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Watershed Characteristics Report

Chapter 8
Water Management in the Santa Clara Basin

Prepared for the
Santa Clara Basin Watershed Management Initiative

by

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Water Management in the Santa Clara Basin

This chapter provides a general description of water management institutions, facilities, and practices in the Santa Clara Basin (the Basin). Emphasis is placed on those facilities and practices that affect the hydrology and water quality of surface streams and groundwater bodies in the Basin. Institutional arrangements for water management are usually influenced more by the boundaries of political units of government than by the physical characteristics of the landscape; therefore, this chapter is organized by political boundaries.

8.1 Introduction

Water in the Basin is managed intensively to meet human needs. The natural surface water and groundwater hydrology of the Basin is manipulated to supply water to homes, businesses, and farms, and to minimize flooding. Surface runoff is impounded in reservoirs, treated, and supplied to customers or released to recharge basins where it percolates into the ground. Water is also supplied to customers from wells that extend into the deep aquifer that underlies much of the Basin. Because the water resources of the Basin are insufficient to meet local needs, water is imported from the Sacramento-San Joaquin River Delta (the Delta) and the Tuolumne River in the Sierra Nevada.

About 40 percent of the water supplied to homes and businesses is used outdoors, where it evaporates, is transpired by plants, or percolates into the ground. The other 60 percent is discharged to municipal wastewater collection systems. Most municipal wastewater is treated and discharged to the waters of San Francisco Bay (the Bay). Currently, about 3 percent of the municipal wastewater produced in the Basin is treated and recycled, primarily for landscape irrigation.

Major exploitation of groundwater in the Basin began in the 1860s as farmers began growing water-intensive crops. Drawdown of the groundwater table caused rapid land subsidence, altering the slope and elevation of streams, destabilizing banks, and increasing tidewater incursion and the frequency of flooding.

Urban development has encroached upon the floodplains of the Basin's rivers and creeks. Before development, floodwaters could overflow creek banks and spread across the land without adverse consequences. Now, if floodwaters are not contained within the creek banks, property damage ensues. To prevent overbank flooding, creek channels have been modified to accommodate larger flows than they did under natural conditions.

8.2 Water Supply

8.2.1 Institutional Arrangements

Three major water suppliers are located in the Basin: Santa Clara Valley Water District (Water District), Alameda County Water District (ACWD), and City and County of San Francisco Water Department (SFWD). The Water District is the largest water supplier in the Basin. Together with the SFWD, it provides water in the 12 watersheds in the Basin that lie wholly within Santa Clara County. The SFWD also provides water in the San Francisquito Creek watershed. The ACWD provides water in the Arroyo la Laguna watershed that lies in Alameda County.

The Water District is primarily a water wholesaler. It supplies water to 13 public and private water retailers in the southern and central portions of the Basin. The retailers supply water to homes, businesses, and government agencies. The Water District sells treated water directly to some retailers, and also ensures that the groundwater basin underlying Santa Clara Valley contains sufficient water to enable retailers and other groundwater users to draw water from their own wells. The groundwater basin is artificially recharged with local and imported surface water by the Water District. The Water District also supplies water directly to some agricultural customers. Large retail agencies supplied with water by the Water District include the San Jose Water Company, the Great Oaks Water Company, the California Water Service Company, and the cities of San Jose, Santa Clara, Sunnyvale, and Milpitas.

The SFWD wholesales water to retail purveyors in the northern portions of the Basin. Within Santa Clara County it provides water to the cities of Palo Alto, Los Altos Hills, Mountain View, Santa Clara, Sunnyvale, and Milpitas. Within San Mateo County, the SFWD wholesales water to the cities of East Palo Alto, Portola Valley, Menlo Park, and Woodside. The ACWD supplies water directly to customers in the cities of Fremont and Newark. Wholesale and retail water purveyors for communities in the Basin are shown in Table 8-1 (Water District 1990).

8.2.2 Sources

The Water District obtains its water from local surface water and groundwater sources in the Santa Clara and Pajaro River basins and from the State Water Project and the San Felipe Division of the federal Central Valley Project. Water obtained from Pajaro River Basin sources is supplied to customers in that basin. It is not exported to the Santa Clara Basin.

Both the State Water Project and the Central Valley Project divert water from the southern end of the Delta. State Water Project water is delivered to Santa Clara County by the South Bay Aqueduct. Central Valley Project water is conveyed southward from the Delta by the California Aqueduct or the Delta-Mendota Canal to the O'Neill Forebay. Water from the forebay is pumped into San Luis Reservoir and then conveyed to the Water District water system through more than 35 miles of pipelines and tunnels.

