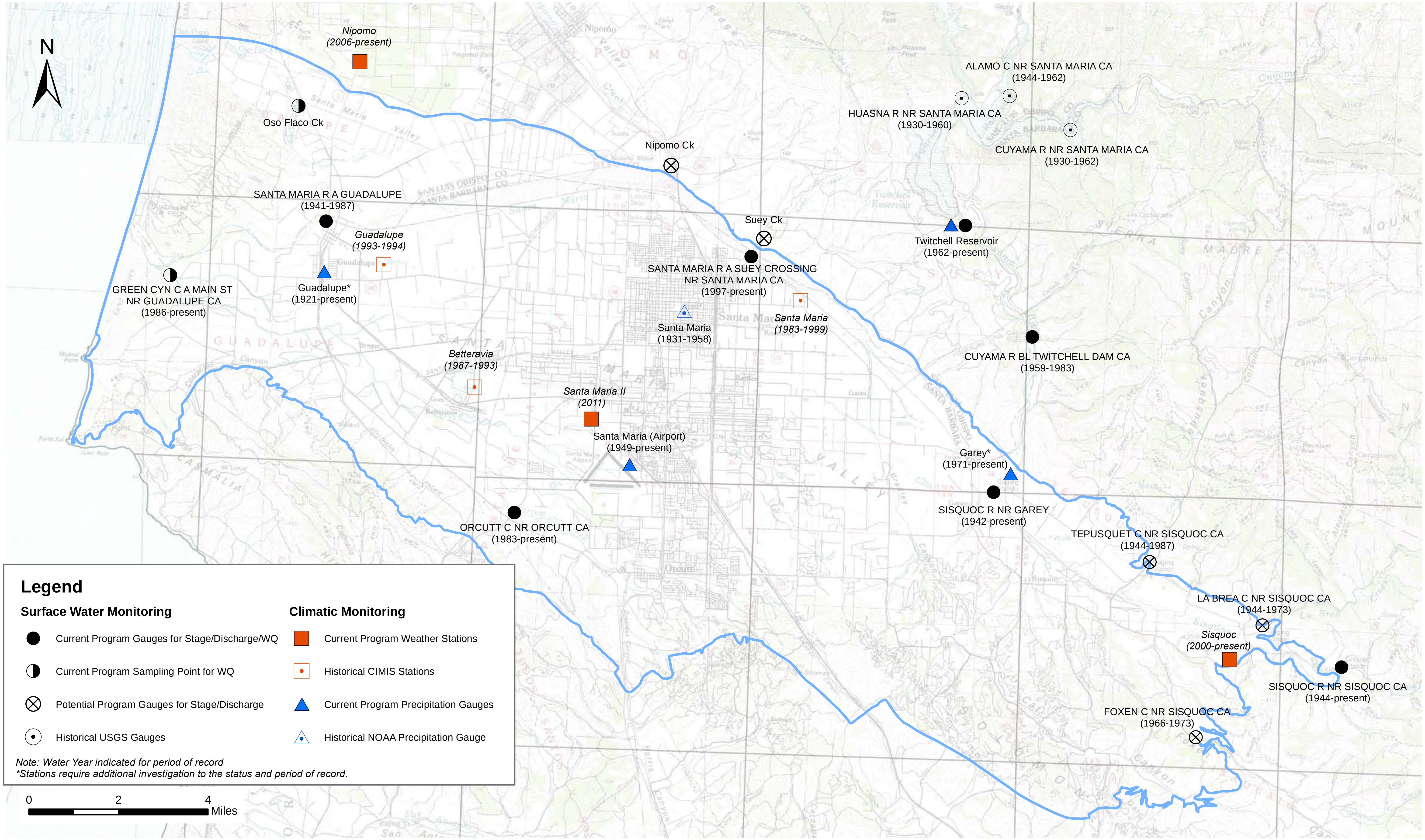

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Figure 3
Surface Water and Climatic Monitoring Network
Santa Maria Valley Management Area

Table 1a
Well Network for Monitoring Shallow Groundwater
Santa Maria Valley Management Area
(corresponds to Figure 2a)

