Santa Maria River Valley Groundwater Basin

- Groundwater Basin Number: 3-12
- County: Santa Barbara and San Luis Obispo
- Surface Area: 184,000 acres (288 square miles)

Basin Boundaries and Hydrology

This groundwater basin underlies the Santa Maria Valley in the coastal portion of northern Santa Barbara and southern San Luis Obispo Counties. The basin also underlies Nipomo and Tri-Cities Mesas, Arroyo Grande Plain, and Nipomo, Arroyo Grande and Pismo Creek Valleys (DWR 2002). The basin is bounded on the north by the San Luis and Santa Lucia Ranges, on the east by the San Rafael Mountains, on the south by the Solomon Hills and the San Antonio Creek Valley Groundwater Basin, on the southwest by the Casmalia Hills, and on the west by the Pacific Ocean. Several rivers and creeks drain westward to the Pacific Ocean. The Santa Maria Valley is drained by the Sisquoc, Cuyama, and Santa Maria Rivers and Orcutt Creek. Tri-Cities Mesa and Arroyo Grande Plain are drained by Arroyo Grande and Pismo Creeks. Nipomo Valley is drained by Nipomo Creek into the Santa Maria River. Annual precipitation ranges from 13 to 17 inches, with an average of 15 inches.

Hydrogeologic Information

Water Bearing Formations

Groundwater is found in alluvium, dune sands, and the Orcutt, Paso Robles, Pismo, and Careaga Formations. Groundwater is unconfined throughout most of the basin except in the coastal portion where it is confined. Specific yield of sediments in the basin ranges from 3 to 21 percent, with a mean specific yield of about 12 percent for parts of the basin in San Luis Obispo County (DWR 2002), and up to about 15 percent in Santa Barbara County (Lipinski 1985; DWR 1999). The average total thickness of the water-bearing materials is about 1,000 feet with a maximum thickness of 2,800 (SBCWA 1996) to 3,000 feet (Worts 1951).

Alluvium and Dune Deposits. Holocene alluvium consists of unconsolidated lenticular bodies of gravel, sand, silt, and clay. This alluvium reaches a maximum thickness of about 250 feet (Miller and Evenson 1966). Specific yield of Holocene alluvium ranges from about 6 to 23 percent and has a median value of about 12 percent for deposits in San Luis Obispo County (DWR 2002); the specific yield of deposits in Santa Barbara County is likely similar. Pleistocene and Holocene dune deposits consist of well-rounded, fine- to coarse-grained sand. Holocene dune deposits are typically found along a coastal belt and attain a maximum thickness of 100 feet (Woodring and Bramlette 1950; DWR 2002). Pleistocene dune deposits found under Tri-Cities Mesa range to about 60 feet thick and those under Nipomo Mesa range to about 300 feet thick (DWR 2002). Specific yield of Pleistocene dune deposits ranges from 5 to 26 percent and has an median value of about 13 percent for Tri-Cities Mesa and 17 percent for Nipomo Mesa (DWR 2002).

Orcutt Formation. The Pleistocene age Orcutt Formation consists of sand and interbeds of coarse gravel, with minor amounts of silt and clay restricted

to the upper parts of the unit (Woodring and Bramlette 1950). The Orcutt Formation can reach a maximum thickness of 225 feet, particularly along the axis of the Santa Maria Valley syncline (Worts 1951).

Paso Robles Formation. The Pliocene-Pleistocene age Paso Robles Formation typically consists of unconsolidated to poorly consolidated coarse to fine-grained gravel, sand, silt, and clay (DWR 2002). In this basin, the Paso Robles Formation ranges from about 40 feet near Pismo Creek (DWR 2002) to 2,000 feet (Woodring and Bramlette 1950; Worts 1951) near Orcutt (Worts 1951). Specific yield of the Paso Robles Formation ranges from 4 to 20 percent, with median values of 6 to 11 percent for different parts of the basin in San Luis Obispo County (DWR 2002). Specific yield for the Paso Robles Formation in Santa Barbara County is estimated to average about 12 percent (DWR 1969).

Careaga Formation. The late Pliocene age Careaga Formation is described as unconsolidated deposits of fine- to medium-grained, marine sand with some silt (Worts 1951), and unconsolidated to well consolidated, coarse- to fine-grained sand, gravel, silty sand, silt, and clay (DWR 2002). Thickness of this unit ranges from about 150 to 700 feet in the San Luis Obispo County portion of the basin (DWR 2002) and ranges from 50 to 2,250 feet thick (Woodring and Bramlette 1950) elsewhere in the basin. Specific yield of the Careaga Formation ranges from 5 to 26 percent, with median values of 8 to 10 percent for different parts of the basin in San Luis Obispo County (DWR 2002).