Table 8-1
Retail and Wholesale Water Purveyors

Community	Retail Water Purveyors	Wholesale Water Purveyors
Campbell	San Jose Water Company	Water District
Cupertino	City of Cupertino, San Jose Water Company, and California Water Service Company	Water District
East Palo Alto	East Palo Alto Water District	SFWD
Fremont	ACWD	ACWD
Los Altos	California Water Service Company	Water District
Los Altos Hills	Purrissima Hills Water District, California Water Service Company	SFWD, Water District
Los Gatos	San Jose Water Company	Water District
Menlo Park	California Water Service Company	SFWD
Milpitas	City of Milpitas	Water District, SFWD
Monte Sereno	San Jose Water Company	Water District
Morgan Hill	City of Morgan Hill	Water District
Mountain View	City of Mountain View	Water District, SFWD
Newark	ACWD	ACWD
Palo Alto	City of Palo Alto	SFWD
Portola Valley	California Water Service Company	SFWD
San Jose	City of San Jose, San Jose Water Company, and Great Oaks Water Company	Water District, SFWD
Santa Clara	City of Santa Clara	Water District, SFWD
Saratoga	San Jose Water Company	Water District
Sunnyvale	City of Sunnyvale	Water District, SFWD
Woodside	California Water Service Company	SFWD

The Water District manages surface water and groundwater resources conjunctively. Until the 1930s, farmers and other residents of Santa Clara Valley obtained their water from wells; however, pumping from the groundwater basin at rates in excess of its natural recharge capacity led to falling groundwater levels and land subsidence. In 1929, the Water District's predecessor, Santa Clara Valley Water Conservation District, was formed to halt land subsidence in the valley, which was done by constructing surface water reservoirs to capture winter rains and release them at a controlled rate to recharge the groundwater basin. When the South Bay Aqueduct was completed in the 1960s, the Water District began using imported water to recharge the groundwater basin. Although about half of Santa Clara County's water supply still comes from wells, groundwater levels have been rising since the 1960s, and land subsidence has become negligible (DeAnza College 1981; Water District Updated 1998).

The City and County of San Francisco's Hetch Hetchy system was built in the 1920s to supply water to residents of San Francisco. The system consists of three reservoirs on the Tuolumne River and its tributary streams, and the Hetch Hetchy Aqueduct that extends about 135 miles from the reservoirs, across the Central Valley of California, to Crystal Springs Reservoir in San Mateo County. The SFWD wholesales water that is chlorinated, but otherwise untreated, to a number of retailers whose service areas lie close to the Hetch Hetchy Aqueduct, as indicated in Table 8-1. Water treatment and distribution facilities are owned and operated by the water retailers.

The ACWD obtains its water from three sources: local surface and groundwater, the State Water Project, and the Hetch Hetchy system. Local surface water and groundwater are obtained from the Alameda Creek watershed outside the Basin and the Niles Cone groundwater subbasin. The State Water Project diverts water from the southern end of the Delta and conveys it to Alameda County in the South Bay Aqueduct. The Hetch Hetchy Aqueduct passes through the ACWD service area. A turnout from the Hetch Hetchy Aqueduct supplies water to the ACWD. The ACWD blends Hetch Hetchy water with water from its other sources (ACWD 1998). From the point of view of the Basin, all of the ACWD's water supply is imported.

Table 8-2 lists the sources of water supplied to each community in the Basin. Almost all communities have more than one source.

All water purveyors in the Basin are implementing demand management measures designed to increase the efficiency of use of existing water sources and to postpone the need to develop new sources. All three water wholesalers and many of the retailers have executed a memorandum of understanding sponsored by the California Urban Water Conservation Committee that commits the agencies to implement certain water conservation best management practices (BMPs). Typical water conservation measures include water-saving plumbing fixtures in homes and offices, water-efficient landscape design, high-efficiency landscape irrigation equipment, customer education, and financial incentives for conservation.

8.2.3 Water Supply Facilities

8.2.3.1 Surface Water Reservoirs

The Water District operates 10 large surface water reservoirs that conserve local runoff for either recharge into groundwater basins or treatment and distribution to customers (Water District Updated 1998). Eight of the reservoirs are located in the Basin and are used to supply water to customers there. They are shown on Figure 8-1. Neither the ACWD nor the SFWD own or operate surface water reservoirs in the Basin. The general characteristics of the reservoirs are listed in Table 8-3. Flow regimes in the Guadalupe River, Coyote Creek, and Stevens Creek are affected by surface water reservoir operations.

