# Santa Maria Groundwater Basin

### *Physical Description*

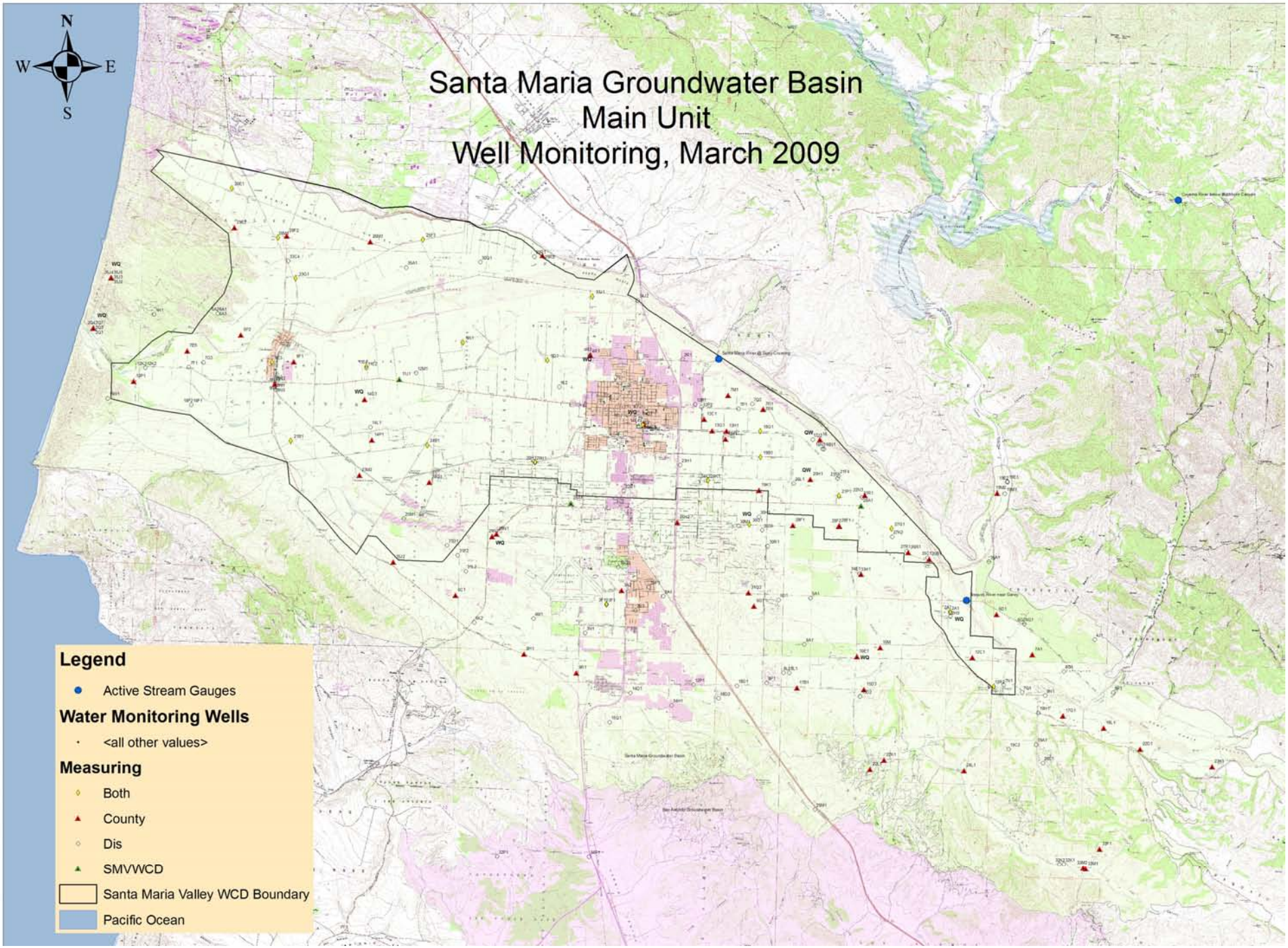
The Santa Maria Groundwater Basin Main Unit is a 170 square mile alluvial basin that is bordered by the Nipomo Mesa and Sierra Madre Foothills to the north, the San Rafael Mountains to the east, the Solomon-Casmalia Hills to the south and the Pacific Ocean to the west (See Santa Maria Groundwater Basin Map, pages X and X). The Basin is situated in the northwest portion of Santa Barbara County and extends into the southwest portion of San Luis Obispo County. The Valley is approximately 28 miles long and 12 miles wide. Average rainfall varies from about 12 to 16 inches per year within the basin. Surface drainage is primarily from the Sisquoc and Santa Maria Rivers that traverse the north side of the basin from east to west. Orcutt Creek, Bradley Canyon, Cat Canyon and Foxen Canyon are the primary drainages on the south side of the basin. Near the coast west of Bonita School Road, the aquifer is confined under silt and clay, composing the upper part of the alluvium; the remaining part of the basin east of Bonita School Road is considered to be unconfined. Depression of the water table occurs in areas of heavy pumping.

