# San Francisco Bay Hydrologic Region

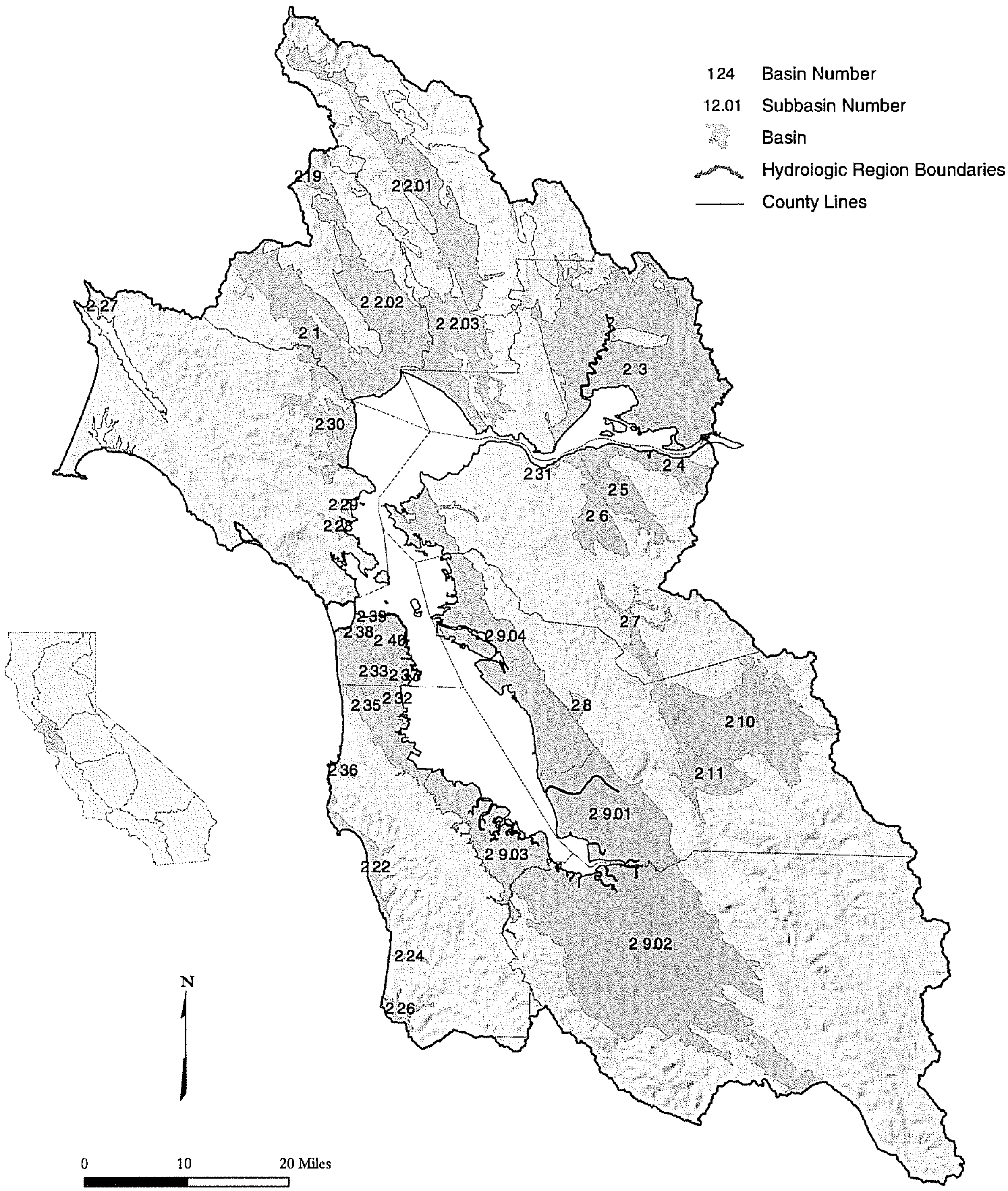


**Figure 27 San Francisco Bay Hydrologic Region**

## 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.

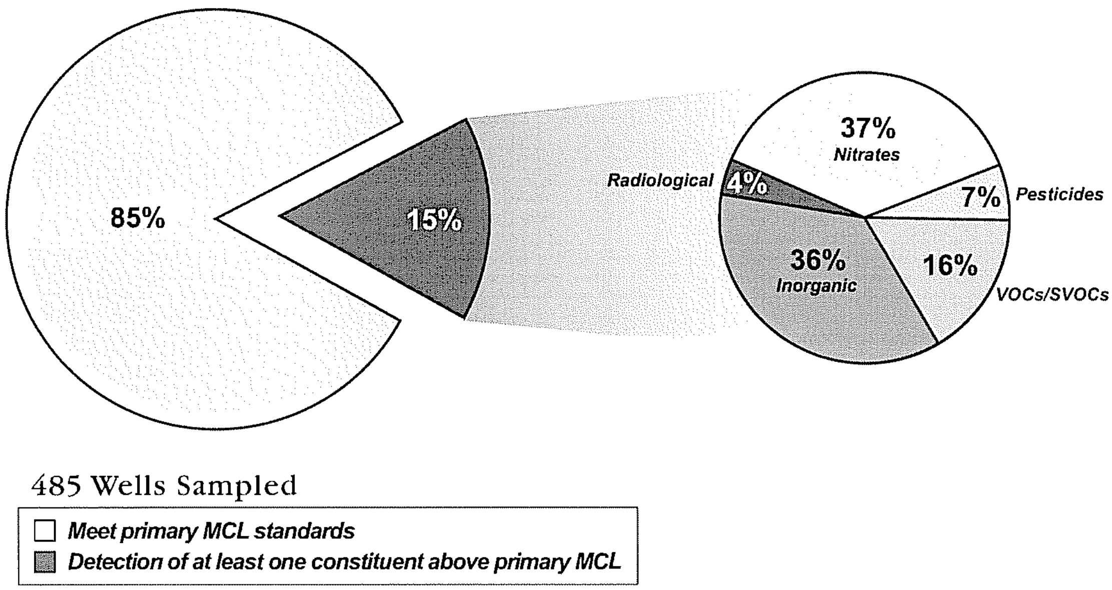


**Figure 28 MCL exceedances in public supply wells in the San Francisco Bay Hydrologic Region**

**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 – I | |
| 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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# Westside Groundwater Basin