8.2.3.2 Artificial Groundwater Recharge Facilities

Extensive groundwater occurs in the geologic strata underlying the floor of Santa Clara Valley. At the northern and southern ends of the valley are two aquifers separated by an impermeable zone known as an aquitard. The upper unconfined aquifer extends from a few feet below the ground surface to the top of the aquitard at a depth of about 150 feet. The confined lower aquifer lies below the 20- to 100-foot-thick aquitard. It is used as a source of potable water supply. A single unconfined aquifer lies under the remainder of the valley floor. Figure 8-1 shows the extent and location of the confined and unconfined aquifers.

Precipitation and stormwater runoff percolate into the unconfined aquifer. In areas where the aquitard is present, water is only able to enter the upper aquifer and then flow toward the Bay. In areas with no aquitard, water is able to migrate downward, recharging both the upper and lower aquifers.

Table 8-2
Sources of Community Water Supply

City	Local Surface Water and Groundwater	Hetch Hetchy	Sacramento – San Joaquin River Delta
Campbell	✓		✓
Cupertino	✓		✓
East Palo Alto		✓	
Fremont	✓		✓
Los Altos	✓		✓
Los Altos Hills	✓	✓	✓
Los Gatos	✓		✓
Menlo Park	✓	✓	✓
Milpitas		✓	✓
Monte Sereno	✓		✓
Morgan Hill	✓		✓
Mountain View	✓	✓	✓
Newark	✓		✓
Palo Alto	✓[1]	✓	
Portola Valley	✓	✓	
San Jose	✓	✓	✓
Santa Clara	✓	✓	✓
Saratoga	✓		✓
Sunnyvale	✓	✓	✓
Woodside	✓	✓	✓

[1] Backup municipal supply.

Table 8-3
Characteristics of Water Supply Reservoirs in the Santa Clara Basin

Reservoirs	Capacity (acre-feet)	Upstream Drainage Area (square miles)	Surface Area (acres)	Reservoir Length (miles)	Watershed
Almaden	1,780	12	59	1.1	Guadalupe
Anderson	89,073	192.7	1,244	7.8	Coyote
Calero	10,050	6.9	347	2.2	Guadalupe
Coyote	22,925	121	638	4.8	Coyote
Guadalupe	3,723	5.9	79	1.1	Guadalupe
Lexington	19,834	37.5	404	2.5	Guadalupe
Stevens Creek	3,465	17.3	92	1.1	Stevens Creek
Vasona	400	43.9	58	0.8	Guadalupe

Under natural conditions, some of the water flowing in streams in the Basin percolates into the ground and fills or recharges the upper and lower aquifers. The Water District artificially increases the rate of groundwater recharge by releasing water from reservoirs and pipelines to streams during the dry season. The water released percolates into the streambed or is diverted to percolation ponds. Recharge is enhanced in the areas that are hydraulically connected to the lower aquifer. Neither the ACWD nor the SFWD operate artificial recharge facilities in the Basin.

The Water District owns and operates numerous groundwater recharge facilities in the Basin (Water District Updated 1998). These facilities percolate both locally developed and imported water into the groundwater basin. The facilities consist of offstream percolation pond systems and instream facilities. Water is diverted from a creek or released from a pipeline into one of 15 percolation pond systems. The percolation pond systems are listed in Table 8-4. Numerous semipermanent or seasonal instream facilities have also been used to increase groundwater recharge. These instream facilities consist of small, temporary dams that back up water and increase the rate of percolation into the streambed (Water District 1999a).

The average annual recharge capacity of the facilities is 157,200 acre-feet per year. Instream recharge typically accounts for about half of total recharge capacity (Water District 1996). The locations of the groundwater recharge percolation pond systems are shown on Figure 8-1. Flow patterns in the Guadalupe River, Coyote Creek, Upper Penitencia Creek, and Stevens Creek are affected by recharge operations.

8.2.3.3 Water Treatment Facilities

Seven water treatment plants provide water to customers in the Basin. Their locations are shown on Figure 8-1. Three plants are owned and operated by the Water District and are used to treat

FIGURE 8-1 (front)

FIGURE 8-1 (back)

imported water and minor quantities of local surface water before it is supplied to retailers. The retailers supply treated water to homes and businesses in Santa Clara County.

Rinconada Water Treatment Plant was constructed in 1967 and has a maximum capacity of 75 million gallons per day (mgd). It provides treated water to the cities of Mountain View, Los Altos, Sunnyvale, Cupertino, Santa Clara, San Jose, and Campbell. Penitencia Water Treatment Plant was constructed in 1974 and has a maximum capacity of 42 mgd. Penitencia supplies treated water to the cities of Milpitas and San Jose. Santa Teresa Water Treatment Plant was built in 1989 and has a capacity of 100 mgd. It supplies treated water to southern portions of the city of San Jose (Water District Updated 1998).

