Watershed Management Plan

# Volume One
# Watershed Characteristics Report

## Unabridged
## 2003 Revision

SANTA CLARA BASIN

WMI

WATERSHED
MANAGEMENT INITIATIVE

**Prepared by the**
**Santa Clara Basin Watershed Management Initiative**
**www.scbwmi.org**

**Revised August 2003**

## ABOUT THIS VOLUME

This is Volume One of the Watershed Management Plan, "Watershed Characteristics Report," a product of the Santa Clara Basin Watershed Management Initiative. It is the first volume of a planned four comprising the Watershed Management Plan for the Santa Clara Basin. An abridged version of this report, which condenses the information contained in this volume, is also available. Chapter numbers and major sections in this report correspond to those in the abridged version. The abridged version can be obtained from the Project Coordinator for the Watershed Management Initiative at the address below or visit the web site, where both the abridged and unabridged versions of this report are available for review and downloading.

## WE WOULD LIKE TO HEAR FROM OUR READERS

The Watershed Management Initiative values community participation and welcomes your feedback for consideration in future publications. If you would like to comment on this document, or are interested in playing a part in managing our watershed, please visit our website at **www.scbwmi.org**.

Please cite this report as:

> Santa Clara Basin Watershed Management Initiative. 2001. Watershed Characteristics Report. Watershed Management Plan, Volume One (Unabridged). Prepared by the Santa Clara Basin Watershed Management Initiative, which is a stakeholder group organized to protect and enhance the Santa Clara Basin watershed. February 2001.

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# Watershed Characteristics Report

# Summary

SANTA CLARA BASIN

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**Prepared for the**
**Santa Clara Basin Watershed Management Initiative**

**by**

**Watershed Assessment Consultant**

**Revised August 2003**

# Watershed Characteristics Report Summary

# List of Authors

**REPORT PREPARATION TEAM**

*with consultant support from*


***URS Greiner Woodward Clyde***
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Funded by:
Santa Clara Valley Water District
and
City of San Jose


**Revised August 2003**

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# Summary

## S.1 Introduction

The Santa Clara Basin (the Basin) is defined as the portion of San Francisco Bay (the Bay) south of the Dumbarton Bridge and the 840-square-mile area of land that drains to it. Great strides have been made over the last two decades to reduce pollution levels and sources into the Bay. However, contaminant levels of concern still exist throughout the Bay and its tributary steams. In the Basin, which drains to the South Bay, efforts are being made to address the existing pollution problems, which are derived from numerous diffuse sources as well as pollution "legacies" that were introduced to the Bay decades ago but still persist. Further improvement will depend on putting into effect a management program that takes into account all of the human activities that influence watershed health and aquatic resources, a program that is not limited just to municipal wastewater and urban runoff discharges, which have been the focus of most regulatory attention to date. **The purpose of the Santa Clara Basin Watershed Management Initiative (WMI) is to develop and implement a comprehensive watershed management program, one that recognizes that healthy watersheds mean addressing water quality problems and quality of life issues for the people, animals, and plants that live and work in the watershed.**

In 1996, the WMI was established by the U.S. Environmental Protection Agency, the State Water Resources Control Board, and the San Francisco Bay Regional Water Quality Control Board (Regional Board) as a pilot project for California's Watershed Management Initiative, which is a statewide effort to manage water resources at the watershed scale. The WMI is being guided by a group of stakeholders, that is, individuals and representatives of organizations, which have a stake or interest in the outcome of the WMI. The stakeholders include representatives of local, state, and federal government agencies, business, agricultural and industry associations, and environmental groups. This group is known as the Core Group.

The WMI plans to publish a watershed management plan in four volumes, as well as a number of supporting documents. The four volumes consist of this watershed characteristics report, a watershed assessment report, a watershed action alternatives report, and a watershed action plan. This watershed characteristics report contains an overall description of the Basin's natural, cultural, and regulatory setting.

## S.2 Report Preparation Process

This report was developed as a collaborative effort by the stakeholders in the WMI. All decisions regarding the preparation and review process were made by the Core Group – individuals and representatives of public and private organizations with a stake in the outcome of the watershed planning process for the Basin. This group, representing a wide range of views and interests, reviewed and commented on all the material in this volume, which is based on work prepared by various subgroups of the Core Group and Watershed Assessment Consultant. The work of preparing this report was done by WMI's Report Preparation Team (RPT). An abridged version of this report was also produced for distribution to the general pubic. For reference the abridged version is referred to as "Volume One: Watershed Characteristics Report" and this volume as "Volume One Unabridged."

The Core Group established a number of subgroups to conduct or oversee portions of the WMI's work. The subgroups include the Watershed Assessment Subgroup, Land Use Subgroup, Bay Modeling and Monitoring Subgroup, Regulatory Subgroup, Communications Subgroup, Flood Management Subgroup, Data Management Subgroup, Wetlands Advisory Group, Planning Subgroup, Outreach Subgroup, and Budget and Personnel Subgroup. The membership of the subgroups includes both Core Group members and other stakeholder representatives with expertise or an interest in the topics.

An additional group, the RPT, was established by the Core Group to oversee the preparation of the watershed characteristics, watershed assessment, and watershed action alternatives reports. The RPT created a number of work groups to explore certain issues and submit their findings to the Core Group. The RPT directs the work of the Watershed Assessment Consultant (WAC). The WAC provides technical and production support to the WMI. The Core Group, through the Santa Clara Valley Water District, contracted with URS Greiner Woodward Clyde to serve as the WAC. Analytical work is conducted by subgroups or by the WAC. Each of the products prepared by the subgroups or the WAC is reviewed by the RPT, revised as necessary, and forwarded to the Core Group for review and consideration.

## S.3 Cultural Setting of the Santa Clara Basin

### S.3.1 History

The Basin has been inhabited for at least 10,000 years. When the Spanish arrived in the Bay region in 1769, the Basin was inhabited by several Native American groups or tribelets with the Ohlone predominant among them. The groups, which consisted of 20 to 200 individuals, were hunter-gatherers subsisting on fish and shellfish and a great variety of plant foods. The native population, always small and widely dispersed, was forced into missions by the arriving Spanish and decimated by diseases for which they had little immunity. Their culture disrupted, the survivors found marginal subsistence on ranches or on the fringes of towns. Nonetheless, many of the Ohlone people retain their cultural identity today.

In 1777, Mission Santa Clara was first established on the west bank of the Guadalupe River. Cattle grazing and small-scale farming were the primary economic activities. The discovery of gold in 1849 accelerated the influx of population to California and created a great demand for agricultural products. To meet the demand, large-scale commercial farms were established for the first time on the fertile soils of Santa Clara Valley. For the next 30 years, barley, wheat, and hay were the valley's primary products, but by the 1880s the invention of the refrigerated railroad car enabled many farmers to switch from field crops to more profitable fruit tree crops.

By the 1930s, many of Santa Clara Valley's orchards began to be replaced by homes and businesses. At that time, the Navy established an airbase at Moffett Field that served as a magnet for technology-based enterprises. By the 1960s, the booming electronics industry had taken root and the valley, now nicknamed "Silicon Valley," became one of the fastest growing urban areas in the U.S. Today, the northern portion of the Basin is almost exclusively urban. The southern portion of the Basin remains largely rural and is devoted to cattle ranching, water supply catchments, and scattered low-density residential development.

### S.3.2 Population

The current population of the Basin is estimated to be 1.9 million. Population growth is expected to continue in the next 20 years, but at a slower rate than in the recent past. By 2020, the population of the Basin will likely approach 2.2 million.

Most demographic statistics are kept on a countywide basis, making it difficult to separately compile data for the Basin. However, because 86 percent of the Basin's land area and 90 percent of the Basin's population are in Santa Clara County, that county's statistics provide a strong indication of the characteristics of the Basin as a whole. Most county residents dwell in single-family homes and are employed in manufacturing (26 percent), services (31 percent), or wholesale and retail trades (18 percent). Unemployment is currently low and mean household income high, probably in excess of $80,000.

Santa Clara County has an ethnically diverse population. Whites constituted about 70 percent of the population in 1990, the time of the last census, but the proportion of nonwhites has increased since then. In 1990, nonwhite races with significant populations included Asian/Pacific Islanders (15.9 percent), blacks (3.8 percent), Native Americans (0.6 percent), and other races (9.4 percent). Hispanics, a multiracial group, made up about 21 percent of the population in 1990.

## S.4 Land Use in the Santa Clara Basin

About one-third of the land surface in the Basin is devoted to urban uses, while the remainder is open space. Residences and commercial and industrial premises occupy 23.4 percent and 11.2 percent of the land, respectively. Most of the open space is forest (33.8 percent) or rangeland (19.6 percent). The remaining open space is occupied by agriculture, parks, wetlands, and open water. A small proportion of the Basin, less than 1 percent, is designated as vacant.

Urban development is expected to continue in the Basin, but at a slower rate than in the recent past. The area of land devoted to urban use is expected to grow from 34.6 percent in 1995 to 36.3 percent in 2020.

## S.5 Organizational Setting

The Basin includes about one-half of Santa Clara County and smaller portions of San Mateo and Alameda Counties. Twenty cities lie within the Basin wholly or in part. A number of special districts exist within the Basin. They include resource conservation districts, transportation districts, and water districts.

Three universities, Stanford, Santa Clara, and California State University at San Jose, and a number of community colleges provide higher education in the Basin. Approximately 350 public elementary, middle, and high schools are also in the Basin.

Many environmental organizations are active in the Basin. Those with a particular interest in streams and wetlands include the Santa Clara Valley Chapter of the Audubon Society, the San Francisco Bay Bird Observatory, the Friends of Stevens Creek Trail, the Peninsula Conservation Center Foundation, CLEAN South Bay, Santa Clara County Streams For Tomorrow, and the Creek Connections Action Group. The Peninsula Conservation Center is administering a coordinated resource management and planning program for San Francisquito Creek watershed, which lies at the northwestern edge of the Basin.

## S.6 Regulatory Setting

Water resources management in California occurs within a complex regulatory setting. Instream water quality is regulated pursuant to the federal Clean Water Act and California's Porter-Cologne Act. Removal of water from freshwater bodies is regulated under state water law that recognizes both riparian and appropriative rights. The filling of wetlands is regulated pursuant to the Clean Water Act. Actions that could jeopardize the continued existence of certain plants, animals, and insects are regulated under the federal Endangered Species Act and similar state statutes. Land use, an important influence on instream water quality, is regulated by cities and counties. Finally, the quality of drinking water is regulated pursuant to the federal Safe Drinking Water Act and California's Safe Drinking Water and Toxic Enforcement Act. Although all of the statutes referenced above influence aspects of the WMI, the Clean Water Act and the Porter-Cologne Act are its most important influences.

### S.6.1 Clean Water Act

The Water Pollution Control Act Amendments of 1972 (later referred to as the Clean Water Act) have as their goal the restoration of the physical, chemical, and biological integrity of the nation's waters. The primary mechanism to achieve the goal is the National Pollutant Discharge Elimination System (NPDES). The Clean Water Act requires that parties seeking to discharge pollutants to the waters of the U.S. obtain a permit under the NPDES. A discharge of pollutants from a source with a single readily identifiable point of discharge such as a municipal wastewater outfall is only permitted if it meets certain quality standards, known as effluent limits. Effluent limits are based on available wastewater treatment technology. Municipal wastewater must receive a minimum of secondary treatment before discharge. Industrial wastewater must receive the equivalent of secondary treatment.

In 1987, the Clean Water Act was amended to place more emphasis on the control of pollutants from diffuse sources. Municipalities with populations over 100,000 were required to obtain NPDES permits for discharges of stormwater.

The Clean Water Act calls for the adoption of ambient water quality standards and periodic assessment of the condition of waterbodies to determine whether they are in compliance with the standards. If, after implementation of technology-based effluent limits, ambient water quality in a waterbody still fails to meet applicable standards, then further action is necessary. Studies must be undertaken to determine the total maximum daily load (TMDL) of each pollutant that can be discharged to the waterbody while maintaining compliance with ambient standards. The TMDL is then allocated among pollutant sources. Discharge from each pollutant source must be reduced until it complies with its allocated share of the TMDL.

All municipal and industrial wastewater discharges in the Basin are in compliance with minimum technology-based effluent limits, and best management practices (BMPs) for controlling pollutants in stormwater are being implemented in urban portions of the Basin. But many waterbodies and stream segments do not comply with ambient standards. Two TMDL studies are in progress in the Basin (for copper and nickel in the portion of the Bay south of the Dumbarton Bridge and for mercury in the Guadalupe River watershed). Others are expected in the future.

### S.6.2 Porter-Cologne Act

The Porter-Cologne Act was enacted by the California Legislature in 1969. It created an administrative structure and procedures for management of water quality in the state. California's water quality program is administered by the State Water Resources Control Board and by nine regional water quality control boards. The Regional Board is responsible for regulating water quality in the Basin.

The Porter-Cologne Act called for the preparation of comprehensive water quality control plans or "basin plans" for major watersheds in California. For each waterbody, the plans designate beneficial uses and establish the water quality objectives (ambient standards) necessary to support the beneficial uses. The basin plans also outline the actions needed to bring waterbodies into compliance with water quality objectives. The Water Quality Control Plan for the San Francisco Bay Region, including the Basin, was first made public in 1973. It has been amended several times, most recently in 1995.

The regional boards regulate pollutant discharge through the issuance of waste discharge requirements. Waste discharge requirements are similar to the conditions in an NPDES permit. Their issuance fulfills both the Porter-Cologne Act and Clean Water Act requirements.

## S.7 Natural Setting

The Basin is located near the northern end of California's South Coast Mountain Range. The Basin is bounded on the west by the Santa Cruz Mountains and on the east by the Diablo Range. Ancient rocks, exposed in the mountain ranges, originated as ocean floor and were thrust upward many millions of years ago as the Pacific Plate was forced under the North American Plate. The lands between the ranges filled with material eroded from the mountains, forming Santa Clara Valley. All surface streams in the Basin drain to the Bay.

The Basin has a Mediterranean climate, characterized by dry summers and several months of rain in the winter. Annual average precipitation varies with location. Some locations in the Santa Cruz Mountains receive as much as 60 inches annually, whereas the Basin floor near San Jose receives only 13 inches. Precipitation varies considerably from year to year and extended periods of drought occur fairly frequently.

Flow in surface streams reflects the seasonality of precipitation. Before Santa Clara Valley became urbanized, it is likely that most surface streams dried up in the summer months except for the lower reaches of the larger streams that were fed by groundwater. Early Spanish explorers identified the only two streams in the area in which water flowed year-round, Coyote Creek and Guadalupe River. Today, streamflow and groundwater levels are partly controlled by water management activities, as discussed in the following section.

Vegetation and wildlife populations in the Basin have been greatly altered in the last 200 years. Before settlement by Euro-Americans, the floor of Santa Clara Valley was a grassy oak-studded plain. Streams flowing across the plain were lined with dense stands of cottonwoods, willows, and sycamores. The mountains to the west were heavily forested with Douglas fir and redwood of considerable dimension. To the east, grassland covered the Diablo Range, with the exception of densely wooded arroyos and scattered oaks and pines. To the north, large areas of salt and brackish marsh extended along the shore of the Bay.

Today, little of the Basin’s native vegetation remains. Most of the valley floor has been converted to urban uses. Native grassland and savanna has been replaced by parks, residential yards, landscaped areas, and impervious surfaces free of vegetation (roads, parking lots, and buildings). Landscaped areas and parks are largely planted with nonnative species. Urban development, agricultural activities, and alteration of stream channels for flood control purposes have greatly reduced the extent of riparian forests. Much of the salt or brackish marsh along the shore of the Bay has been enclosed by dikes and converted to salt ponds.

In the foothills, the native grassland and savanna have been largely replaced by nonnative grassland. The Santa Cruz Mountains remain forested but most of the large, very old trees have been removed. Throughout the Basin, invasive nonnative plant species are displacing native species with a consequent reduction in wildlife habitat value.

Before settlement by Euro-Americans, the Basin supported a very diverse fauna that included grizzly bears, elk, pronghorn, black-tailed deer, sea otters, and harbor seals. Waterfowl were extraordinarily abundant, including such species as snow goose, Ross’ goose, canvasback, green winged teal, Canada goose, northern pintail, and American widgeon. Bald eagles and California condors were common.

Changes in terrestrial and aquatic habitats brought about by human activities in the Basin have reduced wildlife populations and diversity. Most of the large mammal species no longer exist in the Basin. Ninety taxa of animals, birds, reptiles, insects, and amphibians have declined sufficiently in numbers to be listed by state and federal agencies as deserving special protection and monitoring. A few species have probably benefited from changes in habitat. For example, the conversion of marsh to salt ponds has increased populations of white pelicans, Caspian terns, Forster's terns, snowy plovers, and several other bird species.

Currently, the known fish fauna of flowing streams in the Basin consists of 11 native species and 19 nonnative species. Most native species are intolerant of disturbance caused by human activities and have declined as a result. Six native fish species are extinct within the Basin. California roach and Sacramento sucker are the most abundant of the native species. Remnant steelhead and salmon runs exist in Coyote Creek, Stevens Creek, San Francisquito Creek, and Guadalupe River. A small run of anadromous Chinook salmon occurs in the Guadalupe River.

## S.8 Water Management in the Santa Clara Basin

Water in the Basin is managed intensively to meet human needs. The natural distribution and circulation of surface waters and groundwaters are 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. Imported water is conveyed to the Basin from the Sacramento-San Joaquin River Delta, via the state-owned South Bay Aqueduct and the federally owned San Felipe Project, and from the Tuolumne River in the Sierra Nevada, via the city of San Francisco's Hetch Hetchy system. Approximately 60 percent of the water used in the Basin is imported.

About 40 percent of the water supplied to homes and businesses is used outside, primarily for landscape irrigation. Most of the other 60 percent of the water is discharged to municipal wastewater collection systems. Municipal wastewater is treated at one of several wastewater treatment plants and discharged to the waters of the Bay. Currently, about 3 percent of the municipal wastewater produced in the Basin is treated and recycled, primarily for landscape irrigation. The proportion of municipal wastewater that is recycled is expected to grow rapidly in the next 20 years with a corresponding reduction in the proportion discharged to the Bay.

Urban development has altered the hydrology of the Basin and increased flood hazard. Permeable soils have been replaced by impermeable surfaces such as roads, parking lots, and the roofs of buildings. As a result, the amount of water percolating into the soil has decreased and the rate and volume of stormwater runoff increased. Furthermore, 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 the increased volumes of stormwater cannot be contained within the creek banks, property damage usually ensues. Severe flooding has occurred many times as the Basin has developed. Although flood management projects have been built on most of the Basin's rivers and creeks, damaging flooding continues to occur. In the last 3 years the Guadalupe River, Coyote Creek, and San Francisquito Creek have all flooded.

To prevent overbank flooding, creek channels have been modified to accommodate much larger flows than they did under natural conditions. Creeks have been straightened, enlarged, and lined with concrete and rock and confined within levees and floodwalls to increase their capacity to convey floodflows without damage.

Until relatively recently, stormwater management in urban areas was largely a matter of preventing loss of life or property during floods. Urban stormwater was viewed as less contaminated than municipal and industrial discharges and little effort was made to control its quality. Now it is widely accepted that urban stormwater is a contaminated waste stream that needs to be managed. Several programs are being implemented in the Basin to reduce the discharge of pollutants in urban stormwater runoff. They involve the adoption of a wide range of BMPs that reduce the mass of pollutants entering the urban storm drainage system or remove pollutants from stormwater before it is discharged to creeks and the Bay.

Volume One Unabridged
**Watershed Characteristics Report**

# Chapter 1
# Introduction

SANTA CLARA BASIN
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**Prepared for the**
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# Watershed Characteristics Report
# Chapter 1: Introduction

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John Davis, Senior Project Manager

Funded by:
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**Revised August 2003**

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## Figures

# Chapter 1
# Introduction

This chapter contains a description of the Santa Clara Basin Watershed Management Initiative (WMI) and its purpose. General information on the characteristics of Santa Clara Basin (the Basin) is provided together with a summary of other plans and studies and their relationship to the WMI.

## 1.1 Santa Clara Basin Watershed Management Initiative

### 1.1.1 Purpose

The Basin is defined as the portion of San Francisco Bay (the Bay) south of Dumbarton Bridge and the 840-square-mile area of land that drains to it. Great strides have been made over the last two decades to reduce pollution levels and sources into the Bay. However, contaminant levels of concern still exist throughout the Bay and its tributary steams. In the Basin, which drains to the South Bay, efforts are being made to address the existing pollution problems, which are derived from numerous diffuse sources as well as pollution “legacies” that were introduced to the Bay decades ago but still persist. Further improvement will depend on putting into effect a management program that takes into account all of the human activities that influence watershed health and aquatic resources, a program that is not limited just to municipal wastewater and urban runoff discharges, which have been the focus of most regulatory attention to date. **The purpose of the WMI is to develop and implement a comprehensive watershed management program, one that recognizes that healthy watersheds mean addressing water quality problems and quality of life issues for the people, animals, and plants that live and work in the watershed.**

In 1996, the U.S. Environmental Protection Agency, the State Water Resources Control Board, and the San Francisco Bay Regional Water Quality Control Board (Regional Board), working with local government agencies and special interest groups, established the WMI as a pilot project for California’s Watershed Management Initiative. The Watershed Management Initiative is a statewide effort to manage water resources at the watershed scale.

For this effort, a watershed is defined as a land area in which surface water flows to a particular river, stream, or creek. Watersheds are also places where people live, work, and recreate. Watersheds provide habitat for wildlife and plants. In urban areas today, many streams have been altered by modern development so that watershed boundaries are not necessarily obvious. But they are there nevertheless. The WMI is being guided by a group of stakeholders, that is, individuals and representatives of organizations, who have a stake or interest in the outcome of the WMI. The stakeholders include representatives of local, state, and federal government agencies; business, agricultural, and industry associations; and environmental and civic groups.

### 1.1.2 Goals of the Watershed Management Initiative

The six primary goals developed by the stakeholders for the WMI are as follows:

- Ensure that the WMI is a broad, consensus-based process.
- Ensure that necessary resources are provided for implementation.
- Simplify compliance with regulatory requirements without compromising environmental protection.
- Balance the objectives of water supply management, habitat protection, flood management, and land use to protect and enhance water quality.
- Protect and/or restore streams, reservoirs, wetlands, and the Lower South Bay for the benefit of fish, wildlife, and human uses.
- Develop an implementable watershed management plan that incorporates science and will be continuously improved.

A work plan has been developed to guide the WMI through completion of its ultimate product, a comprehensive watershed management plan. The WMI plans to publish the plan in four volumes along with a number of supporting documents. The four volumes will consist of this watershed characteristics report, a watershed assessment report, a watershed action alternatives report, and a watershed action plan. The four documents are referred to collectively as the watershed management plan. This watershed characteristics report contains an overall description of the Basin's natural, cultural, and regulatory setting.

## 1.2 Location and Characteristics of the Santa Clara Basin

### 1.2.1 Study Area Definition and Regional Location

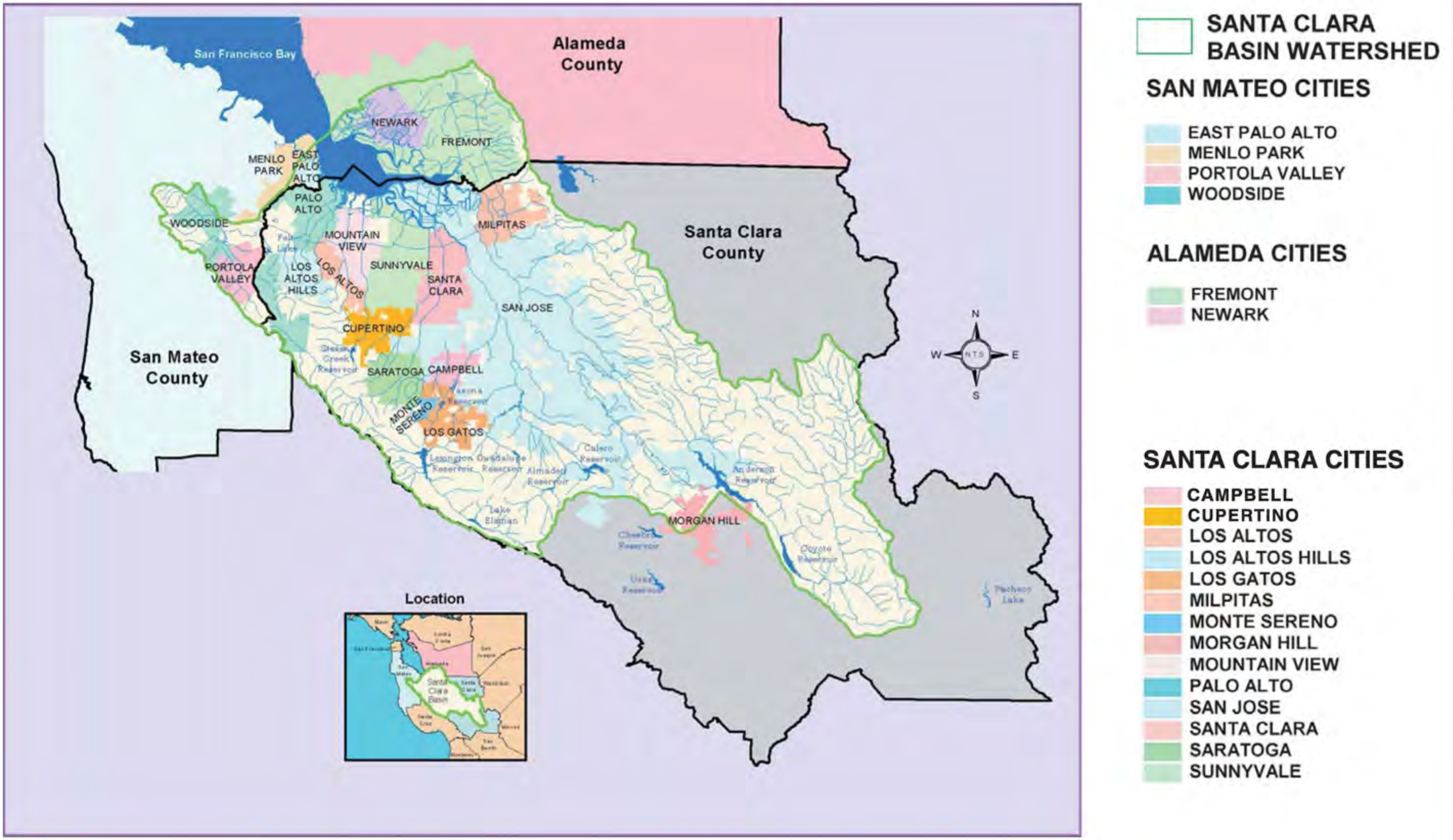
The Basin is defined as the portion of the Bay south of Dumbarton Bridge and the 840-square-mile area of wetlands and uplands that drains to it. The basin is located at the southern end of the San Francisco Bay Area as shown on Figure 1-1. It is bounded by Dumbarton Bridge to the north, the crest of the Diablo Mountains to the east, and the crest of the Santa Cruz Mountains to the west and south.

### 1.2.2 Political Boundaries

The Basin includes about one-half of Santa Clara County and smaller portions of San Mateo and Alameda counties. Twenty cities lie within the Basin in whole or in part. The boundaries of the cities and counties in the Basin are shown on Figure 1-2. A number of special districts exist within the Basin. They include the Santa Clara Valley Water District (Water District), which is the primary water wholesaler in the Basin and is also responsible for flood protection.

**FIGURE 1-1**
**Regional Location of Santa Clara Basin**


Source: Santa Clara Valley Water District




Source: Santa Clara Valley Water District

Watershed Characteristics Report

WMI Santa Clara Basin

**FIGURE 1-2**
Counties and Municipalities in the Santa Clara Basin

### 1.2.3 General Characteristics

Currently, about 1.9 million people reside in the Basin, a little less than half of them in the most populous city, San Jose. Silicon Valley, the birthplace of the semiconductor industry and home to many advanced technology-based businesses, is partially located within the Basin.

Until World War II, the Basin was devoted almost exclusively to agriculture, initially as a producer of field crops and later of fruit. Beginning in the 1930s, the establishment of the U.S. Naval Air Station at Moffett Field acted as a magnet for technology-based businesses. By the 1960s, the booming electronics industry had taken root and Santa Clara Valley had become one of the fastest growing urban areas in the U.S. Today, in the northern part of the Basin, most of the orchards have been replaced by residential, commercial, and industrial land uses. The southern portion of the Basin remains largely rural and is devoted to cattle ranching, water supply catchments, and scattered low-density residential development.

### 1.2.4 Watersheds

For the purposes of the WMI, the Basin has been divided into 13 subbasins or watersheds and the Baylands. The locations and boundaries of the watersheds are shown on Figure 1-3. The 13 watersheds are associated with the main streams in the Basin and the lands that drain to them. The Baylands consist of the tidal wetlands bordering the Bay that lie between mean low water and the highest observed tide[1]. All watersheds include the channels through which their draining streams reach the open waters of the Bay. It should be noted that Upper Penitencia Creek is discussed in the report as a subwatershed within the Coyote Creek watershed. It is also possible that the Coyote Creek watershed will be divided at Anderson Dam into two watersheds for future WMI analyses: Upper Coyote and Lower Coyote. The 13 watersheds and the Baylands, as described in this report, are listed in Table 1-1.

The streams that drain three of the watersheds, Coyote Creek, Arroyo la Laguna, and Lower Penitencia Creek, have their headwaters in the Diablo Mountains. The headwaters of the streams draining the other ten watersheds are in the Santa Cruz Mountains. The lower reaches of all the streams are confined between levees or within concrete- or rock-lined channels, and sometimes enclosed in culverts, as they flow through urban areas to the Lower South Bay.

## 1.3 Elements of the Watershed Management Plan

The watershed management process was divided into four phases as shown diagrammatically on Figure 1-4 (this figure is commonly referred to as the “Roadmap”). The phases are:

[1] The Wetlands Advisory Group has proposed a more refined definition of the Baylands for use by the WMI in future analysis and reporting (see Glossary in Attachment B and discussion in Section 7.2.1).

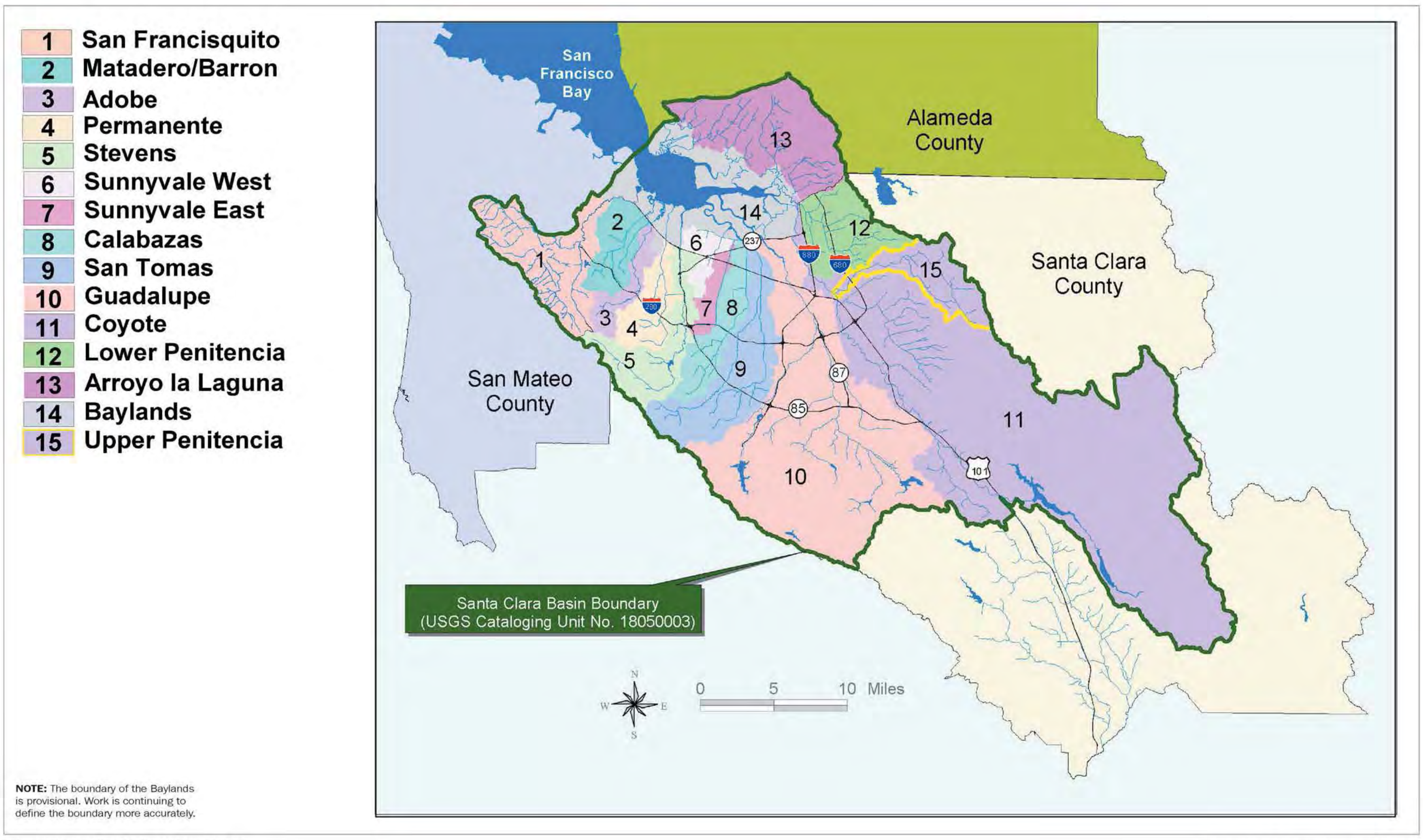
**Table 1-1**
**Watersheds Within the Santa Clara Basin** [1]

| Watershed | Area (square miles) |
|---|---|
| Coyote Creek | 321 |
| Guadalupe River | 170 |
| Arroyo la Laguna | 74 |
| San Tomas Aquino/Saratoga Creeks | 45 |
| San Francisquito Creek | 43 |
| Baylands | 33 |
| Stevens Creek | 29 |
| Lower Penitencia Creek | 29 |
| Calabazas Creek | 21 |
| Permanente Creek | 17 |
| Matadero/Barron Creeks | 17 |
| Adobe Creek | 11 |
| Sunnyvale West Channel | 8 |
| Sunnyvale East Channel | 7 |

[1] Eleven of the watersheds lie wholly within Santa Clara County. The Arroyo la Laguna and San Francisquito Creek watersheds lie primarily within Alameda and San Mateo counties, respectively. Watershed boundaries and areas were delineated by EOA, Inc.

- Characterization: Overall characterization of the environmental setting of the Basin (Watershed Characteristics Report)
- Assessment: Assessment of the watersheds and determination of their ability to support desired uses (Watershed Assessment Report)
- Problem Identification and Development of Alternative Management Strategies: Identification of the factors that prevent waterbodies from supporting the desired uses and development of alternative management strategies that will enable the uses to occur (Watershed Action Alternatives Report)
- Selection and Prioritization of Management Strategies: Selection and prioritization of management strategies for protecting and enhancing watersheds, and development of an implementation plan (Watershed Action Plan)

A report will be prepared at the conclusion of each phase. The names of each report are shown in parentheses above.




Source: Santa Clara Valley Water District

Watershed Characteristics Report

**FIGURE 1-3**
**Santa Clara Basin Watershed Boundaries**

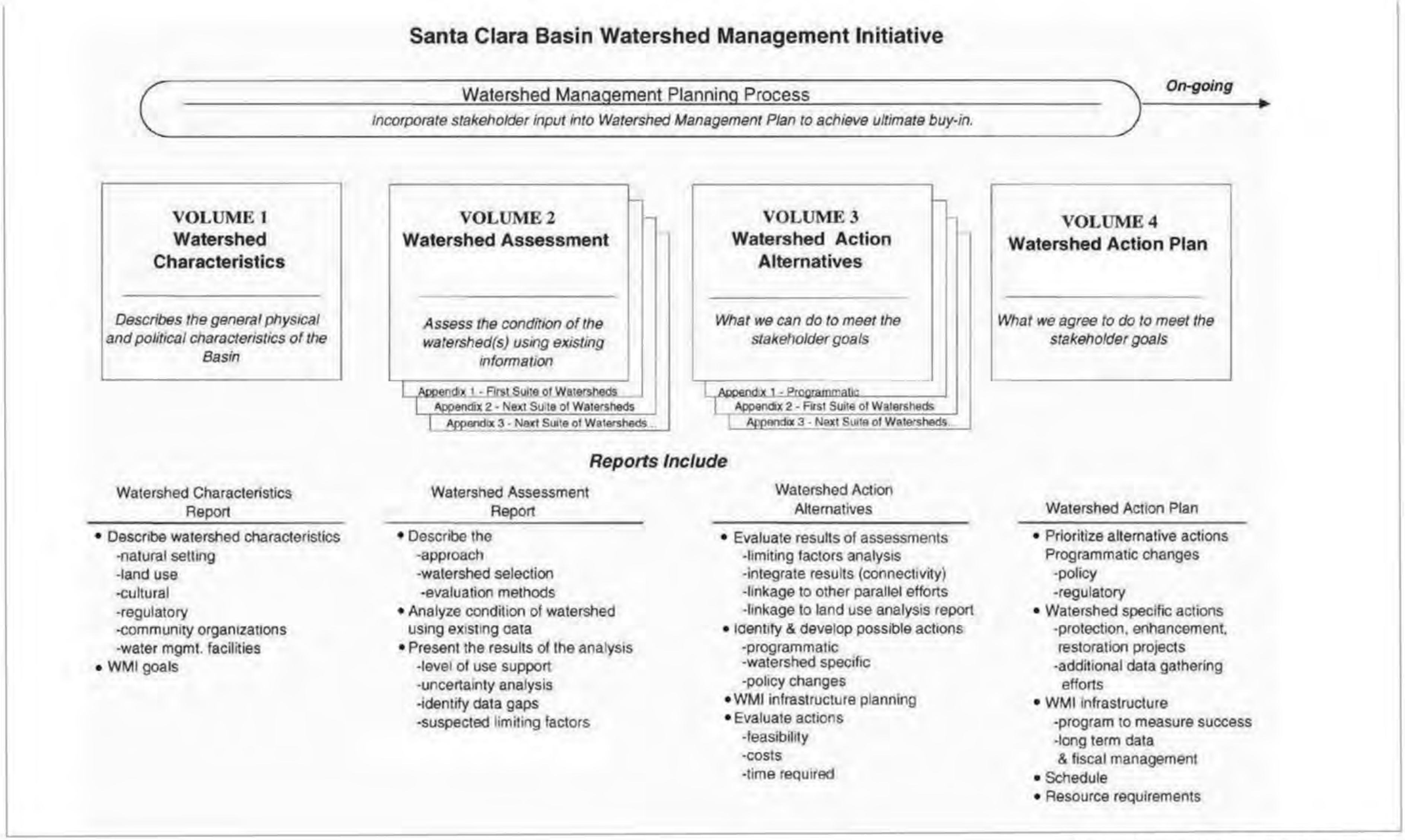



**FIGURE 1-4**
**Major Elements of the Watershed Management Plan**

### 1.3.1 Phase I Watershed Characterization

In the watershed characterization phase, information was compiled on the overall environmental setting of the Basin. Environmental elements characterized included history, culture, demography, land use, and natural resources. Information was also compiled on the regulatory and organizational setting and current water management practices.

