# Appendix G: Supplemental Water Supply Information

- DWR Groundwater Bulletin 118

# San Francisco Bay Hydrologic Region

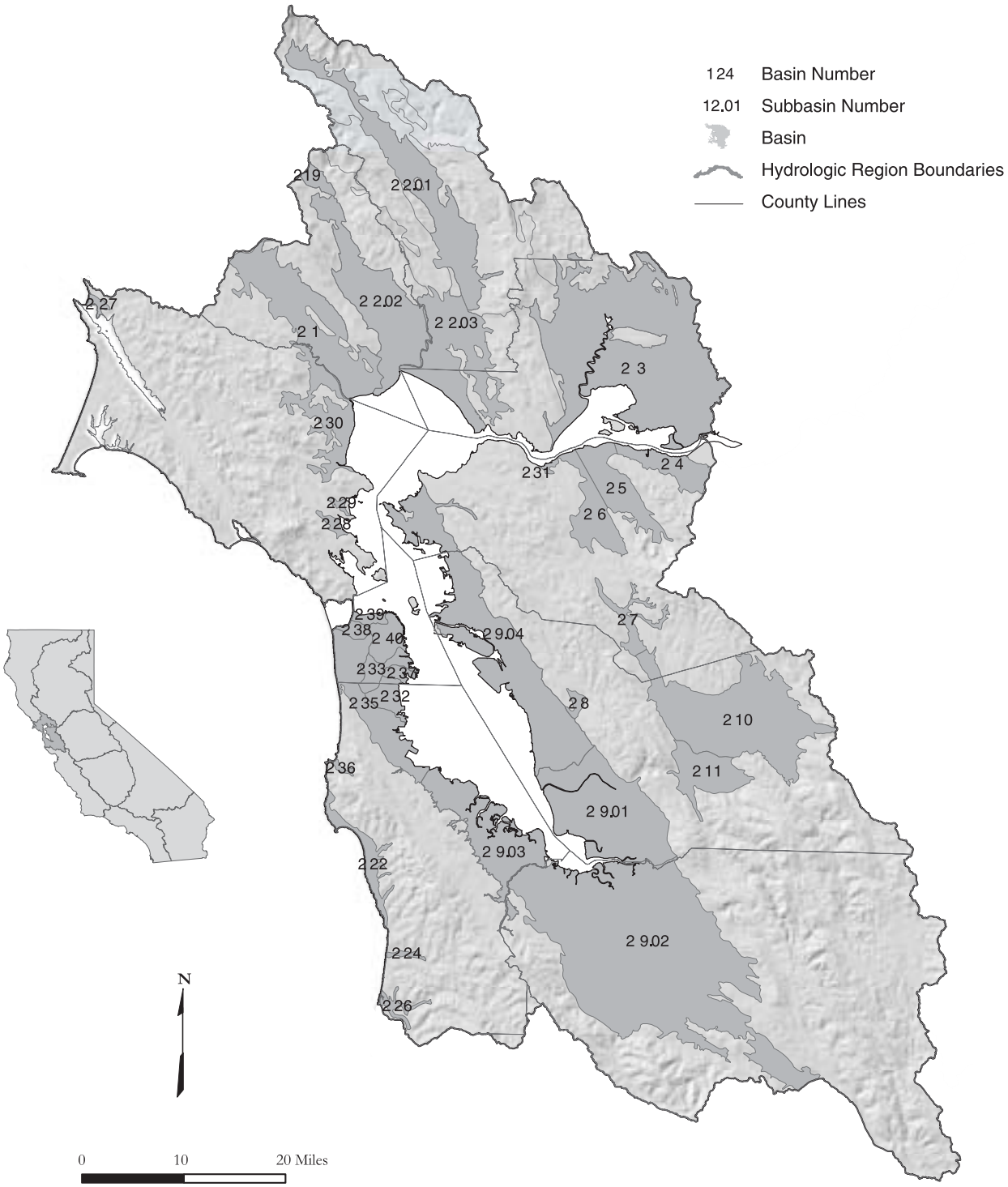


**Figure 27 San Francisco Bay Hydrologic Region**

## Basins and Subbasins of the San Francisco Bay Hydrologic Region

| Basin/subbasin | Basin name |
|---|---|
| 2-1 | Petaluma Valley |
| 2-2 | Napa-Sonoma Valley |
| 2-2.01 | Napa Valley |
| 2-2.02 | Sonoma Valley |
| 2-2.03 | Napa-Sonoma Lowlands |
| 2-3 | Suisun-Fairfield Valley |
| 2-4 | Pittsburg Plain |
| 2-5 | Clayton Valley |
| 2-6 | Ygnacio Valley |
| 2-7 | San Ramon Valley |
| 2-8 | Castro Valley |
| 2-9 | Santa Clara Valley |
| 2-9.01 | Niles Cone |
| 2-9.02 | Santa Clara |
| 2-9.03 | San Mateo Plain |
| 2-9.04 | East Bay Plain |
| 2-10 | Livermore Valley |
| 2-11 | Sunol Valley |
| 2-19 | Kenwood Valley |
| 2-22 | Half Moon Bay Terrace |
| 2-24 | San Gregorio Valley |
| 2-26 | Pescadero Valley |
| 2-27 | Sand Point Area |
| 2-28 | Ross Valley |
| 2-29 | San Rafael Valley |
| 2-30 | Novato Valley |
| 2-31 | Arroyo Del Hambre Valley |
| 2-32 | Visitacion Valley |
| 2-33 | Islais Valley |
| 2-35 | Merced Valley |
| 2-36 | San Pedro Valley |
| 2-37 | South San Francisco |
| 2-38 | Lobos |
| 2-39 | Marina |
| 2-40 | Downtown San Francisco |

## Description of the Region

The San Francisco Bay HR covers approximately 2.88 million acres (4,500 square miles) and includes all of San Francisco and portions of Marin, Sonoma, Napa, Solano, San Mateo, Santa Clara, Contra Costa, and Alameda counties (Figure 27). The region corresponds to the boundary of RWQCB 2. Significant geographic features include the Santa Clara, Napa, Sonoma, Petaluma, Suisun-Fairfield, and Livermore valleys; the