Table 8-4
Groundwater Recharge Percolation Pond Systems in the Santa Clara Basin

Percolation Pond	Surface Area (acres)	Source of Water		Affected Creeks	Watershed
		Local	Imported		
Alamitos	11	✓	✓	Alamitos, Guadalupe	Guadalupe
Budd	9	✓	✓	Los Gatos	Guadalupe
Camden	62	✓	✓	Los Gatos	Guadalupe
Coyote	30	✓	✓	Coyote	Coyote
Ford Road	34	✓	✓	Coyote	Coyote
Guadalupe	31	✓	✓	Alamitos, Guadalupe	Guadalupe
Kooser	2		✓	-	Guadalupe
Los Capitarcillos	63	✓	✓	Guadalupe	Guadalupe
McClellan	2.5		✓	-	Stevens Creek
McGlincey	7	✓	✓	Los Gatos	Guadalupe
Oka Lane	17	✓	✓	Los Gatos	Guadalupe
Overfelt	6	✓		Upper Penitencia	Coyote
Page	14	✓	✓	Los Gatos	Guadalupe
Penitencia	24	✓	✓	Upper Penitencia	Coyote
Sunnyoaks	3	✓	✓	Los Gatos	Guadalupe

The ACWD owns and operates two water treatment plants: Mission San Jose Water Treatment Plant and Water Treatment Plant No. 2. The Mission San Jose plant was built in 1976 and has a capacity of 9 mgd. Water Treatment Plant No. 2 was completed in 1993 and has a capacity of 28 mgd (ACWD 1998). The treatment plants serve the cities of Fremont and Newark.

The San Jose Water Company operates two small water treatment plants that treat water from Los Gatos and Saratoga Creeks and supply it to customers in Saratoga, Monte Sereno, and Los Gatos (Water District Updated 1998).

The California Water Service Company operates a small water treatment plant at Bear Gulch Reservoir in Atherton (outside of the Basin) that treats water obtained from Bear Gulch Creek in the San Francisquito Creek watershed. This water is blended with water from the SFWD's Hetch Hetchy system and is used for domestic supply in Menlo Park, Portola Valley, Woodside, and other adjacent cities outside of the Basin.

The SFWD provides filtration treatment of its Hetch Hetchy water (supplemented with water from Calaveras Reservoir in Alameda County outside of the Basin) at its Sunol Valley Treatment Plant in Sunol, outside of the Basin. This water is supplied to customers in several Basin communities.

8.2.3.4 Wells

The Water District manages the groundwater basin that underlies Santa Clara Valley to ensure that sufficient water is present to enable the owners of wells to withdraw the water they need without causing land subsidence. The Water District maintains records of wells and controls the conditions under which wells can be placed in service and abandoned. It charges a fee for use of groundwater that is referred to as the groundwater charge. The Water District does not itself own and operate municipal drinking water wells. The SFWD and the ACWD own and operate municipal drinking water wells, but these lie outside the Basin in the Alameda Creek drainage.

Various measures are implemented by the Water District to protect the quality of groundwater. They are referred to collectively as the Wellhead Protection Program and include measures to control saltwater intrusion into freshwater aquifers, measures to reduce the amount of nitrate that enters groundwaters, and measures to protect groundwaters from leaking underground tanks, dry wells, and other contaminant sources (Water District 1999b).

Currently about 6,700 registered public and private supply wells are located in Santa Clara County, although not all of these are in the Basin. Over 500 wells are used for public water supply. Most city water departments and investor-owned water utilities in the valley, including the cities of Campbell, Cupertino, Los Altos, Morgan Hill, Mountain View, San Jose, Santa Clara, Sunnyvale, San Jose Water Company, Great Oaks Water Company, and California Water Service Company, obtain a portion of their supplies from wells. Private wells, other than those operated by investor-owned utilities for public water supply purposes, are responsible for only 1 to 2 percent of total withdrawals from the groundwater basin underlying Santa Clara Valley (Water District 1995). These wells are, however, an important water supply resource in Woodside and Portola Valley.

8.2.3.5 Surface Water Diversions

The only direct onstream diversions of local surface waters for municipal purposes in the Basin are located on Saratoga, Los Gatos, and Bear Gulch creeks. The first two diversions are operated by the San Jose Water Company and are used, together with groundwater, to supply water to parts of Monte Sereno, Los Gatos, and Saratoga. The third diversion is operated by the California Water Service Company and is used, together with water from SFWD's Hetch Hetchy System, to supply water to parts of Woodside, Menlo Park, and Portola Valley. The locations of these diversions, along with those of other nonmunicipal diversions, are shown on Figure 8-2. Larger quantities of local surface waters are diverted for municipal use elsewhere in the Basin, but the diversions are made from storage reservoirs rather than streams.