### 1.3.2 Phase II Watershed Assessment

The purpose of the watershed assessment phase is to characterize environmental conditions in individual watersheds of the Basin and to determine whether the waters and waterways of the Basin are supportive of certain beneficial uses and stakeholder interests, referred to collectively by the WMI as primary uses. The primary uses include four state-designated beneficial uses – protection of fish and wildlife, protection of rare and endangered species, use of water for municipal water supply, and use of waterbodies for water-contact recreation – and a stakeholder interest, protection from flooding.

Three watersheds, the San Francisquito Creek, Upper Penitencia Creek (a subwatershed of Coyote Creek), and Guadalupe River, will be analyzed in Phase II. The ability of stream reaches and waterbodies to support the desired uses will be evaluated in the watershed assessment report and recommendations will be made for future data collection and monitoring. The detail of the assessment will be a function of available data because no field data collection will be undertaken as part of Phase II. Information concerning conditions in the Baylands area will also be included.

### 1.3.3 Phase III Problem Identification and Development of Alternative Management Strategies

Following the assessment phase, a determination will be made of the reasons stream reaches or waterbodies are unable to support desired uses. The WMI will then develop a list of possible corrective actions and evaluate their technical and economic feasibility. The possible corrective actions will be largely programmatic rather than site-specific. Programmatic corrective actions are those that apply to an entire watershed or perhaps the entire Basin. However, potential site-specific corrective actions may be developed and evaluated where supportable by the available data. The results of Phase III will be documented in a Watershed Action Alternatives Report.

### 1.3.4 Phase IV Watershed Action Plan

In Phase IV, the WMI will develop and propose policy and regulatory changes and remedial and restoration projects for implementation. The selected actions will be detailed in a watershed action plan. The plan will include estimated costs of selected actions, a schedule for implementation, and a delineation of the roles and responsibilities of WMI stakeholders in implementing the plan and monitoring its effects. The plan will describe how success will be determined and how the plan should be modified in the future in response to new data and lessons learned.

## 1.4 Watershed Characteristics Report

### 1.4.1 Purpose

Before assessing watersheds in detail and identifying and evaluating management alternatives, it is important to first develop a common understanding of environmental conditions in the Basin as a whole. The information contained in this watershed characteristics report has been reviewed and approved by the stakeholders and provides the factual basis for moving ahead with the next phases of the WMI process.

### 1.4.2 Report Preparation

The overall approach to preparing the watershed characteristics report was developed by the Report Preparation Team (RPT). The RPT prepared the Consolidated Action Plan (CAP), which described the tasks to be conducted, the schedule, the work products, and the party responsible for conducting the work. The CAP also identified the process and steps for review and approval of all work products. Work was conducted by stakeholders, organized into several groups, with support provided by consultants. Financial resources to fund consultants and in-kind services were provided by various WMI member agencies, including the Water District, the City of San Jose, and the Santa Clara Valley Urban Runoff Pollution Prevention Program. Grant funding was also provided by the Regional Board in the form of a 205(j) Grant and a grant from the joint federal/state CALFED Program. Quality assurance efforts included convening a technical review panel to review key technical products that provided the basis for conducting the assessment.

### 1.4.3 Structure and Content of Report

The watershed characteristics report contains eight chapters. Following this introduction, Chapter 2 contains a description of the methods used to prepare the report. The overall technical approach is described together with the roles of various participants in the report preparation process and the arrangements for quality assurance/quality control. Chapter 3 describes the cultural characteristics of the Basin including a brief history and information on the Basin's current population. Current and future land uses are described in Chapter 4. Chapter 5 identifies various governmental and nongovernmental organizations in the Basin with an interest in the environment. These include environmental, business, community, agricultural and recreational organizations and local government. A description of the regulatory setting is contained in Chapter 6. It includes a summary of laws and regulations pertaining to air and water quality, natural resources, use of the land, and other human activities that may affect environmental quality. The roles and responsibilities of regulatory agencies are also described in Chapter 6. The natural resources of the Basin are described in Chapter 7 with particular emphasis given to those species that depend on waterways and riparian corridors. Current water management practices are described in Chapter 8.

## 1.5. Previous Related Studies and Plans

The plans developed by the WMI are founded on or coordinated with many earlier and contemporaneous studies and plans for water quality and natural resource management in the Basin. The following paragraphs are a description of other plans and studies relevant to the WMI and indicate how the WMI's work is linked to them.

### 1.5.1 Clean Water Act-Related Plans and Studies

Several of the earlier plans and studies most relevant to the WMI were prepared to satisfy the requirements of two laws: California's Porter-Cologne Act and the federal Clean Water Act. The Porter-Cologne Act of 1969 established the institutional arrangements for regulation of water quality in California and called for the preparation of regional water quality control plans to guide water pollution abatement efforts. The Water Pollution Control Act Amendments of 1972, later referred to as the Clean Water Act, put in place national technology-based standards for municipal and industrial discharges and established a nationwide permitting system to ensure compliance with the standards (National Pollutant Discharge Elimination System or NPDES). The Clean Water Act also called for the preparation of regional plans for water pollution control. In California, the overlapping regulatory requirements of the two laws are administered by the State Water Resources Control Board, and in the Basin, by the board's regional arm, the Regional Board.

#### *1.5.1.1 Water Quality Control Plan for San Francisco Bay Basin*

The San Francisco Bay Region Water Quality Control Plan or "Basin Plan" was first released in 1973 and has been amended repeatedly, most recently in 1995. The regional planning requirements of both the Porter-Cologne Act and the Clean Water Act are fulfilled by the Basin Plan.

The Basin Plan includes a list of major waterbodies in the Basin and lists the beneficial uses that they currently support or could be reasonably expected to support in the future. Numerical and narrative objectives or standards for water quality in each of the waterbodies are contained in the Basin Plan. If water quality is in compliance with the standards, then the waterbodies are expected to support their designated beneficial uses. The Basin Plan also provides the basis for setting effluent limits in individual wastewater discharge permits that are consistent with the Clean Water Act's technology-based discharge requirements and overall water quality objectives for receiving waters.

From the early 1970s to the present, the Regional Board has issued NPDES permits to all dischargers of municipal and industrial wastewater in the Basin in accordance with Basin Plan and Clean Water Act requirements. Many millions of dollars have been invested by communities in the Basin to bring their wastewater discharges into compliance with permit requirements. As a result, water quality in some waterbodies in the Basin, especially in the Lower South Bay, has improved compared to 1970 conditions.

The Regional Board, the agency with primary responsibility for updating and implementing the Basin Plan, is a participant in the WMI. It is expected that the results of the WMI's work will be incorporated into future amendments to the Basin Plan.

#### *1.5.1.2 Clean Water Act Section 303(d) and 305(b) List*

Under Sections 303(d) and 305(b) of the Clean Water Act, California is required to conduct a water quality assessment survey every 2 years and prepare a list of waterbodies that are not meeting water quality standards after the application of the required technology-based controls. The list is submitted to the U.S. Environmental Protection Agency for approval. The most recent submittal for the San Francisco Bay Area lists many waterbodies in the Basin as out of compliance with water quality standards, including the Lower South Bay.

It is expected that the watershed assessment conducted as part of the WMI will produce information the Regional Board could use in preparing its next 303(d) and 305(b) list for waterbodies in the Basin.

#### *1.5.1.3 Total Maximum Daily Load Process*

A waterbody is listed as 'impaired,' under Section 303(d), when the water quality standards for a particular contaminant are exceeded even after control measures have been applied. When a waterbody is listed, the Clean Water Act requires that a total maximum daily load (TMDL) of the contaminant be established. A TMDL is the maximum amount of the contaminant that can be discharged into the waterbody without exceeding the water quality standard or objective for that contaminant.

The Lower South Bay is the main receiving waterbody for the Santa Clara Basin – all of the streams in the watershed flow into the Lower South Bay. The southernmost part of the Bay was put on the Section 303(d) list as early as 1996 because water quality monitoring had determined that the levels of metals, particularly copper and nickel exceeded the water quality standards/objectives set for the Bay. Sources of copper and nickel include stormwater runoff and discharges from municipal wastewater treatment plants.

In January 1998, with funding from the City of San Jose, several WMI stakeholders began a 4-year project to develop copper and nickel TMDLs for the Lower South Bay. Using the WMI's Bay Monitoring and Modeling Subgroup to convene the process, the TMDL project emphasized stakeholder collaboration through a TMDL Work Group. The Work Group brought together representatives from the cities responsible for municipal wastewater treatment plants, stormwater programs, regulatory agencies, environmental and civic groups, industry and business, as well as scientists to address the complex issues and review the technical studies associated with the TMDL process.

Over the last 2 years, a comprehensive environmental assessment was conducted using existing data to evaluate the condition of the beneficial uses of the Lower South Bay as part of the TMDL process. The Impairment Assessment Report was completed in June 2000; the Work Group issued three key findings to the Regional Water Quality Control Board:

- The impairment of the South Bay due to copper or nickel is unlikely.
- Copper and nickel should be removed from the Section 303(d) list of impaired waterbodies.
- Site-specific objectives for copper and nickel should be established.

The Regional Board is expected to adopt these recommendations in October 2000 and the result will be the development of additional action plans that will serve to prevent any further water quality degradation due to copper or nickel. The tasks associated with these action plans will be incorporated into regulatory requirements included in wastewater and stormwater permits as well as in the recommendations of the Watershed Action Plan. The success of this stakeholder-driven copper/nickel TMDL process serves as a model for future TMDLs that will be conducted over the next several years.

Under this model, the WMI will serve as the stakeholder clearinghouse for TMDL studies in the Lower South Bay, including the mercury TMDL process in the Guadalupe River watershed and the sediment TMDL in the San Francisquito Creek. It is expected that the recommendations of these TMDL processes will be incorporated into the WMI's Watershed Action Plan to ensure that the burden and the benefits of these recommendations are agreed upon and shared by all stakeholders.

#### *1.5.1.4 San Francisco Estuary Project*

Section 320 of the Clean Water Act established the National Estuary Program. As an estuary judged to be of national significance, San Francisco Bay and the Sacramento-San Joaquin River Delta were selected for the program. The San Francisco Estuary Project was created to prepare a plan to protect and restore the estuary. Finished and approved by the Governor and the U.S. Environmental Protection Agency in 1993, it is known as the San Francisco Estuary Comprehensive Conservation and Management Plan (CCMP). The chair of the WMI Core Group sits on the committee responsible for implementation of the CCMP and is thus able to facilitate coordination of CCMP and WMI activities.

#### *1.5.1.5 Stormwater Management Plans (see also Section 8.4.2)*

The 1987 amendments to the Clean Water Act included the requirement that NPDES permits be obtained by municipalities that operate separate storm sewer collection systems to control urban stormwater discharges to waters of the U.S. The County and the 13 cities in the Basin operate collection systems that convey stormwater from streets and paved surfaces to the watershed creeks through a system of inlets, underground pipes, and outfalls and are subject to the permit.

The Water District has jurisdiction over the stream channels and is considered a key agency for the purpose of protecting beneficial uses and maintaining water quality. Stormwater permits to discharge stormwater from these urban areas were first issued to the Santa Clara Valley Urban Runoff Pollution Prevention Program, a consortium of these cities, Santa Clara County and surrounding counties, and the District as co-permittees in 1990. Conditions in the permit require co-permittees to implement state-approved stormwater management plans currently called Urban Runoff Management Plans. The plans call for the implementation of a broad range of programs that incorporate best management practices (BMPs) designed to reduce the discharge of contaminants in stormwater to the "maximum extent practicable." The BMPs are primarily nonstructural urban "good housekeeping" measures including public education programs, elimination of sanitary and illegal dumping into stormdrains, street sweeping, catch basin cleaning, and standards for new development that will limit the emission of water pollutants. In addition, the permit requires that these agencies work together to develop watershed management measures through a watershed management strategy for the Basin. The 'Watershed Management Measures' element of the permit is a major driver for agency participation in the WMI and development of the Watershed Management Plan.

### 1.5.2 Plans Prepared by Santa Clara Valley Water District

Several plans have been developed by the Water District to fulfill its responsibilities for water supply and flood management in much of the Basin. Both responsibilities need to be considered by the WMI.

#### *1.5.2.1 Integrated Water Resources Plan*

The Integrated Water Resources Plan, finalized in 1997, describes the Water District's preferred strategy for providing a reliable supply of high-quality water to its customers through the year 2020. It is relevant to the WMI because the Water District's operations profoundly affect the management and distribution of water in the Basin.

The preferred strategy has four new elements, two of which, water banking and long-term water transfers from other water agencies, are expected to produce most of the additional water needed to meet demand in the Water District's service area in 2020. Water banking involves artificially recharging excess water from the Sacramento and San Joaquin Rivers into groundwater reservoirs in the Central Valley in wet years. In dry years, it is withdrawn and used to satisfy water demand that would otherwise have to be met by diverting water from surface waterbodies. Water banking would increase the Water District's ability to obtain water from the Sacramento-San Joaquin River Delta in dry years. The other elements are water recycling and demand management (water conservation).

#### *1.5.2.2 Comprehensive Flood Management Program*

As part of a comprehensive flood management program, the Water District is currently reviewing flood protection needs on all creeks in its service area. The goal of the program is to provide protection from a 1 percent flood, that is, a flood with a 1 percent chance of occurrence in any given year. About one-half of the creeks managed by the Water District currently meet this goal, and a number of additional flood management projects are planned in the next few years. Other local government entities, such as the San Francisquito Creek Joint Powers Authority, will play critical roles on individual sub-basins. It will be important to coordinate the Water District's flood management program with the WMI and all local government entities to meet both the need for protection from flooding (a goal of both the program and the WMI) and the WMI's natural resource enhancement goals. Coordination between all parties is the role of the WMI's Flood Management Subgroup.

### 1.5.3 Other Studies and Plans

#### *1.5.3.1 San Francisco Bay Area Wetlands Ecosystem Goals Project*

The CCMP developed by the San Francisco Estuary Project identified the protection and restoration of wetlands as one of its highest priorities. The San Francisco Bay Area Wetlands Ecosystem Goals Project was set up to develop a vision of the habitats that are needed to sustain healthy populations of fish and wildlife in the baylands of the Bay. The project assembled available information on the wetlands bordering the Bay, including those within the Basin, assessed their current condition, and established goals for improvements. The Baylands Ecosystem Goals for the Lower South Bay include increasing the area of tidal marsh from 9,000 acres to between 24,000 to 29,000 acres, and improving between 10,000 and 15,000 acres of saline ponds to provide better wildlife habitat.

The Baylands Ecosystem Goals will serve as the foundation for a watershed assessment of the Baylands portion of the Basin.

#### *1.5.3.2 City and County General Plans*

City and county general plans delineate current and permissible future land uses within the Basin. Community general plans are updated periodically. Land use in the Basin influences water quality and wildlife habitat values in stream corridors and the amount of water that streams must carry. Protection of natural resources, a goal of the WMI, may require changes in land use plans. The WMI's recommendations for improvements will need to be incorporated into future community general plan updates.

#### *1.5.3.3 Fisheries and Aquatic Habitat Collaborative Effort*

The Water District manages several streams in the Basin, primarily Coyote Creek, Guadalupe River, and Stevens Creek, for water supply and flood control purposes. The Water District has been named in a complaint filed before the State Water Resources Control Board charging that its management practices are having adverse impacts on salmon and steelhead and their habitat. To address the complaint the Fisheries and Aquatic Habitat Collaborative Effort (FAHCE) was initiated jointly by the Water District and the California Department of Fish and Game. The

FAHCE involves the completion of a number of studies designed to provide a technical basis for formulating management regimes for the three streams that better balance environmental and economic goals. It is expected that data from the FAHCE will be used in the watershed assessment phase of the WMI.

#### *1.5.3.4 Coordinated Resources Management Planning for the San Francisquito Creek Watershed*

The San Francisquito Coordinated Resources Management and Planning (CRMP) group, now called the San Francisquito Watershed Council (Watershed Council) was established under a statewide program designed to facilitate cooperation between government, residents, business and other interested parties on resource management issues. The Peninsula Conservation Center Foundation (now called Acterra) is serving as the non-profit group to house the Watershed Council. The Watershed Council prepared a draft watershed plan focusing on several issues, including natural resources, erosion, pollution, flooding, and several social concerns (damaging flooding occurred on the creek in February 1998). Information from the Watershed Council will be used during the watershed assessment phase of the WMI.

Following the preparation of the draft watershed plan, a new local agency was created, the San Francisquito Joint Powers Authority (JPA). The JPA is a coalition of local government agencies created to plan and implement flood management and watershed protection plans. Development of improvements for San Francisquito Creek will require action by the JPA and coordination with the Watershed Council and the WMI.

Volume One Unabridged
**Watershed Characteristics Report**

# Chapter 2
# Report Preparation Process

**Prepared for the**
**Santa Clara Basin Watershed Management Initiative**

**by**

**Watershed Assessment Consultant**

**Revised August 2003**

# Watershed Characteristics Report
# Chapter 2: Report Preparation Process

## List of Authors

**REPORT PREPARATION TEAM**

*with consultant support from*

***URS Greiner Woodward Clyde***
John Davis, Senior Project Manager

Funded by:
Santa Clara Valley Water District
and
City of San Jose

**Revised August 2003**

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# Chapter 2
# Report Preparation Process

## 2.1 Overall Approach

The Santa Clara Basin Watershed Management Initiative (WMI) plans to publish a watershed management plan in three volumes as well as a number of supporting documents. The three major documents are this Watershed Characteristics Report, a Watershed Assessment Report, and a Watershed Action Plan. The reports represent a consensus of the views of the Core Group, the group of stakeholders that participates in the WMI.

The report preparation process was designed to facilitate collaboration among the stakeholders in the WMI. All decisions regarding the report preparation and review process were made by the Core Group. Analytical discussions and work are conducted by subgroups or by the Watershed Assessment Consultant (WAC). Products prepared by the subgroups and the WAC are reviewed by the Report Preparation Team (RPT). Products approved by the RPT are forwarded to appropriate subgroups and the Core Group for review and consideration.

## 2.2 WMI Groups and Subgroups

### 2.2.1 Role of the Core Group

The WMI is directed by the Core Group. As of August 2003, the Core Group consisted of individuals and representatives of 34 public and private organizations with a stake in the outcome of the watershed planning process for Santa Clara Basin (the Basin). The Core Group members represent a wide range of views and interests. Their affiliations are shown in Table 2-1. The participation of affected parties in the planning process is encouraged and crucial to obtain broad community support.

The Core Group developed and approved a document that describes how the Core Group will make decisions. The document, referred to as the "Signatory Document," requires that the Core Group strive to reach a consensus before making a decision. If the Core Group makes a recommendation that is not agreed to by all then the recommendation will be accompanied by a report of the views of the dissenting members.

The Core Group also approved a Consolidated Action Plan (CAP) that describes the tasks needed to complete the first phase of the work that culminates in the publication of the Santa Clara Basin Watershed Characteristics Report.

**Table 2-1**
**Watershed Management Initiative Signatories[1]**

| **Public Agencies** | **Business and Trade Associations** | **Civic and Environmental Groups and Programs** |
|---|---|---|
| California Department of Fish and Game | California Restaurant Association/Dairy Belle Freeze | CLEAN South Bay |
| City of Cupertino | Home Builders Association of Northern California | Greenbelt Alliance |
| City of Palo Alto | San Jose Silicon Valley Chamber of Commerce | League of Women Voters |
| City of San Jose | Santa Clara Cattlemen's Association | Salmon and Steelhead Restoration Group |
| City of Santa Clara | Santa Clara County Farm Bureau | San Francisco Bay Bird Observatory |
| City of Sunnyvale | Silicon Valley Manufacturing Group | San Francisquito Watershed Council |
| Guadalupe-Coyote Resource Conservation District | | Santa Clara Valley Audubon Society |
| San Francisco Bay Regional Water Quality Control Board | | Sierra Club Loma Prieta Chapter |
| San Francisquito Creek Joint Powers Authority | | Silicon Valley Pollution Prevention Center |
| Santa Clara County | | Silicon Valley Toxics Coalition |
| Santa Clara County Open Space Authority | | Western Waters Canoe Club |
| Santa Clara Valley Transportation Authority | | |
| Santa Clara Valley Urban Runoff Pollution Prevention Program | | |
| Santa Clara Valley Water District | | |
| U.S. Army Corps of Engineers | | |
| U.S. Environmental Protection Agency | | |
| U.S. Department of Agriculture Natural Resource Conservation Service | | |

[1]As of July 2002

### 2.2.2 Role of Subgroups

The Core Group established special purpose subgroups to conduct or oversee portions of the WMI's work (Figure 2-1). The subgroups include the Watershed Assessment Subgroup, Land Use Subgroup, Bay Monitoring and Modeling Subgroup, Regulatory Subgroup, Communications Subgroup, Flood Management Subgroup, Sustainable Water Supply Subgroup, Wetlands Advisory Group, Data Management Subgroup, and Report Preparation Team. Each subgroup has a mission, goals and objectives. The subgroups and their work statements are listed in Table 2-2. The membership of the subgroups includes both Core Group members and other stakeholder representatives with expertise or an interest in the topics.

### 2.2.3 Role of Report Preparation Team

The RPT oversees the preparation of the Watershed Characteristics Report and the Watershed Assessment Report. Each of the products prepared by the subgroups are reviewed by the RPT, revised as necessary, and forwarded to the Core Group for approval.

### 2.2.4 Role of Work Groups

The RPT used a number of work groups to explore issues and submit findings to the Core Group in the form of technical memoranda. Work Group A identified the list of data types that could support the assessment. Work Group C recommended that the representative watersheds be the San Francisquito Creek, Guadalupe River, and Upper Penitencia Creek subwatershed. Work Group D developed a process for prioritizing impediments (factors that limit a waterbody's ability to support desired beneficial uses).

### 2.2.5 Role of the Watershed Assessment Consultant

The WAC has provided technical and production support. The WMI Core Group, through the Santa Clara Valley Water District, contracted with URS Greiner Woodward Clyde to assist with the watershed assessment. The WAC's tasks focused on the scientific and technical analyses needed to determine the condition of the three initial subbasins. Other consultants have also provided technical support to the development of the baseline characterization of the Basin.

## 2.3 Document Review Process

The Watershed Characteristic Report was authored by the WAC and various subgroups. The WAC submitted preliminary drafts of their sections to the RPT for review. Some chapters of the Watershed Characteristics Report were overseen and produced by subgroups. For these, the subgroups first approve of their written work, and then forwarded their sections to the RPT for review and conformity with the report outline. The RPT then reviewed the sections for tone, grammar, and content. Based on the review, the section was either approved for Core Group review or sent back to the subgroup for revision. Once the RPT approved a document, the document was forwarded to the Core Group for review. The Core Group either approved of the document as written or referred it back to the subgroup or the WAC for revision. Revised documents were again reviewed by the RPT and then compiled by the WAC to create this unabridged version of the Watershed Characteristics Report (Unabridged Volume One). And abridged version of this report was also produced by the RPT for distribution to the general public. Both the abridged Watershed Characteristics Report and this Unabridged Volume One were sent to the Core Group for its review and approval.

## 2.4 Quality Management

Data will be gathered from a variety of sources to conduct the assessment. It can be expected that data will be of variable quality. To ensure that the assessment is based on reliable data, all data used will be screened. The spatial and temporal coverage provided by the data and its statistical validity will be checked before it is approved for use.

For the watershed assessment and other products of the WMI to be accepted by policy makers, the public, and the scientific community, the products need to meet scientific standards for accuracy and consistency. To ensure that this goal is accomplished, the WMI followed quality assurance/quality control measures. At the heart of the quality assurance/quality control plan is the use of technical review panels to review key products and decisions.

The members of the first technical review panel used in the assessment process are listed in Table 2-3. All panel members are respected in their fields and are independent of the WMI process. The review was conducted in a series of workshops. Written comments provided by panel members were reviewed and considered by the Core Group.

## 2.5 Acknowledgements

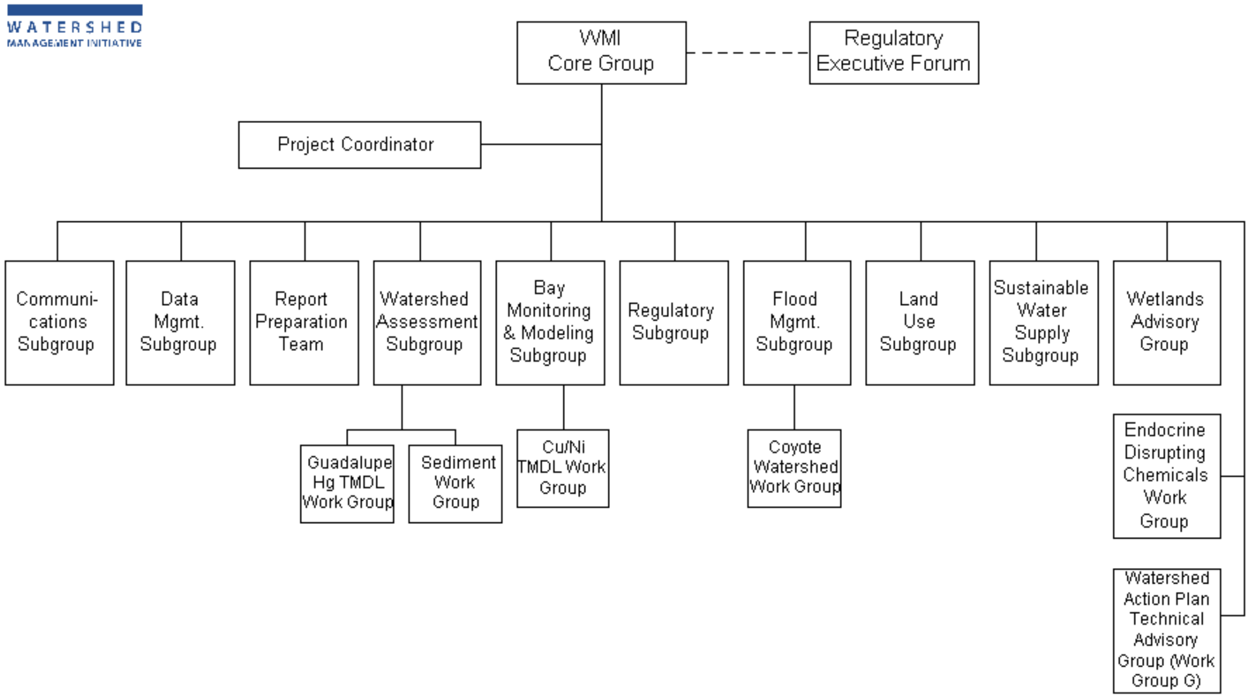
Many individuals and organizations participated in the preparation of Unabridged Volume One. They include the members of the Core Group, subgroups, and RPT. Although many contributed to the individual chapters in this report, the primary authorship was as follows. The summary and Chapters 1, 2, 3, and 8 were prepared by the WAC, which includes the firms of URS Greiner Woodward Clyde, Montgomery Watson, Thomas Reid Associates, Entrix Inc., and Professor Jerry Smith of San Jose State University. The Land Use Subgroup prepared Chapter 4 with the assistance of the Santa Clara Valley Urban Runoff Pollution Prevention Program and EOA, Inc. The Outreach Group prepared Chapter 5. The Regulatory Subgroup prepared Chapter 6 with assistance from Larry Walker Associates. The Watershed Assessment Subgroup prepared Chapter 7 with assistance from the RRM Design Group/Habitat Restoration Group, Balance Hydrologics, and EOA, Inc. Funding and/or in-kind services were provided by the Santa Clara Valley Water District, Santa Clara Valley Urban Runoff Pollution Prevention Program, the cities of San Jose, Sunnyvale, and Palo Alto.

FIGURE 2-1
**Santa Clara Basin Watershed Management Initiative Organization Chart**

# Santa Clara Basin Watershed Management Initiative Organization Chart

As of February 2002

*Mission*
*To protect and enhance the watershed, creating a sustainable future for the community and the environment*



## Table 2-2 Subgroups of the Santa Clara Basin Watershed Management Initiative

| SUBGROUP | WORK STATEMENT |
|---|---|
| Bay Modeling and Monitoring | • Provide technically sound tools to investigate and evaluate the potential water quality impacts of various south bay water quality management options.<br>• Develop technically supportable permit limits (concentration & mass).<br>• Develop the technical support for attainable water quality objectives including expected attainment dates.<br>• Develop a technically supportable first phase Total Maximum Daily Loading along with a plan to refine the estimates. |
| Communications* | • Ensure effective communication across all stakeholders, core group, subgroups and key decision-makers.<br>• Identify, coordinate and initiate effective outreach programs.<br>• Create and disseminate public outreach materials for the WMI.<br>• Establish, track, and document WMI expenditures.<br>• Establish work priorities and recommend expenditures to conduct that work.<br>• Oversee personnel matters of the WMI.<br>• Ensure that the WMI has a comprehensive, overall work plan and the resources to implement the plan.<br>• Providing guidance to Project Coordinator.<br>• Oversee the Action Plan Development Process.<br>• Evaluate structure, functions, and effectiveness of WMI and propose appropriate changes. |
| Data Management | • Provide the Watershed Management Initiative Stakeholders with accurate and reliable data in a timely and cost-effective manner on an on-going basis. |
| Flood Management | • Identify and integrate flood management issues as a part of the watershed planning process. |
| Land Use | • Identify and address land use planning interests and issues that need to be considered within the watershed plan. |
| Regulatory | • Improve long term regulatory certainty by integrating and prioritizing the permit recommendations of the other subgroups.<br>• Will serve as a discussion and recommendation forum for the Basin's permitting issues. |
| Report Preparation Team | • Plan and develop the Watershed Characteristics Report, Watershed Assessment Report, and Watershed Action Alternatives. |
| Sustainable Water Supply | • Identify and recommend sustainable water resource management opportunities that protect beneficial uses within the pilot watersheds and the Santa Clara Basin. |
| Watershed Assessment | • Provide a solid scientific foundation for watershed planning and land use decisions.<br>• Identify existing data resources, assemble available data, evaluate the quality of existing data, identify data gaps, develop and implement strategies for data acquisition and management and implement data interpretations which will lead to effective planning decisions. |
| Wetlands Advisory Group | • Promote the integration of wetland management actions into the overall Watershed Management Plan.<br>• Provide technical assistance on wetlands in an advisory function to the Subgroups and the Core Group for all WMI products. |

*Includes four workgroups: 1) Budget and Personnel; 2) Outreach; 3) Planning

**Table 2-2**
**Subgroups of the Santa Clara Basin Watershed Management Initiative**

| Subgroup | Members | Mission | Major Tasks |
|---|---|---|---|
| **<u>Bay Modeling and Monitoring</u>**<br>Co-Chairs: Dan Bruinsma<br>777 N. First St., Suite 450<br>San Jose, CA 95112<br>408-277-5533<br>408-277-3606 (f)<br>dan.bruinsma@ci.sj.ca.us<br><br>Tom Mumley<br>Regional Water Quality Control Board<br>1515 Clay Street, Ste 1400<br>Oakland, CA 94612<br>510-622-2395<br>510-622-2460 (f)<br>tem@rb2.swrcb.ca.gov | **<u>Members</u>**<br>Regional Board<br>Guadalupe-Coyote Resource Conservation District (RCD)<br>City of San Jose<br>City of Palo Alto<br>City of Sunnyvale<br>Dept. of Fish & Game<br>CLEAN South Bay<br>Santa Clara Valley Water District<br>Santa Clara Valley Urban Runoff Pollution Prevention Program (SCVURPPP)<br>United States Environmental Protection Agency (EPA)<br>SF Baykeeper<br>League of Women Voters<br>S. F. Estuary Institute | To establish a sound scientific and technical basis for future regulatory decisions affecting the Lower South Bay, and for documenting the policies that govern those decisions. In particular, strategies developed by the subgroup will support the assessment of beneficial uses of the Bay and tributary sloughs, as well as water quality objectives and permit conditions (including other potential regulatory options) to protect those beneficial uses. The subgroup will provide recommendations regarding the implementation of monitoring and modeling strategies that form the scientific basis for assessing the ecological condition of the slough areas and main water mass of the Lower South Bay. | • Finalize regulatory strategy<br>• National Pollutant Discharge Elimination System (NPDES) permit applications<br>• TMDL Study<br>- Finalize Impairment Assessment Report<br>- Transmit to Regional Board<br>• Interim permit actions<br>• Reissue NPDES permits |
| **<u>Budget and Personnel</u>**<br>Chair: Phil Bobel<br>City of Palo Alto<br>2501 Embarcadero Way<br>Palo Alto, CA 94303<br>650-329-2285<br>650-494-3531 (f)<br>phil_bobel@city.palo-alto.ca.us | **<u>Members</u>**<br>City of Palo Alto<br>City of San Jose<br>City of Sunnyvale<br>Santa Clara Valley Water District<br>Regional Board<br>WMI Project Coordinator | Focus resources on key priorities. | • Develop and execute a process for collecting financial information<br>• Organize and analyze financial information concerning WMI “income” expenditures<br>• Act as the Personnel Committee for WMI staff<br>• Identify work priorities for expenditures for each fiscal year<br>• Develop a plan for obtaining resources for each fiscal year<br>• Insure contracts are established and funds are secured for the Project Coordinator position (and Project Coordinator support) for each fiscal year |

**Table 2-2 (continued)**
**Subgroups of the Santa Clara Basin Watershed Management Initiative**

| Subgroup | Members | Mission | Major Tasks |
|---|---|---|---|
| **Communications/Outreach**<br>Chair: Jim Fiedler<br>Santa Clara Valley Water District<br>5750 Almaden Expressway<br>San Jose, CA 95118<br>408-265-2607 x2736<br>408-266-6256 (f)<br>fiedler@scvwd.dst.ca.us<br><br>Outreach Chair:<br>Bruce Frisbey<br>City of San Jose<br>4242 Zanker Road<br>San Jose, CA 95134<br>408-945-5152<br>408-945-5486 (f)<br>bruce.frisbey@ci.sj.ca.us | **Members**<br>City of San Jose<br>SCVURPPP<br>City of Sunnyvale<br>Regional Board<br>Santa Clara Valley Water District<br>CLEAN South Bay | Ensure that decision makers are informed and engaged throughout the Watershed Management Initiative (WMI) process, so that the outcome of the effort is supported. Identify, coordinate, and initiate an effective outreach program. | • Ensure the WMI has useful and accurate stakeholder lists<br>• Develop and communicate key messages from core group to decision makers and stakeholders (e.g., letters, presentations, executive forum)<br>• Audit the WMI communication's process to ensure its effectiveness<br>• Facilitate the WMI's decision-making process<br>• Review WMI/Watershed Management Outreach (WMO) survey results and develop WMO outreach strategy<br>• Plan and develop a WMI newsletter and distribution strategy<br>• Develop and distribute WMI fact sheets as needed<br>• Prepare Chapter 5 of Watershed Characteristics Report (watershed organizations)<br>• Develop long-term outreach strategy |
| **Data Management**<br>Chair: Jerry Cox<br>Santa Clara Valley Water District<br>5750 Almaden Expressway<br>San Jose, CA 95118<br>408-265-2607 x 2536<br>408-266-0271(f)<br>jerry.cox@scvwd.dst.ca.us | **Members**<br>SCVURPPP<br>Silicon Valley Toxics Coalition<br>Santa Clara Valley Water District<br>City of San Jose | Ensure that the WMI stakeholders have access to available data and information resources that are necessary to support the Watershed Management Initiative goals | • Plan for the development, implementation, and maintenance of a data management system<br>• Create a model data sharing agreement<br>• Create short-term data management plan<br>• Create long-term data management plan/strategy<br>• Identify entities external to the WMI that are engaged in similar data management activities and explore joint opportunities with the WMI |