Marin and San Francisco peninsulas; San Francisco, Suisun, and San Pablo bays; and the Santa Cruz Mountains, Diablo Range, Bolinas Ridge, and Vaca Mountains of the Coast Range. While being the smallest in size of the 10 HRs, the region has the second largest population in the State at about 5.8 million in 1995 (DWR 1998). Major population centers include the cities of San Francisco, San Jose and Oakland.

## Groundwater Development

The region has 28 identified groundwater basins. Two of those, the Napa-Sonoma Valley and Santa Clara Valley groundwater basins, are further divided into three and four subbasins, respectively. The groundwater basins underlie approximately 896,000 acres (1,400 square miles) or about 30 percent of the entire HR.

Despite the tremendous urban development in the region, groundwater use accounts for only about 5 percent (68,000 acre-feet) of the region's estimated average water supply for agricultural and urban uses, and accounts for less than one percent of statewide groundwater uses.

In general, the freshwater-bearing aquifers are relatively thin in the smaller basins and moderately thick in the more heavily utilized basins. The more heavily utilized basins in this region include the Santa Clara Valley, Napa-Sonoma Valley, and Petaluma Valley groundwater basins. In these basins, the municipal and irrigation wells have average depths ranging from about 200 to 500 feet. Well yields in these basins range from less than 50 gallons per minute (gpm) to approximately 3,000 gpm. In the smaller basins, most municipal and irrigation wells have average well depths in the 100- to 200-foot range. Well yields in the smaller and less utilized basins are typically less than 500 gpm.