The Santa Maria Groundwater Basin has three distinguishable units that appear to have only limited interaction: the Main Basin Unit, the Nipomo Mesa Unit, and the Arroyo Grande Unit. In previous reports and analyses by SBCWA only the Main Basin Unit has been addressed. The Nipomo Mesa and Arroyo Grande Units are completely within San Luis Obispo County. The Nipomo Mesa consists of older dune sands and alluvial deposits resting atop the Paso Robles formation that thins north of the Santa Maria River and the Santa Maria Main Basin Unit. The Arroyo Grande Unit consists of well-sorted alluvial deposits resting atop a thin veneer of the Paso Robles formation, terminating in the 5 cities area in San Luis Obispo County. The California Department of Water Resources (DWR) released Water Resources of the Arroyo Grande – Nipomo Mesa Area in 2003 which focuses on the Arroyo Grande, Nipomo Mesa and Valley, and Oso Flaco areas. The report concludes that no overdraft currently exists in the areas of the study using a climatic base period of 1984-1995.

**The following sections pertain to only the Santa Maria Main Basin in Santa Barbara County and the Oso Flaco area in the southwest corner of San Luis Obispo County.**

### *History and Analyses*

The Basin is best described by Worts (1947, 1951), Miller and Evanson (1966) and SBCWA (1977, 1994). As one of the largest agricultural and historically important oil producing coastal valleys of California, this basin has been studied extensively. Modern exploration began in 1888 when the area's geological features were mapped by the State mineralogist in conjunction with the University of California Geology Program and the USGS. Beginning in 1903 the area grew rapidly in response to oil development, and in 1907 the first comprehensive report on the area was published. USGS Bulletin 322 focused mainly on the basin geology and included some mention of water resources. Water resources examined in that particular report were limited to water diversions from surface runoff of winter and springtime river flows and perennial springs, and from



artesian wells in the western part of the basin as groundwater pumping had yet to be developed. Examination of the basin continued to be focused mainly on oil until 1931 when Lippincott established baseline hydrologic conditions for consideration of federal and state funding toward flood control and water conservation projects.

In 1946 USGS Bulletin 222 concluded that a 12,000 AF annual overdraft existed within the basin. The period of the most comprehensive evaluation of the basin began in 1947 and continued until 1966 with work by Worts, Miller and Evanson. Using data from this period, the perennial yield of the basin was determined to be 70,000 AF (revised from 57,000 AF) and the annual overdraft to be about 20,000 AFY. In 1976 the Toups Corporation was hired by the City of Santa Maria to perform a thorough Water Resources study of the basin. This report concluded that in 1976 the average annual overdraft of the basin was 6,000 AF and projected to be 25,000 AF by the year 2025 without the procurement of additional water sources. The USGS completed a report in 1976 (USGS WRI 76-128) focusing on the water quality of the basin, specifically in regard to increasing nitrogen levels. This report listed the calculated average annual overdraft to be 10,000 AF.

Using updated data and climate trends, a 1977 SBCWA comprehensive report of the basin determined that an average annual overdraft of 20,000 AF existed and projected it to grow to 30,000 AF by the year 2000. In 1985 the USGS produced report 85-4129 which focused on recharge of the basin. In 1991 the Water Agency with the help of Boyle Engineering produced the report “Santa Barbara County Growth Inducement Potential of State Water Importation” which considered the growth inducement potential at the water purveyor level. The report serves as an analysis of 1990 water supply conditions as well as a projection for the 21$^{st}$ century. This report calculated the annual average overdraft to be about 37,000 AF in 1990 without state water and about 15,700 AF in the year 2000 with the implementation of state water. In 1994 the Water Agency assembled the “Santa Maria Valley Water Resources Report” which updated and organized information from previous reports and studies of the basin. This report presented no new information but provided a comprehensive overview of water resources and served as a precursor to a water management plan for the basin.

In 1997 the Santa Maria Valley Water Conservation District (SMVWCD) hired Luhdorff and Scalmanini Engineers to do a report entitled “Special Assessments of Groundwater Management”. The 1996 voter approved proposition 218, required such a report before new assessments could be levied on property owners. This report stated that the hydrologic conditions of the basin imply a long-term stability comprised of periodic groundwater level declines and recoveries, as opposed to an average annual overdraft. Luhdorff and Scalmanini were again hired by the SMVWCD to expand their investigation of the basin and in March 2000 they released a report utilizing a numerical flow model to establish an up-to-date perennial yield of the basin based on the most recent recharge and discharge conditions. This report concluded that the basin was essentially in balance, relying on a base study period of 1968 to 1989.

***Santa Maria Agriculture and Petroleum Operations in the central part of the Basin***


In 2001 SBCWA was commissioned by the Santa Barbara County Administrators Office to update the 1991 "Santa Barbara County Growth Inducement Potential of State Water Importation" report as part of the strategic scan of resources the County was developing (the title of this report is "Santa Barbara County Water Supply and Demand Comparisons 2002 Update"). Analyses generated for this report show that a 2,368 AF groundwater overdraft existed (Ahlroth, 2001) and under current trends of usage and climate a slightly higher overdraft will exist by 2020. The reduction in overdraft from previous SBCWA analyses is mainly due to State Water importation. This analysis is a model result quantifying all inputs and outputs from the basin and using a 1943-1999 base period. The results of this modeling effort are supported by water level readings made throughout the basin by the County and USGS.