**Table 2-2 (continued)**
**Subgroups of the Santa Clara Basin Watershed Management Initiative**

| Subgroup | Members | Mission | Major Tasks |
|---|---|---|---|
| **<u>Flood Management</u>**<br>Sarah Young<br>Santa Clara Valley Water District<br>5750 Almaden Expressway<br>San Jose, CA 95118<br>408-265-2607 x 2468<br>408-264-6958 (f)<br>sarayoun@scvwd.dst.ca.us | **<u>Members</u>**<br>EPA<br>Dept. of Fish & Game<br>Regional Water Quality Control Board<br>Guadalupe-Coyote RCD<br>U.S. Army Corps of Engineers<br>Streams for Tomorrow<br>League of Women Voters | Identify and integrate flood management issues as part of the watershed planning process | • Develop framework for integrating flood management (FM) goals within WMI<br>• Identify FM goals, link to other subgroups<br>• Develop prototype agreement Memorandum of Understanding/Memorandum of Agreement (MOU/MOA) for addressing FM issues<br>• Develop FM General Plan for the Basin<br>• Integrate flood plan recommendations with Santa Clara Valley Water District's Comprehensive Flood Management effort and Stream Maintenance program Environmental Impact Report (EIR)<br>• Coordinate with the SCVWD on project design and implementation for Upper Penitencia, Lower Stevens, and Berryessa Creeks |
| **<u>Land Use</u>**<br>Chair: Dan Cloak<br>EOA, Inc<br>1410 Jackson Street<br>Oakland, CA 94612<br>510-832-2852<br>510-832-2856 (f)<br>dtcloak@eoainc.com | **<u>Members</u>**<br>Santa Clara Audubon<br>Regional Board<br>SCVURPPP<br>City of San Jose<br>Silicon Valley Mfg Group<br>Cattleman's Association<br>League of Women Voters<br>Santa Clara Valley Water District<br>Guadalupe-Coyote RCD<br>City of Cupertino<br>Santa Clara County<br>CLEAN South Bay<br>Home Builders Association<br>San Jose Chamber of Commerce | Identify and address land use planning interests and issues that need to be considered within the watershed plan | • Complete assigned land use sections of the Assessment (i.e., land use data analysis, imperviousness, land use in riparian corridors, relationship of land use to watershed characteristics, watershed maps)<br>• Complete assigned regulatory section of Assessment (i.e., state laws and enabling legislation, regional plans and planning agencies, local planning polices)<br>• Participate in review of current projects that affect watersheds<br>• Identify and evaluate policies and measures that can protect/enhance<br>• Evaluate stormwater BMPs from a watershed perspective<br>• Develop summary and recommendations for Watershed Management Plan |

**Table 2-2 (continued)**
**Subgroups of the Santa Clara Basin Watershed Management Initiative**

| Subgroup | Members | Mission | Major Tasks |
|---|---|---|---|
| **<u>Planning</u>**<br>Chair: Kirsten Struve<br>City of San Jose<br>777 N. First St., Suite 450<br>San Jose, CA 95112<br>408-277-4512<br>408-277-3606 (f)<br>kirsten.struve@ci.sj.ca.us | **<u>Members</u>**<br>City of San Jose<br>City of Palo Alto<br>CLEAN South Bay<br>Regional Board | Provide broad overall planning for the implementation of the WMI within the framework of Core Group direction and serve as "guardian" for stakeholder interests. | • Provide broad overall planning for the implementation of the WMI<br>• Oversee development of the WMI vision |
| **<u>Regulatory</u>**<br>Chair: Wil Bruhns<br>Regional Water Quality Control Board<br>1515 Clay Street, Ste 1400<br>Oakland, CA 94612<br>510-622-2372<br>510-622-2460 (f)<br>wkb@rb2.swrcb.ca.gov | **<u>Members</u>**<br>EPA<br>City of San Jose<br>City of Palo Alto<br>Dept. of Fish & Game<br>SF Baykeeper<br>CLEAN South Bay<br>Silicon Valley Toxics Coalition<br>EOA/SCVURPPP<br>Regional Board | Improve long-term regulatory certainty by integrating and prioritizing the permit recommendations of the other subgroups. Will serve as a discussion and recommendation forum for the Basin's permitting issues | • Identify all regulatory requirements that impact the WMI<br>• Prepare Regulatory Assessment<br>• Publicly Owned Treatment Works (POTW) NPDES Permits<br>• Urban Runoff Permits<br>• 401/404 Permits<br>• Identify other regulatory efforts that protect the environment<br>• Identify mechanisms to address nonurban runoff |
| **<u>Report Preparation Team</u>**<br>Chair: Sarah Young<br>Santa Clara Valley Water District<br>5750 Almaden Expressway<br>San Jose, CA 95118<br>408-265-2607 x2468<br>408-264-6958 (f)<br>sarayoun@scvwd.dst.ca.us | **<u>Members</u>**<br>City of San Jose<br>Santa Clara Valley Water District Consultant Staff | Plan preparation of the four volumes comprising the Watershed Management Plan (including this Watershed Characteristics Report and the Watershed Assessment Report) | • Plan and manage preparation of the Watershed Management Plan (develop workplans, coordinate with subgroups, provide overall project management for the reports) |

| Table 2-2 (continued)<br>Subgroups of the Santa Clara Basin Watershed Management Initiative | | | |
|---|---|---|---|
| **Subgroup** | **Members** | **Mission** | **Major Tasks** |
| **<u>Sustainable Water Supply</u>**<br>Acting Chair: Eric Rosenblum<br>City of San Jose<br>4245 Zanker Road<br>San Jose, CA 95134<br>408-945-3026<br>408-934-0476 (f)<br>eric.rosenblum@ci.sj.ca.us | **<u>Members</u>**<br>City of San Jose<br>Santa Clara Valley Water District<br>CLEAN South Bay<br>Silicon Valley Toxics Coalition | **<u>Mission:</u>**<br>Identify and recommend sustainable water resource management opportunities that protect beneficial uses within the pilot watersheds and the Santa Clara Basin. | • Major tasks are currently being developed. |
| **<u>Watershed Assessment</u>**<br>Chair: Kristen Sipes<br>City of San Jose<br>4245 Zanker Road,<br>San Jose, CA 95134<br>408-945-3060<br>408-934-0315 (f)<br>kristen.sipes@ci.sj.ca.us | **<u>Members</u>**<br>Regional Board<br>City of San Jose<br>Dept. of Fish & Game<br>CLEAN South Bay<br>Santa Clara Valley Water District<br>City of Sunnyvale<br>San Francisquito Creek Coordinated Resources Management and Planning (CRMP)<br>Silicon Valley Toxics Coalition<br>SCVURPP | Provide a solid scientific foundation for watershed planning | • Prepare a list of biological and chemical data to collect for the assessment<br>• Participate in RPT Work Groups A, C, and D<br>• Prepare Chapter 7, Natural Setting of the Watershed Assessment Report<br>• Review of work prepared by RPT, other subgroups, and consultants<br>• Monitor the status of other stream studies<br>• General Participation in WMI<br>• Track WAS-related parallel programs<br>• Host urban creek TMDL workgroups<br>• Host Guadalupe mercury TMDL workgroup<br>• Participation on the Riparian Restoration and Coyote Watershed workgroups<br>• Continuous improvement of assessment strategies<br>• Track sediment TMDL |

**Table 2-2 (concluded)**
**Subgroups of the Santa Clara Basin Watershed Management Initiative**

| Subgroup | Members | Mission | Major Tasks |
| --- | --- | --- | --- |
| **Wetland Advisory Group**<br>Cochairs are:<br>Deborah Johnston, Dept. of Fish and Game, 20 Lower Ragsdale Dr. #100, Monterey, CA 93940<br>(831) 649-7141<br>johnstondfg@compuserve.com<br>and<br>Luisa Valiela, U.S. EPA, 75 Hawthorne St. WTR-3, San Francisco, CA 94105<br>(415) 744-1991.<br>Valiela.Luisa@epamail.epa.gov | **Members**<br>Streams for Tomorrow<br>City of San Jose<br>Audubon Society<br>San Francisco Bay Bird Observatory<br>Fish and Wildlife<br>Santa Clara Valley Water District<br><br>*Stakeholder attendance will vary depending on the short term* | **Mission:**<br>Promote the integration of wetland management actions into the overall Watershed Management Plan being developed by the WMI and provide technical assistance on project and program develop-ment on an as-needed basis. This will be accomplished through ongoing advice to the subgroups, the process of characterizing and assessing the Baylands to determine the level of support for selected beneficial uses (an analysis that will be included in the Watershed Assessment Report), and as an advisory function to the Report Preparation Team (RPT) and Core Group for all WMI products<br><br>Meetings will be scheduled on an as-needed basis, and will be issue-oriented which we expect may mean changes in membership over time | **Short Term** (focus on Assessment phase)<br>• Review and choose the wetland definition(s) for use in the assessment.<br>• Provide a wetlands map(s) for the assessment.<br>• Ensure that wetlands are appropriately addressed.<br>• Review the Wetlands Project to ensure accuracy of products and identification of issues and direction.<br>• Incorporate findings of Baylands Ecosystem Project report in Watershed Assessment Report as appropriate.<br><br>**Long Term** (focus on Management Plan phase)<br>• Integrate the suggested actions of the Baylands Ecosystem Project with the tasks appropriate will for our watershed management plan. The next step of the Baylands Project is development of proposed elements to be incorporated into the WMI Management.<br>• Work closely with relevant subgroups to develop implementation actions that integrate wetland needs with other programmatic areas, such as flood control, water quality improvement, fish and wildlife enhancement, recreation, and land use planning.<br><br>**Long Term** (beyond Management Plan)<br>• Create a process to provide, and/or, an advisory group to the Regional Water Quality Control District (RWQCB) for Clean Water Act<br>• 401 certifications related to the SCBWMI issues as requested |

| **Table 2-3**<br>**Members of Technical Review Panel**<br>**(March – July 1999)** |
|---|
| Steve Abbors<br>Manager, Watershed and Recreation Division, East Bay Area<br>East Bay Municipal Utilities District<br>500 San Pablo Dam Road<br>Orinda, CA |
| Ken Brown<br>Aquatic Ecologist<br>Center for Watershed Protection<br>8391 Main Street<br>Ellicott City, MD |
| Jim Buchholz<br>Vice-President<br>Wetlands Research Associates<br>2169G East Francisco Blvd.<br>San Rafael, CA |
| Russ Flegal<br>Professor, Environmental Toxicology<br>ETOX – Applied Sciences 269<br>University of California<br>1156 High Street<br>Santa Cruz, CA |
| Bob Klamt<br>Fisheries Scientist<br>1502 Kona Place<br>Santa Rosa, CA |

Volume One Unabridged

**Watershed Characteristics Report**

# <u>Chapter 3</u>
# Cultural Setting of the Santa Clara Basin

SANTA CLARA BASIN

WMI

WATERSHED MANAGEMENT INITIATIVE

**Prepared for the**
**Santa Clara Basin Watershed Management Initiative**

**by**

**Watershed Assessment Consultant**

**February 2001**

# Watershed Characteristics Report Chapter 3: Cultural Setting of the Santa Clara Basin

# List of Authors


**REPORT PREPARATION TEAM**

*with consultant support from*

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Funded by:
Santa Clara Valley Water District
and
City of San Jose


**February 2001**

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# Chapter 3
# Cultural Setting of the Santa Clara Basin

This chapter contains a summary of the cultural history of Santa Clara Basin (the Basin) and a description of current community characteristics, including statistical information on population, numbers of households, income, and ethnicity. Some information on the Basin's expected demographic and economic future is provided.

## 3.1 Summary of Santa Clara Basin Cultural History

At one time, the entire Basin including the area currently occupied by San Francisco Bay (the Bay) was a great river valley, with its mouth at an ocean coast as much as 25 to 30 km (15 to 18 miles) west of the present Golden Gate. By about 11,000 years ago, as sea levels rose in response to glacial melt, ocean waters began to rise, flowing through the Golden Gate and forming the San Francisco Bay estuary. By about 6,000 years ago, the Bay had assumed its historical configuration as a wide, relatively shallow estuary, ringed by extensive salt marshes.

The Basin is located at the southern end of the Bay in one of the most seismically active areas in the world. The Basin is drained by the creeks of southeastern San Mateo County, northern Santa Clara County, and southwestern Alameda County. The Bay's marshes and creeks, and the Bay itself, have played an essential role in human occupation and use of the Basin for the last 10,000 years. Due to changes in sea level over time, it is likely that the locations of many of the oldest shoreline occupation sites have been inundated, while many sites may now be further from the shore than at the time of their occupation. It is thought that Coyote Creek, which currently drains north to the Bay, has drained southward to Monterey Bay at times past. The fact that the Coyote Creek and Pajaro River drainages are separated by a low divide composed of alluvial material supports this hypothesis (Elasser 1985). These changes in course may have affected the location of human settlements along Coyote Creek.

The 19th and 20th centuries saw marked changes in the natural setting of the Bay. Between 1850 and 1880, extensive hydraulic mining in the Sierra Nevada foothills washed tremendous volumes of sediment into the Sacramento and San Joaquin Rivers and their tributaries. The sediment then washed downstream through the Sacramento-San Joaquin River Delta to the Bay. It is estimated that over a billion yards of sediment were deposited in the Bay between 1849 and 1914 as the result of mining, erosion stemming from deforestation of the Santa Cruz Mountains, and overgrazing (Louderback 1951). Diking and filling of the Bay for urban development and other uses began as early as 1850, and by 1950 as much as one-third of the Bay had been filled to create land or to be managed for salt production.

Another episode of marked changes in the natural setting began in the early part of this century. The water resources of the valley were first tapped by the Spanish, but large-scale exploitation of the artesian wells and groundwater of the valley began in the 1860s when farmers began to switch from dry farmed wheat to water-intensive fruit crops (Rickman 1981). Drawdown of the region's groundwater table for intensive agriculture resulted in rapid land subsidence particularly near the mouths of creeks draining into the Bay. By 1933, the valley had subsided an average of 10 feet as a result of groundwater overdraft. In an effort to slow land subsidence, six reservoirs were built in the 1930s for water conservation and aquifer recharge.[1]

Land subsidence altered the slope of the Basin's streams and their elevation relative to sea level, destabilizing streambanks, increasing the incursion of tidal waters and increasing the frequency of flooding of the low-lying areas (Water District 1978). As a result, the rate of sediment deposition in the lower reaches of the Basin's streams also increased. One marked effect of this episode is that historical features and prehistoric archaeological deposits were very rapidly buried under thick layers of sediment. It is not uncommon for archaeological sites to be discovered beneath recent deposits of 10 to 20 feet of sediment. This phenomenon is particularly apparent in the lower watersheds of the Guadalupe River and Coyote Creek, areas that were foci of both historical and prehistoric occupation.

### 3.1.1 Native Americans

Human occupation of the Basin is evident as early as 10,000 years ago (cf. Moratto 1984). However, little is known about this period. When the Spanish arrived in the San Francisco Bay region, the Basin was inhabited by Native Americans of the Puichon, Tamien, and Alson Ohlone (or Costanoan) tribelets. The Ohlone are thought to have entered the region about 1,500 years ago, probably displacing populations already present. Numerous politically autonomous Ohlone tribelets or groups were present in the San Francisco Bay Area (the Bay Area), distributed in village groups of 20 to 200 individuals, which were loosely allied along family lines with the other groups in their tribelet. The Ohlone were hunter-gatherers, utilizing both semipermanent villages and more specialized seasonal camps, and a wide range of hunting and foraging strategies. In the Basin, Ohlone settlements tended to cluster along creeks (particularly perennial streams) and along the margins of the marshes. Populations were small and fairly widely dispersed. Archaeologically, occupation sites most often appear as "shell middens," organically rich deposits of earth and shell that often include human remains as well as cultural features.

The resources of the Bay and its marshes were essential to most Ohlone groups. In addition to acorns gleaned from the oak groves of the hills and bayside plain, primary foods included fish and shellfish, waterfowl, and a wide range of plant foods, as well as large and small game. Agriculture was not practiced, but a wide variety of plant foods were collected. Plant materials were used skillfully and extensively, not only for food, but also for shelter, clothing, twine and nets, boats, and finely made basketry. A wide variety of shell ornaments were manufactured, and bone and ground and chipped stone tools are common archaeologically. Minerals such as cinnabar, a mercury ore used for pigment, and salt from the marshes were also mined. Although material culture was relatively simple, the Ohlone were enmeshed in an extensive trade network.

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[1] Groundwater overdraft and land subsidence continued into the late 1960s when they were halted by better management of the groundwater basin. See Chapter 8 for a description of water management in the Basin.

For example, obsidian from distant sources in the Sierra Nevada and eastern California, as well as from closer sources near Santa Rosa, is fairly common at the Basin archaeological sites. The reader is referred to Milliken (1991) or Levy (1978) for a concise summary of Ohlone ethnography. A popular account is presented by Margolin (1978).

The entry of the Spanish into the Bay Area in 1769 and the missionization process that followed were highly disruptive to Ohlone culture. Introduced diseases devastated local native populations. Although it had been the intent of the Spanish to return Ohlones to the land after they had acquired farming and ranching skills and been converted to Catholicism, in fact only a handful of Ohlone individuals ever received land grants from the Spanish or Mexican governments. Instead, most mission survivors, deprived of their ancestral skills and land, found marginal subsistence as laborers on Mexican ranchos or on the fringes of towns. Nonetheless, many Ohlone retained their cultural identity. A significant cultural revival has occurred in the past few decades. Ohlone representatives are active participants in most local prehistoric archaeological projects.

### 3.1.2 Spanish and Mexican Periods

The earliest land-based explorations of the Basin took place in the late 1760s. At this time, Spanish explorers made their way north from Monterey in search of sites at which missions could be established. Traffic through the area increased markedly with the establishment of the Spanish mission and presidio at San Francisco in 1776. Mission Santa Clara was established on the west bank of the Guadalupe River in 1777, close to a perennial source of water. The secular Pueblo San Jose de Guadalupe was established upstream later that year as a support community to provide food for the military garrisons in the area. Santa Clara Valley, or Llano de los Robles (literally, “Plain of the Oaks”) as it was then known, was the best place in the Bay Area to grow food and was roughly equidistant between the Presidios of Monterey and San Francisco (Jacobsen 1984). The mission was subsequently moved several times after it was destroyed by earthquakes and winter flooding. Small-scale farming and cattle grazing took place throughout the Basin during this period and many highly successful nonnative plant species were introduced. In 1797, Mission San Jose was established in what was to become the city of Fremont. By this time, native villages were virtually depopulated, and settlement was concentrated at the missions, their outposts, and the small pueblo of San Jose (which had a population of only 171 in 1800) (Brack et al. 1991).

With Mexican independence from Spain in the early 1820s, and secularization of the missions in 1834, a larger stream of settlers began to flow into Santa Clara in quest of land for new ranchos. Mexican independence also opened California to foreign trade (formerly banned by the Spanish government) with the result that many more outsiders began to look toward California as a source of land and wealth. The land was quickly parceled out to Mexican grantees, who claimed vast holdings to enable them to run cattle on land that was only poorly watered. Ports were established on the Guadalupe River as well as in the East Bay to provide for shipment of tallow, hides, and other ranch products. However, many of the Mexican grantees had to struggle to hold their lands, as rival claimants and squatters flowed into the territory. The United States looked toward this territory for westward expansion and, in 1848, over 529,000 square miles (including all of Alta California) was ceded to the U.S. by the Treaty of Guadalupe Hildago, which ended the Mexican War (Brack et al. 1991).

### 3.1.3 California Gold Rush Era

The discovery of gold in 1848 rapidly accelerated the influx of population to the region. Although much of the vast immigration of the period between 1848 and 1854 was focused on the gold fields of the Sierra foothills, entrepreneurs – after a brief depopulation of the area with the end of the first rush – were quick to recognize the opportunity to profit from the burgeoning population. The gold seekers and their suppliers in the booming city of San Francisco (earlier called Yerba Buena) needed to be fed, and the vast, accessible, fertile lands of the Basin became very attractive. Ship landings spurred the growth of farming and commerce throughout the Basin. Alviso, on the Bay, became a major port. Just south of Coyote Hills on one of the largest and deepest sloughs in the East Bay an old landing was used so much by the Russians trading with Mission San Jose that it was called the Russian Landing (later renamed Beard's, Mayhew's, and Jarvis Landing for subsequent owners and captains). Origin Mowry sailed up a slough south of Beard's Landing, took up a ranch, built a road through the tules, and established Mowry's Landing (later Larkin's Landing). Captain Calvin Valpey established Warm Springs Landing on the Mud Slough branch of Coyote Creek and M.W. Dixon built Dixon's Landing to the south near the county line. The earthquake of 1868 destroyed on of the warehouses and 5,000 sacks of grain sank into the slough (Holmes 1992).

During the 1850s, a great influx of agriculturists took place in the region. Commercial farms on a substantial scale were established for the first time. In contrast to the focus on cattle during the 1830s and 40s, over the next few decades farms began to specialize in the production of field crops – barley, hay and wheat. Flour and grist mills made important contributions to the local economy. The commerce of the region was sent by boat from Alviso and the other East Bay landings to San Francisco. The latter half of the 19th century saw the development of mining and logging industries. The New Almaden mines, on the west side of the valley, were the major source of the enormous amount of mercury used in the extraction of gold from ore in the Sierra Nevada. The mines were an important part of the valley economy in the second half of the 19th century (Hoover et al. 1990). Logging occurred in the upper reaches of the Basin, particularly on upper San Francisquito Creek. Logs were shipped out from ports on the Bay, including the Port of Redwood City. Scow schooners sailed up to wharves at Cooley's Landing at the Ravenswood port or Wilson's Landing (originally Clarke's) on Mayfield Slough near its juncture with San Francisquito Creek and loaded hides, lumber, grain, hay, oyster shells, and produce such as strawberries to deliver to San Francisco. Rail lines were established, connecting San Jose with San Francisco and the East Bay and points east by the 1860s. Small farm communities grew up on the bayside plain, and farming developed as the region's primary industry. The invention of the refrigerated railroad car in the 1880s led to increased emphasis on the profitable (but perishable) fruit tree crops, and by the mid-1880s lands on which grains had formerly been grown were being planted in orchards. James Lick, an early benefactor to the State of

California, grew hay for the livery stables in San Francisco and then tended fruit orchards from 1850 to 1875.

### 3.1.4 The Twentieth Century

In the first three decades of the 20th century, Santa Clara Valley became the leading fruit-producing area in California. Most fruit farms were small and the development of the fruit industry supported a larger number of small family farms. A small orchard could produce a good living for a single family. Hay production and row crops still took up a substantial part of the land, but fruit production was more lucrative. Fruit drying and packing, and later canning, became important industries. After the disastrous earthquake and fire of 1906 virtually destroyed San Francisco, many businesses relocated southward to make new starts, and the size of the small farm communities of the area increased.

Beginning in the 1920s, the wide availability and popularity of automobiles contributed significantly to the increased suburban growth and development of the highway network in the Basin. Native American trails were the foundation of the Basin's highways and included the current routes of U.S. Highway 101, State Highway 17, Interstate 580 (Altamont Pass) and State Highway 152 (Pacheco Pass). Most of the state highways were built by the mid-1940s. The first restricted-access roads, or freeways, were built in the Basin in the 1950s and extended into and through the cities in the 1960s. The regional population grew slowly and steadily, based primarily on the agricultural industry. Gradually the small farm communities became small urban and industrial centers. San Jose, geographically well positioned for access to both the urban and the agricultural centers of California, flourished.

The establishment of Moffett Field in Mountain View in the early 1930s marked a significant step in the industrialization of the area. The establishment of this major naval air base acted as a catalyst in the region for the development of major aviation and related industries on the cutting edge of the era's technology, initiating a pattern that has continued into the present. New industries were drawn to the area by the military development. World War II and the ensuing cold war era of high military spending by the federal government encouraged this rapid expansion, which brought with it an expanded work force and related service population.

The diking off and filling of lands along the shoreline of the Bay, begun in the 19th century, accelerated in the 20th as the economy of the region grew. Land settlement made it necessary to raise levees to exclude tidal waters and sedimentation of channels caused the demise of the port at Alviso. Some of the diked-off lands were developed as salt ponds and several sewage treatment plants and sanitary landfills were built on land that was formerly open water or wetlands.

### 3.1.5 Silicon Valley

This burgeoning high technology industrial growth set a long-term trend for the region. Engineers at Stanford University, who had already begun research relevant to the fledgling electronics industry, contributed to the establishment of the first electronics firms. "Silicon Valley" had been born. War-related aerospace and electronics enterprises began to cluster in the Palo Alto area. By the 1960s, the electronics industry had taken root, and the valley became one of the fastest growing urban areas in the country (Saxenian 1981).

As Palo Alto's industrial land filled up, the electronics and the new semiconductor industry began to move south, first to the adjacent towns of Sunnyvale and Mountain View, then into Santa Clara and Cupertino. These cities began to develop high-tech industrial parks, which spurred further growth. Residential land was rezoned for industrial use. By 1970, the northern part of the valley became the industrial belt, while the southern valley became a focus for residential and support development (Saxenian 1981).

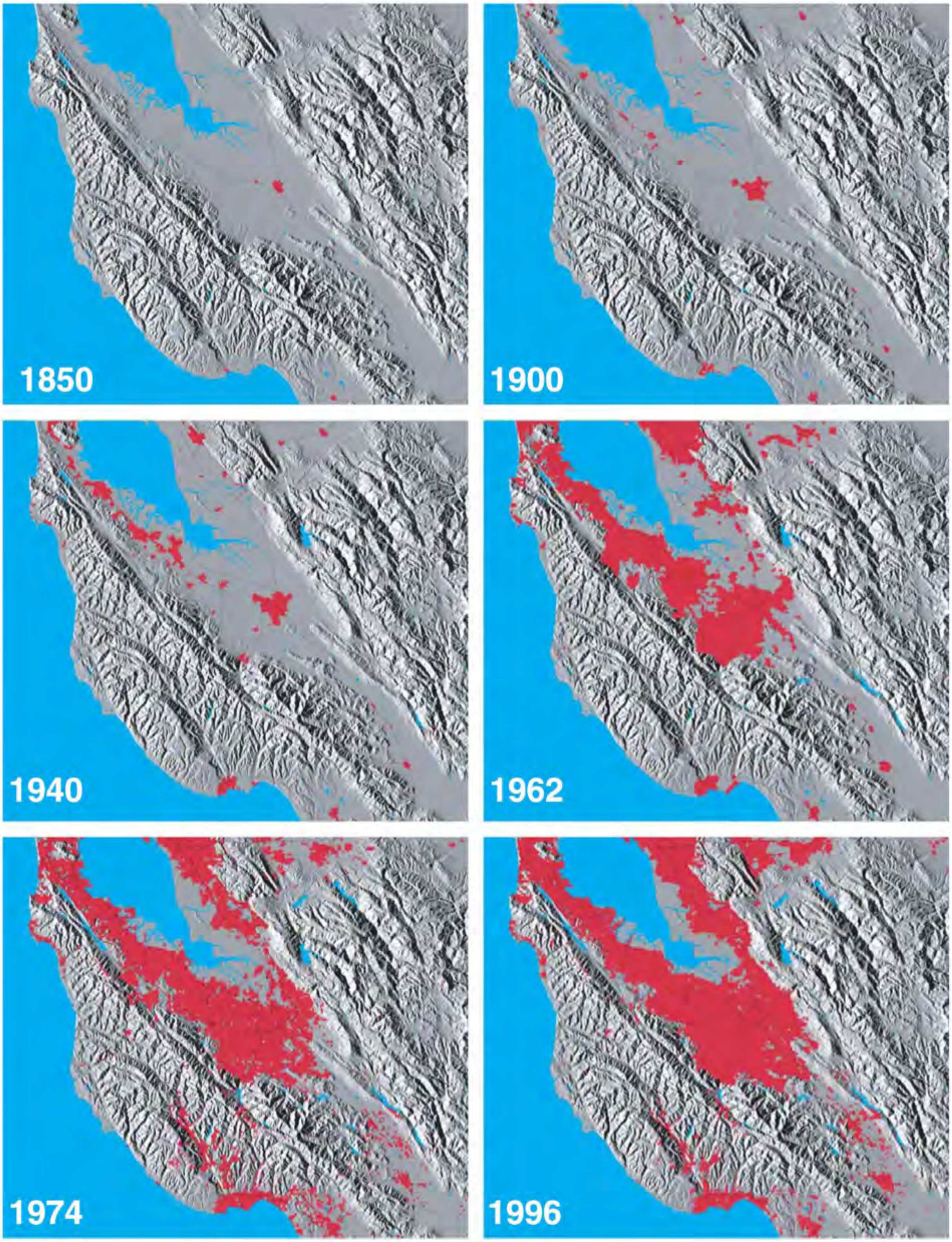
As industry grew in the Santa Clara Valley region, population and demand for residential development, service industries, and transportation network correspondingly increased. With this growth, the agricultural industry began a decline, and more and more land was converted from agricultural to residential and multiple urgan uses. This trend increased as agriculture became less and less lucrative in comparison with the competing land uses. By the 1980s, agriculture had been pushed to the margins of the Basin, except for a few remnant in-holdings.

Settlement patterns based on income were a feature of the Basin's early urban development. The electronics industry employs large numbers of both highly paid professionals and less skilled production workers. The more affluent gravitated toward the foothill and southern San Mateo County cities while the production workers made their homes in San Jose, Campbell, Milpitas, and southern Alameda County (Saxenian 1981).

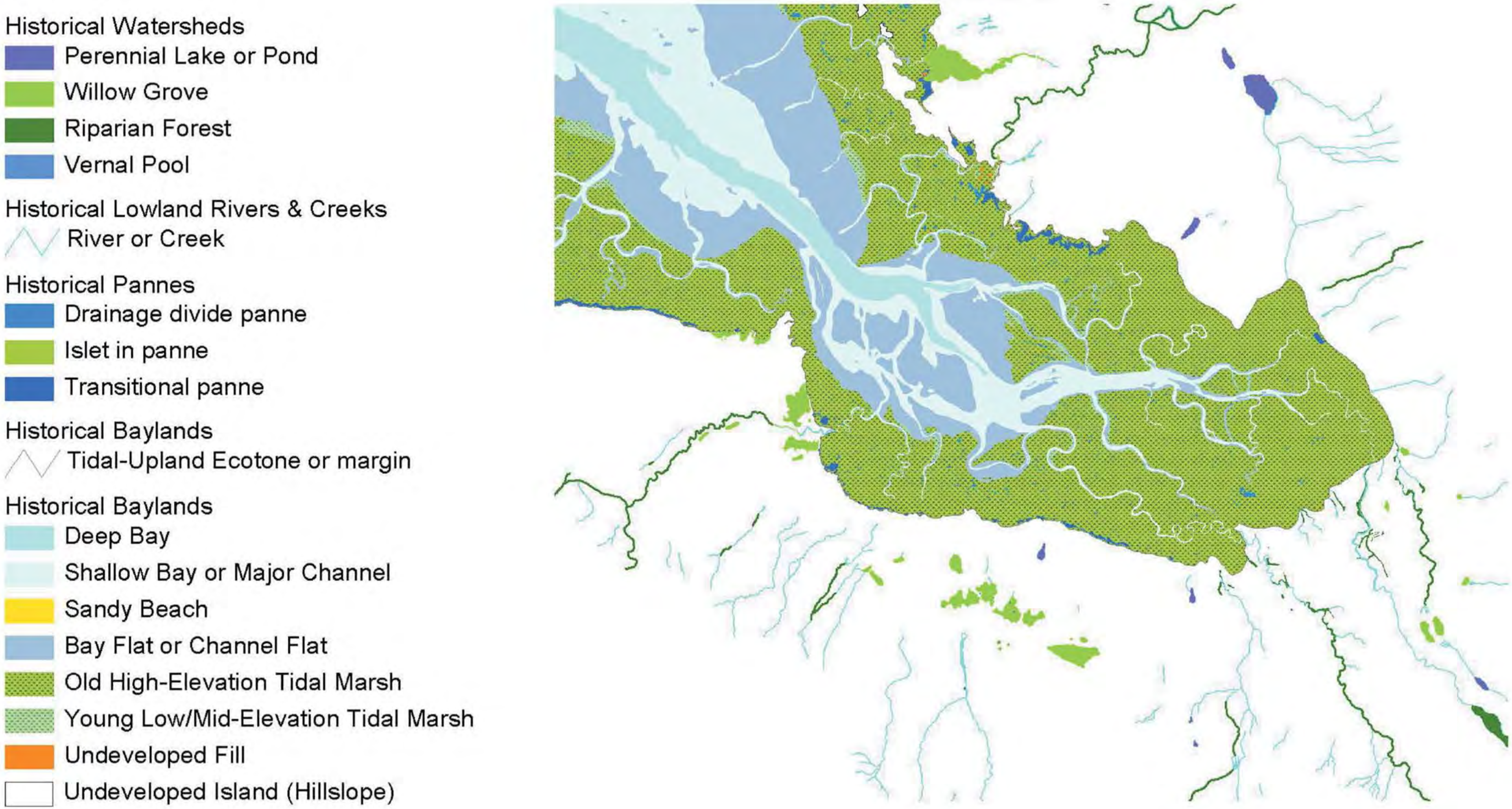
In recent years, a number of factors have constrained economic development in the region including the high cost of housing, a labor shortage due to lack of affordable housing, traffic congestion, and regional opposition to urban sprawl. As a consequence, some communities have adopted urban growth boundaries and policies that encourage the provision of affordable housing. New industrial areas have been built in developed areas in northern San Jose and in Fremont and Newark, rather than on the fringes of the metropolitan area. And increased emphasis is being given to improving mass transit as a way of reducing traffic congestion and air and water pollution.

Figure 3-1 shows the pattern of urbanization for the South Bay from the middle of the last century to the late 1990s. Figures 3-2 and 3-3 show how the margins of the South Bay have changed over time (between 1800 and 1998) as a result of human settlement and use.

## FIGURE 3-1
## Patterns of Urbanization in the South Bay 1850-1996




Source: Santa Clara County

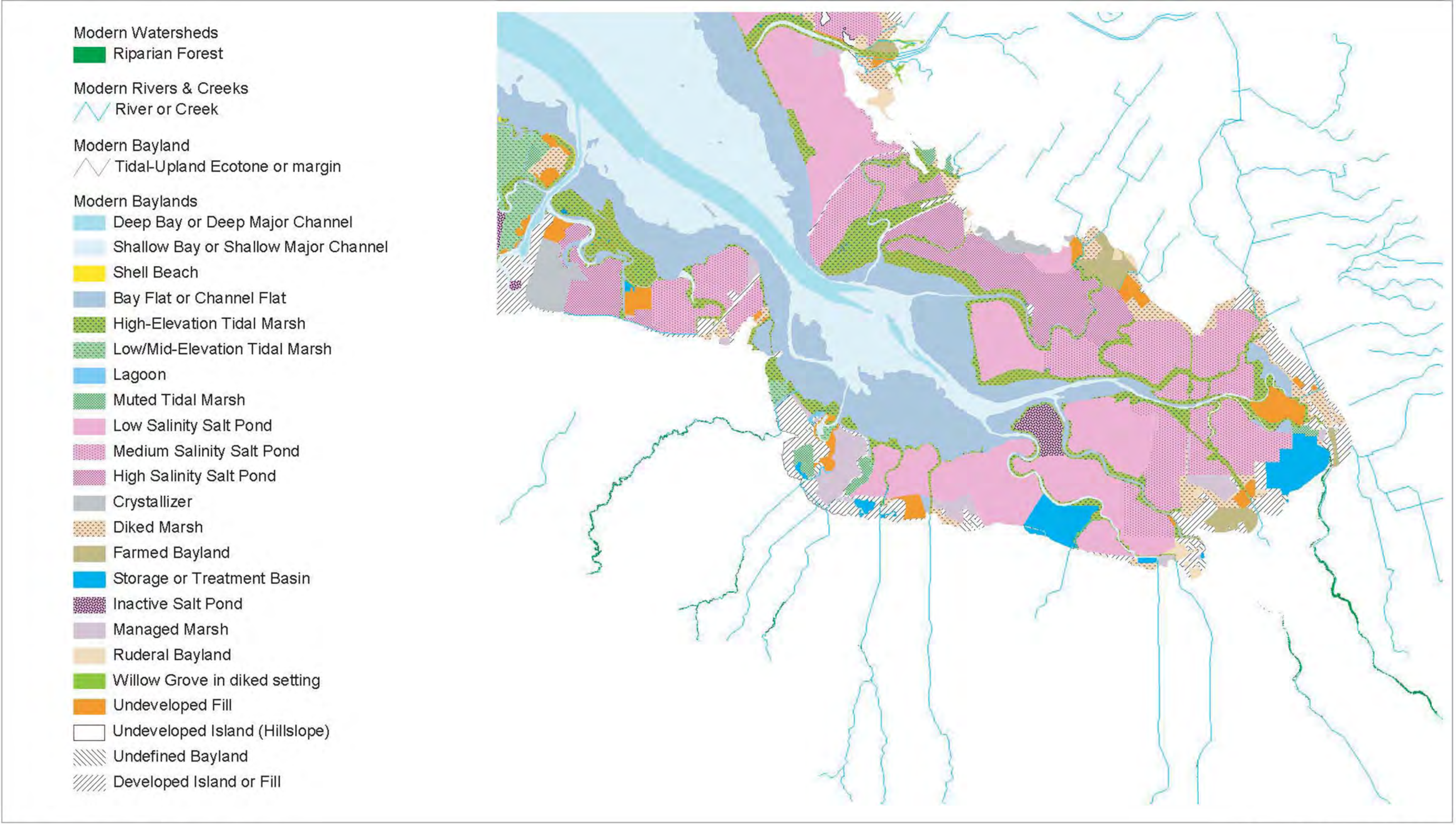



Source: San Francisco Estuary Institute, 1998-1999





**FIGURE 3-2**
**Past Distribution of Baylands and Adjacent Habitats (1800)**




*Source: San Francisco Estuary Institute, 1998-1999*



**FIGURE 3-3**
**Present Distribution of Baylands and Adjacent Habitats (1998)**

## 3.2 Demographic and Cultural Inventory

The boundaries of the Basin do not coincide with county boundaries. Most of the Basin (86 percent) lies within Santa Clara County but about 9 percent of the Basin is in Alameda County and 5 percent is in San Mateo County. Because most statistics are kept on a countywide basis, it is difficult to separately compile data for the Basin. In the discussion that follows, data from Santa Clara County are used as a surrogate for the Basin as a whole, unless otherwise indicated. It should be noted, however, that significant portions of southern and western Santa Clara County do not lie within the Basin. Because these areas are lightly populated relative to the portions of the county within the Basin, they probably do not greatly affect the statistical data described below.