Land subsidence has been a significant problem in the Santa Clara Valley Groundwater Basin in the past. An extensive annual monitoring program has been set up within the basin to evaluate changes in an effort to maintain land subsidence at less than 0.01 feet per year (SCVWD 2001). Additionally, groundwater recharge projects have been implemented in the Santa Clara Valley to ensure that groundwater will continue to be a viable water supply in the future.

## Groundwater Quality

In general, groundwater quality throughout most of the region is suitable for most urban and agricultural uses with only local impairments. The primary constituents of concern are high TDS, nitrate, boron, and organic compounds.

The areas of high TDS (and chloride) concentrations are typically found in the region's groundwater basins that are situated close to the San Francisco Bay, such as the northern Santa Clara, southern Sonoma, Petaluma, and Napa valleys. Elevated levels of nitrate have been detected in a large percentage of private wells tested within the Coyote Subbasin and Llagas Subbasin of the Gilroy-Hollister Valley Groundwater Basin (in the Central Coast HR) located to the south of the Santa Clara Valley (SCVWD 2001). The shallow aquifer zone within the Petaluma Valley also shows persistent nitrate contamination. Groundwater with high TDS, iron, and boron levels is present in the Calistoga area of Napa Valley, and elevated boron levels in other parts of Napa Valley make the water unfit for agricultural uses. Releases of fuel hydrocarbons from leaking underground storage tanks and spills/leaks of organic solvents at industrial sites have caused minor to significant groundwater impacts in many basins throughout the region. Methyl tertiary-butyl ether (MTBE) and chlorinated solvent releases to soil and groundwater continue to be problematic. Environmental oversight for many of these sites is performed either by local city and county enforcement agencies, the RWQCB, the Department of Toxic Substances Control, and/or the U.S. Environmental Protection Agency.

### *Water Quality in Public Supply Wells*

From 1994 through 2000, 485 public supply water wells were sampled in 18 of the 33 basins and subbasins in the San Francisco Bay HR. Analyzed samples indicate that 410 wells, or 85 percent, met the state primary MCLs for drinking water standards. Seventy-five wells, or 15 percent, have constituents that exceed one or more MCL. Figure 28 shows the percentages of each contaminant group that exceeded MCLs in the 75 wells.

Table 16 lists the three most frequently occurring contaminants in each contaminant group and the number of wells in the HR that exceeded the MCL for those contaminants.