Pismo Formation. The late Pliocene age Squire Member of the Pismo Formation is an important source of groundwater in the basin north of the Santa Maria River fault. The Squire Member consists of coarse- to fine-grained sand interbeded with discontinuous layers of silt and clay, and ranges from about 50 to 550 feet thick (DWR 2002). Specific yield of the Squire Member of the Pismo Formation ranges from 3 to 19 percent, with median values from 7 to 10 percent for parts of the basin north of the Santa Maria River fault in San Luis Obispo County (DWR 2002).

Restrictive Structures

In Santa Barbara County, the north-trending Santa Maria and Bradley Canyon faults displace the Paso Robles and Careaga Formations, but do not appear to displace younger sediments (Worts 1951). The Santa Maria fault displaces Pliocene units vertically by about 150 feet, and a steepening of the hydraulic gradient near the trace of this fault indicates that this fault is a partial barrier to groundwater flow (SBCWA 1977). The Santa Maria River fault cuts northwestward through the basin in San Luis Obispo County (DWR 2002). Water levels at different elevations across some sections of this fault suggest that it is a barrier to groundwater movement in formations below the Pleistocene dune sand deposits (DWR 2002).

Recharge

Natural recharge to the basin comes from seepage losses from the major streams, percolation of rainfall, and subsurface flow (DWR 2002). Percolation of flow in Pismo Creek provides recharge for the northern portion of the basin (DWR 2002). Percolation of flow in Arroyo Grande

Creek, controlled by releases from Lopez Dam, provides recharge for the Tri-Cities Mesa, Arroyo Grande Plain, and Arroyo Grande Valley portions of the basin (DWR 2002). Percolation of flow in Santa Maria River, controlled in part by releases from Twitchell Dam, provides recharge for the Santa Maria Valley portion of the basin (DWR 1999; 2002). Both Twitchell and Lopez Dams are operated so as to optimize groundwater recharge for the Santa Maria Groundwater Basin (DWR 2002). Incidental recharge includes deep percolation of urban and agricultural return water, treated wastewater return and septic tank effluent. Some subsurface inflow comes from consolidated rocks surrounding the basin and also from San Antonio Creek Valley Groundwater Basin (SBCWA 1977).

Groundwater Level Trends

Hydrographs show that water levels near Tri-Cities Mesa generally remained stable in the Paso Robles Formation and the alluvium from about 1965 through 2000 (DWR 2002). Groundwater levels in the deeper Squire Member of the Pismo Formation near Tri-Cities Mesa declined during the 1980s and partially recovered by 2000 to about 4 to 11 feet below late 1970s-early 1980s levels (DWR 2002). Groundwater levels beneath Nipomo Mesa declined from 1 to 10 feet in the northern part during 1975 through 2000 and as much as 58.6 feet in the central part during 1968 through 2000; whereas water levels were stable in the western and southeastern parts, generally following rainfall cycles (DWR 2002). Groundwater levels beneath Santa Maria Valley generally declined during 1945 through 1977, recovered by about 1986, declined again until about 1992, then recovered to near historic high levels by 1998 (DWR 2002).

Groundwater flow is generally westward toward the Pacific Ocean. A large groundwater depression beneath Nipomo Mesa, in the northern part of the basin, has directed groundwater flow locally toward the depression (DWR 2002).

Groundwater Storage

Groundwater Storage Capacity. The total storage capacity of the portion of the basin in San Luis Obispo County is estimated to be about 4,000,000 af, with about 784,000 of that capacity residing above mean sea level (DWR 2002). Based on estimates of groundwater in storage for 1968 (DWR 1969), the total storage capacity of the basin must be greater than 14,900,000 af.

Groundwater in Storage. The maximum historical water levels occurred in 1918 and the groundwater in storage above mean sea level, for that year, in the Santa Maria Valley part of the basin is estimated to have been about 3,070,000 af (SBCWA 1977). Groundwater in storage in the Santa Barbara County portion of the basin during spring 1968 was estimated to have been about 11,000,000 af, and in the San Luis Obispo County portion to have been about 3,870,000 af (DWR 1969). Groundwater in storage for the Santa Maria Valley portion above sea level is estimated to have been 2,500,000 af in 1984 and 2,300,000 af in 2000 (SBCWA 1999; 2001). Groundwater in storage in the San Luis Obispo County portion of the basin is estimated to have been 3,411,100 af in 1985 and 3,399,700 af in 1995 with groundwater in storage above mean sea level estimated to have been 231,100 af in 1985, and 219,700 af in 1995 (DWR 2002).