### 3.2.1 Existing Community Characteristics

#### *3.2.1.1 Population, Age, and Households*

Santa Clara County is the most populous county in the Bay Area and accounts for about one fourth of the Bay Area's total population. According to the Association of Bay Area Governments (ABAG), the total population of Santa Clara County is estimated to reach 1.74 million by year 2000, having grown by about 16 percent since 1990 (see Table 3-1). San Jose is the largest incorporated city in the county and accounts for more than half of the county population. The other most populous communities in the Basin are Sunnyvale, Santa Clara, Mountain View, Fremont, and Newark. The population of the Basin as a whole is estimated to be about 1.9 million in year 2000.

**Table 3-1**
**Population Statistics**

| Statistic | 1990 | 2000 |
|---|---|---|
| Total population of Santa Clara County | 1,500,000 | 1,740,000 |
| Number of households | 522,040 | 565,730 |
| Average household size | 2.81 | 3.01 |

According to the 1990 census, a total of 522,040 households existed in the county. ABAG estimates that this number will reach 565,730 by year 2000. The average household size is also projected to increase from 2.81 in 1990 to 3.01 by 2000.

Based on the 1990 census, seniors over 65 represent about 9 percent of the county population. Children under 5 represent 9 percent. Approximately 16 percent of the county population is school-aged (see Table 3-2).

| **Table 3-2 Population Distribution by Age (1990)** | |
|---|---|
| 5 years and under | 8.9% |
| 6-18 years | 16.5% |
| 19-24 years | 9.9% |
| 25-44 years | 37% |
| 45-64 years | 18.4% |
| 65 years and over | 8.7% |

### *3.2.1.2 Housing*

Of the 581,532 housing units in Santa Clara County in January 1999, approximately 64 percent are single-family housing units (see Table 3-3). Multiple-family housing units represent 32 percent and mobile homes make up about 4 percent of the housing stock in the county. The vacancy rate in the county is 3.9 percent.

| **Table 3-3 Housing Resources** | | |
|---|---|---|
| Total housing units | 573,593 | 100% |
| Single-family units | 368,188 | 64% |
| Multiple-family units | 184,787 | 28% |
| Mobile homes | 20,618 | 4% |
| Owner occupied | 307,354 | 59% |
| Renter occupied | 212,826 | 41% |

### *3.2.1.3 Work Force*

Based on 1998 data, Santa Clara County civilian labor force is composed of an average of 962,700 people (see Table 3-4). As of January 1999, the civilian labor force numbered 963,900, with an unemployment rate of 3.7 percent.

**Table 3-4**
**Civilian Labor Force**

| Statistic | 1998 | 1999 |
|---|---|---|
| Total work force | 962,700 | 963,900 |
| Persons employed | 931,700 | 928,236 |
| Persons unemployed | 31,000 | 35,664 |
| Unemployment rate | 3.2% | 3.7% |

Farming accounts for about 4 percent of all employment (see Table 3-5). Of nonfarming sectors, the leading sectors in terms of employment are service industries (32 percent), manufacturing (27 percent), and trade (19 percent). Other sectors including finance, insurance and real estate, government, construction, transportation, communications, and utilities together account for about 22 percent of the county nonfarm employment (EDD 1999).

**Table 3-5**
**Employment by Sector**

| | | |
|---|---|---|
| Farming | 38,556 | 4% |
| Manufacturing | 265,100 | 27.5% |
| Service | 306,200 | 31.8% |
| Trade | 184,300 | 19% |
| Other | 212,058 | 22% |

### 3.2.1.4 Income

The U.S Census Bureau compiles statistics on median household income and ABAG estimates mean income. The census records show that median income in Santa Clara County in 1995 was \$53,400. ABAG data show that the mean household income in Santa Clara County in 1990 was \$70,262 and was estimated to rise to \$88,700 by 2005. This increase is due to a number of factors including rising wages, a growing percentage of middle-aged high-income wage earners, more workers per household, and a decreasing percentage of entry-level, low-wage workers. Income disparities exist between communities within Santa Clara County - mean household incomes range from a low of \$57,831 to a high of \$215,293 in 1990 (ABAG 1997).

### 3.2.1.5 Spoken Languages

English is the predominant spoken language in the Basin. Based on data on the number of children enrolled in the Limited-English-Proficiency Program at Santa Clara public schools, the top five primary languages, other than English, spoken in homes in the county are Spanish, Vietnamese, Tagalog, Cantonese, and Laotian. Other languages include Khmer, Punjabi, Korean, Russian, Mien, Mandarin, Farsi, Arabic, Hmong, and Armenian, listed in declining order of use.

### 3.2.1.6 Racial Composition/Ethnicity

The 1990 census reports the racial composition of the county as 70.3 percent Caucasian, 15.9 percent Asian/Pacific Islander, 3.8 percent African-American, 0.6 percent Native American, and 9.4 percent other races. Asian/Pacific Islanders are comprised predominantly of Chinese, followed by Filipinos, Vietnamese, Japanese, and Asian Indians. According to ABAG projections, Asian/Pacific Islanders are expected to make up 25 percent of the county population by 2005. Based on California Department of Finance (1999) projections they will account for 33 percent of the county population by 2015 (San Jose Mercury News 1999). Hispanics, a multiracial group, made up about 21 percent of the county population in 1990 and are also expected to account for approximately 33 percent of the population by 2015. Currently, non-Hispanic Caucasians make up approximately 49 percent of the county population (San Jose Mercury News 1999).

#### *3.2.1.7 Schools*

Santa Clara County has 33 school districts. The districts operate over 330 public schools including 227 elementary schools, 60 middle schools, 46 high schools, and 5 adult schools. The county is also home to three universities and a number of community colleges.

### 3.2.2 Projected Community Characteristics

#### *3.2.2.1 Projected Population Growth*

Growth in the county's population is expected to continue, but at slower rates than in the past. By the year 2010, county population should reach an estimated 1.864 million people, and by 2020 it is expected to reach 1.9 million. That means that during the 2000-2020 period, Santa Clara County will see a population increase of about 190,900 persons (11 percent growth) and 85,310 new households (15 percent growth). Annual growth rates between 2000 and 2010 will average less than 20,000 new persons per year. This moderate growth will be associated with moderate employment growth and housing development (ABAG 1997).

Most of the growth is expected to occur in San Jose and to a somewhat lesser extent in south county. North and west county areas are expected to see relatively little growth. San Jose will be the single fastest growing city in the entire Bay Area and will account for 64 percent of the growth in county households between 2000 and 2010 and 56 percent of the household growth between 2010 and 2020. Sunnyvale, Gilroy, Morgan Hill, and Santa Clara are the other cities in the county that are expected to experience growth in the number of households between 2000 and 2020 (ABAG 1997).

Some of the other demographic changes expected to occur in the near term (by 2005) include an increase in the size of the average household, increase in the percentage of population more than 64 years of age, an increase in Hispanic population, an increase in the Asian/Pacific Islander population, and a corresponding decline in the percentage of Caucasians.

#### *3.2.2.2 Projected Economic Growth*

High technology jobs drive the county's economy, and will continue to fuel most of the county's employment growth in future years. The regional economy is expected to grow and diversify in the coming years. During the 2000 to 2010 period, the county is expected to add 128,000 jobs, growing an average of 1.2 percent annually. An estimated 65,200 (about 51 percent) of the new jobs will be in the manufacturing sector. The county will also see strong growth in the service sector (ABAG 1997).

Between 2010 and 2020, the county will add 89,400 new jobs. About 40 percent of that increase will be in manufacturing and 38 percent in service jobs. Manufacturing job growth will occur primarily in San Jose, Sunnyvale, and Milpitas. Most of the new service jobs will be added in San Jose, Santa Clara, and Morgan Hill. Overall, job growth in Santa Clara County will outpace new employed residents by 55,000. This gap is the largest projected between the number of new residents and jobs in any county in the Bay Area (ABAG 1997).

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**Volume One Unabridged**
**Watershed Characteristics Report**

# Chapter 4
# Land Use in the Santa Clara Basin

**Prepared for the**
**Santa Clara Basin Watershed Management Initiative**

**by**

**Land Use Subgroup**

**February 2001**

# Watershed Characteristics Report
# Chapter 4: Land Use in the Santa Clara Basin

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Funded by:
Santa Clara Valley Urban Runoff Pollution Prevention Program
(SC17.02 and SC20.04)

**February 2001**

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# Chapter 4
# Land Use in the Santa Clara Basin

## Effects of Land Use on Watersheds

This chapter was prepared by the Land Use Subgroup, with assistance from the Santa Clara Valley Urban Runoff Pollution Prevention Program (SCVURPPP). This chapter is intended to assist urban planners, development project reviewers, and other stakeholders in understanding the effects of land uses on waterbodies in the Santa Clara Basin (the Basin).

This introduction reviews the literature relating land use to watershed characteristics and provides an overview of current issues relating to land use and watershed protection in the Basin. The introduction concludes with an idea, developed by the Land Use Subgroup, for advancing the process of land use planning for watershed protection.

The following sections discuss:

- Existing land uses and projected development
- Distribution of imperviousness in the basin
- Land uses within riparian corridors

Section 6.7 (Regulation of Land Use) in Chapter 6 (Regulatory Setting) provides additional information needed to develop the land use element of a watershed management plan. In particular, Section 6.7.1 describes the state laws and enabling legislation that empower municipalities to protect watersheds, and Section 6.7.4 compares and contrasts existing municipal watershed protection policies.

### 4.1.1 Overview: Spatial Pattern Matters

Meaningful assessment of the effects of land use on the beneficial uses of creeks, rivers or estuaries requires a watershed-level analysis. Since the era of the New Deal (Riley 1998), the effects of forestry, grazing, or agriculture on rural watersheds have been addressed by conservation districts, and more recently, through local Coordinated Resource Management and Planning (CRMP) stakeholder processes. In general, successful rural watershed management plans have considered how land uses relate spatially to watershed features (e.g., location of grazing or manure storage relative to streams, maintenance of riparian corridors). They have also explicitly integrated social and demographic considerations—such as who owns and takes care of the land—in selecting and implementing appropriate “best management practices” (BMPs).

By contrast, federal mandates (Clean Water Act) have required urban areas to implement BMPs to prevent pollutants from reaching stormdrains to the “maximum extent practicable.” There has been little systematic analysis of the spatial relationships between land uses and streams in urban areas, nor assessment of how social and economic factors affect these spatial relationships.

Nevertheless, the impacts of urbanization are closely linked to the spatial pattern of development. The pattern matters more than the proportion of the entire watershed that is urbanized, more than the relative proportions of urban land uses.

In her book *Restoring Streams in Cities,* Ann Riley concludes: "Of all the land-use changes that can impact a watershed and its hydrology, urbanization is by far the most significant" (Riley 1998).

As Dr. Riley states:

> The worst physical modification of urban watersheds is the relegation of stream channels and tributaries to underground culverts. Riparian zones are eliminated or separated from the stream channels. Removal of streamside vegetation results in the loss of nutrients to the aquatic organisms, loss of shade, increased bank erosion, lateral movement of the stream channel, increased sedimentation, and decreased pool depths. Floodplains become separated from the stream channels because the channels have become incised or deepened, or the previous land-use practices have added large layers of fill to floodplains, or both these things have happened. Structural barriers such as levees and floodwalls and channelization can be added causes of this separation. Floodplains can be one of the most biologically productive parts of the watershed system as well as a storage and conveyance area for floodwater, but they are often impacted by urbanization….
>
> Urbanization tends to increase the volume and peak of streamflows. The delivery of runoff to streams after the beginning of rainfall becomes flashier, reducing the lag time between the rainfall and the peak of a stream's flood stage (Riley 1998).

Nonurban land uses, such as grazing and agriculture, also affect watersheds. The most severe impacts to Basin streams, however, are related to urbanization. Comprehensive watershed management will require maintaining and managing these uses, but the biggest challenge, by far, will be to preserve and enhance streams in urban areas.

The effects of urbanization cannot be reduced to pollutants per acre, or even to increases in acre-feet of runoff, but rather are engendered by a myriad of changes to drainage patterns, changes that accelerate the movement of runoff into streams, alter the patterns of erosion and deposition within the streambanks, and alter the flow of water, sediment, and nutrients between streams and riparian areas.

Although municipalities' General Plans coordinate the spatial arrangement of land uses, they generally do not incorporate the relationship of land to drainage and to waterbodies. There is a conceptual gap between the tools of urban planning—tools developed to coordinate traffic circulation, and to balance jobs with housing—and the needs of the watershed planner. Although most municipalities have adopted preservation of water resources as a goal of their comprehensive plan and have the authority to undertake a variety of initiatives, they lack a methodology for developing and implementing measures to protect and enhance watersheds at the appropriate watershed-wide scale.

To develop such a methodology, it is necessary to examine the spatial patterns of urban development, including the social causes and ecological consequences of those patterns. As the primer, *Landscape Ecology Principles in Landscape Architecture and Land Use Planning*, states:

> Spatial pattern matters. It is no longer appropriate to plan based on totals or averages of prices, jobs, wages, parkland, bicycle paths, logging area, waterflows, and so forth. Rather, the arrangement of land uses and habitats is critical to planning, conservation, design, management and policy (Dramstad et al. 1996).

### 4.1.2 Spatial Patterns of Urbanization

To understand the relationship between urban land uses and the streams that drain them, we must first review the characteristics and spatial relationships of the land uses themselves. As is documented in Section 4.2, the predominant characteristic of land uses in the Basin is the continuous swath of urban development across the valley and into the lower foothills of the Basin. Viewed in the context of land use change over the past 150 years, the pattern has been characterized as "sprawl."[1]

The report of the President's Council on Sustainable Development, Task Force on Sustainable Communities, defines "sprawl" as:

> …low-density development that spreads out from the edges of cities and towns. It is poorly planned, and often situated without regard to the overall design of a community or a region. It often results in types of development—such as rambling, cookie-cutter subdivisions and strip malls—that perpetuate homogeneity, make inefficient use of land, and rely almost exclusively on automobiles for transportation (President's Council on Sustainable Development 1997).

In an April 12, 1999 report, the conservation organization American Rivers paints an alarming portrait of how land use change is affecting rivers across the U.S.: "…sprawl is one of the fastest growing, most ominous threats to our nation's rivers. Sprawl wreaks havoc on both the quality of water in a river and on the amount of water flowing between the banks (American Rivers Press Release 1999)."

The Sierra Club's October 1998 report, "Dark Side of the American Dream" describes the origins of the problem this way:

[1] A pictorial and video representation of urbanization sprawling across the Bay Area can be viewed at http://geo.arc.nasa.gov/sge/william/urban.html.

> Since the end of World War II, the American Dream has been defined as a house in the suburbs. Sparked by a series of federal and state government policies, including home-buying subsidies provided by the GI Bill, massive roadbuilding projects and community planning designed around the car, Americans abandoned the cities for greener pastures in suburbia.
>
> The consequences of decades of unplanned, rapid growth and poor land-use management are evident all across America: increased traffic congestion, longer commutes, increased dependence on fossil fuels, crowded schools, worsening air and water pollution, lost open space and wetlands, increased flooding, destroyed wildlife habitat, higher taxes and dying city centers (Sierra Club 1999).

Over the past year, despite the protests of the Heritage Foundation (Cox 1999), “sprawl” has become the focal point for an intensifying national debate on land use changes, how they affect society, and how they affect the environment—in particular, how these changes affect watersheds.

### 4.1.3 A Short History of Ideas About Cities and Nature

Economic and population growth (spurred by private investment and government defense spending) caused the Basin’s rapid post-war urbanization. But policies—and ideas behind those policies—account for the spatial arrangement of urban land uses. Where did those ideas come from? As population and economic activity continue to grow, can different ideas about cities help bring about land use patterns that support society and nature alike?

The decrying of sprawl links general unease over rampant environmental destruction with unease over social divisions and loss of quality of life. The urban designer Peter Calthorpe conveys the sensibility that for city dwellers, community and ecology are necessarily connected:

> Communities historically were embedded in nature—it helped set both the unique identity of each place and the physical limits of the community. Local climate, plants, vistas, harbors, and ridgelands once defined the special qualities of every memorable place. Now smog, pavement, toxic soil, receding ecologies, and polluted water contribute to the destruction of neighborhood and home in the largest sense (Calthorpe 1993)….

How did sprawl get started? Calthorpe’s end-of-the-twentieth-century reaction to the problems of suburban development was presaged, a century ago, by the reaction of planners and academics to the overcrowded living conditions, poverty and unhealthful conditions of 19$^{th}$ century cities.

Indeed, the very conception of this Watershed Characteristics Report might be seen as a reflection, nearly a century later, of Patrick Geddes’ idea of a regional plan (for Edinburgh, Scotland), as described in Lewis Mumford’s *The Story of Utopias* (Mumford 1963):

> The aim of the Regional Survey is to take a geographic region and explore it in every aspect. It differs from the social survey with which we are acquainted in America in that

> it is not chiefly a survey of evils; it is, rather, a survey of the existing conditions in all their aspects; and it emphasizes to a much greater extent than the social survey the natural characteristics of the environment, as they are discovered by the geologist, the zoologist, the ecologist—in addition to the development of natural and human conditions in the historic past, as presented by the anthropologist, the archaeologist, and the historian. In short, the regional survey attempts a local synthesis of all the specialist 'knowledges.'

Geddes' purpose was to create a rational basis for planning future development that would avoid the environmental and social pitfalls of industrial-age cities.

Attempts to "design away" the problems of urban life begin with the Englishman Ebenezer Howard, who proposed, in 1898, to halt the growth of London and repopulate the countryside with a new kind of "Garden City" where the city poor might once again live close to nature. (Jane Jacobs describes this conception as a kind of "model company town, with profit-sharing" [Jacobs 1961]).

Le Corbusier expanded this modernist vision with his 1920s "Radiant City," which incorporated then-new building technology. He wrote: "[S]upposing we are entering the city by way of the Great Park. Our fast car takes the special elevated motor track between the majestic skyscrapers: as we approach nearer, there is seen the repetition against the sky of the 24 skyscrapers; to our left and right on the outskirts of each particular area are the municipal and administrative buildings; and enclosing the space are the museums and university buildings. The whole city is a Park."

Lewis Mumford said the "City in the Park" idea "misconceived the nature and functions of both city and park…. a suburban conception. By its very isolation of functions that should be closely connected to every other aspect of city life… it can be detached from the organic structure of the city and planted anywhere…. The City in a Park has now taken a more acceptable, commercially attractive form, and has become a City in Parking Lot (Mumford 1986)." Here Jane Jacobs agreed with Mumford, saying that Le Corbusier's technocratic approach attempted to "sort and sift out of the whole certain simple uses, and to arrange each of these in relative self-containment" (Jacobs 1961).

These ideal cities (examples include Howard's Welwyn Garden City, Le Corbusier's Contemporary City, and Frank Lloyd Wright's Broadacre City) expressed not only an ideal form of urban design, but also a design for a social utopia. They were rarely built, but as Jacobs notes, they greatly influenced city planning and legislation affecting housing and housing finance.

The utopian vision of suburbia was posed as a solution to the social ills of the day, but was also rooted in intellectual city dwellers' idealization of nature. Roderick Nash notes in his 1973 book, *Wilderness and the American Mind*: "Appreciation of wilderness began in the cities. The literary gentleman wielding a pen, not the pioneer with his axe, made the first gestures of resistance against the strong currents of antipathy [toward the wilderness]" (Nash 1982). Mumford notes:

"This impulse to have closer contact with the rural scene was fed by the literature of the Romantic movement, from Rousseau on to Thoreau; but it did not originate there…. The rich families of Florence, Rome and Venice in the fifteenth and sixteenth centuries [built] country villas…. What marks the modern age is that both the impulse and the means of achieving it have become universal" (Mumford 1986).

By 1962, when Jane Jacobs wrote *The Death and Life of Great American Cities*, the unintended consequences of utopian city planning—particularly the separation of land uses and the incorporation of natural areas into the urban realm—were all too apparent. She noted: "There are dangers in sentimentalizing nature. Most sentimental ideas imply, at bottom, a deep if unacknowledged disrespect. It is no accident that we Americans, probably the world's champion sentimentalizers about nature, are at one and the same time probably the world's most voracious and disrespectful destroyers of the wild and rural countryside."

Heedless of warnings by Jacobs and others, the utopian ideology of suburbia has governed post-World War II land development throughout the San Francisco Bay Area (the Bay Area). As Calthorpe notes:

> Every piece of land in the USA is controlled by codes and planning documents that evolved after WWII. These controls have been largely founded on modernist principles—segregation of uses, circulation systems focused on the car, and a loss of public orientation for buildings and gathering places. With the exception of a few urban centers, every city, county and town has a set of zoning ordinances, planning codes, street standards and perhaps a comprehensive plan that binds the area to a future of sprawl-like development (Calthorpe 1993).

### 4.1.4 Economy, Equity, Environment

The engineering of a modernist landscape has been implemented despite the additional public and private costs compared to more dense, integrated urban development. Tina Axelrad's 1998 synthesis of the national literature on the costs of urban sprawl notes that: "Generally, patterns of sprawl characterized by large-lot, single-family developments far from the "core" of a metropolitan area, will result in greater public capital and operating costs for local roads, schools, and utility infrastructure" (Axelrad 1998).

Urban Ecology, a Bay Area organization dedicated to "promoting urban environments that are ecologically, socially and economically healthy," has noted the "hidden costs" associated with sprawl in the Bay Area. Pacific Gas and Electric's rate structure spreads the additional costs for gas and electricity distribution in 1 DU/2 to 5 acres areas to urban, as well as suburban, ratepayers. City dwellers' tax dollars end up subsidizing new roads and utility systems, instead of going toward transit systems and urban services they need (Urban Ecology 1996).

Another cost of sprawl is the high rate of pedestrian injury and death. Of all Bay Area counties, Santa Clara has the second-lowest proportion of its population walking to work (2.1 percent);

however, it had a relatively high incidence (44.7/100,000 population) of pedestrian injuries and fatalities (Bay Area Transportation and Land Use Coalition 1999).

The tendency toward sprawl is exacerbated, in California, by the effects of Proposition 13. For example, Santa Clara County voters passed an extension of a half-cent sales tax increase (Proposition A, 1992) to provide $3.5 billion for light rail expansion. The measure was struck down, however, by the California Supreme Court, which rules that the sales tax extension would require a two-thirds majority.

To make up for the shift of taxing power away from municipalities and toward the state, municipalities have been pressed to approve commercial development, because it produces higher tax revenues than does housing, and demands less outlay for public services. This forces cities to vie with each other for commercial projects, undercutting their ability to negotiate mitigation measures for development.

Social attitudes and effects, including "economic polarization," are making it difficult to control sprawl. In a May 1998 report prepared for the Urban Habitat Program (a nonprofit organization founded in 1989 to "develop multicultural urban environmental leadership for sustainable communities in the San Francisco Bay Area") Myron Orfield warns:

> There is a dangerous social and economic polarization occurring in the San Francisco Bay Area…. First, poverty and social and economic need has concentrated and is deepening in central city neighborhoods and in older, inner suburbs…. This concentration destabilizes schools and neighborhoods, is associated with increases in crime, and results in the flight of middle-class families and businesses. As social needs accelerate in the central cities, inner suburbs, and many outlying communities, the property tax base supporting local services erodes. Second, in a related pattern, growing middle-income communities are beginning to experience increases in their poverty and crime rates, and could well become tomorrow's troubled suburban places…. Third, upper-income residentially exclusive suburban places are capturing the largest share of regional infrastructure spending, economic growth and jobs. As the property tax base expands in high property-wealth areas and their housing markets remain exclusive, these areas…become both socially and politically isolated from regional responsibilities.
>
> Overlaying this socioeconomic polarization is an environmental nightmare. As the wave of socioeconomic decline rolls outward from the central cities and older, inner-ring suburbs, tides of middle-class homeowners sweep into fringe communities. Growing communities, facing tremendous service and infrastructure needs, offer development incentives and zone in ways that allow them to capture the most tax base. In so doing, they lock the region into 1 DU/2 to 5 acres development patterns that are fiscally irresponsible, foster automobile dependency, contaminate groundwater, and needlessly destroy tens of thousands of acres of forest and farmland….

> At (literally) either end of regional polarization are two seemingly unrelated but actually quite interconnected negative impacts: the concentration of poverty in the region's core, and environmental degradation on the region's fringe (Orfield 1998).

Although Bay Area concentrations of poverty are most pronounced in Oakland and San Francisco, there is reason to be concerned about the connection between economic polarization and environmental degradation in the Basin. San Jose had no "extreme" poverty census tracts in 1980 or in 1990; however, the number of tracts characterized as "transitional"— where between 20 and 40 percent of the population lives below the federal poverty line ($1,111/month for a family of three in 1998 (U.S. Department of Agriculture 1998), a measure that is generally assumed to grossly underestimate actual poverty (Schwarz 1998))—increased from 11 to 15.

### 4.1.5 Effects of Urbanization on Santa Clara Basin Watersheds

A number of studies have investigated, or are investigating, physical and biological parameters of Basin streams, but the overall condition of aquatic ecosystems has not been systematically assessed. A detailed assessment of conditions in three Basin watersheds will be reported in Volume 2 of the Watershed Management Plan (Watershed Assessment Report). It is possible, however, based on a knowledge of watershed structure and function, and examination of land use patterns—to identify generalized effects of land use on Basin streams.

Bay Area landscapes have been progressively altered, over 150 years, by mining, forestry, ranching, agriculture, and urbanization. Chapter 7.1 includes descriptions of the Basin's presettlement flora and fauna and changes due to development.

Because we are accustomed to the current conditions of creeks, we are most likely to notice when "normal" conditions change. Visible trash and pollutants, bank washouts, increased turbidity, and fish kills are immediate and obvious effects of land use; however, these visible changes are usually symptomatic of larger, more serious changes affecting hydrology, flow regime, and riparian vegetation.

Urbanized areas extend over the valley floor to an elevation of 600 to 800 feet. Above this level, moderately sloped areas are mostly rangeland, and steep-sloped areas are forested. Within the urbanized area, small patches of natural area and park dot an otherwise continuous swath of residential, industrial and commercial development. Continuous bands of riparian vegetation along creeks, which typify less disturbed areas in the region, exist in some urbanized watersheds; in others, they have been reduced to a few disconnected lengths or eliminated entirely (see Sections 7.1 and 7.2).

From a watershed perspective, the primary effects of sprawl development are the segregation of land uses, low density, and dependency on automobiles for transportation. The vast, uniform swath of houses and workplaces disrupts watershed function principally by altering the characteristics of its drainage. The principles of landscape ecology tell us that the disturbance from the natural landscape pattern—most notably the narrowing and linear discontinuity of streamside corridors—will have specific effects on the functioning of watersheds.

Land uses change the characteristics of a watershed when, individually or in combination, they alter its structure or impair key ecological functions. These changes are best understood by how they affect ecosystem structure, processes, and functions (Federal Interagency Stream Restoration Working Group 1998). Wesche describes the chain of events as follows: changes in land use lead to changes in geomorphology and hydrology, to changes in stream hydraulics, sediment transport and storage, and on to changes in the functions of stream habitat (Wesche 1985).

The following discussion is organized under these topics:

- Urbanization and Imperviousness
- Geomorphic Changes and Disconnection of Streams from Floodplains
- Riparian Areas
- Pollutants

### 4.1.6 Urbanization and Imperviousness

Various studies have simply correlated biological changes with urbanization or other land use change, without elucidating causal mechanisms.

Karr (Karr and Chu 1997) uses simple graphs to illustrate that biological metrics (benthic index of biological integrity, taxa richness) decline with increasing "human influence." The latter quantity is characterized by percent impervious area or (even more simply) by subjective characterizations of intensity of use (after Patterson 1996). Pitt and Bozeman (1982) were unable to conclude that urban runoff pollutants impair beneficial uses of Coyote Creek, but did find significant differences in fish and benthic macroinvertebrate assemblages (decreased diversity and biomass) in urban locations.

May et al. (1997a) use percent total impervious area to represent "urbanization" of streams in the Puget Sound (Washington) region, and correlate other quantifiable measures related to habitat quality (road density, 2-year storm/baseflow discharge ratio, riparian buffer width, and quantity of large woody debris). The authors show that road density is strongly correlated to percent total impervious area, and could even be used as a substitute measure for imperviousness.

Schueler (1994) demonstrates the relationship between increased impervious cover and increases in peak flow and total volume of runoff. Schueler concludes that the hydrologic changes cause degradation of habitat structure, water quality, and biodiversity of aquatic systems at relatively low levels of imperviousness (10 to 20 percent of total drainage area).

Tom Richman, in his design guidance manual prepared for the Bay Area Stormwater Management Agencies Association (BASMAA 1999), summarizes the environmental consequences of impervious land coverage:

- Rainwater is prevented from infiltrating the soil and recharging groundwater. This reduces base streamflows.

- More rainwater runs off, and runs off more quickly, increasing flow volumes, accelerating erosion in natural channels, and reducing habitat. Flooding and channel destabilization may lead to channelization of the stream, with further loss of beneficial uses.

- As runoff moves over large impervious areas, it collects and concentrates pollutants.

- Impervious surfaces retain and reflect heat, causing increases in ambient air and water temperatures (BASMAA 1999).

Increased imperviousness has little effect on flows during “extreme” events (such as the extensive flooding in the Santa Clara Valley 1952-1953). During these events, rainfall saturates even natural soils, rendering them effectively impervious. Hollis (1975) shows that urbanization can increase smaller frequent floods by up to 10 times, while extreme events barely increase at all. Mineart and Ha (1999) showed that flooding in Coyote Creek has not increased with urbanization, largely due to management of flows at Anderson Dam; however, there may have been an increase in the tendency to flood in specific urban catchments within the watershed.

Related to imperviousness is the increase in drainage density, which is defined as the length of drainage conduit (pipe, ditch, or stream) divided by the drainage area (Graf 1977). Drainage density encourages rapid runoff, exacerbating the effects of imperviousness, but also represents physical alteration of smaller tributary streams.

The studies by Schueler (1994), May et al. (1997a), and others show that imperviousness is correlated to an increase in peak and volume of flow (particularly during smaller storms and in smaller streams) and that imperviousness is also correlated to reduced habitat quality, as measured by biological indices. To understand the causal relationships, however, it is necessary to examine the relationship between imperviousness and stream geomorphology.

#### *4.1.6.1 Changes to Geomorphology and Disconnection from Floodplains*

The most significant and characteristic impacts of land use to Santa Clara Valley streams are (1) the destabilization of streambeds and banks, which is caused by imperviousness, increased drainage density, and changes to sediment inputs; (2) agricultural and urban encroachment on riparian corridors; (3) gravel quarry operations; and (4) the disconnection of streams from floodplains, caused by erosive downcutting of streambeds and by construction of channels and levees.

Imperviousness associated with urban development magnifies the peak flow and total runoff during the 1.5- to 2-year flood event—the size of flood that most strongly influences stream characteristics. The major “work” by a perennial stream in moving sediment, and thereby determining its form, is accomplished by floods which occur, on average, at 1- to 2-year intervals (Leopold et al. 1995). Consistently, this frequency corresponds to the flood of near bankfull depth, i.e., the discharge when water just begins to leave the channel and spread onto the floodplain.

Ann Riley summarizes the scientific consensus on the geomorphic parameters of streams in equilibrium with their channel:

- Depth of flow is proportional to discharge. Depths increase with increasing discharges, but not as much as width.
- Channel width is proportional to both water discharge and sediment discharge.
- Channel shape (width/depth) is directly related to sediment discharge.
- Channel gradient flattens with an increase in discharge and increases with a decrease in discharge.
- Channel slope is proportional to both sediment discharge and sediment grain size.
- Sinuosity (or degree of meandering) is proportional to valley slope.
- Meander wavelengths tend to maintain a constant relationship with channel width. Increased discharges tend to increase meander wavelength and channel width (Riley 1998).

To understand the geomorphological relationship between watershed disturbance and stream health, Dave Rosgen advocates a stepwise analysis of stream geomorphology (channel slope, shape and patterns), followed by a detailed morphological description (width/depth, sinuosity, channel slope, channel materials). According to Rosgen, these steps are required before proceeding to develop a description of stream condition as it relates to “stream potential,” defined as the best condition achievable for a stream’s morphological characteristics. The degree of departure from potential is then assessed by comparing the subject stream to criteria based on streams of similar geomorphic type (Rosgen 1996).

The geomorphology of the Santa Clara Valley—a gently sloping plain underlain by alluvial gravels interspersed with clays—was created by the “work” of streams carrying sediment down from the hillsides. The relatively flat alluvial plain was created (and in geologic time, is being recreated) by streams moving back and forth over the valley floor.

In addition to reconstructing and maintaining the characteristic channel morphology and substrate, periodic flooding is essential to some riparian plants (e.g., willows and cottonwoods) and replenishes floodplains with sediments and nutrients. The flooding yields a “pulsed” increase in habitat, which is essential for invertebrate communities, amphibians, reptiles, and fish spawning. Flooding also replenishes shallow groundwater, extending streamflows longer into the summer (Federal Interagency Stream Restoration Working Group 1998).

#### 4.1.6.2 Riparian Areas

"Riparian" may be simply defined as "streamside." Ann Riley summarizes the functions of riparian vegetation in supporting fish habitat:

- Tree roots and other growth bind the streambank soil and resist erosion. This produces deeper channels with banks that are undercut but held together with exposed root systems. These undercut banks, with overhanging vegetation, provide important escape cover for fish.

- Riparian vegetation moderates water temperatures.

- Most of a stream's biological energy comes from plant detritus.

- Woody debris that falls in the stream creates habitat in backwater pools and provides storage for sediment that would otherwise be released into spawning areas.

- Riparian vegetation slows flood velocities and helps deposit and store sediment on the floodplains, rather than in the stream channel.

- A well-vegetated channel helps store water during the rainy season; subsequent release in the dry season helps maintain base flows (Riley 1998).

In addition, riparian vegetation helps to moderate stream temperatures, which in turn moderates fluctuations in dissolved oxygen concentrations and the toxicity of pollutants.

As is noted in the *Riparian Corridor Policy Study* (City of San Jose 1994):

> … land uses, coupled with the accompanying need for flood protection have, over time, altered the natural features of the City's landscape, including the amount and condition of its riparian resources. Creeks and rivers that historically supported relatively wide corridors of natural vegetation over their floodplains now support narrow bands of vegetation within their banks or have been modified for flood protection and water supply purposes.

Similar conditions exist throughout the urbanized areas within the Basin.

#### 4.1.6.3 Pollutants

Santa Clara Basin streams receive no discharges from industries or municipal wastewater. Industrial discharges are routed to municipal sanitary sewers and then to one of three regional municipal wastewater treatment plants. These plants discharge to tidal sloughs or to San Francisco Bay (the Bay). Runoff from urban and rural areas and open space contributes pollutants to Basin streams. Many toxicants are associated with the particulate matter in urban runoff; this particulate matter is deposited in stream sediments (Pitt et al. 1995; Schueler 1987; Pitt and Bozeman 1982).

From 1989 to 1996, Bay Area stormwater agencies regularly sampled urban runoff flows during storm events. The samples were analyzed to determine the concentrations of potentially toxic chemical constituents. A 1996 summary of this monitoring, prepared for the BASMAA, concluded that concentrations of metals in runoff from urban areas are generally lower than the U.S. Environmental Protection Agency's dissolved water quality criteria for the protection of freshwater aquatic life.

Concentrations of total cadmium, copper, lead, nickel and zinc were sometimes higher than Regional Water Quality Control Board (Regional Board) freshwater objectives. Concentrations of total mercury were generally higher than objectives; however, these standards are designed to prevent accumulation of mercury in fish tissues. The duration of stormflows is much shorter than this period for which objectives are designed. The stormwater agencies conducted additional studies to determine whether the presence of these metals caused the runoff to be toxic to stream organisms. Toxicity, when found, was generally attributable to nonpolar organics, rather than particulates or dissolved metal ions (BASMAA 1996, pg. 7-1). Sampling and laboratory bioassays conducted in 1988-1992, however, indicated that dissolved metals caused runoff from the Walsh Avenue catchment, an industrial area in the City of Santa Clara, to be acutely toxic to the water flea *(Ceriodaphnia dubia)* under laboratory conditions. Runoff from the catchment had elevated concentrations of zinc, copper, and lead.

The results of chemical monitoring of runoff suggest that metals in urban runoff can potentially cause toxicity to stream organisms; however, actual toxic effects are probably rare because of instream dilution, sorption, and speciation (BASMAA 1996). In addition, there is evidence that organophosphate pesticides (e.g., Diazinon) occur at concentrations toxic to *Ceriodaphnia dubia*; however, laboratory toxicity results have not been correlated to instream impacts (Katznelson and Mumley 1997).

Although urban land uses as a whole result in increased pollutant concentrations in runoff, the distinction among residential, commercial, and industrial land uses is statistically insignificant when compared with other sources of variability. In general, average pollutant concentrations in runoff do not vary significantly from one place to another within an urbanized watershed (Schueler 1987; Chandler 1994). Pollutant concentrations do increase when impervious cover is greater than 40 percent to 50 percent of the drainage area (Konnan 1999); however, runoff volume is the single most important variable for predicting pollutant loads (Charbeneau and Barrett 1998). A recent study in the Basin found that localized sources (e.g., fugitive emissions from electroplating operations) may elevate concentrations of copper and nickel in runoff from specific industrial sites. The study confirmed, however, that as a whole, different types of urban land uses do not produce significantly different concentrations of copper and nickel in runoff (Soller and Gallo 1998). This suggests that control of imperviousness and total quantity of runoff may be the most meaningful strategy for reducing urban runoff pollutant loads to the Bay.

Efforts to reduce pollutant concentrations in the Bay have focused on the total load of pollutants coming from the watershed and their long-term effects on biota. By contrast, the most significant pollutant effects on aquatic life in streams may be acute response to transitory phenomena. Anecdotal evidence links first-of-season rainstorms with low dissolved oxygen and fish kills in the Basin's urban creeks (Stevenson 1999). Throughout the year, illegal dumping incidents can cause severe, localized effects in creeks.