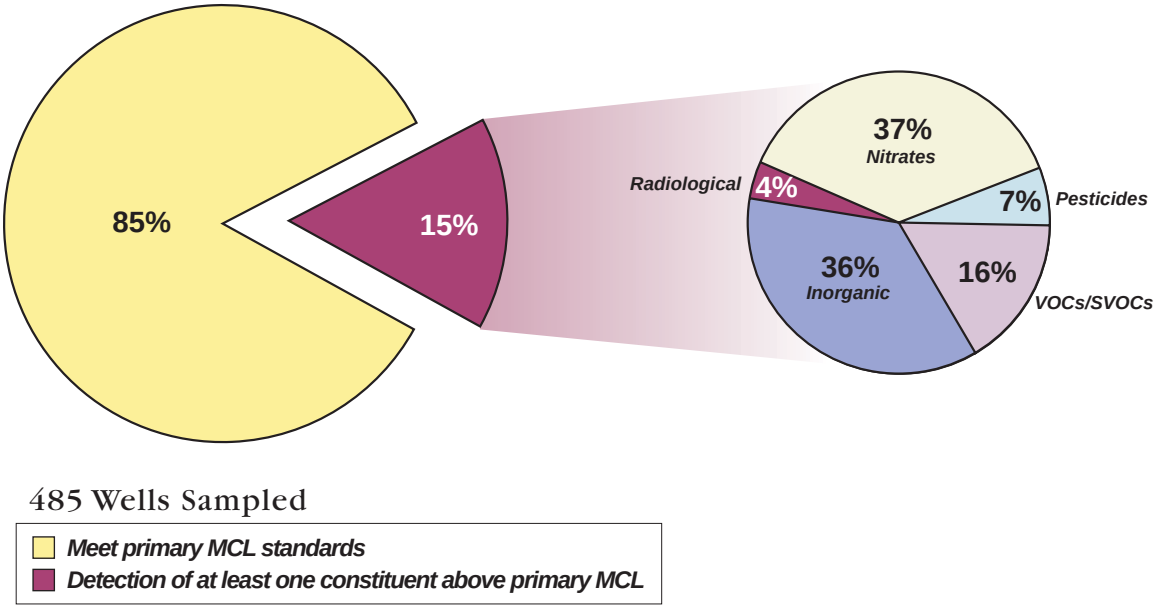


**Figure 28 MCL exceedances in public supply wells in the San Francisco Bay Hydrologic Region**

**Table 16 Most frequently occurring contaminants by contaminant group in the San Francisco Bay Hydrologic Region**

| Contaminant group | Contaminant - # of wells | Contaminant - # of wells | Contaminant - # of wells |
|---|---|---|---|
| Inorganics | Iron – 57 | Manganese – 57 | Fluoride – 7 |
| Radiological | Gross Alpha – 2 | Radium 226 – 1 | |
| Nitrates | Nitrate (as $NO_3$) – 27 | Nitrate + Nitrite – 3 | Nitrite (as N) – 1 |
| Pesticides | Di(2-Ethylhexyl)phthalate – 4 | Heptachlor – 1 | |
| VOCs/SVOCs | PCE – 4 | Dichloromethane – 3 | TCE– 2<br>Vinyl Chloride – 2 |

TCE = Trichloroethylene
PCE = Tetrachloroethylene
VOC = Volatile Organic Compound
SVOC = Semivolatile Organic Coumpound

### Changes from Bulletin 118-80

Since Bulletin 118-80 was published, RWQCB 2 boundary has been modified. This resulted in several basins being reassigned to RWQCB 1. These are listed in Table 17.

**Table 17 Modifications since Bulletin 118-80 of groundwater basins in San Francisco Bay Hydrologic Region**

| Basin name | New number | Old number |
|---|---|---|
| McDowell Valley | 1-56 | 2-12 |
| Knights Valley | 1-50 | 2-13 |
| Potter Valley | 1-51 | 2-14 |
| Ukiah Valley | 1-52 | 2-15 |
| Sanel Valley | 1-53 | 2-16 |
| Alexander Valley | 1-54 | 2-17 |
| Santa Rosa Valley | 1-55 | 2-18 |
| Lower Russian River Valley | 1-60 | 2-20 |
| Bodega Bay Area | 1-57 | 2-21 |

No additional basins were assigned to the San Francisco Bay HR in this revision. However, the Santa Clara Valley Groundwater Basin (2-9) has been subdivided into four subbasins instead of two, and the Napa-Sonoma Valley Groundwater Basin is now three subbasins instead of two.

There are several deletions of groundwater basins from Bulletin 118-80. The San Francisco Sand Dune Area (2-34) was deleted when the San Francisco groundwater basins were redefined in a USGS report in the early 1990s. The Napa-Sonoma Volcanic Highlands (2-23) is a volcanic aquifer and was not assigned a basin number in this bulletin. This is considered to be a groundwater source area as discussed in Chapter 6. Bulletin 118-80 identified seven groundwater basins that were stated to differ from 118-75: Sonoma County Basin, Napa County Basin, Santa Clara County Basin, San Mateo Basin, Alameda Bay Plain Basin, Niles Cone Basin, and Livermore Basin. They were created primarily by combining several smaller basins and subbasins within individual counties. This report does not consider these seven as basins. There is no change in numbering because the basins were never assigned a basin number.