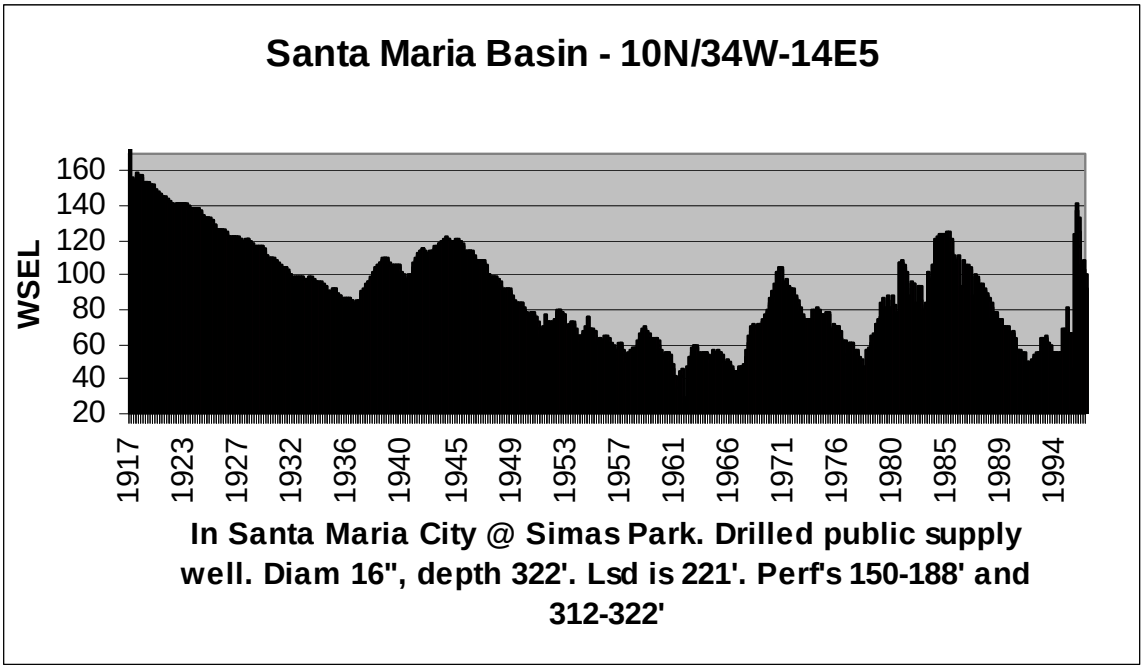
In order to resolve the conflicting conclusions of historic studies and reports, the SBCWA hired Hopkins Groundwater Consultants Inc. to perform an independent evaluation of the methodologies and conclusions of SBCWA's work. Hopkins concluded that the overdraft is indeed somewhere between 2,000 and 3,000 AF per year and that the SBCWA methodologies, including use of the SBCWA Santa Maria Valley water budget model (SMVWBM) to assess basin conditions, are both effective and comprehensive. This assessment also confirms that the importation of state water has taken considerable pressure off of the groundwater resources in this basin.

**Table of Historical Water Budget Analyses for the Santa Maria Groundwater Basin**

| *Year* | *Agency* | *Calculated Overdraft (AF/y)* | *Base Period Used* |
|---|---|---|---|
| 1946 | USGS | 12,000 | 1931-1946 |
| 1966 | USGS | 20,000 | 1931-1966 |
| 1976 | City of S.M. | 6,000 | 1935-1974 |
| 1976 | USGS | 10,000 | 1946-1976 |
| 1977 | SBCWA | 20,000 | 1918-1975 |
| 1991 | SBCWA | 15,700 | 1918-1990 |
| 2000 | SMVWCD | 0 | 1968-1989 |
| 2002 | SBCWA | 2,400 | 1943-1999 |

Fluctuations in Basin "Water in Storage"

The conditions of the basin can be assessed by looking at the hydrograph below from observation well 10N/34W-14E5:

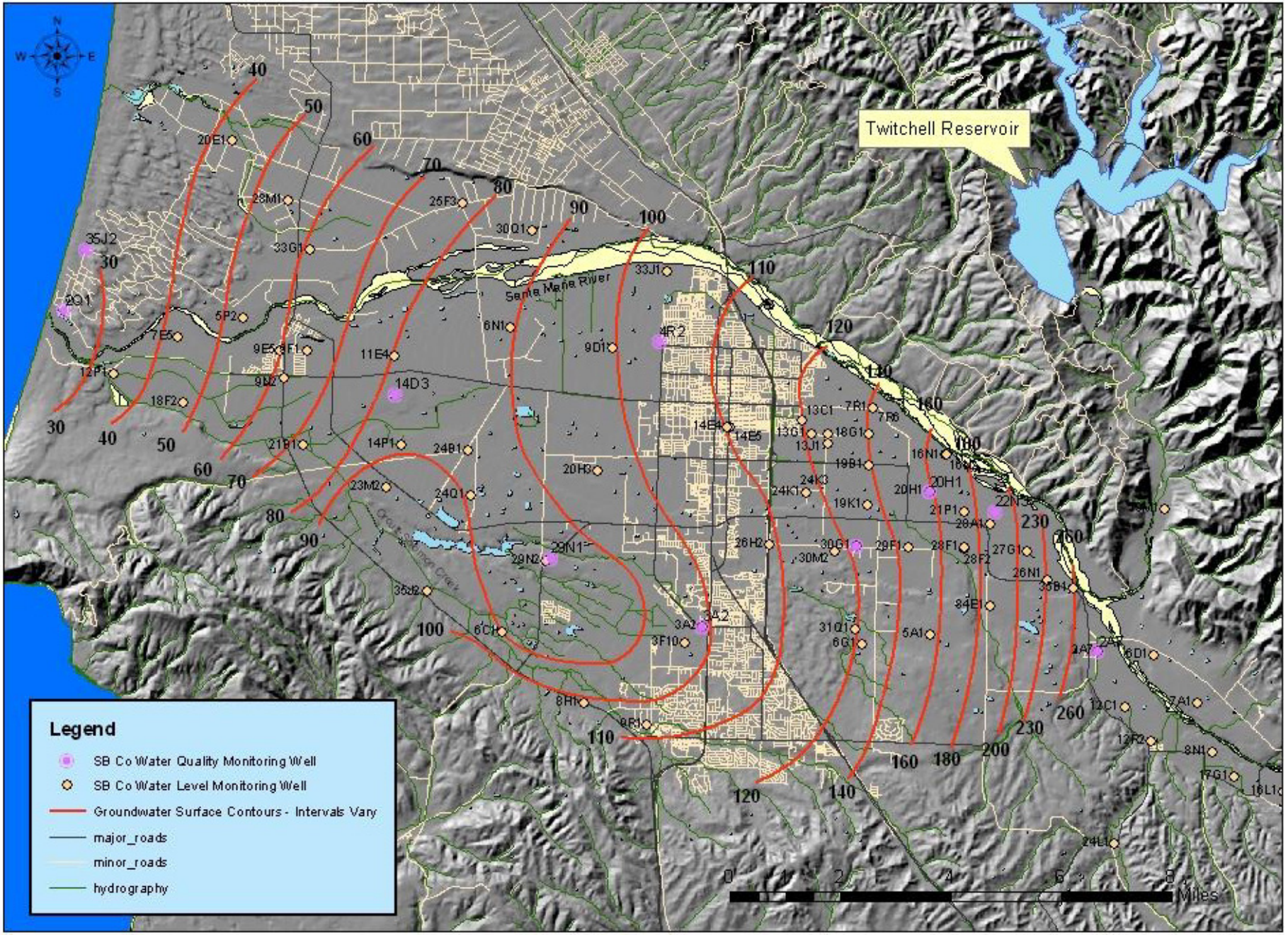



Note that during the early part of the record, the slopes of both increasing and decreasing water levels are more gradual than those of the later part of the century. The higher rate of *filling* in the later part of the century is a function of the presence of the Twitchell Reservoir Project, which adds, on average, an additional 18,000 AF per year of recharge to the basin. The higher rate of dewatering is due to increased pumpage of the basin. One can expect that given an extreme drought such as the 1987-1991 or 1945-1951 droughts, and under current usage conditions, that the basin would be dewatered at an alarming rate, and could result in the lowest water levels in recorded history.

The gross perennial yield of the basin is estimated to be approximately 125,000 acre-feet per year. Water storage above sea level within the basin was estimated to be about 2.5 million AF (MAF) in 1984, 1.97 MAF in 1991, and 2.5 MAF in 2002 (Ahlroth, 2002). The maximum recorded storage level occurred in 1918 and was estimated to be over 3 MAF. The portion of the groundwater basin located in San Luis Obispo County in 1975 was estimated by the California Department of Water Resources to contain about 226,000 AF, a part of which is included in the SBCWA estimate.

# Santa Maria Groundwater Basin Water Surface Contours

Spring 2004



***Water Supply and Usage***

The basin supplies groundwater to the City of Santa Maria, Golden State Water Company, the City of Guadalupe, Casmalia Community Services District, oil operations and private agriculture throughout the Valley. Groundwater was the only source of water used within the Valley until 1997 when State Water was imported as an additional source. The table on the following page lists groundwater extractions from the water purveyors within the Santa Maria Basin. Note that the town of Casmalia lies outside of the Santa Maria Basin but the water supplied to the town is drawn from just within the Basin boundary. In addition, agricultural, oil industry and farmstead usage is estimated to be around 120,000 Acre-Feet per year (gross amount).

The Cities of Santa Maria and Guadalupe, and Golden State Water Company (formally California Cities Water Company) of Orcutt have contracted to receive a combined total of 17,250 AFY from the State Water Project (SWP). Actual deliveries in 2008 were 7,792 AF to the City of Santa Maria, 348 AF to the City of Guadalupe and 233 AF to California Cities Water Company. The City of Santa Maria holds 16,200 AFY of entitlement. (Please see State Water Project, page X). According to the City of Santa Maria Water Master Plan, approximately two-thirds of its SWP supply is designated for blending purposes to meet established City water quality objectives and will not be used to support new development. Thus, this use of SWP water represents a corresponding reduction in long-term pumpage (and overdraft) of the basin. Another benefit of SWP water importation is the relatively high quality of return flows from water use in the City. This serves to improve overall water quality in the basin.