Groundwater Budget (Type A)

Groundwater budget information for the years 1959 through 1975 was estimated by Jones (1979). Annual recharge from flow in the Santa Maria and Sisquoc Rivers is estimated to have been about 6,000 af during 1978 through 1980 (Lipinski 1985). A study of the water resources of the San Luis Obispo County portion of the basin estimated water budgets for the years 1975 through 1995, with projected budgets for the years 2010 and 2020 (DWR 2002). This study estimates the average total annual inflow for 1984 through 1995 at 29,200 af and the average total outflow at 33,100 af for the San Luis Obispo County portion of the basin (DWR 2002). A groundwater budget chiefly for the Santa Barbara County portion of the basin estimates a mean annual recharge to the basin of 85,300 af and a total outflow for 1975 conditions of 105,100 af/yr (SBCWA 1977).

Groundwater Quality

Characterization. Groundwater character in this basin is variable and classified as a mixed–ion type, where there is no dominant cation or anion (DWR 2002). The central part of the basin in San Luis Obispo County is chiefly calcium-magnesium sulfate; whereas, groundwater in the northwestern part of the basin is more commonly calcium bicarbonate or calcium sulfate in character (DWR 2002). TDS concentrations vary throughout the basin, but tend to increase from east to west (SBCWA 1999; 2001) and increase toward the center of the basin beneath the cities of Santa Maria and Guadalupe in Santa Barbara County (DWR 1964). TDS concentrations also increase southward, away from the recharge area of the Santa Maria River (SBCWA 1999; 2001). East of Guadalupe, TDS concentrations increased to more than 3,000 mg/L in 1975 (SBCWA 1999; 2001). Water from 78 public supply wells has an average TDS content is 598 mg/L and ranges from 139 to 1,200 mg/L.

Impairments. Historically, the Santa Maria Valley Groundwater Basin has been subject to high nitrate concentrations, particularly in the vicinity of the City of Santa Maria and in Guadalupe (SBCWA 1999; 2001; DWR 2002). Nitrate concentrations have been recorded as high as 240 mg/L (DWR 2002). A small number of wells sampled during 1990 through 2000 show nitrate concentrations that exceed the MCL, mostly in the northern part of the basin (DWR 2002). High TDS, sulfate or chloride content impairs groundwater in some parts of the basin (DWR 2002).

Water Quality in Public Supply Wells

Constituent Group[1]	Number of wells sampled[2]	Number of wells with a concentration above an MCL[3]
Inorganics – Primary	81	2
Radiological	79	1
Nitrates	81	15
Pesticides	79	0
VOCs and SVOCs	79	1
Inorganics – Secondary	81	19

[1] A description of each member in the constituent groups and a generalized discussion of the relevance of these groups are included in *California's Groundwater – Bulletin 118* by DWR (2003).
[2] Represents distinct number of wells sampled as required under DHS Title 22 program from 1994 through 2000.
[3] Each well reported with a concentration above an MCL was confirmed with a second detection above an MCL. This information is intended as an indicator of the types of activities that cause contamination in a given basin. It represents the water quality at the sample location. It does not indicate the water quality delivered to the consumer. More detailed drinking water quality information can be obtained from the local water purveyor and its annual Consumer Confidence Report.

Well Production characteristics

	Well yields (gal/min)	
Municipal/Irrigation	Range: Alluvium 13-2,300 Paso Robles Fm. 1-2,500 Squire Member, Pismo Fm. 90 – 1,000	Median: 60 45-1,580 270 (DWR 2002)
	Total depths (ft)	
Domestic	Range: 16-1,220 ft	Average: 281 ft (1,188 well completion reports)
Municipal/Irrigation	Range: 25-1,470 ft	Average: 337 ft (616 well completion reports)

Active Monitoring Data

Agency	**Parameter**	**Number of wells /measurement frequency**
USGS	Groundwater levels	72
San Luis Obispo County	Groundwater Levels	214/spring and fall
USGS	Miscellaneous water quality	10
Department of Health Services and cooperators	Title 22 water quality	108

Basin Management

Groundwater Management:	Groundwater beneath San Luis Obispo County Flood Control and Water Conservation District Zone 3, the northwestern coastal portion of the basin, has been cooperatively managed since 1983. An agreement among landowners and cities in Zone 3 was formalized in 2002 that provides for allocation of groundwater supplies and cooperative groundwater management (Santa Maria Groundwater Litigation 2002).
Water agencies	
Public	City of Santa Maria, City of Guadalupe, City of Arroyo Grande, City of Pismo Beach, Casmalia CSD, Nipomo CSD, Oceano CSD, Santa Maria WCD, County of San Luis Obispo Department of Public Works, Santa Barbara County Water Agency.
Private	California Cities Water Company, Rural Water Company, Southern California Water Company.