## Table 18 San Francisco Bay Hydrologic Region groundwater data

| Basin/Subbasin | Basin Name | Area (acres) | Groundwater Budget Type | Well Yields (gpm) | | Active Monitoring | | | TDS (mg/L) | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Maximum | Average | Levels | Quality | Title 22 | Average | Range |
| 2-1 | PETALUMA VALLEY | 46,100 | C | 100 | - | 16 | 7 | 24 | 347 | 58-650 |
| 2-2 | NAPA-SONOMA VALLEY | | | | | | | | | |
| 2-2.01 | NAPA VALLEY | 45,900 | A | 3,000 | 223 | 19 | 10 | 23 | 272 | 150-370 |
| 2-2.02 | SONOMA VALLEY | 44,700 | C | 1,140 | 516 | 18 | 9 | 35 | 321 | 100-550 |
| 2-2.03 | NAPA-SONOMA LOWLANDS | 40,500 | C | 300 | 98 | 0 | 6 | 9 | 185 | 50-300 |
| 2-3 | SUISUN-FAIRFIELD VALLEY | 133,600 | C | 500 | 200 | 21 | 17 | 35 | 410 | 160-740 |
| 2-4 | PITTSBURG PLAIN | 11,600 | C | - | - | - | - | 9 | - | - |
| 2-5 | CLAYTON VALLEY | 17,800 | C | - | - | - | - | 48 | - | - |
| 2-6 | YGNACIO VALLEY | 15,500 | C | - | - | - | - | - | - | - |
| 2-7 | SAN RAMON VALLEY | 7,060 | C | - | - | - | - | - | - | - |
| 2-8 | CASTRO VALLEY | 1,820 | C | - | - | - | - | - | - | - |
| 2-9 | SANTA CLARA VALLEY | | | | | | | | | |
| 2-9.01 | NILES CONE | 57,900 | A | 3,000 | 2,000 | 350 | 120 | 20 | - | - |
| 2-9.02 | SANTA CLARA | 190,000 | C | - | - | - | 10 | 234 | 408 | 200-931 |
| 2-9.03 | SAN MATEO PLAIN | 48,100 | C | - | - | - | 2 | 14 | 407 | 300-480 |
| 2-9.04 | EAST BAY PLAIN | 77,400 | A | 1,000 | UNK | 29 | 16 | 7 | 638 | 364-1,420 |
| 2-10 | LIVERMORE VALLEY | 69,500 | A | - | - | - | - | 36 | - | - |
| 2-11 | SUNOL VALLEY | 16,600 | C | - | - | - | - | 2 | - | - |
| 2-19 | KENWOOD VALLEY | 3,170 | C | - | - | - | - | 13 | - | - |
| 2-22 | HALF MOON BAY TERRACE | 9,150 | C | - | - | 5 | - | 9 | - | - |
| 2-24 | SAN GREGORIO VALLEY | 1,070 | C | - | - | - | - | - | - | - |
| 2-26 | PESCADERO VALLEY | 2,900 | C | - | - | 3 | - | 4 | - | - |
| 2-27 | SAND POINT AREA | 1,400 | C | - | - | - | - | 6 | - | - |
| 2-28 | ROSS VALLEY | 1,770 | C | - | - | - | - | - | - | - |
| 2-29 | SAN RAFAEL VALLEY | 880 | C | - | - | - | - | - | - | - |
| 2-30 | NOVATO VALLEY | 20,500 | C | - | - | - | - | 1 | - | - |
| 2-31 | ARROYO DEL HAMBRE VALLEY | 790 | C | - | - | - | - | - | - | - |
| 2-32 | VISITACION VALLEY | 880 | C | - | - | - | - | - | - | - |
| 2-33 | ISLAIS VALLEY | 1,550 | C | - | - | - | - | - | - | - |
| 2-35 | MERCED VALLEY | 10,400 | C | - | - | - | - | 10 | - | - |
| 2-36 | SAN PEDRO VALLEY | 880 | C | - | - | - | - | - | - | - |
| 2-37 | SOUTH SAN FRANCISCO | 2,170 | C | - | - | - | - | - | - | - |
| 2-38 | LOBOS | 2,400 | A | - | - | - | - | - | - | - |
| 2-39 | MARINA | 220 | A | - | - | - | - | - | - | - |
| 2-40 | DOWNTOWN SAN FRANCISCO | 7,600 | C | - | - | - | - | - | - | - |

gpm - gallons per minute
mg/L - milligram per liter
TDS - total dissolved solids

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# Santa Clara Valley Groundwater Basin, Santa Clara Subbasin