8.3 Wastewater Management

8.3.1 Institutional Arrangements

Wastewater from urban and suburban parts of the Basin is collected in piped systems and conveyed to one of several treatment plants for treatment and disposal or recycling. Municipalities and special districts are responsible for collection of wastewater from homes and businesses in urban and suburban areas. Wastewater treatment and disposal services are provided by the cities of Palo Alto and Sunnyvale, the Union Sanitary District, the South Bayside System Authority, and a consortium of municipalities and special districts that are tributary to the San Jose-Santa Clara Water Pollution Control Plant.

With a single exception, industrial wastewater produced in the Basin is discharged to municipal wastewater collection systems rather than directly to surface waters. In many cases, industries are required to pretreat their wastewater before it is discharged to the municipal sewer. FMC in Fremont is responsible for the only direct discharge of industrial wastewater to surface waters.

In rural areas of the Basin, septic tank systems are used to dispose of wastewater from isolated homes and ranches. Septic tank systems are owned and operated by individual property owners.

8.3.2 Wastewater Management Facilities

8.3.2.1 Treatment and Disposal Systems

Three major municipal wastewater treatment plants are located in the Basin. Their locations are shown on Figure 8-1. Three plants serve the urban communities of Santa Clara County. The San Jose Santa-Clara Water Pollution Control Plant receives wastewater from the cities of Campbell, Cupertino, Los Gatos, Milpitas, Monte Sereno, San Jose, Santa Clara, and Saratoga, and has a capacity of 167 mgd. The Palo Alto Regional Water Quality Control Plant receives wastewater from the cities of Palo Alto, East Palo Alto, Los Altos, Los Altos Hills, and Mountain View, and from Stanford University, and has a capacity of 39 mgd. Wastewater from the city of Sunnyvale is treated at its own water pollution control plant. The plant has a capacity

of 30 mgd. All three plants provide tertiary treatment and discharge effluent to shallow sloughs contiguous with the Bay, south of the Dumbarton Bridge. All three discharge points are within the Basin.

Municipal wastewater produced in the cities of Newark and Fremont is collected and conveyed to the Union Sanitary District Wastewater Treatment Plant in Union City. The plant, which has a capacity of 35 mgd, discharges secondary effluent to the East Bay Dischargers Authority interceptor that conveys wastewater to an outfall that extends into deep waters of the Bay, north of San Mateo Bridge. Both the treatment plant and the outfall are outside the Basin.

Municipal wastewater produced in the city of Menlo Park is conveyed to the South Bayside System Authority treatment plant in Redwood City. Treated effluent is discharged to the Bay between the San Mateo and Dumbarton bridges. Both the treatment plant and the outfall are outside the Basin.

8.3.2.2 Water Recycling

Currently, about 10 mgd of municipal wastewater is recycled in the Basin, primarily for landscape irrigation by the City of Santa Clara. Most of the wastewater being recycled is from the San Jose-Santa Clara Water Pollution Control Plant, but some is also recycled by the cities of Sunnyvale and Palo Alto. The Water District and the City of San Jose are participants in the South Bay Water Recycling Program that is developing plans to expand the reuse of municipal wastewater from the San Jose-Santa Clara Water Pollution Control Plant. The program will have the capacity to recycle 30 mgd of wastewater by 2002 and 100 mgd by 2020. Possible future uses for reclaimed water are augmentation of flow in surface streams and groundwater recharge.

8.4 Surface Water Management Facilities

When undeveloped land is converted to urban uses, both the quantity and quality of stormwater runoff changes. Relatively permeable soils are replaced by impermeable roofs, roads, and parking lots, and consequently the volume of stormwater runoff and the speed with which it reaches streams are both increased from their former values. Furthermore, urban living produces many pollutants that contaminate stormwater as it flows across roofs and street surfaces.

Traditionally, surface water management in urban areas was largely a matter of preventing loss of life or property during storms. Urban stormwater was viewed as relatively uncontaminated, and little effort was made to control its quality. Now it is widely accepted that urban stormwater is a contaminated waste stream and that a relationship exists between surface water quantity and quality; however, existing institutional arrangements have yet to evolve to fully reflect the relationship between stormwater quality and quantity. Currently, the management of surface water quantity (primarily for flood hazard reduction purposes) and surface water quality occurs separately, for the most part. Efforts are in progress to strengthen the links between the two: for example, city and county standards that will both limit the quantity of stormwater runoff from

new developments and control its quality. Also, the Bay Area Stormwater Management

Figure 8-2 (front)

Figure 8-2 (back)

Agencies Association has published design guidance including measures that address both runoff quantity and quality[1].