It should be noted that the maximum amount of SWP water actually delivered to the basin depends on a number of factors including state wide climate, water trade and supplemental programs, environmental constraints, and cost. For example, the SWP has limited 2009 deliveries to 40 percent of maximum entitlement amounts due to the lack of storage in surface reservoirs and the snow pack in the Sierra Nevada Mountains of California.

| **Groundwater** Production in the Santa Maria Basin by Purveyor<br>Acre-Feet | | | | |
|---|---|---|---|---|
| Year | City of Santa Maria | California Cities Water Company | City of Guadalupe | Casmalia Community Services District |
| 1990 | 12,057 | 8,691 | 724 | no data |
| 1991 | 11,478 | 8,210 | 685 | no data |
| 1992 | 11,636 | 8,381 | 718 | no data |
| 1993 | 11,835 | 8,174 | 653 | no data |
| 1994 | 12,133 | 8,572 | 668 | no data |
| 1995 | 12,265 | 8,447 | 662 | no data |
| 1996 | 12,323 | 9,906 | 585 | no data |
| 1997 | 8,011 | 9,375 | 622 | no data |
| 1998 | 410 | 8,113 | 303 | no data |
| 1999 | 454 | 9,026 | 265 | no data |
| 2000 | 547 | 9,130 | 300 | no data |
| 2001 | 2,698 | 8,750 | 434 | no data |
| 2002 | 468 | 9,210 | 384 | no data |
| 2003 | 1,178 | 8,862 | no data | 22 |
| 2004 | 1,223 | 9,141 | no data | no data |
| 2005 | 897 | 9,890 | 415 | 29 |
| 2006 | 543 | 8,526 | 411 | 17 |
| 2007 | 2,550 | 9,410 | no data | 17 |
| 2008 | 6,626 | 9,100 | 684 | 19 |

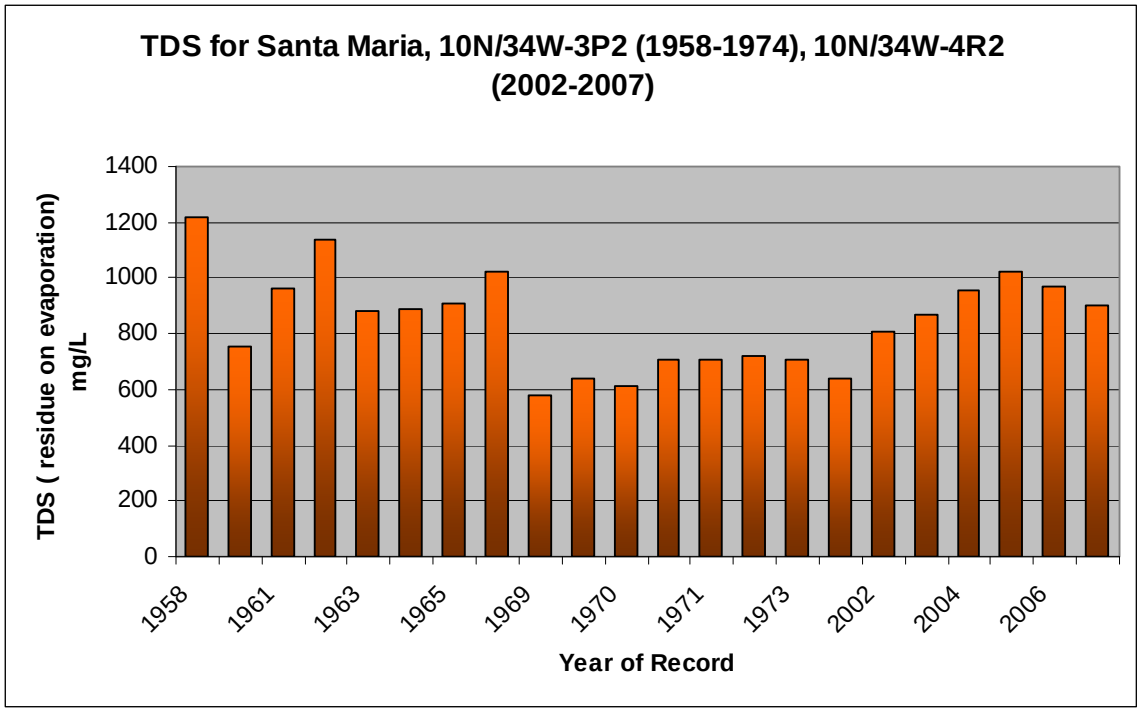
***Water Quality***

Reports by Worts (1951), Toups Corporation (1976), Brown and Caldwell (1976) and Hughes (USGS, 1976) best describe the conditions of water quality within the Basin. Also, the Cachuma Resource Conservation District (CRCD) produced the *Santa Maria Watershed Non-point Source Pollution Management Plan* in September 2000, which serves as a mitigation plan for water quality impairments in the basin and summarizes water quality conditions. Water quality within the basin has been positively affected by the operations of Twitchell Reservoir in which the high sulfate and salts of water from the Cuyama Valley are diluted with the better quality runoff from the Huasna and Alamo Watersheds prior to release. The recharge from Twitchell Reservoir has been reduced from 20,000 AFY per year to 18,000 AFY per year due to the loss of storage from siltation. This estimate does not include the additional recharge from the cloudseeding program and surcharging of the reservoir as they are not yet long-term approved programs.