- Groundwater Basin Number: 2-9.02
- County: Santa Clara
- Surface Area: 153,600 acres (240 square miles)

## Basin Boundaries and Hydrology

The Santa Clara subbasin occupies a structural trough parallel to the northwest trending Coast Ranges. TheDiablo Range bounds it on the west and the Santa Cruz Mountains form the basin boundary on the east. It extends from the northern border of Santa Clara County to the groundwater divide near the town of Morgan Hill. The dominant geohydrologic feature is a large inland valley (Fio and Leighton 1995). The valley is drained to the north by tributaries to San Francisco Bay including Coyote Creek, the Guadalupe River, and Los Gatos Creek. Annual precipitation for the Santa Clara basin ranges from less than 16 inches in the valley to more than 28 inches in the upland areas.

## Hydrogeologic Information

### *Water Bearing Formations*

The water bearing formations of the Santa Clara subbasin include Pliocene to Holocene age continental deposits of unconsolidated to semi-consolidated gravel, sand, silt and clay. Two members form this group, the Santa Clara Formation of Plio-Pleistocene age and the younger alluvium of Pleistocene to Holocene age (DWR 1975). Lithologic similarities make distinction between these two units difficult based on available well data. The combined thickness of these two units probably exceeds 1500 feet (DWR 1967).

**Santa Clara Formation.** The Santa Clara Formation is of Plio-Pleistocene age and rests unconformably on impermeable rocks that mark the bottom of the groundwater subbasin (DWR 1975). The Santa Clara Formation is exposed only on the west and east sides of the Santa Clara Valley. Where exposed, it is composed of poorly sorted deposits ranging in grain size from boulders to silt (DWR 1975). Well logs indicate that permeability increases from west to east and that in the central part of the valley permeability and grain size decrease with depth (DWR 1975).

**Pleistocene-Holocene Alluvium.** The Pleistocene to Holocene alluvium is the most important water bearing unit in the Santa Clara subbasin. The permeability of the valley alluvium is generally high and principally all large production wells derive their water from it (DWR 1975). Comprised generally of unconsolidated gravel, sand, silt, and clay it is deposited principally as series of convergent alluvial fans. It becomes progressively finer-grained at the central portions of the valley. A confined zone is created in the northern portion of the subbasin where overlain by a clay layer of low permeability (SCVWD 2001). The southern portion of the subbasin is generally unconfined and contains no thick clay layers (SCVWD 2001).

### *Recharge Areas*

Natural recharge occurs principally as infiltration from streambeds that exit the upland areas within the drainage basin and from direct percolation of precipitation that falls on the basin floor.

The Santa Clara Valley Water District conducts an artificial (facility) recharge program. This is conducted by releasing locally conserved or imported water to in-stream and off-stream facilities (SCVWD 2001). District wide controlled in-stream recharge accounts for about 45 % groundwater recharge in district facilities (SCVWD 2001). In-stream recharge occurs along stream channels in the alluvial apron upstream from the confined zone. Spreader dams (creating temporary or permanent impoundments in the stream channel) are a key component of the in-stream recharge program, increasing recharge capacity by approximately 10 % (SCVWD 2001).