#### *4.1.6.4 Summary: Effects of Urbanization*

In summary, the beneficial uses of creeks, including those in the Basin, are sustained by:

- A characteristic surface water hydrology, including a bankfull discharge caused by the 1.5- to 2-year flood, with less-frequent floods causing periodic overbanking and extension onto the floodplain
- The sinuosity of the creeks, and movement within their floodplain, which creates and sustains a characteristic stream channel structure and variety of habitat types
- Groundwater inflows to some creek reaches, which determine the extent and annual duration of flow within the channels
- Characteristic extent and types of streamside vegetation

Alterations to creek hydrology, the disconnection of creeks from floodplains, and the loss of riparian vegetation have affected the ability of Basin streams to support healthy aquatic ecosystems. The evidence is mixed on whether pollutants from urban runoff have chronic effects on aquatic life. The long-term fate and effects of urban runoff pollutants in creeks depend on the transport of water and sediment between creek and floodplain, and movement of water and sediment down the stream corridor. Pulses of organic litter and illegally dumped materials can have localized, acute effects.

In the Basin, the spatial pattern of urbanization—a continuous swath of urbanized area across the valley floor—is key to the overall effects of land use on the watershed. That is, the degradation of Basin waterbodies is not so much due to the intensity of land use as it is that land uses are arranged without regard to the natural structure and functions of stream corridors.

### 4.1.7 Opportunities to Change Land Use and Development Patterns

#### *4.1.7.1 "Smart Growth"*

"Smart Growth" has been prescribed as the solution to sprawl. The Urban Land Institute defines smart growth this way:

> "Growth is inevitable, growth is necessary, but how growth is accommodated can be good or bad. In setting the framework for land development and redevelopment, we must

> focus on practices that are environmentally sound, economically vital, and that encourage livable communities—in other words, smart growth" (Pawlukiewicz, undated).

The concept of smart growth is considered new and distinctive (i.e., distinguished from earlier concepts such as "Green Development" [U.S. Environmental Protection Agency 1996]) in that it seeks to identify a common ground where developers, environmentalists, public officials, citizens, and financiers all can find ways to accommodate growth that is acceptable to each entity. Many public officials, citizens, and environmental groups have figured out that the way to get good projects built in the places that make fiscal and environmental sense is to do everything possible to make them economically successful. Projects that are the most sensitive to the environment and to community values should be given the best opportunity to succeed and should not be subject to costly delays and conditions.

On April 26, 1999, the California Senate adopted Senate Resolution 12 (Solis) relative to the use of "Smart Growth" approaches to land use and development.

The resolution indicates that more than 300 California organizations have called upon California officials to follow "Smart Growth" principles in addressing California's future growth and development, including all of the following:

1. Planning for the future, by making government more responsive, effective, and accountable through reforming the system of land use planning and public finance.

2. Promoting prosperous and livable communities, by making existing communities vital and healthy places for all residents to live, work, obtain an education, and raise a family.

3. Providing better housing and transportation opportunities, by developing efficient transportation alternatives and a range of housing choices affordable to all residents without jeopardizing farmland, open space, and wildlife habitat.

4. Conserving green space and the natural environment, by focusing new development in areas planned for growth while protecting air and water quality and providing green space for recreation, water recharge, and wildlife.

5. Protecting California's agricultural and forestlands, by shielding California's farm, range, and forest lands from sprawl and the pressure to convert farmland to development.

This resolution encourages the development of "Smart Growth" approaches to land use and development as an effective way to ensure California's economic prosperity, social equity, and environmental quality (Legislative Analyst 1999).

In the San Francisco Bay Region, the Bay Area Alliance for Sustainable Development—which includes economic development interests, environmental groups, advocates for social equity, and elected officials—envisions:

> …a Bay Area where the natural environment is vibrant, healthy and safe, where the economy is robust and globally competitive, and where all citizens have equitable opportunities to share in the benefits of a quality environment and a prosperous economy.…
>
> The Bay Area Alliance will work with others to identify and protect high-priority lands. We will seek resources to develop a regionwide plan and map showing which lands should be considered for preservation and which should be considered for development, consistent with sustainability criteria. These criteria should include compact, efficient development patterns that use land efficiently, match jobs with housing, link homes, jobs and services, and reduce dependence on motor vehicles. We will work to obtain funds for land protection and management, through acquisition and other means, to protect watersheds and preserve open space, agriculture, and natural resources. We will work with local and regional park and open space agencies, environmental organizations, and local governments to identify priority areas." (Bay Area Alliance for Sustainable Development 1998).

"Smart Growth" incorporates the protection of open space and natural resources, more efficient use of land, and acceptance of more dense development (through an agenda of urban livability and equity). Design of dense, livable multiuse urban spaces ("new urbanism") is a key component of "Smart Growth."

"Smart Growth" is consistent with many of the growth-management policies already adopted in Palo Alto, San Jose and other Basin municipalities. These policies are described in Chapter 6.4. Two current projects within the Basin exemplify the "new urbanism" approach to design and the "Smart Growth" approach to land use policy.

The City of San Jose is currently implementing the "Jackson-Taylor Revitalization Strategy" in a previously industrial area. The project's designer, Peter Calthorpe, describes this vision:

> This project represents a ubiquitous urban opportunity—to transform old rail-oriented industrial zones into mixed-use neighborhoods with excellent transit service…. Decaying industrial sites would redevelop adding density and diversity to a semisuburban section of town. Much of San Jose is marked by an odd combination of an urban street system and a low-rise, 1 DU/2 to 5 acres building fabric.… San Jose has done much to urbanize its downtown through intelligent planning, redevelopment, and a new light rail system. This project would extend this largely successful effort by beginning to create a series of urban nodes radiating from the central city.

> The plan provides for a gradual transition of a 75-acre area directly north of downtown from low-intensity industrial and residential uses to a mix of retail, office, and medium and high-density housing (Calthorpe 1993).

The second project is the Crossings Transit-Oriented Neighborhood Project in Mountain View, which is transforming a 1960s auto-oriented strip mall into a vibrant pedestrian-oriented community. Located adjacent to a new CalTrain commuter station, The Crossings provides a range of housing and retail opportunities, with single-family homes, townhouses, rowhouses, and apartments all located within a short walk of shopping and transit. An interconnected network of tree-lined streets and pedestrian paths knit this new mixed-use neighborhood together. Streets connect to an existing grocery store, allowing residents to walk directly to the store without crossing arterial streets. Community parks and open spaces are distributed throughout the 18-acre site (Calthorpe Associates 1999). Construction on the first phase of the project is nearly complete; 97 single-family homes and 30 townhouses have been completed or are under construction. For Phase II, TPG Development has proposed 240 more units consisting of 5 single-family homes, 132 apartments and 103 row houses. The City of Mountain View is currently reviewing the Phase II proposal (City of Mountain View 1999).

#### *4.1.7.2 Changing Land Use Patterns to Preserve and Enhance the Watershed*

The Federal Interagency Stream Restoration Working Group (1998) (after Schueler 1996a) recommends the following "key tools" for restoring urban streams:

1. Partially restore the predevelopment hydrological regime (e.g., by constructing upstream stormwater detention ponds).
2. Reduce urban pollutant pulses.
3. Stabilize channel morphology (e.g., bank stabilization using bioengineering methods).
4. Restore instream habitat structure that has been "blown out" by erosive floods (e.g., with log checkdams, wing deflectors, or boulder clusters along the stream channel).
5. Reestablish riparian cover.
6. Protect critical stream substrates and reduce clogging by fine sediment deposits (often, the energy of stormwater inflows can be used to create "cleaner" substrates).
7. Allow for recolonization of the stream community (e.g., by removing downstream fish barriers).

As the Working Group notes, "The best results are usually obtained when the following tools are applied together." (Federal Interagency Stream Restoration Working Group 1998).

Some of these tools (#4, #7) require no changes in land use pattern. Some reduction of urban pollutants (#2) is being implemented by municipal urban runoff pollution prevention programs (e.g., elimination of illicit discharges, inspection of industries, cleaning of stormdrains). However, most of the "tools"—most significantly, restoration of the hydrologic regime—would require restoring the landscape pattern that links creeks to floodplains in more or less continuous streamside corridors. Stormwater detention ponds, where appropriate and effective, would need to be located within or adjacent to these corridors. Therefore, preserving and enhancing the watershed will require changes to the spatial structure of land use in the Basin, from one continuous swath of urbanized land to a more fine-grained mosaic characterized by more intensely urbanized areas that are interstitial to broad, continuous stream corridors. Floodplains should be reconnected to streams, where feasible, and development within the floodplain should be designed to accommodate flooding.

Changes to land use patterns may take many decades to significantly improve watershed function; however, advocates of watershed preservation and enhancement should be encouraged by current efforts, already under way, to radically alter the urban fabric to enhance economic sustainability and improve the quality of life. In most cases, the land use pattern changes required to meet these objectives dovetail, rather than conflict, with the changes needed to enhance the watershed. There should be opportunities to apply the methods of landscape ecology to integrate "Smart Growth"- inspired development and redevelopment initiatives with restoration of crucial links between creeks and floodplains.

Richard Register (1987) uses a series of seven maps to illustrate his vision of a Bay Area city transformed, over 40 to 125 years, from a continuous urban swath to patches of intensely developed centers surrounded by agricultural and natural areas. Register's vision is that, even with a 50 percent increase in population, urbanized area would decrease 35 percent (Register 1987).

Implementation of changes in the Basin's land use patterns should not be tied to a utopian vision, however. Consistent with the "Smart Growth" idea, change must be implemented through consensus and practical extension of existing land use policies and initiatives.

#### *4.1.7.3 Linking Development/Redevelopment to Watershed Enhancement*

The Watershed Management Initiative's (WMI's) Land Use Subgroup developed a generalized approach to implementing land use changes that favor watershed enhancement (Santa Clara Basin Watershed Management Initiative 1999). As illustrated on Figure 4-1, land use planners must find ways to translate the "overall objectives" (e.g., goals and mission statements adopted by the WMI, the Bay Area Alliance for Sustainable Development, the California Legislature, and others) to specific municipal actions (i.e., public capital improvements and conditions of approval for private projects).

As is also illustrated on Figure 4-1, the Land Use Subgroup's approach is different than earlier efforts to mitigate the effects of new development on watersheds. In general, those early efforts focused on implementing design features or devices at specific sites without due regard to the characteristics of the surrounding watershed or the placement of the site within the watershed.

The key to changing the effects of land use on watersheds is to express watershed objectives spatially. A future land use pattern—one that protects and enhances the watershed—must be mapped.

The mapping would need to be at a geographic scale that is appropriate to the planning level. The Basin scale—i.e., the WMI's Watershed Management Plan—could map the general spatial objectives for land use change within the major stream and river corridors. Municipalities could consider these objectives for incorporation into their General Plans. The Basin-scale Watershed Management Plan could become the framework for local plans that map, in more detail, the spatial objectives appropriate to protect and enhance subwatersheds. These local plans could be incorporated into Specific Area Plans that would integrate the watershed objectives with social and economic considerations at the neighborhood level. Subwatershed-level Specific Area Plans could then be the basis for reviewing the watershed impacts of specific development projects—and for defining appropriate mitigations for those projects. This would enable municipal planners to address watershed impacts proactively. The mapping should also incorporate a time scale that is appropriate to the changes envisioned (probably measured in decades).

### 4.1.8 Methods for Reducing Impacts from Developed Sites

#### *4.1.8.1 Site Design Considerations*

Control and treatment of runoff requires considerable land area to store water long enough to settle or to infiltrate into the soil. The Metropolitan Washington Council of Governments (Schueler 1987) provided a comprehensive manual for designing "structural" best management practices. The Council updated the manual in 1992 (Schueler et al. 1992). Many of the same structural techniques were incorporated into the *California Storm Water Best Management Practices Handbooks* (California Stormwater Quality Task Force 1993). In 1994, staff from the San Francisco Bay Regional Water Quality Control Board provided guidance for implementing these techniques (Regional Board 1994).

Because runoff cannot be effectively controlled or treated in a small space, emphasis has shifted to site design elements that limit imperviousness and that disperse and infiltrate runoff, rather than collecting and treating it.

Imperviousness has been proposed as an indicator for the extent of urbanization (Schueler 1994). Proposed methods for controlling imperviousness tend to mix urban planning and design objectives (e.g., control of sprawl, and a more pedestrian-oriented urban environment) with site planning and design methods. The *Impervious Surface Reduction Study* (City of Olympia Public Works Department 1995) listed 19 recommendations, including policies to limit sprawl and cluster development, and provide public transit. Methods for reducing imperviousness of developed sites include narrower streets and alleys and the use of pervious paving (City of Olympia Public Works Department 1995).

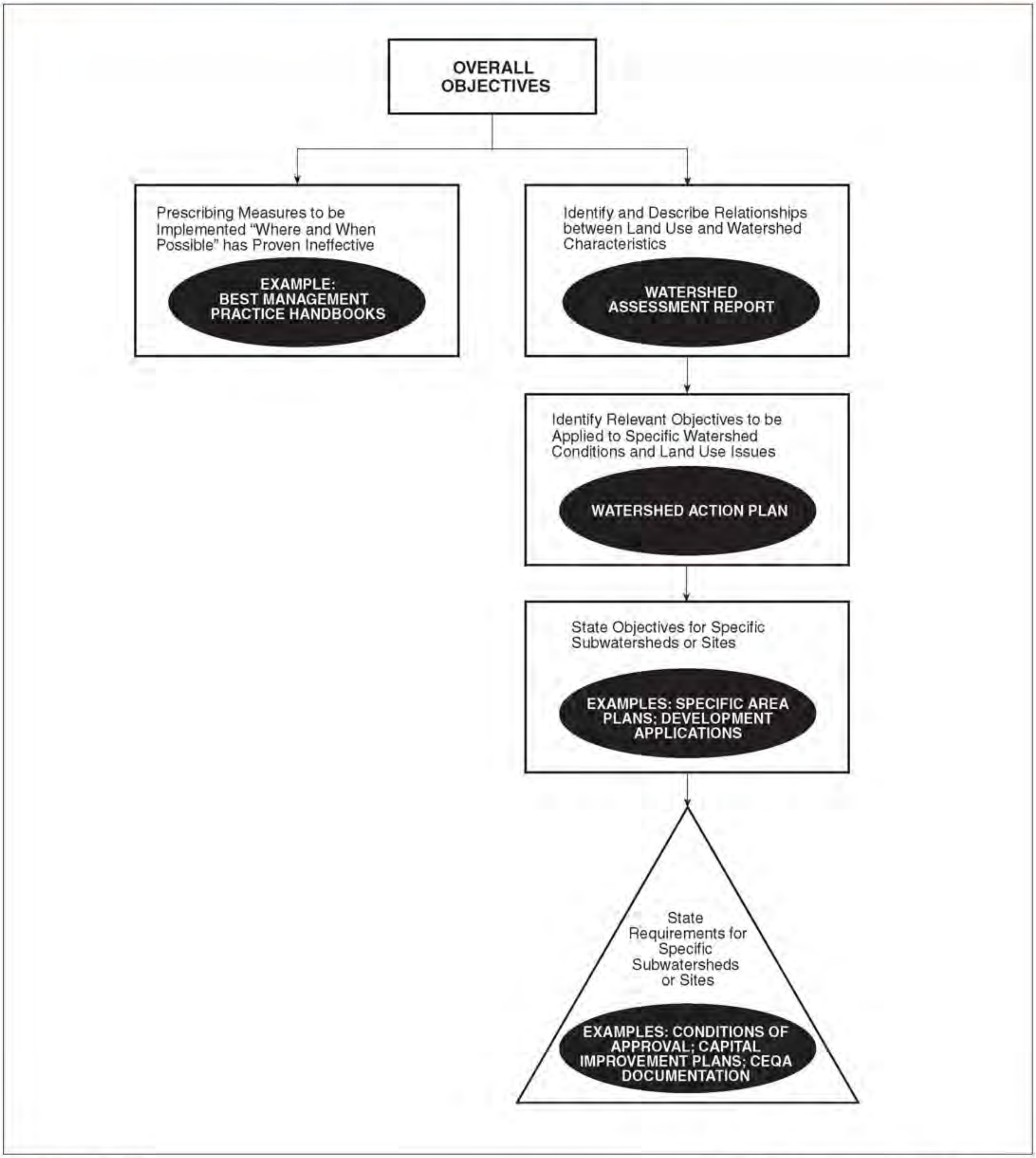
*Start at the Source,* a design guidance manual prepared by BASMAA, promotes "new urbanist" or "neotraditional" neighborhood design as a means of reducing imperviousness (BASMAA 1999). This includes detailed designs for narrower streets and driveways and methods for reducing parking demand. The manual advocates "using drainage as a design element" by integrating open drainage into landscapes, rather than piping runoff offsite. Most of the manual, however, is devoted to site designs and landscape details, with "case studies" showing how these can be applied to typical sites where residential and commercial development are planned. Some design details for street and parking lots are provided, as are details for the use of porous paving materials and for some infiltration devices, such as swales and detention basins.

*The Low Impact Development Design Manual*, prepared by Prince Georges County, Maryland (Prince Georges County Department of Environmental Resources 1997), emphasizes the use of hydrologic analysis, and setting of hydrologic objectives, as a precursor to site planning. *The Consensus Agreement On Model Development Principles To Protect Our Streams, Lakes, and Wetlands* codifies many of these principles and represents consensus reached by a group of planners, architects, engineers, and environmental advocates convened by the Center for Watershed Protection (1998a). Steps to implementing the principles are described in *Better Site Design: A Handbook for Changing Development Rules in Your Community* (Center for Watershed Protection 1998b). Wendy Edde, in a study for the San Mateo Stormwater Pollution Prevention Program (1999), describes methods and incentives used in Santa Monica, San Rafael, and Menlo Park, California, Olympia, Washington, and Charlotte, North Carolina, to reduce impervious surfaces for new developed and redeveloped sites.

Effective urban watershed management will require that site design standards mature beyond "do what you can, where you can" toward explicit consideration of site location and drainage to streams. Imperviousness may be of little account in one watershed location (e.g., in a low-lying district where drainage is pumped over a levee to a tidal slough), but critically important in another (e.g., in a medium-density area with moderate slopes and an intact riparian corridor).

Chapter 6.7.4 compares and contrasts some of the Basin municipalities' existing watershed protection policies. For the SCVURPPP, Pacific Municipal Consultants (1998) prepared a catalog of Basin municipalities' General Plan and Development-related policies, including riparian protection, open space preservation, imperviousness, and policies regarding automobile dependence and transportation use.

## FIGURE 4-1
## Process for Integrating Watershed Management into Land Use Decision Making




Source: EOA, Inc.

#### *4.1.8.2 Reducing Impacts from Existing Land Uses*

As described in its *1997 Urban Runoff Management Plan*, the SCVURPPP assists municipalities within the portion of Santa Clara County that drains to the South Bay, and the Santa Clara Valley Water District (Water District), to implement measures to prevent urban runoff pollutants from entering the stormdrain system.

Each municipality implements a comprehensive program to eliminate illegal discharges to stormdrains and to control pollutants in runoff from urban activities. The municipalities' efforts include response to spills and illegal dumping incidents, cleaning and maintenance of stormdrains, inspections of commercial and industrial facilities, inspections of construction sites, and public education and outreach. The municipalities also take steps to eliminate sources of pollutants related to their own capital improvements, and to ongoing maintenance of streets and public areas.

The SCVURPPP's and municipalities' extensive participation in the Land Use Subgroup is part of a joint effort to develop planning policies and development approval procedures that will protect and enhance the beneficial uses of streams, wetlands, and the South Bay most effectively. The Program and municipalities also participate in other aspects of the WMI.

### 4.1.9 Summary

The national angst over sprawl is often expressed as loss of community and sense of place and immersion in an ugly, environmentally degraded landscape. The origins of sprawl lie in utopian attempts to segregate land uses and develop ideal forms for the city based on romanticized views of nature and society. Despite the warnings of iconoclasts like Jane Jacobs, post-WWII land use and economic policies encouraged and subsidized suburban development. Economic polarization became reflected in urban geography, resulting in disempowered, high-poverty central cities and expansion of 1 DU/2 to 5 acres, high-cost, environmentally unsound development into ecologically sensitive areas. According to Orfield's analysis, this tendency threatens to accelerate unless actions are taken to reverse the trend.

Land uses in the Basin are characterized by a continuous swath of urban development. The primary watershed effects of this development are an increase in imperviousness, increased frequency of flooding, destabilized stream geomorphology, disconnection of streams from floodplains, and loss of riparian corridors. By comparison, toxic pollutants, although a concern, probably have less significant effects on the biological functions of streams. In general, pollutant loading is not a function of specific urban land use, but is related to imperviousness and total volume of runoff.

The California Senate and the Bay Area Alliance for Sustainable Development have adopted a policy of "Smart Growth," which endorses compact efficient development patterns and protection of watersheds and natural areas. Projects typifying "Smart Growth" and "New Urbanism" designs are being built in the Basin.

Enhancement of streams within the urbanized portion of the Basin will require partial restoration of the predevelopment hydrologic regime, including reconnection of streams with floodplains (where feasible) and restoration of riparian cover. This would require changes to the spatial structure of land use in the Basin, from one continuous swath of urbanized land to a more fine-grained mosaic characterized by more intensely urbanized areas that are interstitial to broad, continuous stream corridors.

The Watershed Management Plan should incorporate maps showing spatial objectives for land use changes. In this way, continuing development and redevelopment, as it occurs in the "Smart Growth" context, can contribute toward new spatial patterns that help protect and enhance the watershed.

Implementation of spatial objectives for land use change can best be accomplished through consensus and practical extension of existing land use policies and initiatives. Within newly developed and redeveloped areas, "low-impact" site design techniques, where appropriate, can best be implemented in the context of hydrologic objectives determined for the specific location within a subwatershed. Similarly, the municipalities' comprehensive urban runoff pollution prevention programs will be most effective when they are targeted to subwatershed-scale objectives.

# Patterns of Land Use

***The analysis of land use data presented in this chapter was completed prior to the provisional revision of the Baylands boundary. Information in the text, tables, and figures for the Baylands and Arroyo la Laguna watersheds do not reflect the boundary revisions. The previous boundaries on which the analysis was based are shown on Figure 4-12. The provisional revisions moved the Baylands found in the portion of the Basin that is in Alameda County from the Arroyo la Laguna watershed to the Baylands area.***

### 4.2.1 Introduction

The purpose of this chapter is to describe the distribution of existing and projected land uses in the Basin. Land uses can greatly influence ecosystem structure and function; thus, understanding patterns of land use in the Basin is an important aspect of the Assessment. While topography and climate influence the distribution of natural communities, and to an extent, the pattern of urbanization, land use patterns in the Basin are most influenced by human activities. The information in this chapter includes discussion of how both natural and human factors influence the distribution of land use in the Basin.

### 4.2.2 Methods

Patterns of existing land use and projected development were analyzed at four spatial scales: the Basin, its watersheds and subwatersheds, and municipal jurisdictions (Figures 4-2 and 4-3). Before characterizing the spatial distribution of land uses, appropriate data for land use and hydrologic features were identified. Factors considered are discussed below and included data completeness, accuracy, and precision. Values included in tables were either rounded to integers or to a single decimal.

#### *4.2.2.1 Existing Land Use*

Two land use data sets exist for the Basin: the 1995 data developed by the Association of Bay Area Governments (ABAG 1996), and data maintained by the Santa Clara County Assessor's Office. The ABAG land use data set was used for this analysis because it was the most accurate (all data current as of 1995), and its spatial resolution (1 hectare) was a suitable scale for analysis. ABAG's digital land use data set was established in 1985, based on the land use classification system established by the U.S. Geological Survey (ABAG 1996). ABAG updates this data set every 5 years, identifying land use changes by photointerpreting large-scale (1:3,000) aerial photography, and mapping groundtruthed data on the 1:24,000 base map. Lands that are protected by either public agencies, property easements, or private land trusts were identified using a data set (Bayareap) developed by the GreenInfo Network (GreenInfo Network 1998).

A complete description of how the ABAG 1995 land use data were classified for this analysis is included in Appendix 4A, Table 4A-1. Once classified, land use data were processed in a geographic information system (GIS). Spatial overlays between land use, protected lands, and hydrologic unit data (see next section for definitions) resulted in estimates of existing land uses for the Basin (Table 4-1, Figure 4-3), its watersheds (Tables 4-2 through 4-4, Figures 4-4 through 4-8), and its subwatersheds (Table 4-5, Figure 4-9).

#### *4.2.2.2 Hydrologic Units*

Watershed boundaries were delineated following the definition prescribed by Work Group C in a technical memorandum dated December 3, 1998: a hydrologic unit that drains to tidal waters of the Bay. In addition to the 13 watersheds so defined for the Basin, the tidally influenced area draining to the South Bay, referred to as the Baylands (Work Group C 1998), is also included in this analysis. Subwatersheds were defined by stream order (Strahler 1957). Figure 4-3 portrays Basin, watershed, and subwatershed boundaries, and Appendix 4B describes the process of identifying source data and spatial analyses used to define these respective boundaries. Subwatersheds were used as units of analysis because watershed management plans developed at the subwatershed scale have been most successful (Schueler 1996b), and the greatest success at correlating percent impervious area to environmental indicators of riparian corridors has been at this scale (Schueler 1995a).

#### *4.2.2.3 Jurisdictions*

The percentage of land uses within Santa Clara County municipalities was described previously by the SCVURPPP (1997). Their calculations are presented in Table 4-6, and trends are discussed below.

#### *4.2.2.4 Projected Development*

Projected development was analyzed using data (Projections '98) that ABAG developed by surveying local government land use policies (including general plans, zoning, urban growth boundaries, and other policies specific to land development) to determine the amount of land available for development between 1995 and 2020 (ABAG 1998). Unlike the existing land use data, which have a fine spatial resolution and numerous land use categories, the Projections '98 data were generated at a coarser spatial resolution (U.S. Census tracts[2]) and for fewer land use categories (residential and industrial/commercial only). Projections '98 includes the acreage of each Census tract expected to be developed, and the acreage projected to be available for development for each 5-year period starting from 1995. The available acreage category includes vacant and redevelopable land, but excludes parks, open space, agriculture, vacation homes, and rural residential housing (less than 1 dwelling unit [DU]/10 acres). Using these data, it was possible to calculate (1) the percent of Census tract and watershed acreage projected to be developed; and (2) the increase in the percent of each watershed projected to be developed for both categories of land use (Table 4-7, Figures 4-10 through 4-12). The process used to analyze the Projections '98 data is included in Appendix 4B. Watersheds with the greatest percentage of either residential or industrial/commercial development, or residential and industrial/commercial development were chosen by identifying those for which the percent watershed area, for the respective development classes, exceeded the median value for all watersheds.

### 4.2.3 Results

#### *4.2.3.1 Existing Land Use*

Existing land use is described at four spatial scales: for three hydrologic units–the basin, watersheds, and subwatersheds–and for municipalities. To understand subsequent sections, the following terms are defined: residential development is presented in terms of density, or DU/acre, and is grouped into three categories: 1 DU/2 to 5 acres, 1 to 3 DU/acre, and 4+ DU/acre.

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[2] Units used by the U.S. Government to survey demographics. Census tracts are small, relatively permanent statistical subdivisions of a county that are designed to be homogeneous with respect to population characteristics, economic status, and living conditions. Census tracts do not cross county boundaries. The spatial size of census tracts varies widely depending on the density of settlement. Census tract boundaries are delineated with the intention of being maintained over a long time to enable statistical comparisons between censuses.

**Table 4-1**
**Descriptive Statistics for the Percent of Existing Land Uses in Santa Clara Basin Watersheds**

| Existing Land Uses | Percent Land Uses in Basin | Percent Land Uses in Watersheds | | |
|---|---|---|---|---|
| | | Mean | Median | Standard Deviation |
| Residential, 4+ DU/acre | 21.5 | 29.7 | 32.1 | 18.0 |
| Residential, 1 to 3 DU/acre | 1.8 | 1.1 | 5.8 | 7.7 |
| Residential, 1 DU/2 to 5 acres | 0.1 | 0.6 | 0.7 | 0.6 |
| *Res. Subtotal*[1] | *23.4* | *30.2* | *36.0* | *18.4* |
| Commercial | 3.1 | 4.5 | 4.7 | 3.1 |
| Public, Quasi-Public | 2.5 | 3.1 | 5.7 | 7.3 |
| Industry - Heavy | 2.9 | 3.5 | 5.6 | 6.7 |
| Industry - Light | 1.3 | 1.9 | 2.9 | 2.7 |
| Transportation, Communication | 1.0 | 1.1 | 1.2 | 0.5 |
| Utilities | 0.2 | 0.2 | 0.9 | 1.2 |
| Land Fills | 0.0 | 0.7 | 0.7 | 0.5 |
| Mines, Quarries | 0.2 | 0.3 | 1.2 | 1.7 |
| *Ind/Com. Subtotal*[1] | *11.2* | *16.6* | *19.6* | *15.3* |
| Agriculture | 2.4 | 1.8 | 2.6 | 2.6 |
| Forest | 0.9 | 34.7 | 26.6 | 18.9 |
| Rangeland | 3.9 | 7.0 | 11.6 | 12.0 |
| Urban Recreation | 33.8 | 2.0 | 3.6 | 4.0 |
| Vacant, Undeveloped | 19.6 | 0.9 | 1.0 | 0.6 |
| Wetlands | 4.4 | 25.4 | 25.9 | 25.8 |
| *Subtotal* | *65.0* | *46.0* | *44.1* | *25.3* |
| Bays, Estuaries | 0.0 | na | na | na |
| Freshwater | 0.4 | 0.4 | 0.6 | 0.5 |

[1] Subtotals reflect land uses included in project development (Table 4-7) and may be compared.

## Table 4-2

### Acreage of Existing (1995) Land Uses for Watersheds in the Santa Clara Basin[1]

| Land Uses | Watersheds | | | | | | | | | | | | | | *Total Acres* |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Adobe | Arroyo la Laguna | Baylands | Calabazas | Coyote | Guadalupe | Matadero/ Barron | Lower Penitencia | Permanente | San Francisquito | San Tomas | Stevens | Sunnyvale East | Sunnyvale West | |
| Residential, 4 or more DU/acre | 2,700 | 11,280 | 1,991 | 6,986 | 17,651 | 31,988 | 4,841 | 5,478 | 4,795 | 2,027 | 15,267 | 4,474 | 2,975 | 1,016 | *113,470* |
| Residential, 1 to 3 DU/acre | 680 | - | 7 | 145 | 54 | 240 | 1,730 | 138 | 190 | 6,074 | 30 | 102 | - | - | *9,390* |
| Residential, 1 DU/2 to 5 acres | 0 | 76 | - | 152 | - | - | - | - | 155 | 25 | 159 | - | - | - | *570* |
| *Subtotal* | *3,380* | *11,360* | *2,000* | *7,280* | *17,710* | *32,230* | *6,570* | *5,620* | *5,140* | *8,130* | *15,460* | *4,580* | *2,980* | *1,020* | *123,460* |
| Commercial | 415 | 2,126 | 848 | 1,170 | 2,154 | 4,888 | 549 | 516 | 181 | 495 | 1,784 | 393 | 586 | 246 | *16,350* |
| Public/Quasi-Public | 232 | 931 | 323 | 656 | 1,785 | 2,777 | 1,435 | 539 | 406 | 707 | 1,534 | 202 | 356 | 1,378 | *13,260* |
| Industry - Heavy | 146 | 2,380 | 1,020 | 1,883 | 1,556 | 3,397 | 91 | 499 | 95 | 18 | 1,708 | 732 | 419 | 1,200 | *15,150* |
| Industry - Light | - | 1,817 | 60 | - | 996 | 2,049 | - | 1,386 | 168 | - | - | - | - | 236 | *6,710* |
| Transportation, Communication | 64 | 614 | 267 | 223 | 957 | 1,700 | 108 | 465 | 78 | 217 | 315 | 180 | 83 | 58 | *5,330* |
| Utilities | - | 32 | 828 | - | 70 | 15 | 1 | 1 | | 2 | 40 | 121 | 5 | 17 | *1,130* |
| Landfills | - | - | 6 | - | - | - | - | - | - | - | - | - | - | 34 | *40* |
| Mines, Quarries | - | 163 | - | - | 146 | 28 | - | 62 | 529 | - | - | 62 | - | - | *990* |
| *Subtotal* | *860* | *8,060* | *3,350* | *3,930* | *7,660* | *14,850* | *2,180* | *3,470* | *1,460* | *1,440* | *5,380* | *1,690* | *1,450* | *3,170* | *58,950* |
| Agriculture | 20 | 3,758 | 1,014 | 45 | 11,638 | 3,120 | - | 509 | - | 490 | 8 | 92 | - | 77 | *20,770* |
| Forest | 2,630 | 930 | - | 1,181 | 102,425 | 37,810 | 792 | 208 | 3,888 | 12,267 | 6,812 | 9,202 | - | - | *178,140* |
| Rangeland | 194 | 9,324 | 341 | 695 | 61,110 | 16,859 | 763 | 7,071 | 305 | 4,100 | 229 | 2,333 | - | 0 | *103,320* |
| Urban Recreation | 58 | 917 | 3,030 | 168 | 2,344 | 2,500 | 365 | 993 | 227 | 425 | 523 | 566 | 118 | 526 | *12,760* |
| Vacant, Undeveloped | 115 | 528 | 123 | 62 | 1,537 | 1,145 | 186 | 414 | 78 | 396 | 257 | 44 | 15 | 72 | *4,970* |
| Wetlands | - | 12,095 | 10,894 | - | - | - | - | - | - | 101 | - | - | - | - | *23,090* |
| *Subtotal* | *3,020* | *27,550* | *15,400* | *2,150* | *179,050* | *61,430* | *2,110* | *9,200* | *4,500* | *17,780* | *7,830* | *12,240* | *130* | *670* | *343,060* |
| Bays, Estuaries | - | - | 2 | - | - | - | - | - | - | - | - | - | - | - | *0* |
| Fresh Water | 1 | 665 | 209 | - | 720 | 399 | 1 | - | - | 72 | 15 | 183 | - | - | *2,270* |
| *Total Acres* | *7,260* | *47,600* | *21,000* | *13,400* | *205,100* | *108,900* | *10,900* | *18,300* | *11,100* | *27,400* | *28,700* | *18,700* | *4,560* | *4,860* | *527,700* |

[1]Analysis was completed prior to the provisional revision of the Baylands boundary, therefore, values depicted for Baylands and Arroyo la Laguna watersheds do not reflect boundary revisions.

**Table 4-3**
**Percent of Santa Clara Basin Watersheds by Existing (1995) Land Uses[1]**

| Watersheds / Land Uses | Adobe | Arroyo La Laguna | Baylands | Calabazas | Coyote | Guadalupe | Matadero/ Barron | Lower Penitencia | Permanente | San Francisquito | San Tomas | Stevens | Sunnyvale East | Sunnyvale West |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Residential, High-Density | 37.1 | 23.7 | 9.7 | 52.3 | 8.6 | 29.4 | 44.6 | 30.0 | 43.2 | 7.4 | 53.2 | 23.9 | 65.3 | 20.9 |
| Residential, Moderate-Density | 9.4 | - | < 0.1 | 1.1 | < 0.1 | 0.2 | 15.9 | 0.8 | 1.7 | 22.2 | 0.1 | 0.5 | - | - |
| Residential, Low-Density | < 0.1 | 0.2 | - | 1.1 | - | - | - | - | 1.4 | 0.1 | 0.6 | - | - | - |
| *Res. Subtotal** | *46.5* | *23.8* | *9.7* | *54.5* | *8.6* | *29.6* | *60.5* | *30.7* | *46.3* | *29.6* | *53.9* | *24.5* | *65.3* | *20.9* |
| Commercial | 5.7 | 4.5 | 4.1 | 8.8 | 1.1 | 4.5 | 5.1 | 2.8 | 1.6 | 1.8 | 6.2 | 2.1 | 12.9 | 5.1 |
| Public, Quasi-Public | 3.2 | 2.0 | 1.6 | 4.9 | 0.9 | 2.5 | 13.2 | 2.9 | 3.7 | 2.6 | 5.3 | 1.1 | 7.8 | 28.4 |
| Industry - Heavy | 2.0 | 5.0 | 4.9 | 14.1 | 0.8 | 3.1 | 0.8 | 2.7 | 0.9 | 0.1 | 6.0 | 3.9 | 9.2 | 24.7 |
| Industry - Light | - | 3.8 | 0.3 | - | 0.5 | 1.9 | - | 7.6 | 1.5 | - | - | - | - | 4.9 |
| Transportation, Communication | 0.9 | 1.3 | 1.3 | 1.7 | 0.5 | 1.6 | 1.0 | 2.5 | 0.7 | 0.8 | 1.1 | 1.0 | 1.8 | 1.2 |
| Utilities | - | 0.1 | 4.0 | - | < 0.1 | < 0.1 | < 0.1 | < 0.1 | - | < 0.1 | 0.1 | 0.6 | 0.1 | 0.3 |
| Land Fills | - | - | < 0.1 | - | - | - | - | - | - | - | - | - | - | 0.7 |
| Mines, Quarries | - | 0.3 | - | - | 0.1 | < 0.1 | < 0.1 | 0.3 | 4.8 | - | - | 0.3 | - | - |
| *Ind/Com. Subtotal** | *11.8* | *16.9* | *16.2* | *29.4* | *3.7* | *13.6* | *20.1* | *19.0* | *13.1* | *5.2* | *18.8* | *9.0* | *31.8* | *65.2* |
| Agriculture | 0.3 | 7.9 | 4.9 | 0.3 | 5.7 | 2.9 | - | 2.8 | - | 1.8 | 0.0 | 0.5 | - | 1.6 |
| Forest | 36.3 | 2.0 | - | 8.8 | 49.9 | 34.7 | 7.3 | 1.1 | 35.0 | 44.7 | 23.7 | 49.2 | - | - |
| Rangeland | 2.7 | 19.6 | 1.7 | 5.2 | 29.6 | 15.5 | 7.0 | 38.7 | 2.8 | 15.0 | 0.8 | 12.5 | - | 0.0 |
| Urban Recreation | 0.8 | 1.3 | 14.3 | 1.2 | 1.0 | 2.1 | 3.3 | 5.1 | 2.0 | 1.5 | 1.8 | 3.0 | 2.6 | 10.8 |
| Vacant, Undeveloped | 1.6 | 1.1 | 0.6 | 0.5 | 0.7 | 1.1 | 1.7 | 2.3 | 0.7 | 1.4 | 0.9 | 0.2 | 0.3 | 1.5 |
| Wetlands | - | 25.4 | 52.0 | - | - | - | - | - | - | 0.4 | - | - | - | - |
| *Subtotal* | *41.6* | *57.2* | *73.4* | *16.1* | *87.0* | *56.2* | *19.3* | *50.0* | *40.5* | *64.8* | *27.3* | *65.4* | *2.9* | *13.9* |
| Bays, Estuaries | - | - | < 0.1 | - | - | - | - | - | - | - | - | - | - | - |
| Freshwater | < 0.1 | 1.4 | 1.0 | - | 0.4 | 0.4 | 0.4 | - | - | 0.3 | 0.1 | 1.0 | - | - |

[1]Analysis was completed prior to the provisional revision of the Baylands boundary. Therefore, values depicted for the Baylands and the Arroyo la Laguna watershed do not reflect the revised boundary.