8.4.1 Flood Management

8.4.1.1 Institutional Arrangements

The provision of local drainage systems that carry stormwater away from homes and businesses is the responsibility of cities and counties in the Basin. City and county watercourses and stormdrains discharge to the Basin's creeks, engineered flood management channels, or in some cases, directly to the Bay. Reduction of flooding along the creeks, major drainage channels, and the Bay shoreline in Santa Clara County is the Water District's responsibility. The Water District is responsible for all creeks and drainage channels with watersheds greater than 320 acres. In Alameda County, reduction of flood hazard along creeks is the responsibility of the Alameda County Flood Control and Water Conservation District. In San Mateo County, responsibility for all aspects of flood management belongs to individual cities and the county. A separate flood management district is responsible for those portions of the San Francisquito Creek watershed that lie within San Mateo County. The flood management district, the cities of Palo Alto, Menlo Park, and East Palo Alto, and the Water District recently (1999) formed a joint powers authority to work together to solve flooding problems on San Francisquito Creek, perform regular creek maintenance, and preserve the creek as a community resource.

Santa Clara County is divided into five flood management zones, four of which, the Coyote Zone, Guadalupe Zone, West Valley Zone, and Lower Peninsula Zone, lie within the Basin. Each zone is a separate fiscal entity with its own revenues and expenditures. The Coyote Zone consists of the Coyote Creek and Lower Penitencia Creek watersheds and includes the subwatershed of Upper Penitencia Creek. The Guadalupe Zone consists of the Guadalupe River watershed. The West Valley Zone consists of the Calabazas Creek and San Tomas Aquino Creek watersheds, and the Sunnyvale East Channel and West Channel watersheds. The Lower Peninsula Zone consists of the Permanente Creek, Matadero/Barron Creeks, Stevens Creek, and Adobe Creek watersheds and a portion of the San Francisquito Creek watershed (Water District, undated).

8.4.1.2 Historical Flooding

While agriculture remained the predominant land use in the Basin, periodic flooding of lands along the creeks was no more than an inconvenience. In fact, most farmers welcomed flooding because it increased the productivity of soils. As land uses in the Basin changed from

[1] *Start at the Source – Design Guidance Manual for Stormwater Quality Protection, 1999 Edition* (BASMAA 1999). Some of the measures suggested in the manual involve promoting infiltration of stormwater as a way of reducing runoff quantity and stormwater pollutant loads. However, any drainage feature that infiltrates urban runoff poses some risk of groundwater contamination. The Santa Clara Valley Urban Runoff Pollution Prevention Program (SCVURPPP) and the Water District have recently worked to reconcile conflicts between the guidance manual and the Water District's Wellhead Protection Program.

agricultural to urban, flooding became less acceptable. Roads, homes, and businesses were built on floodplains where they were vulnerable to damage. Creeks could no longer spill over their banks without adverse consequences. Flood hazard was increased further by the replacement of permeable soils with impermeable roofs, streets, and parking lots. Increased volumes of storm runoff flowed more rapidly to the creeks, causing the creeks to overflow their banks more frequently.

As flooding problems on the floor of Santa Clara Valley became more severe, levees were constructed to contain floodflows along some creeks. Flood management efforts were fragmented until the Santa Clara County Flood Control and Water Conservation District was created in 1951. That agency was merged with the Santa Clara Valley Water Conservation District in 1968 to form the Water District. The Water District assumed responsibility for flood management in all of Santa Clara County (DeAnza College 1981).

In the 1960s and 1970s, many flood management projects were built to protect fast-growing areas in Santa Clara Valley. In the early 1980s, an El Niño winter caused catastrophic flooding in areas where projects had not yet been completed. The severity of the flooding led to approval by the public of a ballot measure providing funds for a countywide flood management program. As part of the program, flood protection projects have been completed on the lower reaches of Coyote Creek and the Guadalupe River and on Lower Penitencia, Alamitos, Ross, San Tomas Aquino, Calabazas, Stevens, and Barron creeks.

Although projects built as part of the program have reduced the risk of flooding for thousands of home and business owners, serious risks remain. Severe flooding has occurred several times in the 1990s. In 1995, rapidly rising water levels in the Guadalupe River prompted evacuation of offices in San Jose's downtown area. In 1997, more then 400 properties along Coyote Creek were flooded. In 1998, flooding occurred along Calera, Berryessa, San Francisquito, and Calabazas creeks. Areas of the county that remain vulnerable to flooding are shown on Figure 8-3. This information is also shown on a watershed-specific basis on Figures 7-11 through 7-23.