Township/ Range	State Well Number	Well Map ID	Monitoring Agency	Actively Monitored for Water Levels	Actively Monitored for Water Quality	To Be Sampled for Water Quality
SHALLOW WELLS						
9N/32W	009N032W06D001S	06D1	USGS	A/S		
	009N032W07A001S	07A1	USGS	A/S		B
	009N032W08N001S	08N1	USGS	A/S		
	009N032W16L001S	16L1	USGS	A/S		
	009N032W17G001S	17G1	USGS	A/S		B
	009N032W22D001S	22D1	USGS	A/S		
	009N032W23K001S	23K1	USGS	A/S		B
9N/33W	009N033W02A001S	02A1	TBD			B
	009N033W05B001S	05B1	TBD			
	009N033W09A001S	09A1	TBD			B
	009N033W11K001S	11K1	TBD			
	009N033W15D002S	15D2	TBD			
	009N033W24L001S	24L1	USGS	A/S		B
9N/34W	009N034W03A002S	03A2	USGS	A/S	A	B
	009N034W04F001S	04F1	TBD			
	009N034W08H001S	08H1	USGS	A/S		B
	009N034W10J001S	10J1	TBD			
	009N034W14H001S	14H1	TBD			B
10N/33W	010N033W07M001S	07M1	USGS	A/S		B
	010N033W07R001S	07R1	USGS	A/S		
	010N033W07R006S	07R6	USGS	A/S		
	010N033W16N001S	16N1	USGS	A/S		
	010N033W16N002S	16N2	USGS	A/S		
	010N033W18G001S	18G1	SMVWCD & USGS	Qtr & S		
	010N033W19B001S	19B1	SMVWCD & USGS	Qtr & S		
	010N033W20H001S	20H1	USGS	A/S	A	B
	010N033W21P001S	21P1	SMVWCD & USGS	Qtr & S		
	010N033W21R001S	21R1	USGS	A/S		B
	010N033W27G001S	27G1	SMVWCD & USGS	Qtr & S		
	010N033W28A001S	28A1	SMVWCD & USGS	Qtr & S		
	010N033W31A001S	31A1	TBD			B
	010N033W34N001S	34N1	TBD			
	010N033W35B001S	35B1	USGS	A/S		B
10N/34W	010N034W06N001S	06N1	SMVWCD & USGS	Qtr & S		B
	010N034W09D001S	09D1	SMVWCD & USGS	Qtr & S		B
	010N034W12D001S	12D1	TBD			B
	010N034W13C001S	13C1	USGS	A/S		
	010N034W13G001S	13G1	USGS	A/S		
	010N034W13J001S	13J1	USGS	A/S		
	010N034W14E004S	14E4	SMVWCD & USGS	Qtr & S	A	B
	010N034W14E005S	14E5	USGS	A/S		
	010N034W20H003S	20H3	SMVWCD & USGS	Qtr & S		B
	010N034W23R002S	23R2	USGS	A/S		B
	010N034W28A002S	28A2	SMVWCD & USGS	Qtr & S		B
	010N034W31F001S	31F1	TBD			
10N/35W	010N035W06A001S	06A1	USGS	A/S		B
	010N035W11J001S	11J1	SMVWCD & USGS	Qtr & S		
	010N035W15C001S	15C1	TBD			B
	010N035W24B001S	24B1	SMVWCD & USGS	Qtr & S		B
	010N035W24Q001S	24Q1	USGS	A/S		
	010N035W27E002S	27E2	TBD			B
	010N035W27R001S	27R1	TBD			
	010N035W36M001S	36M1	TBD			B

Frequency Abbreviation: A/S - Annual/Semiannual; Qtr & S - Quarter & Semiannual; A - Annual; B - Biennial
Agency Abbreviation: SMVWCD - Santa Maria Valley Water Conservation District; SLODPW - San Luis Obispo Department of Public Works; USGS - United States Geological Survey; TBD - To Be Determined

Table 1a (continued)
Well Network for Monitoring Shallow Groundwater
Santa Maria Valley Management Area
(corresponds to Figure 2a)

Township/ Range	State Well Number	Well Map ID	Monitoring Agency	Actively Monitored for Water Levels	Actively Monitored for Water Quality	To Be Sampled for Water Quality
SHALLOW WELLS						
10N/36W	010N036W02Q007S	02Q7	USGS	A/S	A	B
	010N036W12R001S	12R1	TBD			B
11N/34W	011N034W29R002S	29R2	SLODPW & USGS	A/S		B
	011N034W30Q001S	30Q1	SMVWCD & USGS	Qtr & S		B
	011N034W33J001S	33J1	SMVWCD & USGS	Qtr & S		
	011N034W34K001S	34K1	TBD			B
11N/35W	011N035W19C002S	19C2	TBD			B
	011N035W25H001S	25H1	TBD			
	011N035W28F002S	28F2	SLODPW & USGS	A/S		
	011N035W33C003S	33C3	TBD			B
	011N035W35D004S	35D4	TBD			B
11N/36W	011N036W13K002S	13K2	TBD			B
	011N036W13K003S	13K3	TBD			B
	011N036W35J006S	35J6	TBD			B

Frequency Abbreviation: A/S - Annual/Semiannual; Qtr & S - Quarter & Semiannual; A - Annual; B - Biennial
Agency Abbreviation: SMVWCD - Santa Maria Valley Water Conservation District; SLODPW - San Luis Obispo Department of Public Works; USGS - United States Geological Survey; TBD - To Be Determined

Notes on Network Modification:

09N/32W-6D1 previously unclassified; classified as shallow well (depth unknown; compared to wells of known depth, water levels similar to those from shallow wells)
09N/33W-12R2 removed; classified as deep well
10N/33W-18G1 previously unclassified; classified as shallow well (depth = 422'; compared to wells of known depth, water levels similar to those from shallow wells)
10N/35W-11J1 previously unclassified; classified as shallow well (depth = 215'; compared to wells of known depth, water levels similar to those from shallow wells)
11N/34W-33J1 previously not included; classified as shallow well (depth = 149'; water level data recently made available by the USGS)
11N/35W-28F2 previously not included; classified as shallow well (depth = 48'; water level data recently made available by NMMA Tech Comm.)
11N/36W-35J5 removed; classified as deep well

Table 1b
Well Network for Monitoring Deep Groundwater
Santa Maria Valley Management Area
(corresponds to Figure 2b)