As with most groundwater basins, the Santa Maria Basin exhibits better water quality in the deeper and confined aquifer than in the shallow or "water table" aquifer. The shallow zones *usually* contain the most water quality impairments due to the infiltration of pollutants and poor quality surface water. The importation of State Water which is generally of better quality than the local sources provides for higher quality "return flows" and thus improves the basin water quality. In addition to improvements provided by the operations of Twitchell Reservoir and state water importation, the Laguna Sanitation District helps to improve water quality in the basin by utilizing a reverse osmosis process to remove, and a deep injection well to dispose of, approximately 8000 lbs. of salts per day, which would otherwise accumulate in the basin system. With the deep injection system these salts stay far below the aquifer and are not a threat to return to the aquifer. Water quality data is currently collected as part of the County Water Resources-USGS monitoring program as well as from area specific programs, such as the City of Santa Maria and Laguna Sanitation District sewage treatment plants and Southern California Water Company, which serves water to the Orcutt area. The table on page XX lists current water quality monitoring sites as part of the County Water Resources-USGS monitoring program.

Total Dissolved Solids

Data collected from observation wells for a *1976-1977 USGS study* indicated that TDS concentrations generally increase from east to west, with the highest levels occurring in the western part of the basin and TDS concentrations near Guadalupe at over 3,000 mgl. It must be noted that these measurements most likely were made from wells drawing from the shallow water table and may not be indicative of the complete aquifer. Currently, TDS concentrations near Guadalupe are measured at around 1500 mgl and in the center of the basin under the town of Santa Maria appear to also be relatively high (see graph on the following page). Again this is most likely due to recycling of shallow water from irrigation and may not be representative of the aquifer as a whole.




TDS levels increased significantly in Orcutt area wells after the 1930's but have remained relatively stable or even decreased since 1987. The importation and domestic use of State Water Project water now results in better quality discharge from the City of Santa Maria treatment plant on Black Road and also from Laguna Sanitation District to the south. This may greatly improve future water quality within the basin.

Nitrates-Sulfates

A study conducted by the State of California Regional Water Quality Control Board (1995) indicates that the basin is subject to nitrate contamination, particularly in the vicinity of the City of Santa Maria and in Guadalupe. The study shows that nitrate concentrations have increased from less than 30 mgl in the 1950's to over 100 mgl in the 1990's in some parts of the basin. It is again important to note that there is a significant difference in water quality between shallow and deep water. Movement between these different aquifer zones is complex and not well documented. Certainly, the flushing of the basin from wetter climate and lower usage would help protect against water quality impairments.

# Construction Information
## For Groundwater Monitoring Sites
## (Listed East to West)

| State Well ID | USGS Number | Depth | Screen Intervals |
|---|---|---|---|
| 9N/33W-2A1 | 345324120184201 | 48’ | |
| 9N/33W-2A7 | 345325120184201 | 512’ | 125’-507’ |
| 10N/33W-22N3[1] | 345535120204401 | | |
| 10N/33W-20H1 | 345552120220001 | 175’ | 100’-175’ |
| 10N/33W-30G1 | 345459120232301 | 662’ | 325’-662’ |
| 10N/34W-26H2 | 345459120250301 | 445’ | unknown |
| 9N/34W-3A2 | 345340120261801 | 331’ | 247’-331’ |
| 10N/34W-4R2 | 345808120271401 | 401’ | 160’-400’ |
| 10N/34W-29N1 | 345441120291301 | 112’ | 107’- |
| 10N/35W-14D3 | 345712120321701 | 350’ | 102’- |
| 10N/36W-2Q1* | 345823120383901 | 671’ | 568’-671’ |
| 10N/36W-2Q3* | 345823120383903 | 444’ | 397’-444’ |
| 10N/36W-2Q4* | 345823120383904 | 378’ | 291’-378’ |
| 10N/36W-2Q7* | 345823120383907 | 44.2’ | 18.5’-46.5’ |
| 11N/36W-35J2* | 345921120381601 | 615’ | 527’-615’ |
| 11N/36W-35J3* | 345921120381602 | 495’ | 247’-495’ |
| 11N/36W-35J4* | 345921120381603 | 228’ | 175’-228’ |
| 11N/36W-35J5* | 345921120381604 | 138’ | 74’-138’ |

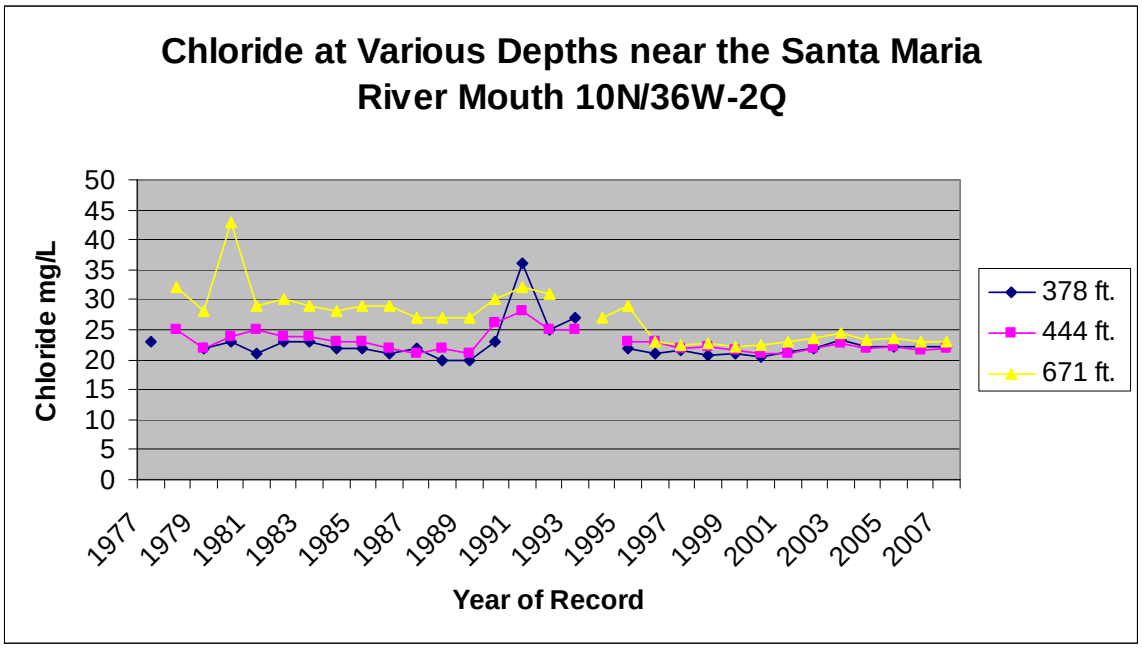
## Description of Surface Water Quality Monitoring Sites