Off-stream recharge facilities include abandoned gravel pits and areas specifically excavated for recharge purposes. Recharge from water delivered to these facilities accounts for approximately 35 % of the recharge district wide (SCVWD)

### *Groundwater Level Trends*

Historically, since the early 1900,s through the mid-1960's water level declines from groundwater pumpage have induced subsidence in the Santa Clara subbasin and caused degradation of the aquifer adjacent to the bay from saltwater intrusion. Prior to importation of surface water via the Hetch Hetchy Aqueduct and South Bay Aqueduct and the introduction of an artificial recharge program water levels declined more than 200 feet in the Santa Clara Valley (Poland and Ireland 1988). Groundwater levels have generally increased since 1965 as a result of increase in recharge and decreases in pumpage (Fio and Leighton 1995). Current hydrographs of index wells within the subbasin maintained by Santa Clara Valley Water District support this trend (www.scvwd.dst.ca/gwuse/gwmimap.htm, 2001).

### *Groundwater Storage*

**Groundwater Storage Capacity.** Operational groundwater storage capacity is an estimate of the storage capacity based on "District Operations" (SCVWD 2001). Operational storage capacity is generally less than total storage capacity. It must account for available pumping capacity, avoidance of land subsidence, and problems associated with high groundwater levels. The operational storage capacity of the Santa Clara Valley subbasin is estimated to be 350,000 acre-feet (SCVWD 2001). This estimate is based on an area defined by the Santa Clara Valley Water District that is approximately 15 square miles smaller than the Santa Clara subbasin boundaries used by the California Department of Water Resources for this publication.

**Groundwater in Storage**. No published report was found addressing the quantity of groundwater presently in storage.

### *Groundwater Budget (Type C)*

Not enough published information was found to present a current groundwater budget detailing inflows and outflows for this basin. Additional information may be available from Santa Clara Valley Water District.

### *Groundwater Quality*

**Characterization.** The groundwater in the major producing aquifers within the basin is generally of a bicarbonate type, with sodium and calcium the principal cations (DWR 1975). Although hard, it is if good to excellent mineral composition and suitable for most uses. Drinking water standards are met at public supply wells without the use of treatment methods (SCVWD 2001).

**Impairments.** Areas with somewhat elevated mineral levels, perhaps associated with historical saltwater intrusion have been observed in the northern basin (SCVWD 2001). Some wells with elevated nitrate concentration have been identified in the southern portion of the basin (SCVWD 2001).

## 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 | 257 | 9 |
| Radiological | 234 | 1 |
| Nitrates | 268 | 10 |
| Pesticides | 253 | 3 |
| VOCs and SVOCs | 252 | 4 |
| Inorganics – Secondary | 257 | 29 |

[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: – 1,650 | Average: 425 (DWR 1975) |
| | **Total depths (ft)** | |
| Domestic | Range: 15 - 800 | Average: 263 (Based on 314 Wells) |
| Municipal/Irrigation | Range: 17 – 1,186 | Average: 278 (Based on 262 Wells) |

## Active Monitoring Data

| Agency | Parameter | Number of wells /measurement frequency |
|---|---|---|
| SCVWD and Cooperators | Groundwater levels | 108 Wells Quarterly, 168 Wells Monthly |
| DWR | Miscellaneous water quality | 10 Wells |
| Department of Health Services and cooperators | Title 22 water quality | 234 Wells |

## Basin Management

Groundwater management:

Water agencies

| | |
|---|---|
| Public | Aldercroft Heights Co WD, Purissima Hills WD, San Martin Co WD, Santa Clara Valley WD |
| Private | |

## References Cited

California Department of Water Resources. Evaluation of groundwater Resources South San Francisco Bay Volume III Northern Santa Clara County Area: Bulletin 118-1, December 1975.

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Fio, J.L. and D.A. Leighton. Geohydrological Framework, Historical Development of the Groundwater System, and General Hydrologic and Water Quality Conditions in 1990, South San Francisco Bay and Peninsula, California, U.S. Geological Survey Open File Report 94-357, 1995.

Santa Clara Valley Water District. www.scvwd.dst.ca/gwuse/gwmimap.htm: October 10, 2001.

Santa Clara Valley Water District. Santa Clara Valley Water District Groundwater Management Plan: July 2001.

## Errata

Changes made to the basin description will be noted here.