**Table 4-4**
**Percent Area Protected by Public Agencies, Property Easements, or Private Land Trusts for Watersheds in the Santa Clara Basin[1]**

| Watersheds | Area (ac) | Protected Area (ac) | Percent Area (ac) Protected |
|---|---|---|---|
| Adobe | 7,242 | 2,473 | 34.2 |
| Arroyo la Laguna | 47,636 | 14,392 | 30.2 |
| Baylands | 20,965 | 6,584 | 31.4 |
| Calabazas | 13,366 | 653 | 4.9 |
| Coyote | 205,145 | 58,031 | 28.3 |
| Guadalupe | 108,912 | 30,682 | 28.2 |
| Matadero/Barron | 10,864 | 620 | 5.7 |
| Lower Penitencia | 18,279 | 1,606 | 8.8 |
| Permanente | 11,096 | 2,180 | 19.7 |
| San Francisquito | 27,417 | 8,798 | 32.1 |
| San Tomas | 28,681 | 3,998 | 13.9 |
| Stevens | 18,686 | 6,619 | 35.4 |
| Sunnyvale East | 4,556 | 118 | 2.6 |
| Sunnyvale West | 4,857 | 285 | 5.9 |

[1] Analysis was completed prior to the provisional revision of the Baylands boundary. Therefore, values depicted for the Baylands and the Arroyo la Laguna watershed do not reflect the revised boundary.

**Table 4-5**
**Acreage of Existing (1995) Land Uses in Subwatersheds in the Santa Clara Basin[1, 2]**

| Watershed | Stream Order | Subwatershed | Land Use | Acreage |
|---|---|---|---|---|
| **Adobe** | 3 | Adobe | Agriculture | 19.8 |
| | | Adobe | Commercial | 415.0 |
| | | Adobe | Forest | 2,629.5 |
| | | Adobe | Freshwater | 1.3 |
| | | Adobe | Heavy Industrial | 146.0 |
| | | Adobe | Residential, 4+ DU/acre | 2,689.0 |
| | | Adobe | Residential, 1 DU/2 to 5 acres | 0.4 |
| | | Adobe | Residential, 1 to 3 DU/acre | 678.8 |
| | | Adobe | Public Quasi-Public | 231.5 |
| | | Adobe | Rangeland | 194.0 |
| | | Adobe | Transportation, Communication | 64.4 |
| | | Adobe | Urban Recreation | 57.6 |
| | | Adobe | Vacant Undeveloped | 115.0 |
| **Arroyo la Laguna** | 4 | Arroyo la Laguna | Agriculture | 3,757.7 |
| | | Arroyo la Laguna | Bays and Estuaries | 647.4 |
| | | Arroyo la Laguna | Commercial | 2,126.5 |
| | | Arroyo la Laguna | Forest | 929.5 |
| | | Arroyo la Laguna | Freshwater | 17.6 |
| | | Arroyo la Laguna | Heavy Industrial | 2,380.1 |
| | | Arroyo la Laguna | Residential, 4+ DU/acre | 11,280.5 |
| | | Arroyo la Laguna | Light Industrial | 1,817.1 |
| | | Arroyo la Laguna | Residential, 1 DU/2 to 5 acres | 75.7 |
| | | Arroyo la Laguna | Mines, Quarries, Gravel Pits | 162.7 |
| | | Arroyo la Laguna | Public/Quasi-Public | 930.9 |
| | | Arroyo la Laguna | Rangeland | 9,324.1 |
| | | Arroyo la Laguna | Transportation, Communication | 613.7 |
| | | Arroyo la Laguna | Urban Recreation | 652.5 |
| | | Arroyo la Laguna | Utilities | 32.1 |
| | | Arroyo la Laguna | Vacant/Undeveloped | 792.5 |
| | | Arroyo la Laguna | Wetlands | 12,095.2 |
| **Baylands** | 4 | Baylands | Agriculture | 1,013.6 |
| | | Baylands | Bays and Estuaries | 147.1 |
| | | Baylands | Commercial | 847.2 |
| | | Baylands | Freshwater | 64.2 |
| | | Baylands | Heavy Industrial | 1,014.6 |
| | | Baylands | Residential, 4+ DU/acre | 1,990.7 |
| | | Baylands | Light Industrial | 59.8 |
| | | Baylands | Residential, 1 to 3 DU/acre | 7.4 |
| | | Baylands | Public/Quasi-Public | 322.7 |
| | | Baylands | Rangeland | 341.3 |

**Table 4-5 (continued)**
**Acreage of Existing (1995) Land Uses in Subwatersheds in the Santa Clara Basin[1, 2]**

| Watershed | Stream Order | Subwatershed | Land Use | Acreage |
|---|---|---|---|---|
| | | Baylands | Sanitary Landfills | 5.9 |
| | | Baylands | Transportation, Communication | 261.2 |
| | | Baylands | Urban Recreation | 2,946.1 |
| | | Baylands | Utilities | 828.2 |
| | | Baylands | Vacant/Undeveloped | 131.2 |
| | | Baylands | Wetlands | 10,558.5 |
| **Calabazas** | 3 | Calabazas | Agriculture | 44.6 |
| | | Calabazas | Commercial | 1,169.9 |
| | | Calabazas | Forest | 1,181.1 |
| | | Calabazas | Heavy Industrial | 1,883.3 |
| | | Calabazas | Residential, 4+ DU/acre | 6,985.7 |
| | | Calabazas | Residential, 1 DU/2 to 5 acres | 152.3 |
| | | Calabazas | Residential, 1 to 3 DU/acre | 145.3 |
| | | Calabazas | Public/Quasi-Public | 655.8 |
| | | Calabazas | Rangeland | 694.7 |
| | | Calabazas | Transportation, Communication | 223.3 |
| | | Calabazas | Urban Recreation | 165.6 |
| | | Calabazas | Vacant/Undeveloped | 64.3 |
| **Coyote** | 2 | Coyote-A16 | Agriculture | 476.1 |
| | | Coyote-A16 | Forest | 4,369.1 |
| | | Coyote-A16 | Rangeland | 1,500.9 |
| | 2 | Coyote-A3 | Forest | 293.2 |
| | | Coyote-A3 | Freshwater | 0.6 |
| | | Coyote-A3 | Rangeland | 2,643.1 |
| | 2 | Coyote-A4 | Forest | 404.0 |
| | | Coyote-A4 | Rangeland | 1,757.9 |
| | 2 | Coyote-A9 | Forest | 2,095.1 |
| | 2 | Coyote-B1 | Forest | 2,022.1 |
| | | Coyote-B1 | Freshwater | 4.5 |
| | | Coyote-B1 | Rangeland | 438.5 |
| | 2 | Las Animas-1 | Agriculture | 64.0 |
| | | Las Animas-1 | Forest | 1,558.8 |
| | | Las Animas-1 | Residential, 4+ DU/acre | 106.3 |
| | | Las Animas-1 | Rangeland | 558.5 |
| | 2 | Upper Thompson | Forest | 1,111.7 |
| | | Upper Thompson | Residential, 4+ DU/acre | 27.3 |
| | | Upper Thompson | Rangeland | 1,652.5 |
| | 3 | Arroyo Aguague-1 | Forest | 2,878.2 |
| | | Arroyo Aguague-1 | Rangeland | 597.7 |
| | | Arroyo Aguague-2 | Forest | 1,502.2 |
| | | Arroyo Aguague-2 | Freshwater | 7.0 |

**Table 4-5 (continued)**
**Acreage of Existing (1995) Land Uses in Subwatersheds in the Santa Clara Basin[1, 2]**

| Watershed | Stream Order | Subwatershed | Land Use | Acreage |
|---|---|---|---|---|
| | | Arroyo Aguague-2 | Rangeland | 512.9 |
| | 3 | Coyote-A1 | Forest | 1,505.0 |
| | | Coyote-A1 | Rangeland | 2,466.9 |
| | 3 | Coyote-A11 | Forest | 1,994.4 |
| | 3 | Coyote-A12 | Forest | 1,789.1 |
| | 3 | Coyote-A13 | Forest | 2,387.8 |
| | | Coyote-A13 | Rangeland | 323.5 |
| | 3 | Coyote-A14 | Forest | 6,208.5 |
| | | Coyote-A14 | Rangeland | 967.9 |
| | 3 | Coyote-A2 | Forest | 91.6 |
| | | Coyote-A2 | Rangeland | 2,837.8 |
| | 3 | Coyote-C23 | Forest | 2,433.9 |
| | | Coyote-C23 | Rangeland | 212.5 |
| | 3 | Las Animas-2 | Agriculture | 1.6 |
| | | Las Animas-2 | Commercial | 39.6 |
| | | Las Animas-2 | Forest | 1,933.2 |
| | | Las Animas-2 | Residential, 4+ DU/acre | 34.6 |
| | | Las Animas-2 | Public/Quasi-Public | 202.7 |
| | | Las Animas-2 | Rangeland | 2,187.0 |
| | | Las Animas-2 | Vacant/Undeveloped | 7.4 |
| | 3 | Lower Thompson | Agriculture | 1,871.4 |
| | | Lower Thompson | Commercial | 916.2 |
| | | Lower Thompson | Forest | 1,814.8 |
| | | Lower Thompson | Heavy Industrial | 44.5 |
| | | Lower Thompson | Residential, 4+ DU/acre | 10,051.4 |
| | | Lower Thompson | Light Industrial | 195.9 |
| | | Lower Thompson | Residential, 1 to 3 DU/acre | 1.4 |
| | | Lower Thompson | Public/Quasi-Public | 846.6 |
| | | Lower Thompson | Rangeland | 7,377.7 |
| | | Lower Thompson | Transportation, Communication | 410.6 |
| | | Lower Thompson | Urban Recreation | 759.2 |
| | | Lower Thompson | Utilities | 12.4 |
| | | Lower Thompson | Vacant/Undeveloped | 460.3 |
| | 3 | Packwood | Forest | 6,071.5 |
| | | Packwood | Rangeland | 755.4 |
| | 3 | San Felipe-1 | Forest | 4,319.2 |
| | | San Felipe-1 | Freshwater | 32.6 |
| | | San Felipe-1 | Rangeland | 1,170.4 |
| | 3 | San Felipe-2 | Forest | 2,039.4 |
| | | San Felipe-2 | Rangeland | 644.0 |
| | 3 | San Felipe-4 | Forest | 2,183.3 |
| | | San Felipe-4 | Rangeland | 335.1 |

**Table 4-5 (continued)**
**Acreage of Existing (1995) Land Uses in Subwatersheds in the Santa Clara Basin[1, 2]**

| Watershed | Stream Order | Subwatershed | Land Use | Acreage |
|---|---|---|---|---|
| | 3 | San Felipe-5 | Forest | 2,966.6 |
| | | San Felipe-5 | Rangeland | 300.4 |
| | 3 | Upper Penitencia-1 | Forest | 3,165.5 |
| | | Upper Penitencia-1 | Freshwater | 24.7 |
| | | Upper Penitencia-1 | Residential, 4+ DU/acre | 1.6 |
| | | Upper Penitencia-1 | Rangeland | 645.1 |
| | 3 | Upper Silver | Residential, 4+ DU/acre | 119.9 |
| | | Upper Silver | Mines, Quarries, Gravel Pits | 5.3 |
| | | Upper Silver | Rangeland | 2,870.1 |
| | | Upper Silver | Transportation, Communication | 4.9 |
| | | Upper Silver | Urban Recreation | 1.9 |
| | | Upper Silver | Vacant/Undeveloped | 437.6 |
| | 3 | Willow Springs | Agriculture | 4,091.1 |
| | | Willow Springs | Commercial | 59.5 |
| | | Willow Springs | Forest | 1,425.3 |
| | | Willow Springs | Heavy Industrial | 2.5 |
| | | Willow Springs | Residential, 4+ DU/acre | 181.5 |
| | | Willow Springs | Public/Quasi-Public | 71.8 |
| | | Willow Springs | Rangeland | 3,296.8 |
| | | Willow Springs | Transportation, Communication | 5.5 |
| | | Willow Springs | Urban Recreation | 27.2 |
| | | Willow Springs | Vacant/Undeveloped | 21.9 |
| | 4 | Coyote A2a | Forest | 9,375.6 |
| | | Coyote A2a | Freshwater | 0.0 |
| | | Coyote A2a | Rangeland | 5,652.5 |
| | 4 | Coyote-A8 | Forest | 8,472.9 |
| | | Coyote-A8 | Rangeland | 3,971.8 |
| | 4 | San Felipe-3 | Agriculture | 868.8 |
| | | San Felipe-3 | Forest | 8,861.0 |
| | | San Felipe-3 | Freshwater | 22.3 |
| | | San Felipe-3 | Rangeland | 2,001.3 |
| | 4 | Upper Penitencia-2 | Agriculture | 164.9 |
| | | Upper Penitencia-2 | Commercial | 89.7 |
| | | Upper Penitencia-2 | Forest | 2,464.2 |
| | | Upper Penitencia-2 | Heavy Industrial | 74.5 |
| | | Upper Penitencia-2 | Residential, 4+ DU/acre | 1,247.3 |
| | | Upper Penitencia-2 | Light Industrial | 62.6 |
| | | Upper Penitencia-2 | Residential, 1 to 3 DU/acre | 53.0 |
| | | Upper Penitencia-2 | Public/Quasi-Public | 37.9 |
| | | Upper Penitencia-2 | Rangeland | 1,888.2 |
| | | Upper Penitencia-2 | Transportation, Communication | 26.6 |
| | | Upper Penitencia-2 | Urban Recreation | 21.9 |

**Table 4-5 (continued)**
**Acreage of Existing (1995) Land Uses in Subwatersheds in the Santa Clara Basin[1, 2]**

| Watershed | Stream Order | Subwatershed | Land Use | Acreage |
|---|---|---|---|---|
| | | Upper Penitencia-2 | Vacant/Undeveloped | 39.3 |
| | 5 | Coyote Mainstem | Agriculture | 4,100.7 |
| | | Coyote Mainstem | Commercial | 1,049.0 |
| | | Coyote Mainstem | Forest | 14,689.2 |
| | | Coyote Mainstem | Freshwater | 628.3 |
| | | Coyote Mainstem | Heavy Industrial | 1,434.9 |
| | | Coyote Mainstem | Residential, 4+ DU/acre | 5,880.8 |
| | | Coyote Mainstem | Light Industrial | 737.5 |
| | | Coyote Mainstem | Mines, Quarries, Gravel Pits | 140.2 |
| | | Coyote Mainstem | Public/Quasi-Public | 626.3 |
| | | Coyote Mainstem | Rangeland | 11,532.4 |
| | | Coyote Mainstem | Transportation, Communication | 509.0 |
| | | Coyote Mainstem | Urban Recreation | 1,346.0 |
| | | Coyote Mainstem | Utilities | 58.0 |
| | | Coyote Mainstem | Vacant/Undeveloped | 758.4 |
| **Guadalupe** | 2 | Canoas | Agriculture | 397.6 |
| | | Canoas | Commercial | 283.4 |
| | | Canoas | Residential, 4+ DU/acre | 2,349.8 |
| | | Canoas | Light Industrial | 11.6 |
| | | Canoas | Mines, Quarries, Gravel Pits | 2.8 |
| | | Canoas | Public/Quasi-Public | 141.3 |
| | | Canoas | Rangeland | 187.0 |
| | | Canoas | Transportation, Communication | 170.0 |
| | | Canoas | Urban Recreation | 38.7 |
| | | Canoas | Vacant/Undeveloped | 164.5 |
| | 2 | McAbee | Commercial | 46.4 |
| | | McAbee | Forest | 818.7 |
| | | McAbee | Residential, 4+ DU/acre | 1,081.8 |
| | | McAbee | Public/Quasi-Public | 17.3 |
| | | McAbee | Rangeland | 19.9 |
| | | McAbee | Urban Recreation | 92.6 |
| | 2 | Ross | Agriculture | 131.1 |
| | | Ross | Commercial | 308.4 |
| | | Ross | Forest | 804.6 |
| | | Ross | Residential, 4+ DU/acre | 4,513.4 |
| | | Ross | Light Industrial | 0.9 |
| | | Ross | Residential, 1 to 3 DU/acre | 54.6 |
| | | Ross | Public/Quasi-Public | 256.9 |
| | | Ross | Rangeland | 34.5 |
| | | Ross | Transportation, Communication | 21.9 |
| | | Ross | Urban Recreation | 119.4 |
| | | Ross | Vacant/Undeveloped | 57.8 |

**Table 4-5 (continued)**
**Acreage of Existing (1995) Land Uses in Subwatersheds in the Santa Clara Basin[1, 2]**

| Watershed | Stream Order | Subwatershed | Land Use | Acreage |
|---|---|---|---|---|
| | 2 | Santa Teresa | Agriculture | 412.7 |
| | | Santa Teresa | Commercial | 562.3 |
| | | Santa Teresa | Forest | 223.2 |
| | | Santa Teresa | Heavy Industrial | 225.0 |
| | | Santa Teresa | Residential, 4+ DU/acre | 3,810.2 |
| | | Santa Teresa | Light Industrial | 275.3 |
| | | Santa Teresa | Residential, 1 to 3 DU/acre | 12.9 |
| | | Santa Teresa | Public/Quasi-Public | 331.3 |
| | | Santa Teresa | Rangeland | 1,792.8 |
| | | Santa Teresa | Transportation, Communication | 82.4 |
| | | Santa Teresa | Urban Recreation | 262.1 |
| | | Santa Teresa | Vacant/Undeveloped | 161.6 |
| | 3 | Calero | Agriculture | 565.9 |
| | | Calero | Commercial | 18.6 |
| | | Calero | Forest | 2,661.3 |
| | | Calero | Freshwater | 17.3 |
| | | Calero | Residential, 4+ DU/acre | 402.2 |
| | | Calero | Light Industrial | 19.8 |
| | | Calero | Residential, 1 to 3 DU/acre | 160.2 |
| | | Calero | Rangeland | 4,166.0 |
| | | Calero | Vacant/Undeveloped | 35.9 |
| | 3 | Upper Guadalupe | Agriculture | 74.2 |
| | | Upper Guadalupe | Commercial | 63.6 |
| | | Upper Guadalupe | Forest | 7,471.7 |
| | | Upper Guadalupe | Freshwater | 5.1 |
| | | Upper Guadalupe | Residential, 4+ DU/acre | 723.3 |
| | | Upper Guadalupe | Light Industrial | 0.5 |
| | | Upper Guadalupe | Residential, 1 to 3 DU/acre | 12.3 |
| | | Upper Guadalupe | Public/Quasi-Public | 11.6 |
| | | Upper Guadalupe | Rangeland | 907.3 |
| | | Upper Guadalupe | Urban Recreation | 185.8 |
| | | Upper Guadalupe | Vacant/Undeveloped | 34.2 |
| | 4 | Alamitos | Agriculture | 477.5 |
| | | Alamitos | Commercial | 1,023.2 |
| | | Alamitos | Forest | 8,847.5 |
| | | Alamitos | Freshwater | 91.3 |
| | | Alamitos | Heavy Industrial | 93.3 |
| | | Alamitos | Residential, 4+ DU/acre | 7,621.5 |
| | | Alamitos | Light Industrial | 460.5 |
| | | Alamitos | Mines, Quarries, Gravel Pits | 7.4 |
| | | Alamitos | Public/Quasi-Public | 480.8 |
| | | Alamitos | Rangeland | 2,939.1 |

**Table 4-5 (continued)**
**Acreage of Existing (1995) Land Uses in Subwatersheds in the Santa Clara Basin[1, 2]**

| Watershed | Stream Order | Subwatershed | Land Use | Acreage |
|---|---|---|---|---|
| | | Alamitos | Transportation, Communication | 219.9 |
| | | Alamitos | Urban Recreation | 198.0 |
| | | Alamitos | Utilities | 7.4 |
| | | Alamitos | Vacant/Undeveloped | 144.8 |
| | 4 | Los Gatos | Agriculture | 224.5 |
| | | Los Gatos | Commercial | 1,147.4 |
| | | Los Gatos | Forest | 16,980.7 |
| | | Los Gatos | Freshwater | 285.0 |
| | | Los Gatos | Heavy Industrial | 251.8 |
| | | Los Gatos | Residential, 4+ DU/acre | 7,585.1 |
| | | Los Gatos | Light Industrial | 306.2 |
| | | Los Gatos | Mines, Quarries, Gravel Pits | 17.3 |
| | | Los Gatos | Public/Quasi-Public | 492.9 |
| | | Los Gatos | Rangeland | 6,805.4 |
| | | Los Gatos | Transportation, Communication | 404.2 |
| | | Los Gatos | Urban Recreation | 300.6 |
| | | Los Gatos | Utilities | 4.9 |
| | | Los Gatos | Vacant/Undeveloped | 453.9 |
| | 5 | Lower Guadalupe | Agriculture | 836.8 |
| | | Lower Guadalupe | Commercial | 1,433.7 |
| | | Lower Guadalupe | Heavy Industrial | 2,827.6 |
| | | Lower Guadalupe | Residential, 4+ DU/acre | 3,901.0 |
| | | Lower Guadalupe | Light Industrial | 973.9 |
| | | Lower Guadalupe | Public/Quasi-Public | 1,044.3 |
| | | Lower Guadalupe | Rangeland | 7.4 |
| | | Lower Guadalupe | Transportation, Communication | 801.3 |
| | | Lower Guadalupe | Urban Recreation | 1,085.1 |
| | | Lower Guadalupe | Utilities | 2.5 |
| | | Lower Guadalupe | Vacant/Undeveloped | 310.8 |
| **Lower Penitencia** | 4 | Lower Penitencia | Agriculture | 509.1 |
| | | Lower Penitencia | Commercial | 516.3 |
| | | Lower Penitencia | Forest | 207.7 |
| | | Lower Penitencia | Heavy Industrial | 498.6 |
| | | Lower Penitencia | Residential, 4+ DU/acre | 5,478.2 |
| | | Lower Penitencia | Light Industrial | 1,386.1 |
| | | Lower Penitencia | Mines, Quarries, Gravel Pits | 61.8 |
| | | Lower Penitencia | Residential, 1 to 3 DU/acre | 138.4 |
| | | Lower Penitencia | Public/Quasi-Public | 538.6 |
| | | Lower Penitencia | Rangeland | 7,071.0 |
| | | Lower Penitencia | Transportation, Communication | 465.5 |
| | | Lower Penitencia | Urban Recreation | 966.3 |
| | | Lower Penitencia | Utilities | 0.5 |
| | | Lower Penitencia | Vacant/Undeveloped | 441.1 |

**Table 4-5 (continued)**
**Acreage of Existing (1995) Land Uses in Subwatersheds in the Santa Clara Basin[1, 2]**

| Watershed | Stream Order | Subwatershed | Land Use | Acreage |
|---|---|---|---|---|
| **Matadero/Barron** | 1 | Barron | Commercial | 87.1 |
| | | Barron | Forest | 1.2 |
| | | Barron | Heavy Industrial | 36.2 |
| | | Barron | Residential, 4+ DU/acre | 555.4 |
| | | Barron | Residential, 1 to 3 DU/acre | 911.8 |
| | | Barron | Public/Quasi-Public | 186.3 |
| | | Barron | Rangeland | 28.4 |
| | | Barron | Urban Recreation | 118.7 |
| | | Barron | Vacant/Undeveloped | 5.0 |
| | 3 | Matadero | Commercial | 462.4 |
| | | Matadero | Forest | 791.0 |
| | | Matadero | Freshwater | 1.2 |
| | | Matadero | Heavy Industrial | 55.1 |
| | | Matadero | Residential, 4+ DU/acre | 4,285.4 |
| | | Matadero | Residential, 1 to 3 DU/acre | 818.6 |
| | | Matadero | Public/Quasi-Public | 1,249.3 |
| | | Matadero | Rangeland | 734.8 |
| | | Matadero | Transportation, Communication | 107.8 |
| | | Matadero | Urban Recreation | 236.9 |
| | | Matadero | Utilities | 0.8 |
| | | Matadero | Vacant/Undeveloped | 190.4 |
| **Permanente** | 3 | Permanente | Commercial | 181.0 |
| | | Permanente | Forest | 3,888.4 |
| | | Permanente | Heavy Industrial | 94.6 |
| | | Permanente | Residential, 4+ DU/acre | 4,794.9 |
| | | Permanente | Light Industrial | 168.1 |
| | | Permanente | Residential, 1 DU/2 to 5 acres | 155.4 |
| | | Permanente | Mines, Quarries, Gravel Pits | 529.3 |
| | | Permanente | Residential, 1 to 3 DU/acre | 190.2 |
| | | Permanente | Public/Quasi-Public | 406.3 |
| | | Permanente | Rangeland | 305.3 |
| | | Permanente | Transportation, Communication | 77.8 |
| | | Permanente | Urban Recreation | 225.0 |
| | | Permanente | Vacant/Undeveloped | 80.1 |
| **San Francisquito** | 1 | Alambique | Agriculture | 4.9 |
| | | Alambique | Forest | 1,157.1 |
| | | Alambique | Freshwater | 1.3 |
| | | Alambique | Residential, 1 DU/2 to 5 acres | 8.2 |
| | | Alambique | Residential, 1 to 3 DU/acre | 239.8 |
| | | Alambique | Rangeland | 134.3 |
| | | Alambique | Wetlands | 16.1 |
| | 3 | Alpine | Agriculture | 30.0 |
| | | Alpine | Commercial | 22.4 |

| Table 4-5 (continued)<br>Acreage of Existing (1995) Land Uses in Subwatersheds in the Santa Clara Basin[1, 2] | | | | |
|---|---|---|---|---|
| **Watershed** | **Stream Order** | **Subwatershed** | **Land Use** | **Acreage** |
| | | Alpine | Forest | 2,451.1 |
| | | Alpine | Freshwater | 14.3 |
| | | Alpine | Residential, 4+ DU/acre | 90.0 |
| | | Alpine | Residential, 1 to 3 DU/acre | 1,215.0 |
| | | Alpine | Public/Quasi-Public | 32.1 |
| | | Alpine | Rangeland | 1,123.2 |
| | | Alpine | Urban Recreation | 22.8 |
| | | Alpine | Wetlands | 17.8 |
| | 3 | Bozzo | Agriculture | 96.5 |
| | | Bozzo | Commercial | 17.3 |
| | | Bozzo | Forest | 1,193.2 |
| | | Bozzo | Freshwater | 21.0 |
| | | Bozzo | Residential, 4+ DU/acre | 22.9 |
| | | Bozzo | Residential, 1 DU/2 to 5 acres | 4.9 |
| | | Bozzo | Residential, 1 to 3 DU/acre | 866.1 |
| | | Bozzo | Public/Quasi-Public | 9.9 |
| | | Bozzo | Rangeland | 443.8 |
| | | Bozzo | Urban Recreation | 56.9 |
| | | Bozzo | Wetlands | 67.5 |
| | 3 | Los Trancos | Agriculture | 41.4 |
| | | Los Trancos | Commercial | 43.3 |
| | | Los Trancos | Forest | 1,747.3 |
| | | Los Trancos | Freshwater | 20.8 |
| | | Los Trancos | Residential, 4+ DU/acre | 127.9 |
| | | Los Trancos | Residential, 1 to 3 DU/acre | 1,421.4 |
| | | Los Trancos | Rangeland | 1,051.5 |
| | | Los Trancos | Transportation, Communication | 53.2 |
| | | Los Trancos | Urban Recreation | 11.9 |
| | | Los Trancos | Vacant/Undeveloped | 306.1 |
| | 3 | West Union | Agriculture | 128.6 |
| | | West Union | Commercial | 1.3 |
| | | West Union | Forest | 4,677.1 |
| | | West Union | Freshwater | 14.8 |
| | | West Union | Residential, 1 DU/2 to 5 acres | 11.6 |
| | | West Union | Residential, 1 to 3 DU/acre | 2,157.5 |
| | | West Union | Public/Quasi-Public | 16.0 |
| | | West Union | Rangeland | 376.7 |
| | | West Union | Transportation, Communication | 45.1 |
| | | West Union | Urban Recreation | 7.4 |
| | | West Union | Vacant/Undeveloped | 42.0 |
| | 4 | San Francisquito | Agriculture | 188.3 |
| | | San Francisquito | Commercial | 410.5 |
| | | San Francisquito | Forest | 1,041.2 |

**Table 4-5 (continued)**
**Acreage of Existing (1995) Land Uses in Subwatersheds in the Santa Clara Basin[1, 2]**

| Watershed | Stream Order | Subwatershed | Land Use | Acreage |
|---|---|---|---|---|
| | | San Francisquito | Heavy Industrial | 18.3 |
| | | San Francisquito | Residential, 4+ DU/acre | 1,786.4 |
| | | San Francisquito | Residential, 1 to 3 DU/acre | 174.8 |
| | | San Francisquito | Public/Quasi-Public | 648.8 |
| | | San Francisquito | Rangeland | 970.3 |
| | | San Francisquito | Transportation, Communication | 118.1 |
| | | San Francisquito | Urban Recreation | 316.7 |
| | | San Francisquito | Utilities | 2.5 |
| | | San Francisquito | Vacant/Undeveloped | 57.7 |
| **San Tomas** | 4 | San Tomas-Aquino | Commercial | 990.4 |
| | | San Tomas-Aquino | Forest | 1,366.5 |
| | | San Tomas-Aquino | Heavy Industrial | 27.8 |
| | | San Tomas-Aquino | Residential, 4+ DU/acre | 10,301.6 |
| | | San Tomas-Aquino | Residential, 1 DU/2 to 5 acres | 158.2 |
| | | San Tomas-Aquino | Residential, 1 to 3 DU/acre | 15.7 |
| | | San Tomas-Aquino | Public/Quasi-Public | 744.6 |
| | | San Tomas-Aquino | Transportation, Communication | 189.4 |
| | | San Tomas-Aquino | Urban Recreation | 265.5 |
| | | San Tomas-Aquino | Utilities | 39.6 |
| | | San Tomas-Aquino | Vacant/Undeveloped | 172.7 |
| | 4 | Saratoga | Agriculture | 8.3 |
| | | Saratoga | Commercial | 793.7 |
| | | Saratoga | Forest | 5,444.7 |
| | | Saratoga | Freshwater | 14.5 |
| | | Saratoga | Heavy Industrial | 1,679.7 |
| | | Saratoga | Residential, 4+ DU/acre | 4,965.1 |
| | | Saratoga | Residential, 1 DU/2 to 5 acres | 1.0 |
| | | Saratoga | Residential, 1 to 3 DU/acre | 14.0 |
| | | Saratoga | Public/Quasi-Public | 789.7 |
| | | Saratoga | Rangeland | 229.5 |
| | | Saratoga | Transportation, Communication | 125.7 |
| | | Saratoga | Urban Recreation | 253.0 |
| | | Saratoga | Vacant/Undeveloped | 88.9 |
| **Stevens Creek** | 3 | Stevens Creek | Agriculture | 92.2 |
| | | Stevens Creek | Commercial | 393.0 |
| | | Stevens Creek | Forest | 9,195.4 |
| | | Stevens Creek | Freshwater | 182.9 |
| | | Stevens Creek | Heavy Industrial | 732.3 |
| | | Stevens Creek | Residential, 4+ DU/acre | 4,473.7 |
| | | Stevens Creek | Mines, Quarries, Gravel Pits | 61.6 |
| | | Stevens Creek | Residential, 1 to 3 DU/acre | 102.0 |
| | | Stevens Creek | Public/Quasi-Public | 202.0 |
| | | Stevens Creek | Rangeland | 2,332.6 |

**Table 4-5 (concluded)**
**Acreage of Existing (1995) Land Uses in Subwatersheds in the Santa Clara Basin[1, 2]**

| Watershed | Stream Order | Subwatershed | Land Use | Acreage |
|---|---|---|---|---|
| | | Stevens Creek | Transportation, Communication | 180.4 |
| | | Stevens Creek | Urban Recreation | 565.7 |
| | | Stevens Creek | Utilities | 121.2 |
| | | Stevens Creek | Vacant/Undeveloped | 44.3 |
| **Sunnyvale East** | 1 | Sunnyvale East | Commercial | 586.1 |
| | | Sunnyvale East | Heavy Industrial | 419.4 |
| | | Sunnyvale East | Residential, 4+ DU/acre | 2,975.3 |
| | | Sunnyvale East | Public/Quasi-Public | 355.6 |
| | | Sunnyvale East | Transportation, Communication | 82.7 |
| | | Sunnyvale East | Urban Recreation | 117.8 |
| | | Sunnyvale East | Utilities | 4.9 |
| | | Sunnyvale East | Vacant/Undeveloped | 14.8 |
| **Sunnyvale West** | 1 | Sunnyvale West | Agriculture | 76.6 |
| | | Sunnyvale West | Commercial | 245.7 |
| | | Sunnyvale West | Heavy Industrial | 1,199.6 |
| | | Sunnyvale West | Residential, 4+ DU/acre | 1,016.0 |
| | | Sunnyvale West | Light Industrial | 235.8 |
| | | Sunnyvale West | Public/Quasi-Public | 1,377.7 |
| | | Sunnyvale West | Rangeland | 0.1 |
| | | Sunnyvale West | Sanitary Landfills | 33.7 |
| | | Sunnyvale West | Transportation, Communication | 57.9 |
| | | Sunnyvale West | Urban Recreation | 526.0 |
| | | Sunnyvale West | Utilities | 16.5 |
| | | Sunnyvale West | Vacant/Undeveloped | 71.5 |

[1] Numbers associated with subwatershed names correspond to the naming convention applied by the Water District and uniquely identify subwatersheds with similar prefixes.
[2] Analysis was completed prior to the provisional revision of the Baylands boundary. Therefore, values depicted for the Baylands and the Arroyo la Laguna watershed do not reflect the revised boundary.

## Table 4-6
## Existing Land Use in Santa Clara County Communities

| Community | Land Area (mi²) | Land Area (ac) | Population (1996)[2] | Estimated Percent of Land Area[1] | | | | | | | | | % Built Out |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Single-Family Res. | Multiple-Family Res. | Commercial | Light Industrial | Heavy Industrial | Public/ Institutional | Parks/ Open Space | Vacant/Raw/ Agricultural Land | Road-ways | |
| Cupertino | 10.4 | 6,656 | 43,650 | 39 | 2 | 8 | 4 | – | 7 | 15 | 8 | 17 | 92 |
| Los Altos | 6.6 | 4,224 | 27,000 | 64 | 7 | 3 | – | – | 6 | 1 | 2 | 17 | 99 |
| Los Altos Hills | 8.4 | 5,376 | 7,800 | 70 | – | – | – | – | 10 | 15 | [8] | 5 | 95 |
| Milpitas | 13.5 | 8,640 | 59,700 | 31 | 5 | 6 | 7 | 10 | 1 | 2 | 26 | 5 | 74 |
| Mountain View | 12.3 | 7,872 | 71,300 | 22 | 22 | 11 | 15 | 4 | 9[4] | 12 | 5 | 18 | 98 |
| Palo Alto | 26 | 16,640 | 58,500 | 19 | 3 | 2 | 7 | 0 | 26 | 37 | 1 | 5 | 99 |
| San Jose[7] | 173.6 | 111,104 | 849,400 | – | 59[6] | 4 | – | 9[5] | 9 | 5 | 13 | – | 83 |
| Santa Clara | 19.3 | 12,352 | 98,000 | 29 | 7 | 7 | 15 | 6 | 8 | 6 | 4 | 18 | |
| Sunnyvale | 25 | 16,000 | 126,100 | 29 | 15 | 7 | – | 18[5] | 9 | 18 | 3 | 2 | 96 |
| Campbell | 6 | 3,840 | 38,250 | 34 | 15 | 9 | 9 | – | 13 | [3] | <1 | 21 | >99 |
| Los Gatos | 10 | 6,400 | 28,950 | 47 | 6 | 6 | 1 | – | 3 | 27 | <3 | 10 | 97 |
| Monte Sereno | 1.5 | 960 | 3,280 | 96 | – | – | – | – | – | 3 | – | 5 | >95 |
| Saratoga | 11.9 | 7,616 | 29,600 | 64 | <1 | <1 | – | – | 6 | 2 | 20 | 6 | 90 |
| Unincorp. County | 961 | 615,040 | 108,500 | 2 | <1 | <1 | <1 | – | <1 | 19 | 73 | 2 | Unk. |

Table Source: SCVURPPP 1997

Data Sources:
1 Santa Clara Valley Stormwater Management Plan 1995-2000.
2 Department of Finance Population Estimates for California Cities and Counties, January 1, 1996 (Report 96 E-1).
3 Included in “Parks/Open Space.”
4 Public/Institutional includes public and private schools, federal government lands, and city/county/state facilities.
5 Percentages for San Jose are of total parcels. Of total area, 24 percent is roadways, and 14 percent is creeks, railroads, and other uses.
6 Combined residential includes single- and multiple-family residences.
7 Combined industrial includes light and heavy industrial facilities.
8 Included in “Public/Institutional.”