Township/ Range	State Well Number	Well Map ID	Monitoring Agency	Actively Monitored for Water Levels	Actively Monitored for Water Quality	To Be Sampled for Water Quality
DEEP WELLS						
9N/33W	009N033W02A007S	02A7	SMVWCD & USGS	Qtr & S	A	B
	009N033W02F001S	02F1	TBD			
	009N033W05A001S	05A1	USGS	A/S		
	009N033W06G001S	06G1	USGS	A/S		B
	009N033W08P001S	08P1	TBD			
	009N033W12R002S	12R2	SMVWCD & USGS	Qtr & S		
	009N033W18R001S	18R1	TBD			B
9N/34W	009N034W03F001S	03F1	USGS	A/S		B
	009N034W04N001S	04N1	TBD			
	009N034W09R001S	09R1	USGS	A/S		B
	009N034W13B006S	13B6	TBD			B
10N/33W	010N033W19K001S	19K1	USGS	A/S		B
	010N033W30G001S	30G1	SMVWCD & USGS	Qtr & S	A	B
10N/34W	010N034W07E004S	07E4	TBD			B
	010N034W12P002S	12P2	TBD			B
	010N034W13H001S	13H1	USGS	A/S		
	010N034W14D001S	14D1	TBD			
	010N034W16K001S	16K1	TBD			B
	010N034W24K001S	24K1	SMVWCD & USGS	Qtr & S		
	010N034W24K003S	24K3	SMVWCD & USGS	Qtr & S		B
	010N034W31J001S	31J1	TBD			B
	010N034W34G002S	34G2	SMVWCD & USGS	Qtr & S		
10N/35W	010N035W07F001S	07F1	TBD			B
	010N035W09F001S	09F1	USGS	A/S		
	010N035W11E004S	11E4	SMVWCD & USGS	Qtr & S		B
	010N035W18F002S	18F2	USGS	A/S		
	010N035W18R001S	18R1	TBD			B
	010N035W21B001S	21B1	SMVWCD & USGS	Qtr & S		B
	010N035W25F001S	25F1	TBD			
	010N035W35J002S	35J2	USGS	A/S		B
10N/36W	010N036W02Q001S	02Q1	USGS	A/S	A	B
	010N036W02Q002S	02Q2	TBD			B
	010N036W02Q003S	02Q3	USGS	A/S	A	B
	010N036W02Q004S	02Q4	USGS	A/S	A	B
	010N036W02Q005S	02Q5	TBD			B
	010N036W02Q006S	02Q6	TBD			B
	010N036W12P001S	12P1	USGS	A/S		B
	010N036W13R002S	13R2	TBD			B
11N/35W	011N035W19E002S	19E2	TBD			B
	011N035W20E001S	20E1	SMVWCD & USGS	Qtr & S		
	011N035W25F003S	25F3	SMVWCD & USGS	Qtr & S		B
	011N035W26K002S	26K2	TBD			B
	011N035W28M001S	28M1	SMVWCD & USGS	Qtr & S		
	011N035W29R001S	29R1	TBD			B
11N/36W	011N036W13K004S	13K4	TBD			B
	011N036W13K005S	13K5	TBD			B
	011N036W13K006S	13K6	TBD			B
	011N036W35J002S	35J2	USGS	A/S	A	B
	011N036W35J003S	35J3	USGS	A/S	A	B
	011N036W35J004S	35J4	USGS	A/S	A	B
	011N036W35J005S	35J5	USGS	A/S	A	B

Frequency Abbreviation: A/S - Annual/Semiannual; Qtr & S - Quarter & Semiannual; A - Annual; B - Biennial
Agency Abbreviation: SMVWCD - Santa Maria Valley Water Conservation District; USGS - United States Geological Survey; TBD - To Be Determined

Notes on Network Modification:

09N/33W-2A7 previously not included; classified as deep well (depth = 512'; water level data recently made available by the USGS)

09N/33W-12R2 previously classified as shallow well; classified as deep well (depth = 640'; compared to wells of known depth, water levels similar to those from deep wells)

10N/35W-9F1 previously unclassified; classified as deep well (depth = 240'; compared to wells of known depth, water levels similar to those from deep wells)

10N/35W-18F2 previously unclassified; classified as deep well (depth = 251'; compared to wells of known depth, water levels similar to those from deep wells)

10N/35W-21B1 previously unclassified; classified as deep well (depth = 300'; compared to wells of known depth, water levels similar to those from deep wells)

11N/35W-20E1 previously unclassified; classified as deep well (depth = 444'; compared to wells of known depth, water levels similar to those from deep wells)

11N/35W-25F3 previously unclassified; classified as deep well (depth unknown; compared to wells of known depth, water levels similar to those from deep wells)

11N/35W-28M1 previously unclassified; classified as deep well (depth = 376'; compared to wells of known depth, water levels similar to those from deep wells)

11N/36W-35J5 previously classified as shallow well; classified as deep well (depth = 135'; compared to wells of known depth, water levels and quality similar to those from deep coastal network wells)

Table 1c
Unclassified Wells for Groundwater Monitoring
Santa Maria Valley Management Area
(shown on Figures 2a and 2b)

Township/ Range	State Well Number	Well Map ID	Monitoring Agency	Actively Monitored for Water Levels	Actively Monitored for Water Quality	To Be Sampled for Water Quality
UNCLASSIFIED WELLS						
9N/32W	009N032W19A001S	19A1	TBD			
	009N032W27K002S	27K2	TBD			
	009N032W29F001S	29F1	TBD			
	009N032W31F003S	31F3	TBD			
	009N032W33F001S	33F1	USGS	A/S		
	009N032W33M001S	33M1	USGS	A/S		
	009N032W33M002S	33M2	USGS	A/S		
9N/33W	009N033W12C001S	12C1	USGS	A/S		
	009N033W14F001S	14F1	TBD			
	009N033W15N001S	15N1	TBD			
9N/34W	009N034W06C001S	06C1	USGS	A/S		
	009N034W15Q001S	15Q1	TBD			
10N/33W	010N033W26N001S	26N1	USGS	A/S		
	010N033W28F001S	28F1	USGS	A/S		
	010N033W28F002S	28F2	USGS	A/S		
	010N033W29F001S	29F1	USGS	A/S		
	010N033W30M002S	30M2	USGS	A/S		
	010N033W31Q002S	31Q2	USGS	A/S		
	010N033W34E001S	34E1	USGS	A/S		
10N/34W	010N034W26H002S	26H2	USGS	A/S		B
	010N034W29N002S	29N2	USGS	A/S		
10N/35W	010N035W05P002S	05P2	USGS	A/S		
	010N035W06A003S	06A3	USGS	A/S		
	010N035W07E005S	07E5	USGS	A/S		
	010N035W09N002S	09N2	USGS	A/S		B
	010N035W14P001S	14P1 (D3)[1]	USGS	A/S	(A)	(A)
	010N035W23M002S	23M2	USGS	A/S		
11N/34W	011N034W31H001S	31H1	TBD			
11N/35W	011N035W33G001S	33G1	SMVWCD & USGS	Qtr & S		B

[1]14P1 actively monitored for levels but not quality. 14D3 actively monitored for quality but not levels.