- Groundwater Basin Number: 2-35
- County: San Francisco, San Mateo
- Surface Area: 25,400 acres (40 square miles)

## Basin Boundaries and Hydrology

The Westside Basin is the largest groundwater basin in San Francisco. It is separated from the Lobos Basin to he north by northwest trending bedrock ridge through the northeastern part of Golden Gate Park (Phillips and others 1993). The San Bruno Mountains bound the basin on the east. The San Andreas fault and Pacific ocean form its western boundary and its southern limit is defined by a bedrock high that separates it from the San Mateo Plain Groundwater Basin (South Bay Groundwater Committee Report 2001). The basin opens to the Pacific Ocean on the northwest and San Francisco Bay on the southeast (Phillips and others 1993). Mean annual precipitation within the basin is in the range of 20 inches to 24 inches.

## Hydrogeologic Information

### *Water Bearing Formations*

Geologically the basin is comprised of two groups, bedrock and unconsolidated materials (Phillips and others 1993). The impermeable bedrock is composed of consolidated sediment of the Franciscan Complex and the Great Valley Sequence of late Jurassic and Cretaceous age (Phillips and others 1993). Unconsolidated materials overlying the bedrock comprise the water bearing formations. These consist of dune sands, the Colma formation of Pleistocene age and the Merced Formation of Pleistocene/Pliocene age (Phillips and others 1993).

The Colma Formation generally overlies the Merced Formation (Phillips and others 1993). The Merced Formation is composed of sand and thin interbedded silt and clay layers of shallow marine depositional origin (Phillips and others 1993). The Colma Formation overlies the Merced Formation consisting of fine-grained sand, silty sand, and inter-fingered clay layers, to 5 feet thick (Phillips and others 1993). Dune sands consisting of fine grained to medium-grained sand overly the Colma formation in most of the basin north of Lake Merced. The dune sands range in thickness from 0 to 150 feet (Phillips and others 1993). Aquifer storage coefficients indicate unconfined conditions at depths less than 100 feet and confined conditions at depths in excess of 100 feet (Phillips and others 1993).

### *Recharge Areas*

Sources of recharge include infiltration of rainfall, infiltration of irrigation water, and leakage from water and sewer pipes. Average groundwater recharge in the Westside Basin for water years 1987 – 1988 was estimated to be 4,846 Acre-Feet/Year (Phillips and others 1993).

### *Groundwater Level Trends*

A USGS study covering the period 1987-1992 showed declining water levels. This is likely the result of a concurrent drought during this period.

Onset of normal precipitation and increased recharge could possibly rectify this occurrence as depleted storage is renewed (Phillips and others 1993).

### Groundwater Storage

**Groundwater Storage Capacity.** No estimate of groundwater storage capacity was found.
**Groundwater in Storage.** No estimate of groundwater in storage was found.

### Groundwater Budget (Type C)

Not enough data exists presently to provide either an estimate of the Westside Basin's groundwater budget or the groundwater extraction from the basin.

### Groundwater Quality

**Characterization.** Most wells showed no dominant cation, with more than 40% of the wells sampled being bicarbonate waters (Westside Basin Partners 2001).
**Impairments.** Although most dissolved constituents meet guidelines established by the US Environmental Protection Agency, nitrate-nitrogen concentrations in the groundwater commonly exceed the primary maximum contaminant level of 10 milligrams per liter (Phillips and others 1993).

## 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 | 16 | 3 |
| Radiological | 12 | 0 |
| Nitrates | 15 | 8 |
| Pesticides | 17 | 0 |
| VOCs and SVOCs | 17 | 2 |
| Inorganics – Secondary | 16 | 5 |

[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 | | |
| | **Total depths (ft)** | |
| Domestic | | |
| Municipal/Irrigation | Range: 130 – 825 | Average: 604 |

## Active Monitoring Data

| Agency | Parameter | Number of wells /measurement frequency |
|---|---|---|
| | Groundwater levels | |
| | Miscellaneous water quality | |
| Department of Health Services and cooperators | Title 22 water quality | 13 Wells |

## Basin Management

| | |
|---|---|
| Groundwater management: | |
| Water agencies | |
| Public | Daly City, City of San Bruno, City of Burlingame |
| Private | California Water Service Company |

## References Cited

Phillips, Steven P., Scott N. Hamlin, Eugene B. Yates. *Geohydrology, Water Quality, and Estimation of Ground-Water Recharge in San Francisco, California 1987-92.* US Geological Survey Water-Resources Investigations Report 93-4019, 1993.

USDA. *United States Average Annual Precipitation, 1961-1990: Map Layer*, 1999

South Bay Groundwater Committee Report. *Results of the April 2000 Westside Basin Twenty-Four Hour Well-Water Level Response Test, 2001.*

## Errata

Changes made to the basin description will be noted here.