**Table 4-7**
**Projected Residential, Industrial, and Commercial Development in Santa Clara Basin Watersheds, 1995-2020[1,2]**

| | Residential | | | | | | | Industrial and Commercial | | | | | | Residential, Industrial/ Commercial |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Watersheds** | **Area (ac)** | **Available for Development (ac)** | **Projected Developed (ac)** | **Percent Available Acreage Projected Developed[3]** | **Percent Watershed Projected Developed (% increase since 1995)** | | **Percent Buildout** | **Available for Development (ac)** | **Projected Developed (ac)** | **Percent Available Acreage Projected Developed[3]** | **Percent Watershed Projected Developed (% increase since 1995)** | | **Percent Buildout** | **Percent Buildout** |
| Adobe | 7,260 | 141 | 60 | 43 | 47 | (0.8) | 98 | 181 | 0 | 0 | 12 | (0.0) | 83 | 94 |
| Arroyo la Laguna | 47,600 | 2,579 | 1,420 | 55 | 27 | (3.0) | 90 | 3,031 | 2,293 | 76 | 23 | (6.5) | 87 | 92 |
| Baylands | 21,000 | 155 | 82 | 53 | 10 | (0.4) | 95 | 1,421 | 727 | 51 | 21 | (4.8) | 81 | 89 |
| Calabazas | 13,400 | 270 | 67 | 25 | 55 | (0.5) | 97 | 401 | 143 | 36 | 31 | (1.4) | 93 | 96 |
| Coyote | 205,100 | 4,119 | 2,502 | 61 | 10 | (1.2) | 90 | 3,540 | 1,165 | 33 | 5 | (0.8) | 75 | 88 |
| Guadalupe | 108,900 | 1,946 | 688 | 35 | 30 | (0.6) | 96 | 1,750 | 841 | 48 | 15 | (0.5) | 93 | 96 |
| Matadero/Barron | 10,900 | 140 | 86 | 61 | 61 | (0.8) | 99 | 6 | 5 | 80 | 20 | (0.1) | 100 | 99 |
| Penitencia | 18,279 | 873 | 643 | 74 | 34 | (3.5) | 95 | 285 | 309 | 108 | 21 | (2.5) | 97 | 98 |
| Permanente | 11,100 | 134 | 41 | 31 | 47 | (0.4) | 98 | 67 | 4 | 6 | 13 | (0.1) | 96 | 98 |
| San Francisquito | 27,400 | 8,090 | 1,666 | 21 | 36 | (6.1) | 59 | 59 | 35 | 60 | 5 | (0.2) | 97 | 64 |
| San Tomas | 27,400 | 256 | 86 | 34 | 54 | (0.3) | 99 | 183 | 267 | 146 | 20 | (1.3) | 99 | 100 |
| Stevens | 18,700 | 183 | 48 | 26 | 25 | (0.3) | 97 | 335 | 35 | 10 | 9 | (0.3) | 84 | 94 |
| Sunnyvale East | 4,560 | 322 | 31 | 10 | 66 | (0.7) | 91 | 220 | 29 | 13 | 33 | (0.9) | 88 | 90 |
| Sunnyvale West | 4,860 | 59 | 5 | 8 | 21 | (0.1) | 95 | 342 | 132 | 38 | 69 | (3.6) | 93 | 94 |
| *Median* | | | | | *35* | *(0.7)* | *95* | | | | *20* | *(0.9)* | *93* | *94* |

Data Source: ABAG 1998.

1 Data include: projected acreage by land use classes (residential and industrial/commercial); acreage available for development by land use class; percent of available acreage that is projected to be developed; percent of watersheds projected to be developed for land use classes by 2020 (includes development existing as of 1995 and projected for 1995 – 2000). Available acreage for development projected for 1995 – 2000 was assumed (ABAG 1998). Percent build-out represents the percent of watershed land *designated for respective land use classes* that will have been developed by 2020. Projected developed acreage may include some redevelopment acreage. Because a single estimate of redevelopment acreage was provided for both residential, commercial, and industrial land use classes (ABAG 1998), the percentage of projected development that could occur as redevelopment could not be calculated for individual land use classes.

2 Analysis was completed prior to the provisional revision of the Baylands boundary. Therefore, values depicted for the Baylands and the Arroyo la Laguna watershed do not reflect the revised boundary.

3 Projected developed acreage may include some redevelopment acreage. Because a single estimate of redevelopment acreage was provided for residential, commercial, and industrial land use classes, the percentage of projected development that could occur as redevelopment could not be calculated for individual land use classes.

## Santa Clara Basin

There are several trends in the spatial distribution of existing land uses in the Basin, influenced both by natural factors such as elevation and precipitation, and by human activities. A distinct transition in land use occurs at about 600 to 800 feet above sea level: areas above this elevation threshold (upper elevation zone) are largely populated by forests and rangelands, whereas areas below this elevation threshold (lower elevation zone) are dominated by an urbanized landscape (Figure 4-4). Several patterns exist within the upper and lower elevation zones.

**Upper Zone**. Forest communities[3] occur predominantly on steeper slopes, while rangeland communities occupy moderately sloped areas. In the western basin hills, forest communities occupy approximately 2 to 10 times more area than rangeland communities. Conversely, in the eastern basin hills, rangeland communities commonly occupy 10 to 40 times more area than forest communities. At high elevations in the eastern hills, however, this trend reverses, and forest occupies a third more area than rangeland.

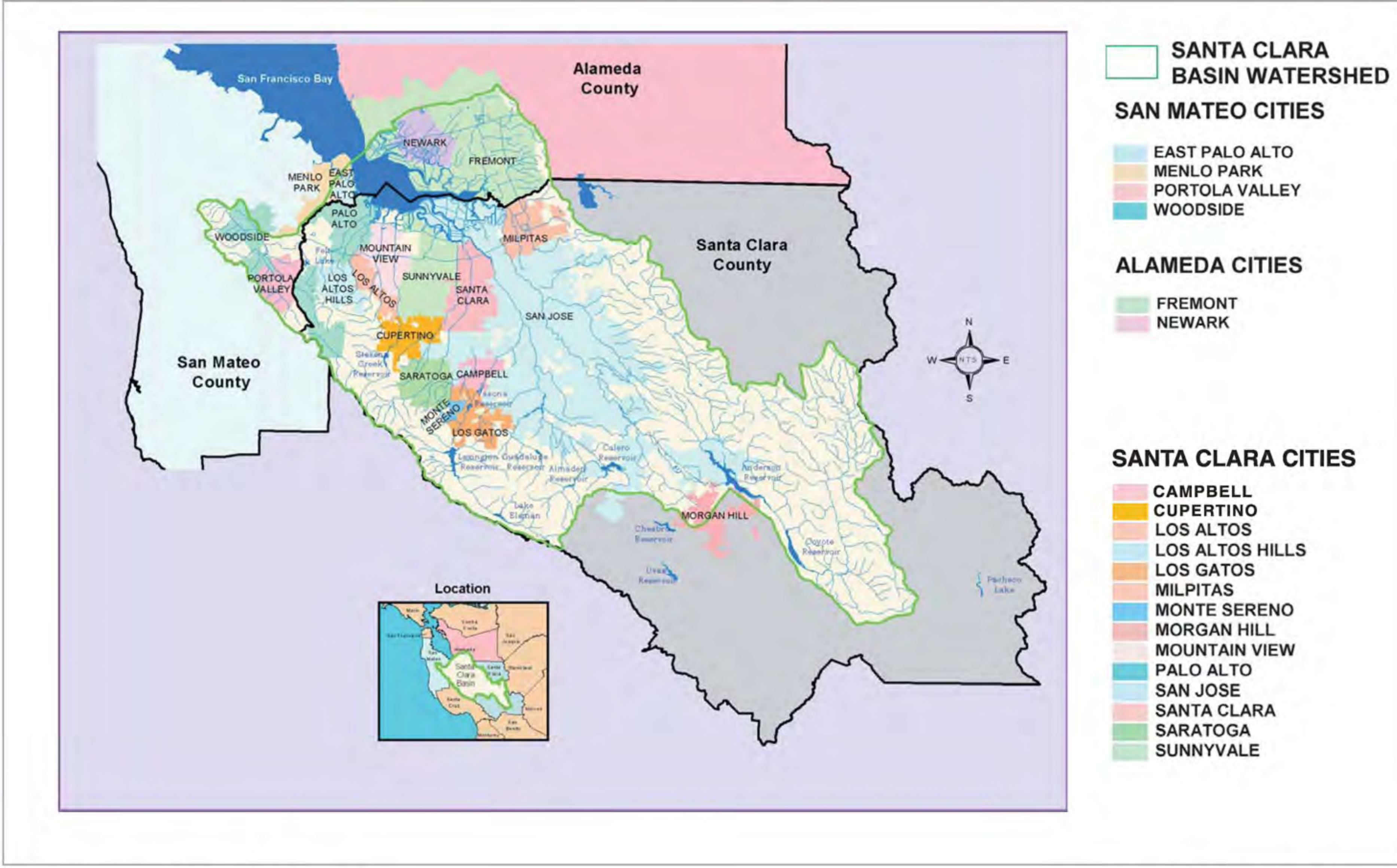
**Lower Zone**. The majority of the Basin floor is occupied by residential communities developed at a density of 4+ DU/acre. The relatively small amount of 1 to 3 DU/acre housing in the Basin occurs in its northwest corner (e.g., San Francisquito, Matadero/Barron, Adobe, and Permanente watersheds). The even smaller amount of 1 DU/2 to 5 acres housing in the Basin occurs in its southwest portion (e.g., Calabazas, San Tomas, and Permanente watersheds). Commercial land uses are distributed throughout the Basin floor but are concentrated along state and county highways. Public and quasi-public land uses are also distributed across the Basin floor, and are more evenly dispersed than commercial land uses. Industrial areas are clustered near the Bay and along major transportation corridors, including rail and interstate highways. The only exception is State Highway 85, which was recently constructed and runs primarily through residential areas. Agricultural land uses occur either near the Baylands or on the urban fringe, mainly on the east side of the Basin.

Percent of each land use in the Basin, and descriptive statistics on land uses in Basin watersheds, are found in Table 4-1.

### Watersheds

Basin watersheds are categorized here using a two-tiered approach: first on the basis of the influence of topography and climate; and second by the relative proportion and distribution of land uses. What follows are narratives describing the distribution of land uses in each watershed, presented first by topographic/climatic category (west side, east side, and valley floor), and subsequently by the relative proportion of land uses within each topographic/ecological category. A description of land use patterns in the Baylands is also included to more completely describe land use patterns in the Basin. The following watershed narratives support Figures 4-3 through 4-7 and Tables 4-2 through 4-4.
Figure 4-2 (front)

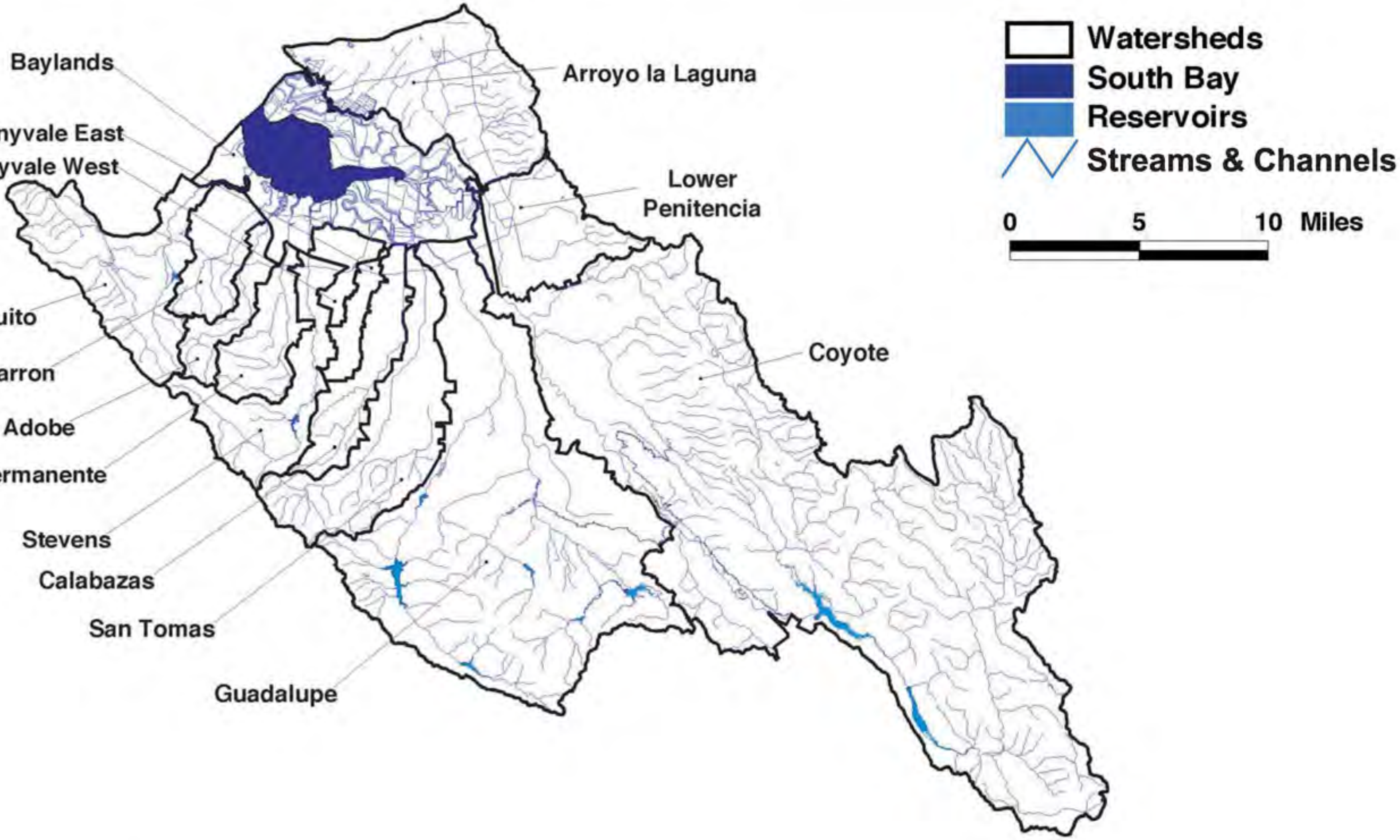
[3] The term “communities” as used here refers to biological, not human communities.