Frequency Abbreviation: A/S - Annual/Semiannual; Qtr & S - Quarter & Semiannual; A - Annual; B - Biennial
Agency Abbreviation: SMVWCD - Santa Maria Valley Water Conservation District; USGS - United States Geological Survey; TBD - To Be Determined

Notes on Network Modification:
09N/32W-6D1 removed; classified as shallow well
10N/33W-18G1 removed; classified as shallow well
10N/35W-9F1 removed; classified as deep well
10N/35W-11J1 removed; classified as shallow well
10N/35W-18F2 removed; classified as deep well
10N/35W-21B1 removed; classified as deep well
11N/35W-20E1 removed; classified as deep well
11N/35W-25F3 removed; classified as deep well
11N/35W-28M1 removed; classified as deep well

Appendix B

2011 Land Use
Data and Image Inventory

Appendix B

2011 Landuse Interpretation

Data and Image Inventory

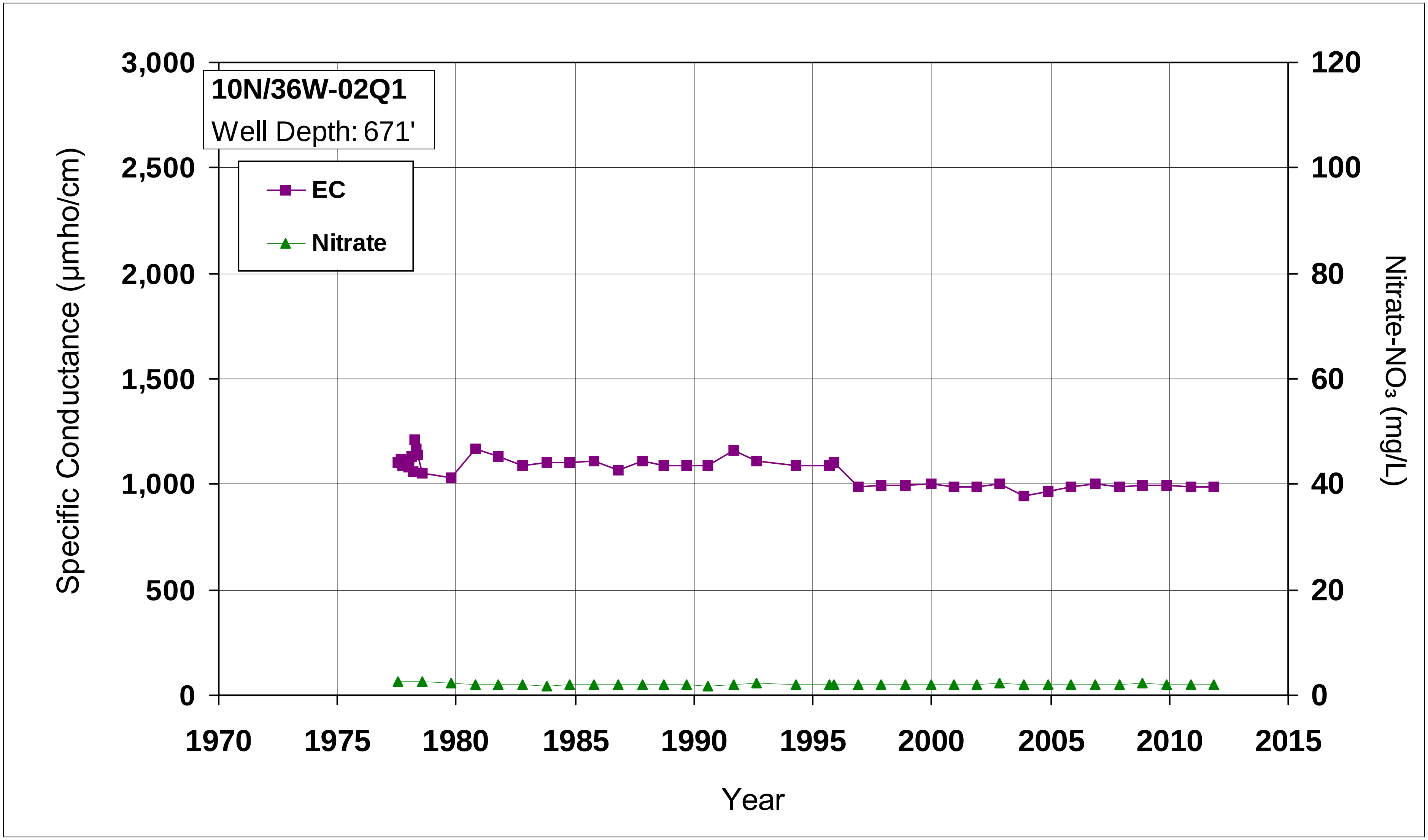
Santa Maria Valley Management Area

Year	Dataset	Data Type and Resolution	Coverage Area	Date	Source
2011	NDVI	L5 Multi-band raster 30m	PR 42/36	January 7, 2011	USGS
	NDVI	L5 Multi-band raster 30m	PR 42/36	January 23, 2011	USGS
	NDVI, CIR Composite	L5 Multi-band raster 30m	PR 42/36	February 8, 2011	USGS
	NDVI	L5 Multi-band raster 30m	PR 42/36	March 28, 2011	USGS
	NDVI	L5 Multi-band raster 30m	PR 42/36	April 29, 2011	USGS
	NDVI	L5 Multi-band raster 30m	PR 42/36	May 31, 2011	USGS
	NDVI, CIR Composite	L5 Multi-band raster 30m	PR 43/36	June 7, 2011	USGS