8.4.1.3 Flood Management Facilities

Flood management measures in Santa Clara County take several forms. Although the primary purpose of the Water District's reservoirs is to store water for direct municipal use or groundwater recharge, they also have an incidental flood management function. Floodwaters from the upland portions of the Basin may be held back by the reservoirs until high flows in the downstream creeks and channels have receded. Other measures include channel modification, embankment stabilization, and raising of roadway bridges. Channel modification may include constructing bypass channels, creating floodplains, and armoring (for example, rock lining) embankments, and has included lining with rock or concrete. These measures increase the ability of creeks and channels to convey floodwater, as can the straightening or enlarging of channels. For example, lined channels offer less resistance to flow than natural channels.

Spillage of water on to floodplains can be prevented by the construction of levees and floodwalls.

Figure 8-3 (front)

Figure 8-3 (back)

The Water District seeks to protect homes and businesses from damage in a flood equal to or less than the 1 percent flood. The 1 percent flood is the flow of water that has a 1 percent chance of occurring in any given year. It is sometimes referred to as the 100-year flood. Of the 642 miles of creeks and drainage channels managed by the Water District, about 350 miles of channel can convey the 1 percent flow without overbank flooding. As a result of the Water District's flood protection efforts, portions of Santa Clara County qualify for reduced flood insurance rates under the National Flood Insurance Program.

The Water District has a comprehensive flood management plan program that is conducting an ongoing review of flood protection needs on all creeks in Santa Clara Valley. A number of potential flood protection projects are being considered, including projects on the east-side tributaries of Coyote Creek (Berryessa, Upper Penitencia, and Lower Silver creeks) and on the middle reaches of the Guadalupe River. Other potential projects on Permanente, Adobe, Matadero, and San Francisquito creeks and the Sunnyvale East and West channels are being studied. The Water District also maintains its flood control channels to ensure that the capacity of the channels is not reduced by accumulated debris or excessive growth of vegetation.

Because natural channels typically only convey the 50 percent flow (2-year return frequency flood) without overbank spillage, it is evident that many channels in the Basin have been greatly altered to permit conveyance of the 1 percent flow. The lower reaches of some streams have also been enclosed in pipes to pass under streets and highways and to provide more developable land. Table 8-5 shows the current characteristics of creek channels in the Basin (Water District Waterways Management Model).

8.4.2 Stormwater Quality Management

In 1987, Congress amended the Clean Water Act in recognition of the growing concern about the adverse effects of urban runoff discharges on the quality of the nation's waters. These amendments required that National Pollutant Discharge Elimination System (NPDES) permits be obtained for urban stormwater discharges. Stormwater discharge permits include a requirement that permit-holders implement state-approved urban runoff management plans designed to control contaminants to the "maximum extent practicable." The plans typically call for the implementation of a broad range of BMPs that will reduce the discharge of contaminants in urban runoff. The BMPs are primarily nonstructural urban "good housekeeping" measures such as street-sweeping, catchbasin cleaning, litter control, and programs to educate the public about pollution caused by urban stormwater. The plans also call for standards for new development that will limit the emission of water pollutants from yet-to-be-built urban neighborhoods.

Table 8-5
Channel Characteristics for Santa Clara Basin Streams [1, 2]

Stream	Length (miles)	Percent Concrete- or Rock-Lined, Culverted	Percent Natural Modified[3]	Percent Natural Unmodified
San Francisquito Creek[4]	79.5	2	2	96
Matadero/Barron Creek	23.5	38	32	30
Adobe Creek	13.5	27	20	53
Permanente Creek	19.6	25	16	59
Stevens Creek	27.9	14	23	63
Sunnyvale West/East Channels	19.3	30	69	1
Calabazas Creek	21.7	40	18	42
San Tomas Aquino Creek	40.0	38	14	48
Guadalupe River	80.8	21	38	40
Coyote Creek	108.7	17	19	64
Lower Penitencia Creek	27.6	25	38	37
Arroyo la Laguna[5]	133.8	34	28	38

[1] Source: Water District Waterways Management Model.
[2] Includes mainstem and major tributaries.
[3] This category includes earthen channels that have been straightened, rerouted, or contained by levees.
[4] Information for Santa Clara County is from the Water District Waterways Management Model . Information for San Mateo County is from field reconnaissance and the San Francisquito Creek GIS file supplied by the Water District.
[5] Source: Alameda County Flood Control and Water Conservation District Improvement Index Maps, August 1994. Includes channels in the portion of the Baylands downstream of the watershed.