| Station Number | Description | Watershed Size |
|---|---|---|
| 11136800 | Cuyama River below Buckhorn Canyon | 886 sq. mi. |
| 11138500 | Sisquoc River near Sisquoc | 281 sq. mi. |
| 11141050 | Orcutt Creek near Orcutt | 18.5 sq. mi. |
| 345727120375401[2] | Green Canyon Creek @ Main St. near Guadalupe | 5.28 sq. mi |

[1]Still searching for construction information on this site
[2]This is actually a “site ID” as no “station ID” is listed for this site

Salt Water Intrusion

Coastal monitoring wells are measured biannually for any indication of seawater intrusion; to date there has been no evidence of such. The concern of seawater intrusion is based on evidence that the Careaga Sand outcrops on the ocean floor several miles west and there are no known barriers to seawater intrusion. Although it is possible that the seawater-fresh water interface has migrated shoreward during drought periods, the slope of groundwater has remained to the west in the westernmost part of the basin. The graph on the following page illustrates the consistency of chloride concentrations though time.




Basin Wide "Salts Balance"

Sources of salt inflow to the Santa Maria Groundwater Basin include surface runoff, M&I accretions and agricultural return flows. Salt removal from the basin occurs through the processes of surface and subsurface outflow. The Water Agency estimated in 1977 that net salt addition to the basin was about 48,000 tons per year (Ahlroth et al) under 1975 conditions and that by 2000 it would be about 53,000 tons per year. A revised analysis of salt loading is a significant task and the Agency is unaware of any similar work to date. As previously mentioned Laguna Sanitation's deep injection of salts greatly helps the basin salt balance.

***2006-2008 Trends***

During the period 2006-2008, the period since the last SBCWA Groundwater Report, the Santa Maria Groundwater Basin received only minor recharge from the spring storms of 2006 and moderate storms of January 2008 that produced runoff after the Zaca Fire. The table below illustrates the rainfall amounts. Note that average precipitation years generally do not produce runoff.

| Station | WY 2005-2006 | WY 2006-2007 | WY 2007-2008 | Average |
|---|---|---|---|---|
| Santa Maria | 16.42 | 5.24 | 13.63 | 13.82 |
| Sisquoc | 19.28 | 5.85 | 15.42 | 15.03 |
| Twitchell Dam | 24.44 | 8.36 | 17.34 | 16.90 |

At the current time groundwater quality is measured at 11 sites throughout the basin and groundwater level is measured at 81 sites. There was little to no change in water quality between 2006-2008 in the basin. There was some recharge from the spring of 2006 storms which brought water levels up in 2007, and there was limited recharge in 2008 after the Zaca Fire. However, fine clay loam sediments from the burned area plugged