	NDVI	L7 Multi-band raster 30m	PR 43/36	June 15, 2011	USGS
	NDVI	L5 Multi-band raster 30m	PR 42/36	July 2, 2011	USGS
	NDVI	L5 Multi-band raster 30m	PR 42/36	July 18, 2011	USGS
	NDVI	L5 Multi-band raster 30m	PR 42/36	September 4, 2011	USGS
	NDVI	L5 Multi-band raster 30m	PR 42/36	September 20, 2011	USGS
	NDVI	L5 Multi-band raster 30m	PR 42/36	October 6, 2011	USGS
	NDVI	L5 Multi-band raster 30m	PR 42/36	October 22, 2011	USGS
	NDVI	L5 Multi-band raster 30m	PR 42/36	November 7, 2011	USGS
	NAIP Digital Ortho Mosaic	Color aerial photo 1m	SLO and SB Cty	June 2009	USDA/FSA/APFO
	NAIP Digital Ortho Mosaic	Color aerial photo 1m	SLO and SB Cty	Summer 2010	USDA/FSA/APFO
	SB Cty Pesticide Crop Report	Crop Polygon shp	SB Cty	2011	SB Cty Ag Co
	SLO Cty Pesticide Permitted Crop	Crop Polygon shp	SLO Cty	2011	SLO Cty Ag Co

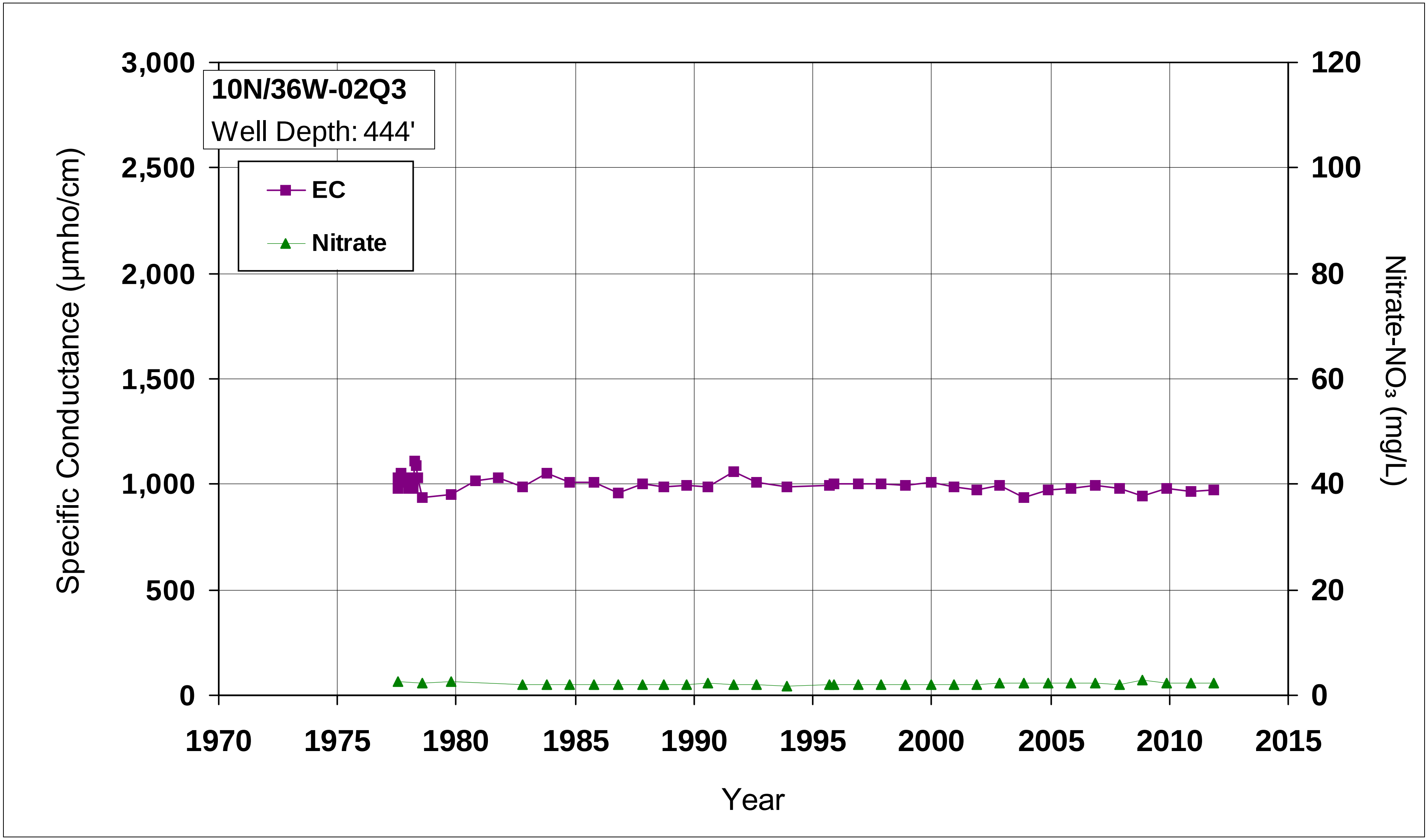
CIR - Color Infrared; L5 - Landsat 5; L7 - Landsat 7; NAIP - National Ag Imagery Program; NDVI - Normalized Difference Vegetation Index; PR - Path/Row; SB Cty - Santa Barbara County; SB Cty Ag Co - Santa Barbara Agricultural Commission; shp - Shapefile; SLO Cty - San Luis Obispo County; SLO Cty Ag Co - San Luis Obispo County Agriculture Commission; USDA/FSA/APFO - United States Department of Agriculture/Farm Service Agency/Aerial Photography Field Office; USGS - United States Geological Survey