References Cited

California Department of Water Resources (DWR). 1964. *Water Quality Objectives, Santa Maria River Valley.* Southern District Report. 53 p.

_____. 1969. *Extent of Ground Water in the Central Coastal Area.* Southern District Technical Information Report No. 1376-10-B-2. 53 p.

_____. 1975. *California's Ground Water*. Bulletin 118.

_____. 1999. *Evaluation of Groundwater Overdraft in the Southern Central Coast Region, Part 2.* Southern District Technical Information Record SD-99-2, 116 p.

_____. 2002. *Water Resources of the Arroyo Grande-Nipomo Mesa Area.* Southern District Report. 166 p.

Jones and Stokes Associates, and Leads, Hill and Jewett, Inc. (Jones). 1979. *Environmental & Resources Reconnaissance Study for State Water Project & Alternatives***,** prepared for the Santa Barbara County Flood Control and Water Conservation District: Sacramento, CA.

Lipinski, P. 1985. *Comparison of Two Methods for Estimating Ground-Water Recharge in 1978-80, Santa Maria Valley, California.* U.S. Geological Survey Water-Resources Investigations Report 85-4129.

Miller, G. A. and R. E. Evenson. 1966. *Utilization of Ground Water in the Santa Maria Valley Area, California.* U. S. Geological Survey Water-Supply Paper 1819-A.

Santa Barbara County Water Agency (SBCWA). 1977. *Final Report; Adequacy of the Santa Maria Groundwater Basin*. 51 p.

_____. 1994. *Santa Maria Valley Water Resources Report*. 114 p.

_____. 1996. *Santa Barbara County 1996 Groundwater Resources Report*. 47 p.

_____. 1999. *Santa Barbara County 1999 Groundwater Report*. 63 p.

_____. 2001. *2000 Santa Barbara Groundwater Report*. 53 p.

Santa Maria Groundwater Litigation. 2002. Settlement Agreement Between Northern Cities, Northern Landowners, and Other Parties: Santa Maria Valley Water Conservation District v. City of Santa Maria. Santa Clara Superior Court, Lead Case No. CV 770214. August 2002. 10 p.

Sylvester, A. G., and A. C. Darrow. 1979. "Structure and Neotectonics of the Western Santa Ynez Fault System in Southern California." *Tectonophysics* 52: 389-405.

Woodring W. P., and M. N. Bramlette. 1950. *Geology and Paleontology of the Santa Maria District California.* U. S. Geological Survey Professional Paper 222.

Worts, G. F. Jr. 1951. *Geology and Ground-Water Resources of the Santa Maria Valley Area, California*. U. S. Geological Survey Water-Supply Paper 1000.

Additional References

California Department of Water Resources (DWR). 1975. Sea-Water Intrusion in California: Inventory of Coastal Ground Water Basins. Bulletin 63-5.

_____. 1970. Santa Maria River Valley Water Quality Conditions, 1969. Southern District Memorandum Report. File No. 282.30. 15 p.

Fuller, Richard H., Averett, Robert C., and W. G. Hines. 1975. Problems Related to Water Quality and Algal Control in Lopez Reservoir, San Luis Obispo County, California. U.S. Geological Survey Water-Resources Investigations 47-74. 46 p.

Hughes, Jerry L. 1977. Evaluation of Ground-Water Quality in the Santa Maria Valley, California. U.S. Geological Survey, Water Resources Investigations 76-128.

Hughes, Jerry L. and John R. Freckleton. 1976. Ground-Water Data for the Santa Maria Valley, California. U.S. Dept. of the Interior, Geological Survey: Open-file report.

Jones, K. and C. Lawrence. 1977. Adequacy of the Santa Maria Groundwater Basin. Various pagings.

Luhdorff and Scalmanini, Consulting Engineers. 1986. State Water Resources Control Board Groundwater "Hot Spots" Project: Well Testing and Site Characterization, Santa Maria Valley; final report. 33 p.

Santa Barbara Board of Supervisors. 1990. Groundwater Quality Monitoring Program for Casmalia Vicinity Wells and Santa Maria Groundwater Basin Wells: Executive Summary of Santa Maria Basin Well Testing.

Santa Barbara County Water Agency (SBCWA). 1979. Revisions and Corrections to Phase I Reports: Errata Report.

Santa Barbara Health Care Services. 1987. Report on Phase 1 of 1987 Biannual Santa Maria Groundwater Basin Quality Monitoring Plan.

Toups Corporation. 1974. Water Resources Management Study: South Coast – Santa Barbara County, a report prepared for the ad hoc committee on water supply: Santa Ana, California, Toups Corporation, 219 p.

Errata

Changes made to the basin description will be noted here.