A permit to discharge stormwater from urban areas in Santa Clara County was issued to the SCVURPPP, a consortium of 15 government agencies, by the San Francisco Bay Regional Water Quality Control Board (Regional Board) in 1990 and reissued in 1995. The permit area lies entirely within the Basin. The co-permittees are the municipalities of Cupertino, Los Altos, Los Altos Hills, Milpitas, Mountain View, Palo Alto, San Jose, Santa Clara, Sunnyvale, Campbell, Los Gatos, Monte Sereno, and Saratoga; Santa Clara County; and the Water District (SCVURPPP 1997). The SCVURPPP is guided by a management committee comprised of one designated voting representative from each co-permittee. The committee administers the program, conducts areawide activities, and prepares and submits annual reports and other documents to the Regional Board. Each co-permittee must also develop individual urban runoff management plans to control the discharge of pollutants from their storm sewer systems.

A similar urban stormwater discharge permit was issued to the Alameda County Urban Runoff Clean Water Program in 1991 and 1996. The cities of Fremont and Newark are copermittees. San Mateo County Stormwater Pollution Prevention Program received its permit in 1993 and 1998. The cities of Menlo Park and East Palo Alto and the towns of Woodside and Portola Valley are copermittees.

8.5 Water Balance

The term water balance is used to describe the overall movement of water into and out of a watershed. A diagrammatic representation of the water balance in the Basin is shown on Figure 8-4. The water balance can be expected to vary from year to year. Conditions in a normal meteorological year are shown in the diagram.

Approximately 415,000 acre-feet of water are used in the Basin each year by residents, commerce, industry, and agriculture. Agricultural water use has declined to approximately 3,000 acre-feet per year as Santa Clara Valley has urbanized. About 240,000 acre-feet per year of water, or 61 percent of the total, is imported from outside the Basin. The remainder is obtained from local surface and groundwater sources[2].

About 60 percent of the water taken from the Basin is used inside homes and businesses and then discharged to the municipal sewer. The other 40 percent is used outside for landscape irrigation and other purposes. Most of the water used outside evaporates, is used by plants, or percolates into the ground. Some flows to the Bay via surface streams and shallow groundwater bodies. Little percolates into the deeper aquifers that are used for water supply because most of the water use occurs in areas where the upper and lower aquifers are separated by an impermeable layer known as an aquitard.

Most municipal wastewater is treated and discharged to the waters of the Bay within the Basin. About 31,000 acre-feet per year are treated and exported from the Basin either to the Bay north of Dumbarton Bridge or to Pajaro River Basin to the south. About 8,000 acre-feet per year are recycled and used for landscape irrigation.

Prior to settlement by Euro-Americans, the groundwater basins underlying the Basin probably remained full or close to full. The 167,000 acre-feet of water that are currently obtained from local surface water and groundwater sources and used for municipal purposes formerly flowed to the Bay in surface streams. Thus, current total flow to the Bay is probably lower than predevelopment flows by about 167,000 acre-feet per year.

Each of the water wholesalers that serve the Basin have prepared long-range plans for meeting future water needs. For example, in 1996, the Water District prepared an integrated water resources plan that includes an evaluation of many options for matching water supply and demand in the next 25 years (Water District 1996). Water conservation and recycling are expected to play a much greater role in overall water management in the Basin in the future. As

[2] The estimates were made using information on water use from the Water District, the ACWD, and the SFWD. The estimates account for the effects of water conservation programs. Adjustments were made to account for the differences between Water District service areas and the Basin boundaries. Water use in north Santa Clara County in 1997 was estimated to be 359,000 acre-feet, of which 44 percent was from local sources. Water use in the Alameda and San Mateo county portions of the Basin were estimated to be 33,000 and 15,000 acre-feet, respectively.

evidence, the Water District's Board of Directors adopted goals for the future use of recycled water with advanced treatment in December 1999.

8.6 References

Alameda County Water District (ACWD). 1998. Alameda County Water District Profile.

Bay Area Stormwater Management Agencies Association (BASMAA). 1999. Start at the Source – Design Guidance Manual for Stormwater Quality Improvement, 1999 Edition. Prepared by Tom Richman and Associates, Consultants.

DeAnza College. 1981. Water in Santa Clara Valley: A History. California History Center.

Santa Clara Valley Runoff Pollution Prevention Program (SCVURPPP). 1997. 1997 Urban Runoff Management Plan.

Santa Clara Valley Water District (Water District). 1990. Discover Water.

Santa Clara Valley Water District (Water District). 1995. The Water Utility Enterprise.

Santa Clara Valley Water District (Water District). 1996. Draft Integrated Water Resources Management Plan.

Santa Clara Valley Water District (Water District). Updated 1998. Water Supply and Distribution Facilities.

Santa Clara Valley Water District (Water District). 1999a. Personal Communication with Joe Aguilera.

Santa Clara Valley Water District (Water District). 1999b. Draft Groundwater Management Plan.

Santa Clara Valley Water District (Water District). Undated. Flood Control in Santa Clara Valley.

FIGURE 8-4 (front)

FIGURE 8-4 (back)