Appendix C

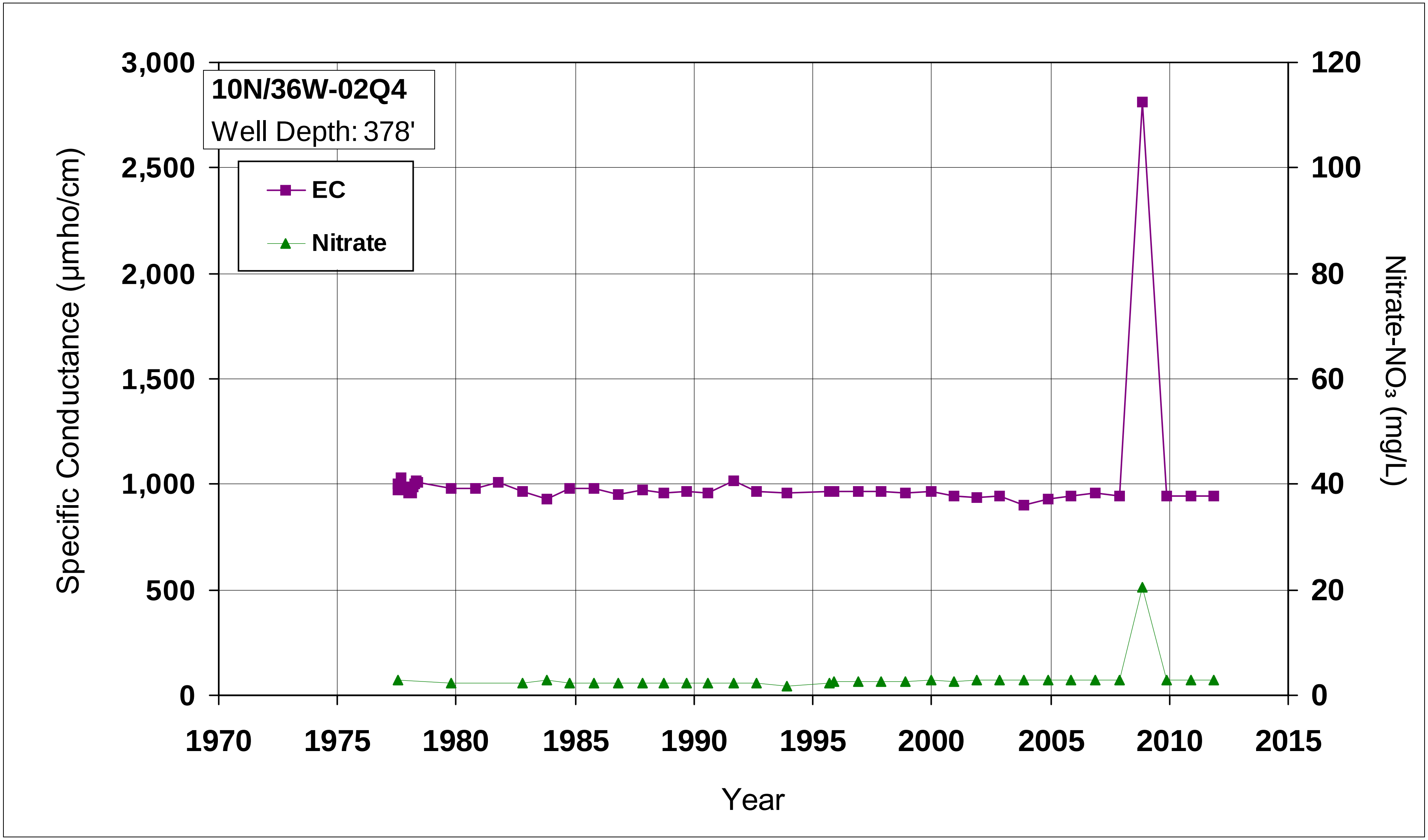
Coastal Groundwater Quality

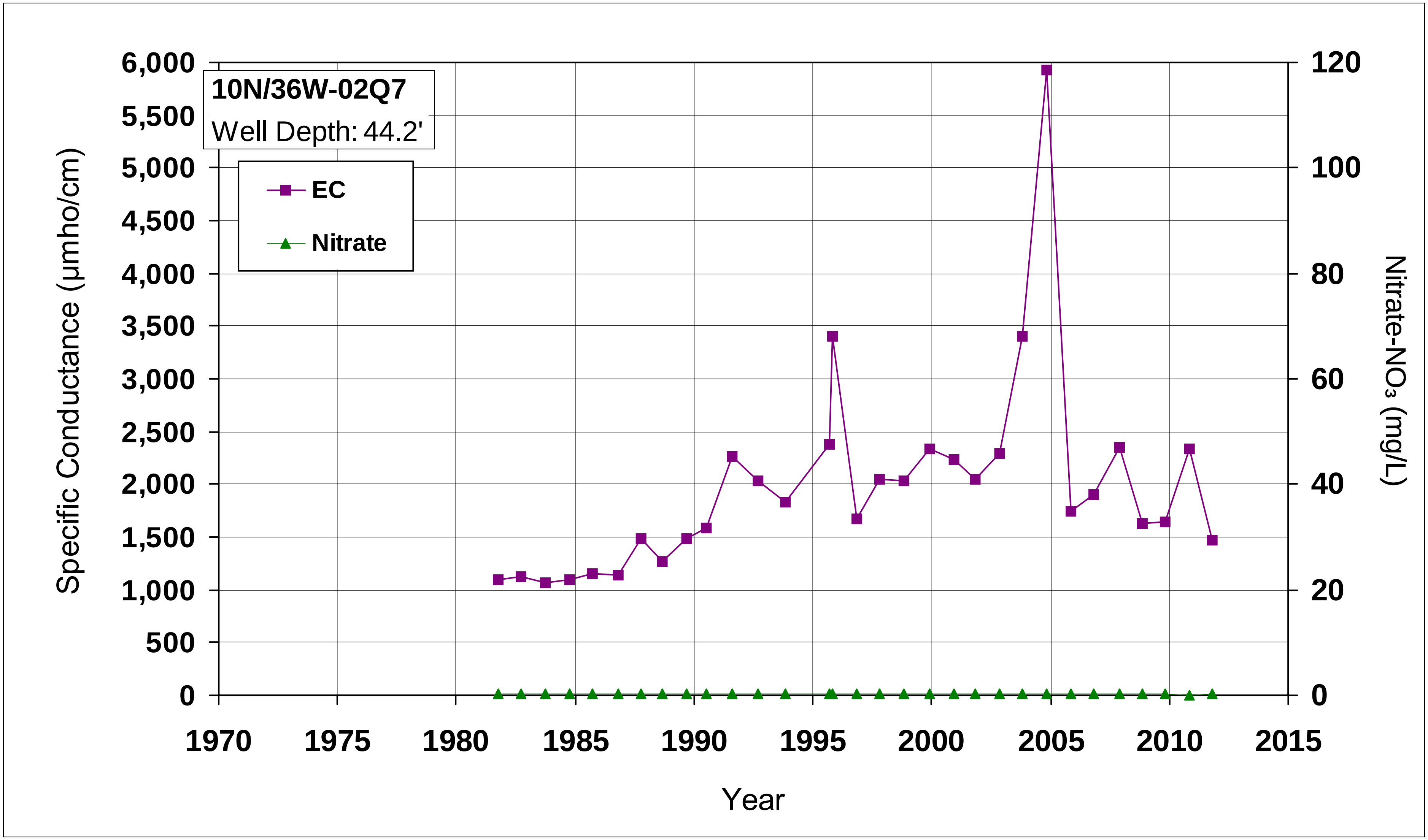


10N/36W-02Q1
Well Depth: 671'
EC
Nitrate
Specific Conductance (µmho/cm)
Nitrate-NO₃ (mg/L)
Year
3,000
2,500
2,000
1,500
1,000
500
0
120
100
80
60
40
20
0
1970
1975
1980
1985
1990
1995
2000
2005
2010
2015



10N/36W-02Q3
Well Depth: 444'
EC
Nitrate
Specific Conductance (µmho/cm)
Nitrate-NO₃ (mg/L)
Year
3,000
2,500
2,000
1,500
1,000
500
0
120
100
80
60
40
20
0
1970
1975
1980
1985
1990
1995
2000
2005
2010
2015


10N/36W-02Q4
Well Depth: 378'
EC
Nitrate
Specific Conductance (µmho/cm)
Nitrate-NO₃ (mg/L)
Year
3,000
2,500
2,000
1,500
1,000
500
0
120
100
80
60
40
20
0
1970
1975
1980
1985
1990
1995
2000
2005
2010
2015


10N/36W-02Q7
Well Depth: 44.2'
EC
Nitrate
Specific Conductance (µmho/cm)
Nitrate-NO₃ (mg/L)
6,000
5,500
5,000
4,500
4,000
3,500
3,000
2,500
2,000
1,500
1,000
500
0
120
100
80
60
40
20
0
1970
1975
1980
1985
1990
1995
2000
2005
2010
2015
Year

Appendix D

Historical Return Flows
From Waste Water Treatment Plants

Appendix D
Estimated Historical Return Flows from Wastewater Treatment Plants
Santa Maria Valley Management Area
(all units in afy unless otherwise noted)