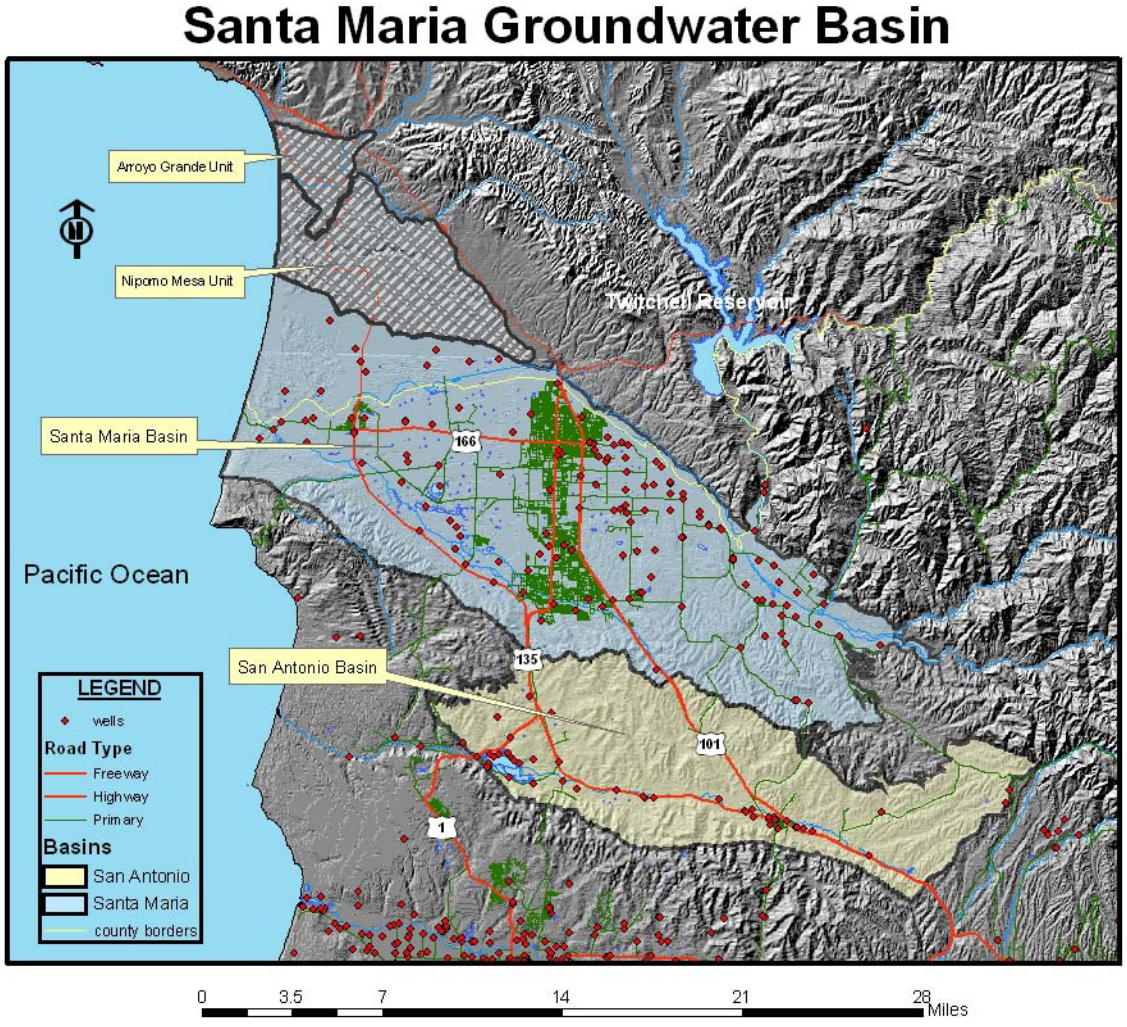
the Santa Maria River channel and as a result not much of the water that flowed in the river in 2008 was able to percolate into the aquifer. In the eastern part of the basin there are places where water level remained steady (9N/33W-12R2) and places where the water level dropped in excess of 20 feet (10N/33W-26N1). This is most likely due to localized pumping patterns. In the central part of the basin, water level has dropped, on average 2 to 5 feet during the period. In the far western part of the basin, water level remained steady during the period 2006-2008.

***Recent Litigation***

Litigation regarding the status and use of groundwater in the Santa Maria Basin was initiated in 1997. Records of these proceedings are available at the website:

*http://www.sccomplex.org/home/index.htm*.

The litigation encompassed all of the Santa Maria Groundwater Basin, not just that part within Santa Barbara County. As previously mentioned, the Santa Maria Groundwater Basin has three distinguishable units that appear to have only limited interaction: the Main Basin Unit, the Nipomo Mesa Unit, and the Arroyo Grande Unit. These units were evaluated in the litigation as one complete basin; however as part of the stipulation they are considered separate management areas.



The judge ruled in proceedings that the basin is not currently in overdraft but that overdraft is likely in the future unless additional conservation measures are undertaken. Overdraft is defined as more water being taken out the basin than is being recharged, over a long period of time. In other words, overdraft can be defined as exceeding the safe yield of the basin (please see groundwater terms section, page X).

The Water Agency, USGS, DWR, and private entities have evaluated the status of the basin; most parties have agreed that the basin has historically been in overdraft to a small, but significant amount. Any amount of overdraft in the basin is significant because overdraft may contribute to water quality degradation including the buildup of nitrates, sulfates, total dissolved solids, and the threat of salt-water intrusion.

SBCWA has an extensive network of water level monitoring wells throughout the basin and when utilized to calculate the storage of groundwater they show that there is indeed a long-term decline in the amount of stored water above sea level in the basin. Recharge to the basin through rainfall infiltration and stream seepage is the dominant factor when evaluating the water budget of a basin. By manipulating the base period to include a wetter or dryer climate, one can produce results showing the basin to be in overdraft, balance, or surplus. To provide the most realistic results, a base period that is most representative of the long term climate must be chosen. Therefore, SBCWA has used a 1943-1999 base period that is believed by staff to be the most representative of the basin's long-term climate.

There was a settlement to the litigation in 2008 but not all parties agreed to the stipulation. The settlement states that Twitchell Reservoir water is to be split between the purveyors and landowners; the purveyors entitled to 80% and the landowners entitled to 20% of the water. For management of the main unit of the Santa Maria Basin the Twitchell Management Authority (TMA) was formed, consisting of water purveyors: the City of Santa Maria, Golden State Water, and the City of Guadalupe as well as private landowners. Like the water from Twitchell Reservoir, The TMA is funded according to an 80/20 split. TMA funds are designated for improvements at the reservoir, expansion of water quality and level monitoring programs, and annual reports on the status and health of the basin. However, the stipulation allows Golden State Water to resign from the TMA and related financial responsibilities if the PUC disallows their request to raise water delivery rates. Should this occur other stipulating parties may also resign from the TMA which could jeopardize the mission and intent of the basin adjudication.