	Total Water Use				**Total WWTP Influent**			**Total WWTP Influent by Purveyor**										**Total WWTP Effluent**					
								Santa Maria				**Golden State Water Company**				**Guadalupe**							
								Influent to WWTP	Influent to WWTP	Total Influent to WWTPs		Influent to WWTP	Influent to WWTP	Total Influent to WWTPs		Influent to WWTP		SM	LSD				Guad
Year	SM	GSWC	GSWC[1]	Guad	SM	LSD	Guad	(SM)	(LSD)[2]	(SM and LSD)	% Water Use[3]	(LSD)	(SM)	(SM and LSD)	% Water Use[4]	(Guad)	% Water Use[5]	Total	Brine Injection[6]	Industrial Use	Irrigation	Total	Total
1997	12,522	9,441	9,387	778	8,406	2,706	467	8,077	95	8,172	65.3	2,611	328.9	2,940	31.3	467	60.0	7,566	78	0	2,357	2,435	420
1998	11,085	8,001	7,960	778	7,475	2,252	467	7,140	95	7,235	65.3	2,157	335.6	2,493	31.3	467	60.0	6,728	78	0	1,949	2,027	420
1999	11,859	9,263	9,193	778	7,996	2,643	467	7,665	95	7,760	65.4	2,548	330.9	2,879	31.3	467	60.0	7,196	78	0	2,301	2,379	420
2000	12,679	9,399	9,342	778	8,369	2,825	467	8,025	95	8,120	64.0	2,730	343.8	3,073	32.9	467	60.0	7,532	78	0	2,464	2,542	420
2001	12,594	9,009	8,950	778	8,734	2,870	467	8,375	95	8,470	67.3	2,775	358.6	3,133	35.0	467	60.0	7,860	78	0	2,505	2,583	420
2002	13,312	9,466	9,409	778	8,868	2,632	467	8,512	95	8,607	64.7	2,537	355.4	2,893	30.7	467	60.0	7,981	78	0	2,291	2,369	420
2003	13,499	9,071	9,023	778	9,108	2,626	467	8,629	95	8,724	64.6	2,531	479.0	3,010	33.4	467	60.0	8,197	78	0	2,285	2,363	420
2004	13,650	9,356	9,302	832	9,555	2,580	499	9,112	95	9,207	67.4	2,485	443.4	2,929	31.5	499	60.0	8,600	78	0	2,244	2,322	449
2005	13,814	8,846	8,802	814	9,657	2,302	488	9,305	95	9,400	68.0	2,207	352.0	2,559	29.1	488	60.0	8,691	78	0	1,994	2,072	439
2006	13,610	8,754	8,700	883	9,487	2,006	529	9,168	95	9,263	68.1	1,911	319.8	2,231	25.6	529	60.0	8,539	78	4	1,724	1,806	477
2007	14,782	9,710	9,652	1,063	9,380	2,150	638	8,971	95	9,066	61.3	2,055	408.6	2,463	25.5	638	60.0	8,442	78	16	1,841	1,935	574
2008	14,235	9,311	9,255	997	9,520	2,271	633	9,026	95	9,121	64.1	2,176	493.7	2,670	28.8	633	63.5	8,568	89	12	1,943	2,044	570
2009	14,172	8,729	8,668	917	9,471	2,237	664	8,952	95	9,047	63.8	2,142	518.9	2,661	30.7	664	72.4	8,524	73	28	1,912	2,013	598
2010	13,294	7,735	7,681	880	8,721	2,336	664	8,177	95	8,272	62.2	2,241	543.6	2,785	36.3	664	75.5	7,849	79	55	1,968	2,102	598
2011	12,665	7,844	7,794	885	9,005	2,361	654	8,442	95	8,537	67.4	2,266	562.5	2,828	36.3	654	73.9	8,104	72	40	2,014	2,125	589

	Effluent Available for Return Flows					**Return Flows**									
	Santa Maria		**Golden State Water Company**		**Guadalupe**	**Santa Maria**				**Golden State Water Company**				**Guadalupe**	
	Effluent from WWTP	Effluent from WWTP	Effluent from WWTP	Effluent from WWTP	Effluent from WWTP	from WWTP	from WWTP			from WWTP	from WWTP			from WWTP	
Year	(SM)	(LSD)	(SM)	(LSD)	(Guad)	(SM)	(LSD)	Total	% Water Use	(SM)	(LSD)	Total	% Water Use[7]	(Guad)	% Water Use
1997	7,270	83	296	2,353	420	7,270	17	7,286	58	296	471	767	8.1	84	11
1998	6,426	82	302	1,945	420	6,426	16	6,442	58	302	389	691	8.6	84	11
1999	6,899	83	298	2,296	420	6,899	17	6,915	58	298	459	757	8.2	84	11
2000	7,223	83	309	2,459	420	7,223	17	7,239	57	309	492	801	8.5	84	11
2001	7,538	83	323	2,500	420	7,538	17	7,554	60	323	500	823	9.1	84	11
2002	7,661	83	320	2,286	420	7,661	17	7,678	58	320	457	777	8.2	84	11
2003	7,766	83	431	2,281	420	7,766	17	7,783	58	431	456	887	9.8	84	11
2004	8,201	83	399	2,240	449	8,201	17	8,217	60	399	448	847	9.1	90	11
2005	8,374	82	317	1,990	439	8,374	16	8,391	61	317	398	715	8.1	88	11
2006	8,251	82	288	1,724	477	8,251	16	8,267	61	288	345	633	7.2	95	11
2007	8,074	81	368	1,853	574	8,074	16	8,090	55	368	371	738	7.6	115	11
2008	8,123	81	444	1,963	570	8,123	16	8,140	57	444	393	837	9.0	114	11
2009	8,057	81	467	1,932	598	8,057	16	8,073	57	467	386	853	9.8	120	13
2010	7,360	80	489	2,022	598	7,360	16	7,376	55	489	404	894	11.6	120	14
2011	7,598	81	506	2,044	589	7,598	16	7,614	60	506	409	915	11.7	118	13

Estimated

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

1) Excludes Sisquoc system water use (typically 40 - 70 afy) for effluent return flow calculations.
2) Average Influent from Santa Maria to LSD (from LSD staff, April 2010)
3) Percentage of SM total water use as total influent to WWTPs = 65.3
4) Percentage of GSWC water use (excluding Sisquoc System) as total influent to WWTPs = 31.3
5) Percentage of Guadalupe total water use as influent to WWTP (from Guad staff, April 2009) = 60.0
6) Average brine amount to injection well for 1997 - 2007; reported amounts for 2008 to present = 78.1
7) Percentage of GSWC total water use (including Sisquoc System) as total influent to WWTPs.