Source: Santa Clara Valley Water District



**FIGURE 4-2**
**Counties and Municipalities in the Santa Clara Basin**

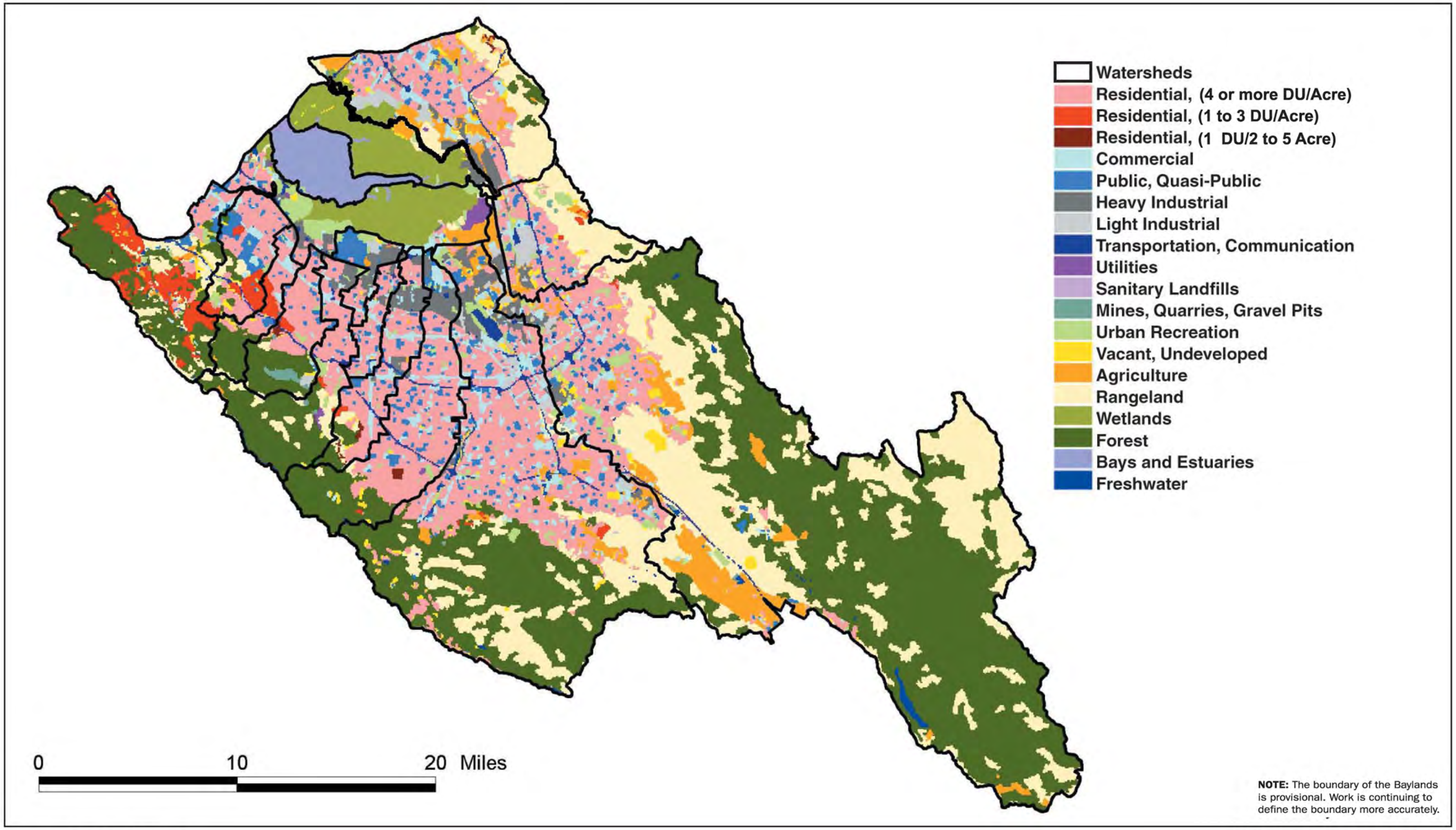



**NOTE:** The boundary of the Baylands is provisional. Work is continuing to define the boundary more accurately.

*Source: EOA, Inc. for SCVURPPP*



**FIGURE 4-3**
**Hydrologic Features in the Santa Clara Basin**

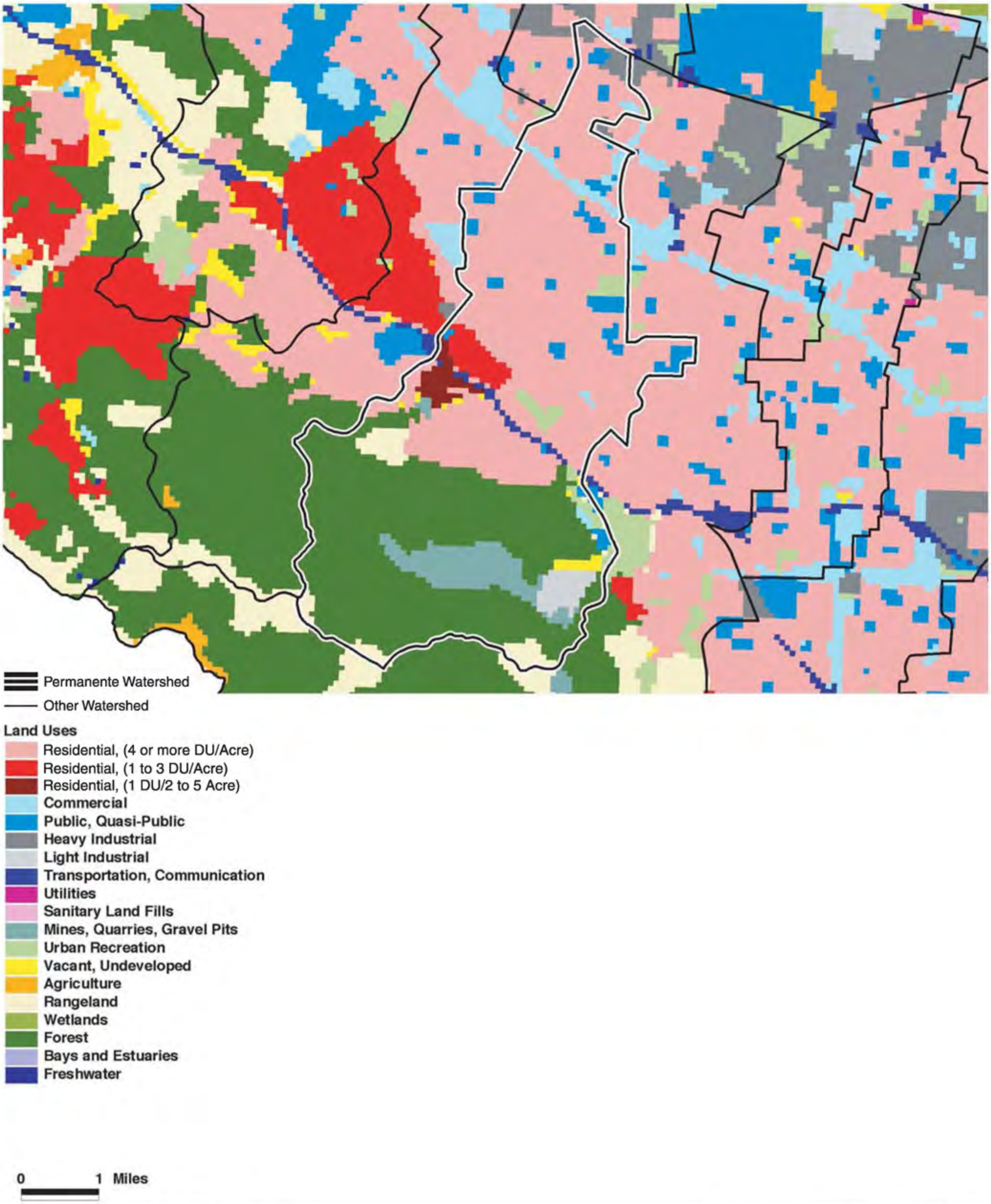



Source: EOA, Inc. for SCVURPPP

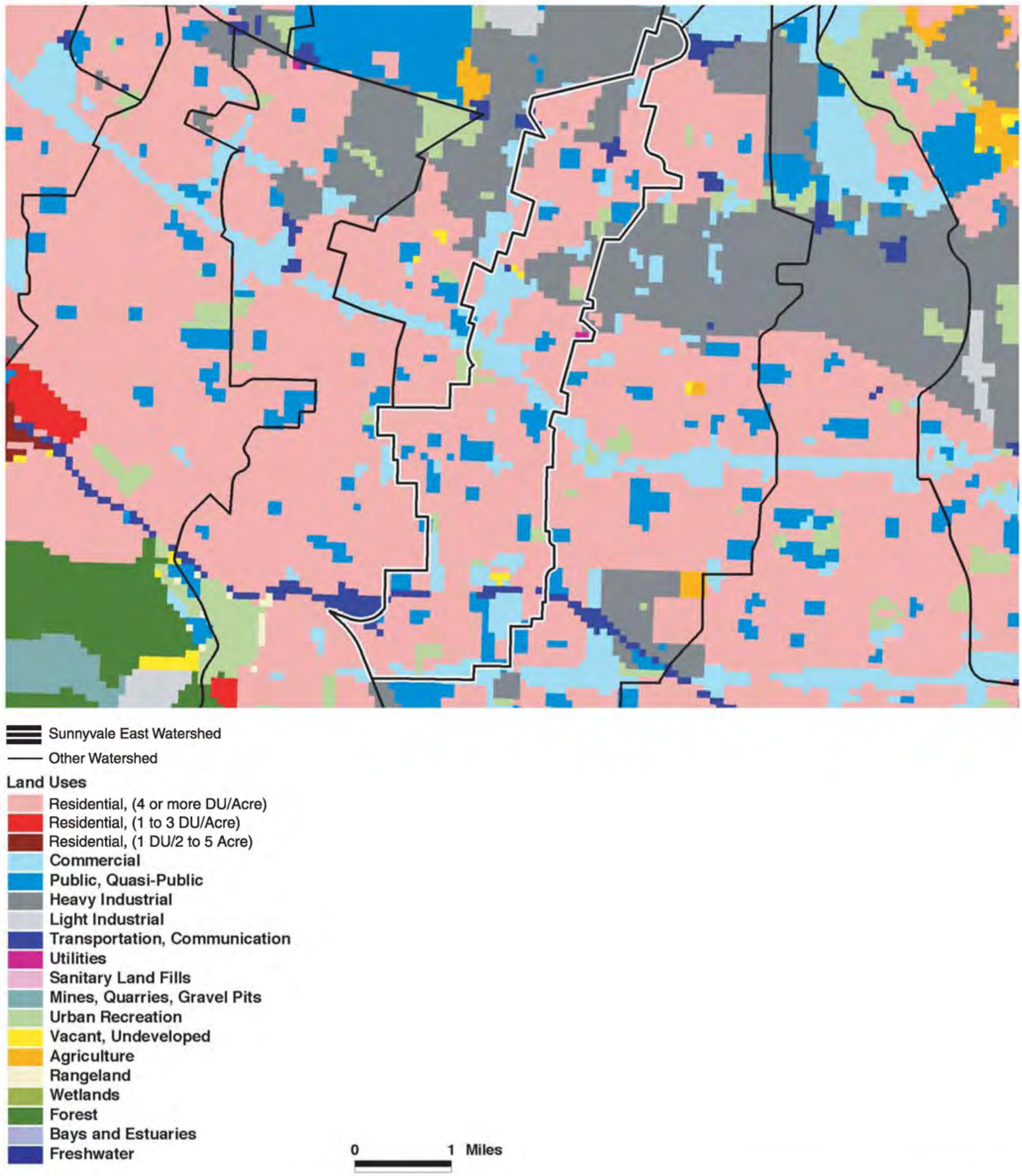


**FIGURE 4-4**
**Existing Land Uses in Santa Clara Basin Watersheds**

**FIGURE 4-5**
**Existing Land Uses in Permanente Creek Watershed**

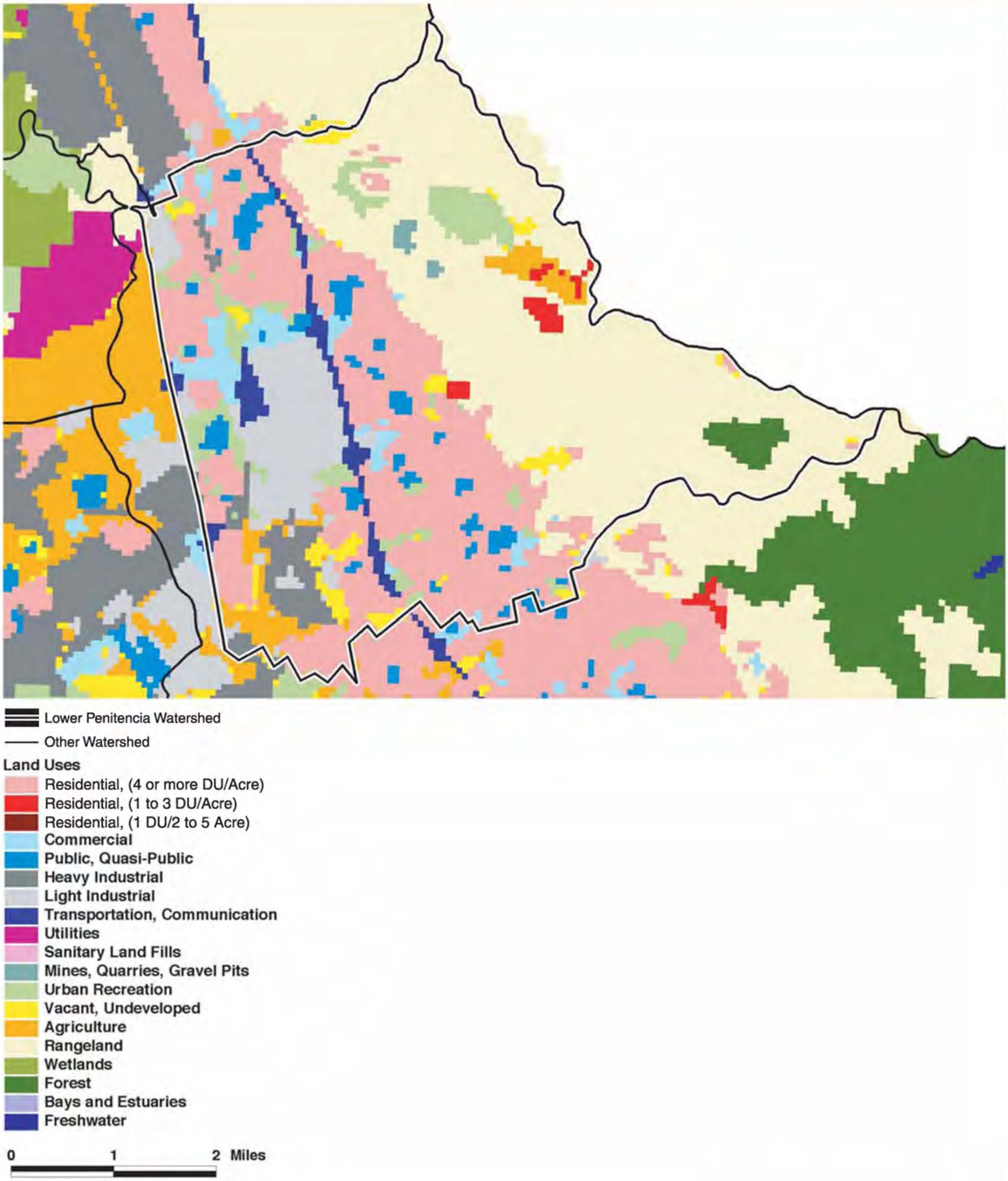



Source: EOA, Inc. for SCVURPPP

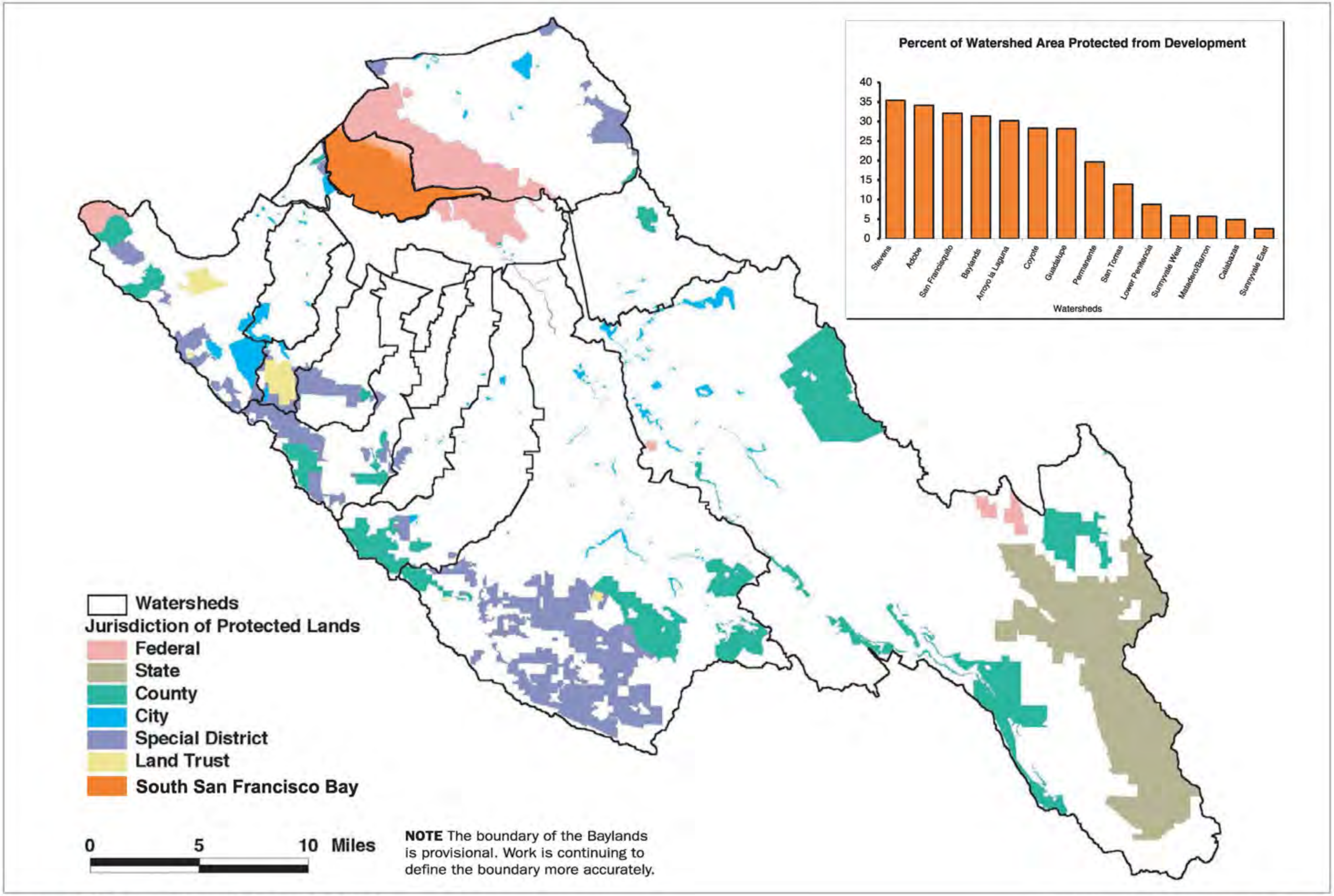



Source: EOA, Inc. for SCVURPPP

# Existing Land Uses in Lower Penitencia Creek Watershed




Source: EOA, Inc. for SCVURPPP

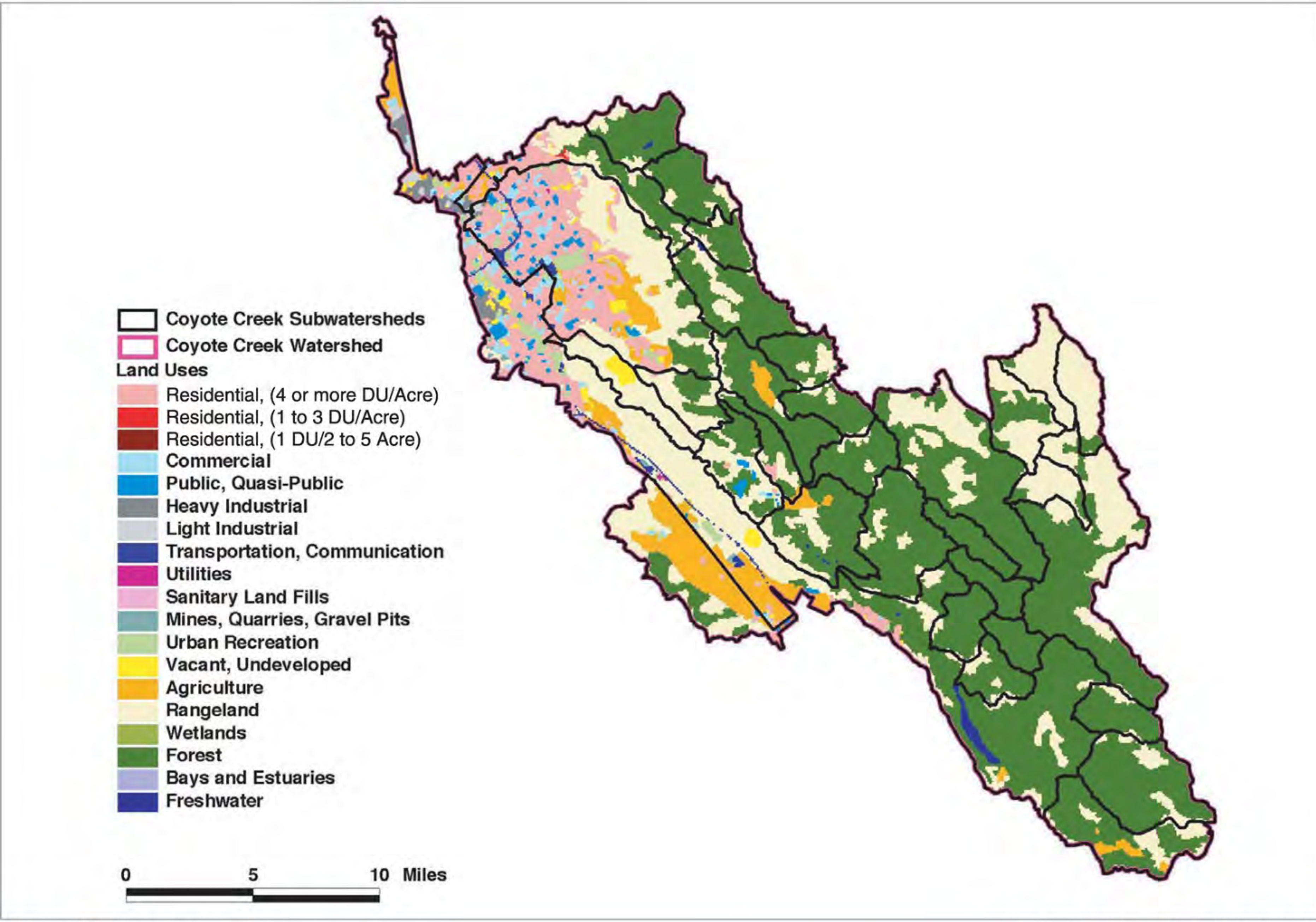



Source: EOA, Inc. and GreenInfo for SCVURPPP

*Watershed Characteristics Report*

**FIGURE 4-8**
**Protected Lands in the Santa Clara Basin**

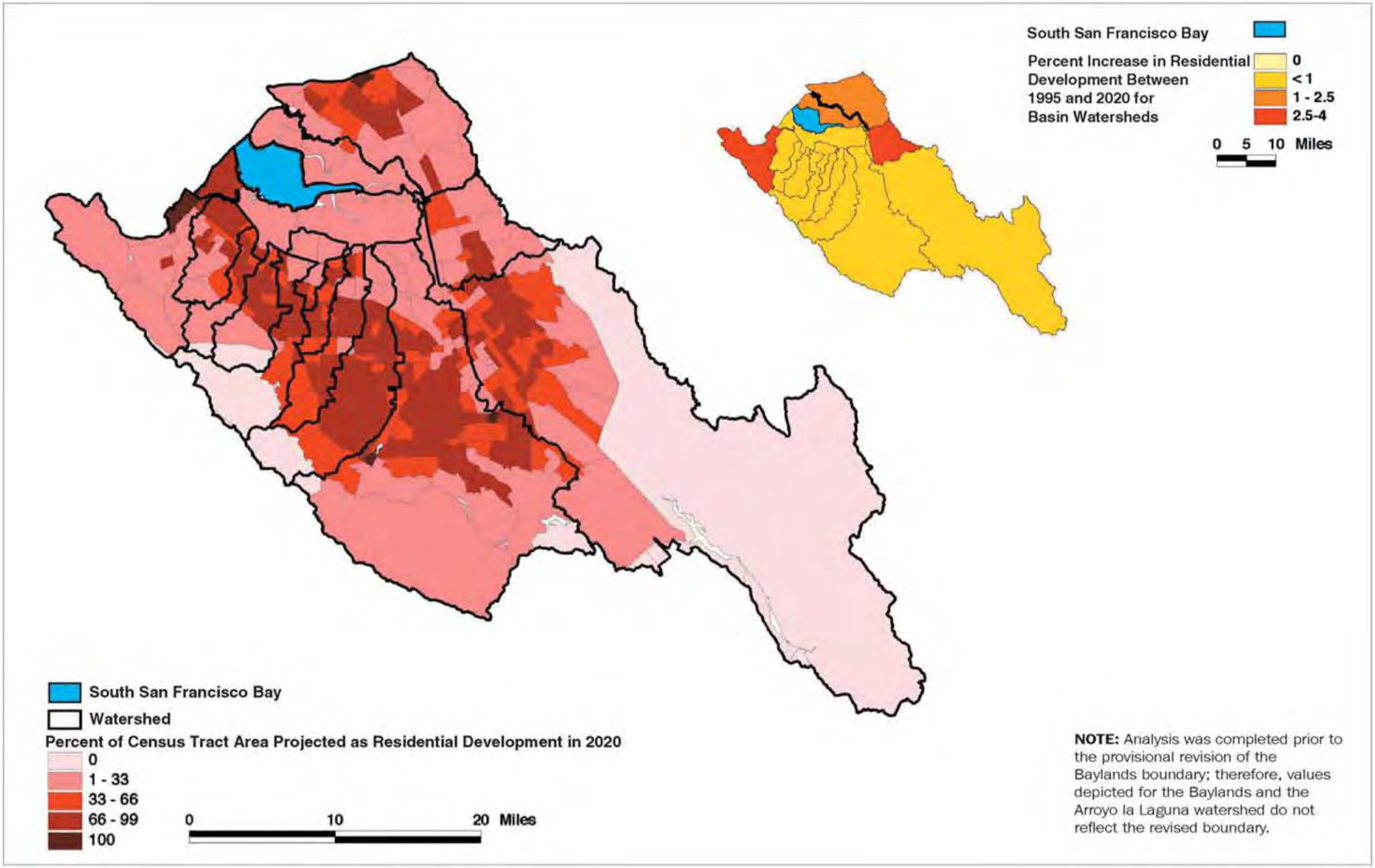
WMI Santa Clara Basin




Source: EOA, Inc. for SCVURPPP



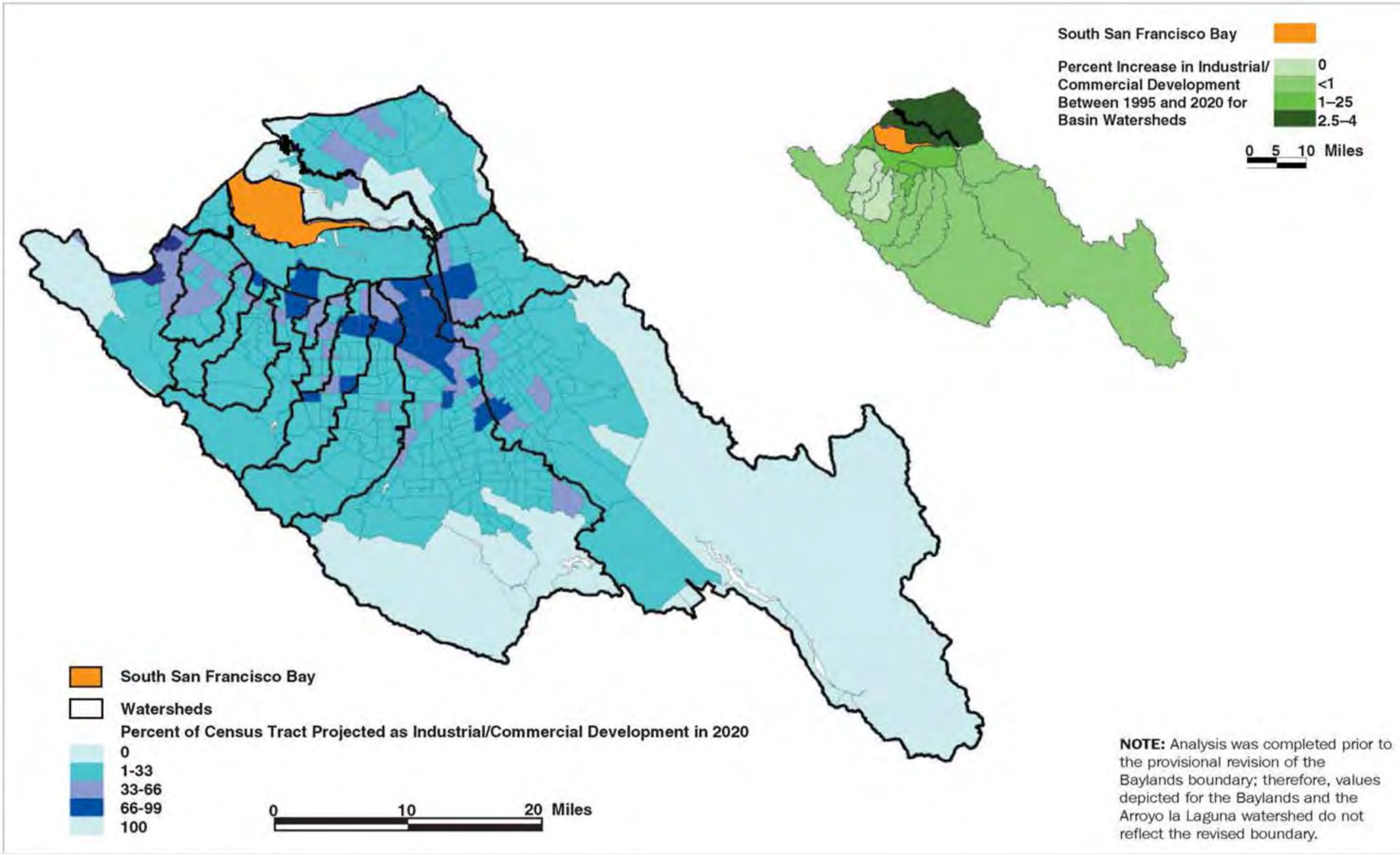
**FIGURE 4-9**
**Existing Land Uses in Coyote Creek Subwatersheds**




Source: EOA, Inc. for SCVURPPP



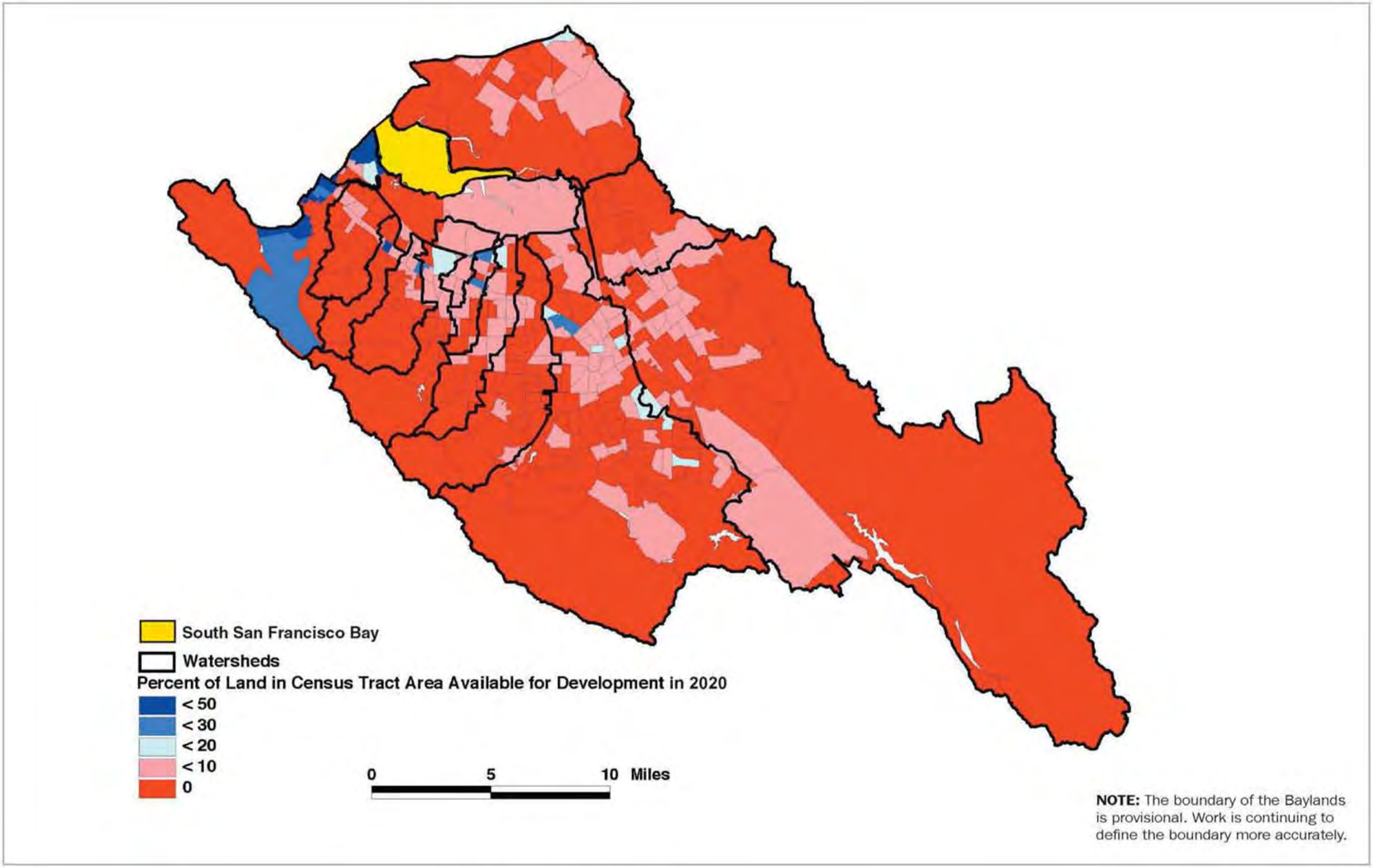
**FIGURE 4-10**
Residential Development Projections, 1995-2020, in Santa Clara Basin Watersheds




Source: EOA, Inc. for SCVURPPP



**FIGURE 4-11**
**Industrial/Commercial Development Projections, 1995-2020, in Santa Clara Basin Watersheds**




Source: EOA, Inc. for SCVURPPP



**FIGURE 4-12**
**Percent of Census Tract Area Available for Development After 2020 in the Santa Clara Basin**

**West Side** (see Figure 4-5 for an example). The west-side watersheds have the following characteristics: headwaters originate in the Santa Cruz Mountains; the upper and lower elevation zones are represented; the upper watershed is primarily nonurbanized and has a high ratio of forest to grassland; the lower watershed is urbanized; and watershed morphology is typically long and slender.

West-side watersheds with a very high proportion of natural areas (50 to 60 percent), a moderate proportion of residential (25 to 30 percent), and low proportion of industrial/commercial development (5 to 15 percent) consist of the following:

Stevens Creek. The majority of the area draining to Stevens Creek watershed in its upper elevation zone is undeveloped (forest or rangeland) and permeable. Notably, this watershed has the highest percentage of area legally protected; thus, about half of the headwaters to Stevens Creek drain protected area, and the remaining headwaters drain primarily forested area. The composition and distribution of land uses in the lower elevation zone is typical of west-side watersheds: the predominant land use is residential, 4+ DU/acre; commercial and public/quasi-public developments are interspersed; and contiguous commercial development is also prevalent along State Highway 82. Industrial development occurs in the downstream area of the watershed and is concentrated near U.S. Highway 101. The land use pattern in the lower elevation zone of Stevens Creek watershed differs from most west-side watersheds by having fewer areas of vacant/undeveloped land and a greater proportion of urban recreation areas.

San Francisquito Creek. The majority of the upper elevation zone in San Francisquito watershed is also undeveloped, primarily existing as forest and rangeland. Permeable, protected land drains to all headwaters of Los Trancos Creek. Most of Corte Madera and West Union Creeks headwaters drain protected or forested areas. In a number of respects, the distribution of land uses in San Francisquito watershed is atypical for west-side watersheds. San Francisquito watershed has a greater proportion of 1 to 3 DU/acre housing than any other watersheds in the Basin, and exhibits a more heterogeneous mix of land uses throughout. The pattern of land use in the upper elevation zone is unusual due to the presence of residential development, consisting of 1 to 3 DU/acre with pockets of 1 DU/2 to 5 acres rather than 4+ DU/acre (as seen in San Tomas, Guadalupe, and Lower Penitencia watersheds). The transition from the upper to the lower elevation zone is unique because land uses shift from primarily natural conditions to moderate, rather than 4+ DU/acre, residential development. Moreover, unlike most other watersheds in the Basin, large contiguous sections of natural areas (forest and rangeland), as well as agriculture, exist in the lower elevation zone. In the lower elevation zone, the diversity and distribution of land uses is greater than other watersheds. The land use pattern typical of most west-side watersheds in the lower elevation zone (predominantly residential, 4+ DU/acre with public/quasi-public and commercial development interspersed) only manifests below 200 feet elevation (downstream of the Hetch Hetchy Aqueduct) whereas most other watersheds exhibit this pattern immediately below the transition zone. Moreover, even in this low position in the watershed, forests and urban recreation areas exist. Stanford University owns 35 percent of the watershed.

Guadalupe River. Like other west-side watersheds, the majority of the upper elevation zone in Guadalupe River watershed is undeveloped (forest and rangeland), however, a greater-than-typical proportion of this area (three-quarters) is legally protected. Thus, virtually all headwaters to Guadalupe River drain from permeable, protected areas. Over three-quarters of the headwaters to Los Gatos Creek drain from such areas, as do about one-half of the headwaters to Alamitos Creek. Unlike other watersheds, numerous pockets of 4+ DU/acre residential development and areas of vacant/undeveloped land also exist in the upper elevation zone. The pattern of land uses in the lower elevation zone is typical of west-side watersheds (see description under Stevens Creek watershed). Exceptional to this watershed is the presence of agriculture in the lower elevation zone (both at its upper and lower extents), and the presence of forest and rangeland. Although a low proportion of this watershed exists as vacant/undeveloped land, a large, contiguous area of vacant/undeveloped land exists in the lower watershed, downstream of U.S. Highway 101. The Guadalupe River watershed is transected by most of the large transportation corridors in the Basin, and an unusually large transportation/communication development exists. One effect of the broad transportation network is a more distributed pattern of industrial uses throughout the lower elevation zone than typically exists in watersheds in the Basin.

West-side watersheds containing a high proportion of natural areas (approximately 40 percent) and residential development (approximately 45 percent) and a moderately low proportion of industrial/commercial development (10 to 15 percent) consist of the following:

Adobe Creek. About 40 percent of the area draining to Adobe Creek watershed is undeveloped, existing primarily as forest in the upper elevation zone, and draining virtually all of Adobe Creek's headwaters. The area in the lower elevation zone is almost exclusively 4+ DU/acre residential development. Near the northern edge of the watershed, southwest of Interstate 280, pockets of vacant/undeveloped land exist and public land use occurs. Immediately north of Interstate 280 the residential land use becomes 1 to 3 DU/acre, and numerous smaller areas under public land use are interspersed. Commercial land use is clustered along U.S. Highway 101. What little industrial development exists in this watershed is located on lands draining to the extreme downstream reaches of Adobe Creek.

Permanente Creek. Similar to Adobe Creek watershed, about 40 percent of the area draining to Permanente Creek is undeveloped, and primarily forested in the upper elevation zone (Figure 4-5) About half of the creek-miles in the upper elevation zone drain are protected, permeable areas. In contrast to the Adobe Creek watershed, both mine/quarry/gravel and light industrial land uses protrude into the forested upper zone of the Permanente Creek watershed. A greater diversity and broader distribution of land uses exist in the lower zone on the southwest side of Interstate 280 than for Adobe Creek watershed. Residential development of 4+ DU/acre occupies the central area, but on the northern edge, pockets of vacant/undeveloped land and residential development of 1 DU/2 to 5 acres exist. Near the southern edge, a mosaic of urban recreation, vacant/undeveloped, public and commercial development, and small blocks of rangeland exist.

West-side watersheds containing a moderate proportion of natural areas (approximately 25 percent); high proportion of residential development (approximately 55 percent) and a moderate proportion of industrial/commercial development (approximately 20 percent) consist of the following:

San Tomas Aquino Creek. Although only a moderate proportion of San Tomas watershed in the upper elevation zone remains undeveloped as forest and rangeland, about two-thirds of these areas are legally protected. The majority of Saratoga Creek's headwaters drain from such protected areas, as do several headwater streams of San Tomas Aquino Creek. The San Tomas watershed is unusual because vacant/undeveloped, commercial, and moderate- and 4+ DU/acre residential development also exist in the upper elevation zone. The lower elevation zone in San Tomas watershed is typical of west-side watersheds (see description for Stevens Creek watershed). Unusual features of this watershed include the presence of the largest contiguous area of 1 DU/2 to 5 acres housing in the Basin, and a distinct land use pattern in the lower watershed (area draining north and south of U.S. Highway 101): virtually all of this area exists as industrial development, with a smaller proportion (than typical for west-side watersheds) of commercial, public/quasi-public, transportation/communication, residential development of 4+ DU/acre, and urban recreation areas. This composition and distribution of land uses is more typical of the valley-floor watersheds.

West-side watershed containing minimal upper elevation zone, a low proportion of natural areas (approximately 15 percent), a very high proportion of residential development (55 to 60 percent), and a moderate proportion of industrial/commercial development (20 to 30 percent) consist of the following:

Matadero/Barron Creeks. Unlike Adobe and Permanente watersheds, the upstream extent of the Matadero/Barron watershed coincides with the transition between upper and lower elevation zones; thus, extremely little area exists in the upper elevation zone. The majority of the area draining to the headwaters of Matadero and Barron Creeks is developed for residential use at either 4+ DU/acre or 1 to 3 DU/acre; only a small proportion of the area draining to the headwaters is undeveloped as either forest or rangeland, or relatively nonurbanized (urban recreation, and vacant/undeveloped land uses). This watershed has the second highest percentage of 1 to 3 DU/acre residential development of watersheds in the Basin. Both the diversity and distribution of land uses present in this watershed are greater than for most other watersheds; forest, grassland, and 1 to 3 DU/acre residential areas extend to the valley floor, up to and beyond where the flood control bypass channels cross the watershed. Areas draining the lower reaches of Matadero and Barron Creeks (less than 200 feet elevation, and north of the Hetch Hetchy Aqueduct) are primarily 4+ DU/acre residential, with very little (less 1 percent) industrial development. An unusual aspect of this watershed is the large proportion of the lower watershed occupied by contiguous public/quasi-public development.

Calabazas Creek. The upper elevation zone of the Calabazas Creek watershed is small compared to other west-side watersheds, but is mostly undeveloped, existing as forest or rangeland (one-quarter of which is legally protected), or as vacant/undeveloped land. Thus, the upper reaches of

Calabazas Creek, and some of its headwaters, drain from permeable, undeveloped areas. A minimal amount of residential development at both 1 DU/2 to 5 acres and 1 to 3 DU/acre exists in the upper elevation zone, but unique to this watershed is the presence of several areas of heavy industry in this zone. The majority of the lower elevation zone is occupied residential development at 4+ DU/acre, with public/quasi-public, commercial, and some urban recreation and agricultural areas interspersed. Two large, contiguous areas of heavy industry are located near Interstate 280 and U.S. Highway 101.

**Valley Floor** (see Figure 4-6 for an example watershed). The Valley Floor has the following characteristics: headwaters originate in the Santa Cruz Mountains; watershed is confined to the lower elevation zone (Basin floor); few natural areas exist; there is a very high proportion of industrial and commercial development (30 to 65 percent); and there is a moderate to very high proportion of residential development (20 to 65 percent):

Valley floor watersheds with a high ratio of industrial/commercial to residential development (3:1) consist of:

<u>Sunnyvale West</u>. Although lacking both forest and rangeland, Sunnyvale West watershed has a very high percentage of urban recreation area (second only to the Baylands watershed), of which approximately one-quarter is legally protected. Such permeable areas, however, are located at the downstream end of the watershed, and thus do not buffer the upper reaches of the channels in this watershed from urbanized areas. The Sunnyvale West watershed is unique in having a greater proportion developed as industrial and commercial land uses than any other Basin watershed. The land use pattern in the upper-third of this watershed is similar to that described for the lower elevation zone of the west-side watersheds (see Stevens Creek watershed description); however, the pattern in the lower two-thirds of the watershed is distinct: industrial and public/quasi-public development cover over three-quarters of the area. The remaining area is mostly occupied by urban recreation, agriculture, and vacant/undeveloped lands.

Valley floor watersheds with a high ratio of residential to industrial/commercial development (2:1) consist of:

<u>Sunnyvale East</u>. The pattern of land use in the Sunnyvale East watershed closely resembles that described for the lower elevation zone of the west-side watersheds (see Stevens Creek watershed description); however, a greater proportion of this watershed is developed as commercial, public/quasi-public, and industrial land uses than the west-side watersheds (Figure 4-6). Virtually none of the land draining to either Calabazas Creek or lower tributaries initiating in Sunnyvale East watershed exists as permeable, undeveloped land use.

**East Side** (see Figure 4-7 for an example). The East Side has the following characteristics: headwaters originate in the Diablo Range; both the upper and lower elevation zones are represented; the upper watershed is nonurbanized and has a high ratio of rangeland to forest; the lower watershed is urbanized; and watershed morphology is broader than west-side watershed morphology.

East-side watersheds with a moderate to high proportion of natural areas (approximately 20 – 40 percent) in upper elevation zone and in which a transition between nonurbanized and urbanized land uses occurs at lower elevation (200 to 400 feet) consist of:

Lower Penitencia Creek. About 50 percent of the Lower Penitencia watershed exists as permeable land uses (40 percent rangeland; 10 percent urban recreation, forest, and agriculture), but less than a quarter of this total area is legally protected (Figure 4-7). Headwater streams for Calera Creek drain this protected area, as do some upper reaches of Arroyo de los Coches Creek; however, none of Berryessa Creek tributaries drain protected areas. Land use patterns in Lower Penitencia's upper elevation zone are typical of east-side watersheds: small pockets of residential development and vacant/undeveloped land, and agriculture amidst undeveloped area with a high ratio of rangeland to forest. Unique for east-side watersheds is the presence of two small mine/quarry/gravel areas in Lower Penitencia's upper elevation zone. The majority of the lower elevation zone is occupied by residential development at 4+ DU/acre. Interspersed are pockets of commercial and public/quasi-public development, and vacant/undeveloped areas. Lower Penitencia watershed is bisected by one major transportation corridor (Interstate 880), near which most of the industrial development lies as both scattered and large contiguous areas, and an area of transportation/communication development exists. Urban recreation areas are associated with the lower reaches of Lower Penitencia, Berryessa, and Calera Creeks. The headwaters of Lower Penitencia Creek, located in the lower elevation zone, drain from agricultural areas.

Arroyo la Laguna. A lower percentage of the Arroyo la Laguna watershed's upper elevation zone exists as permeable land use as compared to that for the Lower Penitencia watershed. Since about one-third of the lower elevation zone exists as wetlands (legally protected), however, a higher percentage of Arroyo la Laguna watersheds is undeveloped. The headwaters for Agua Caliente and Mission Creeks drain from protected, forested areas. Arroyo la Laguna's upper elevation zone has a similar land use pattern to Lower Penitencia's, except that a greater proportion of the residential development is at 1 DU/2 to 5 acres, and a greater proportion of this zone is forested. Land use patterns in the lower elevation zone are also similar to those in Lower Penitencia, mainly differing by having a prevalence of large, contiguous agricultural areas, fewer large areas of rangeland, an area developed for mine/quarry/gravel development, and a large expanse of wetlands by the Bay. Notably, Arroyo la Laguna watershed has the largest percentage of area under agricultural cultivation.

East-side watersheds with a very high proportion of natural areas (approximately 80 percent) in the upper watershed consist of:

Coyote Creek. Despite the relatively vast size of the Coyote Creek watershed, and the huge proportion of undeveloped land in its upper elevation zone, the composition and distribution of land uses are similar to those of other east-side watersheds. The upper elevation zone is comprised mainly of rangeland and forest (about one-third legally protected), but the rangeland-to-forest ratio is lower than for other east-side watersheds. The upper reaches of Arroyo

Aguague, San Felipe, Little Coyote, Middle Fork Coyote, Soda Springs, Grizzly, and numerous unnamed creeks drain from such protected, permeable areas, as do the mid-reaches of Upper Penitencia Creek. Urbanized land use is confined to the downstream region of the lower elevation zone, and to several small areas in the lower elevation zone near the mainstream of Coyote Creek. Within the matrix of residential development at 4+ DU/acre, public/quasi-public and commercial development are interspersed (the latter clustered along major surface streets), and industrial development exists near major transportation corridors, particularly concentrated in the narrow downstream neck of the watershed. Agricultural and vacant/undeveloped lands exist on the up-slope urban fringes, as well as in the narrow downstream neck. Though proportionately less area is agriculturally cultivated than Lower Penitencia watershed, the total area is much greater, and Coyote contains the largest contiguous agricultural areas in the Basin. The frequent interspersion of urban recreation areas, and their presence along much of lower Coyote Creek, is unusual for the east-side, but is also observed in the Guadalupe River watershed.

**Baylands**. The Baylands is a unique area in the Basin because it drains from both the Santa Cruz Mountains and the Diablo Range, contains relatively little development, is mostly at or near sea level, and is over 50 percent wetlands (about one-third of which is legally protected). Approximately 75 percent of its area is permeable and undeveloped, and includes (in addition to wetlands), the greatest percentage of urban recreation and agricultural land uses of any watershed in the Basin (Table 4-3). The predominant developed land use in the Baylands is residential at 4+ DU/acre followed by approximately equal area devoted to development for industrial, commercial and utility enterprises. The Baylands periphery is surrounded, rather than bisected, by major transportation corridors including U.S. Highway 101, Interstate 880, and State Highway 237.

## Subwatersheds

In this section, land use patterns for subwatersheds within the Basin are presented pictorially for one watershed (Figure 4-9) and in tabular format for all watersheds (Table 4-5). Due to the number of subwatersheds (58) in the Basin, an in-depth, narrative description of the composition and distribution of land uses within subwatersheds is not provided here. Analysis of land use at the subwatershed scale, however, will be important for subsequent WMI tasks that (1) evaluate effects of land uses on riparian corridor features and (2) develop watershed management plans.

## Jurisdictions

Jurisdictions included in the Basin are listed and illustrated on Figure 4-2 and in Table 4-6. Most municipalities in the Basin are more than 90 percent built out. Exceptions are Milpitas, San Jose, and unincorporated areas in the county. The following land use patterns are observed for municipalities:

- Residential is the majority land use in west-side communities and in San Jose.

- Commercial land use is less than 12 percent in all communities.
- Industrial land use is greatest (17 to 21 percent) in Milpitas, Sunnyvale, Mountain View, and Santa Clara.
- Public/Institutional land use is greatest in Palo Alto (26 percent); other municipalities range between 0 to 13 percent.
- Parks/Open Space land use is greatest in Palo Alto and Los Gatos.
- Vacant/Agriculture land use is greatest in unincorporated areas of Santa Clara County (73 percent), and is relatively high in Milpitas and Saratoga (20 to 26 percent).
- The percentage of municipal area developed as roadways is greatest in Campbell, Mountain View, Santa Clara, Cupertino, and Los Altos (17 to 21 percent).

#### *4.2.3.2 Distribution of Projected Land Uses by Watersheds (1995 – 2020)*

The following section presents projected land use patterns (Table 4-7, Figures 4-10 through 4-12) for the Basin from 1995 to 2020. The year 1995 was used as the baseline for analysis due to the organization of both existing and projected data (ABAG 1996, 1998). The format of the Projections '98 land use data (ABAG 1998) also defined the finest spatial resolution (U.S. Census tract) and land use categories (residential and industrial/commercial) presented here. Land use patterns are depicted both by U.S. Census tracts to provide information on projected development patterns within watersheds, and by watersheds to provide projected development summaries at the scale of the assessment (e.g., watersheds).

To best understand the results presented below, particularly the estimates of percent buildout (Figure 4-12), it is critical to understand the "available acreage" category included in the Projections '98 data. Thus, in addition to being presented in Appendix 4B, it is reiterated here. The available acreage category includes vacant and redevelopable land, but excludes parks, open space, agriculture, vacation homes, and rural residential housing (less than 1 DU/10 ac). This definition influences how one interprets the information provided for percent watershed area projected as developed, and for percent watershed area available for further development, post-2020. For example, by 2020, the large Census tract in the upper Guadalupe watershed is projected to have no industrial/commercial development, and to have 1 to 33 percent residential development (Figures 4-11 and 4-10, respectively). At that time, this area will be considered built out, because despite the presence of undeveloped land, land use policies indicate that no further land will be available for development after 2020 (Figure 4-12).

### Watersheds

Trends in projected residential and industrial/commercial development are presented below using the following categories: watersheds with the greatest percentage of area developed as residential and/or industrial/commercial land uses; watersheds with the greatest *increase* in the percent of their watershed developed between 1995 and 2020 for residential and/or industrial/commercial land uses; and watersheds with the greatest percent buildout by 2020 (buildout reflects percent watershed development according to zoning for respective development types). Assignment to these categories was determined by identifying which watersheds equaled or exceeded the median values calculated for all watersheds. These trends are supported by Table 4-7 and Figures 4-10 through 4-12.

**Greatest percent watershed developed for residential and/or industrial/commercial land uses by 2020:**

- *Both residential and industrial development*: Calabazas, Matadero/Barron, San Tomas, and Sunnyvale East
- *Residential development only*: Adobe, Permanente, and San Francisquito
- *Industrial development only*: Arroyo la Laguna, Baylands, Lower Penitencia, and Sunnyvale West

**Greatest increase in percent watershed developed since 1995:**

- *Both residential and industrial development*: Arroyo la Laguna, Lower Penitencia, and Sunnyvale East
- *Residential development only*: Adobe, Coyote, Matadero/Barron, and San Francisquito
- *Industrial development only*: Baylands, Calabazas, San Tomas, and Sunnyvale West

**Greatest percent watershed buildout by 2020:**

- *Both residential and industrial development*: Calabazas, Matadero/Barron, Permanente, and San Tomas
- *Residential development only*: Adobe, Guadalupe, and Stevens
- *Industrial development only*: Lower Penitencia, San Francisquito, and Sunnyvale West

The above trends in projected development indicate that, in the next two decades, the northeast section of the Basin (Arroyo la Laguna and Lower Penitencia watersheds) will experience the greatest amount of growth for both residential and industrial/commercial land uses. The northwest corner of the Basin, and much of the eastern Basin, will also experience considerable residential development. Industrial/commercial development will continue to dominate in the valley floor, increasing most in the Baylands and lower portions of watersheds located in south and central areas on the west side of the Basin. By the year 2020, most watersheds will be 90 to 95 percent built out, placing a greater requirement on redevelopment activity. San Francisquito and the watersheds on the east side of the Basin will provide the greatest available acreage for new development.

#### Subwatersheds

The level of effort required to present projected land use patterns for subwatersheds within the Basin such data in pictoral and/or tabular format is beyond the scope of this analysis and will be most relevant once the WMI is ready to prepare the Watershed Assessment Report.

### 4.2.4 Recommendations for Further Analysis

Two analyses of land use data are recommended for the Watershed Assessment Report and subsequent watershed management plans, as described below.

#### *4.2.4.1 Estimate Percent Impervious Cover for Subwatersheds*

Land uses characteristic of urbanization, including residential, commercial, and industrial development, typically increase the amount of impervious surface in watersheds and alter stream morphology, hydrology, and ecology, as well as water quality (Schueler 1995a). At the subwatershed scale, imperviousness can be correlated most successfully to environmental indicators (including fish and macroinvertebrate populations and streambed and bank features) in riparian corridors and addressed most successfully by management plans (Schueler 1995a, 1996b). Section 4.3 describes the percent impervious cover in Basin watersheds and enables the WMI to link impacts of land use patterns to riparian corridor health. For the Watershed Assessment Report and subsequent watershed management plans, however, it would be useful to analyze the percent impervious cover at the scale of subwatersheds.

#### *4.2.4.2 Analyze Land Uses Within Riparian Corridors and Floodplains*

Certain land uses and any impervious areas within riparian corridors and floodplains may have greater impacts on stream ecology and function than land uses outside of these hydrologic units (Tufford et al. 1998; Lammert and Allan 1999). Section 4.4 describes the distribution of land uses and additional features of interest within riparian corridors. For the Watershed Assessment Report and subsequent watershed management plans, it would be useful to examine spatial and temporal trends in the distribution of land uses within riparian corridors, and to correlate these changes with the respective conditions of the biological and physical stream resources.

## Analysis of Imperviousness in Santa Clara Basin Watersheds

### 4.3.1 Introduction

Urbanization of watersheds contributes to changes in basin hydrology, channel morphology, and physiochemical water quality. Cumulatively, these changes impact instream habitat structure and associated biological communities. Quantifying the relationship between urbanization and metrics of aquatic ecosystem health is essential to successfully managing these resources. A common measure of urbanization is the percentage of watershed area covered by impervious surfaces (Arnold and Gibbons 1996). Impervious surfaces are those that prevent or inhibit rainfall infiltration to ground cover and groundwater, and include roads, sidewalks, roof tops, or parking lots. Soil infiltration capacity may also be reduced by accumulated salts associated with runoff, and by compaction associated with development activities that can render even landscaped, pervious areas somewhat impervious (Booth and Jackson 1997). As development increases, so typically does the percentage of watershed area covered by impervious surfaces (referred to as imperviousness).

Imperviousness has been identified as a useful environmental indicator for community-level and watershed planning because it is (1) cost-effective[4], (2) easily quantified, (3) well understood by a variety of professionals, and (4) provides an estimate of cumulative water resource impacts that can be linked to land use planning practices (Arnold and Gibbons 1996; Claytor and Brown 1996; May et al. 1997b; Center for Watershed Protection 1998c).

Imperviousness has most often been estimated using variations on two techniques: (1) direct measurement from remotely sensed data or from topographic maps; and (2) estimation from data including land use, zoning, road area or density, or population. Combining techniques and/or several data sources can improve the overall estimate of imperviousness, particularly when accuracies[5] of data sets vary; for example, the estimate of impervious area directly connected to stormdrain systems could be improved by combining high accuracy road area data with lower accuracy land use data. Choosing a technique or combination thereof depends on the accuracy required to address the questions being asked, and on available budget. The relative benefits of each are summarized below (Table 4-8).

### 4.3.2 Methods

Watershed imperviousness was estimated (Table 4-9) based on the 1995 land use data (ABAG 1996) and used to describe the distribution of land use throughout Basin watersheds (Section 4.1). As discussed in Section 4.1, the accuracy and spatial resolution of the ABAG land use data were suitable for analyzing the distribution of land uses within Basin watersheds; they were also suitable for estimating watershed imperviousness.[6]

[4] Estimating percent imperviousness is cost-effective because data requirements are simple compared to other common techniques such as hydrologic modeling.
[5] Accuracy refers to precision of location, spatial resolution, and currency of data.
[6] At least one study (Couch 1997) found that imperviousness was not a good correlate of biological health (fish community assemblages) because it was not an accurate enough estimate. They resorted to estimating imperviousness from infrared satellite data.

**Table 4-8**
**Techniques Used to Estimate Imperviousness**

| Technique | Effort/ Resources | Accuracy | Utility for Future Forecasting | Utility to Address Better Site Design | When to Use |
|---|---|---|---|---|---|
| Direct Measure | | | | | • GIS system in place<br>• Large budget<br>• Very accurate measure is needed<br>• On a limited basis as a foundation for other techniques |
| Estimate From Data: | | | | | |
| *Land Use* | | | | | • Moderate budget<br>• Moderate accuracy is needed |
| *Zoning* | | | | | • Rough estimate is sufficient<br>• If more accurate land use data are unavailable |
| *Road Area* | | | | | • To estimate impervious area directly connected to stormdrain system<br>• Combine with other data to estimate entire impervious area |
| *Road Density* | | | | | • Rough estimate is sufficient<br>• In urban areas, if road area data are unavailable. |
| *Population* | | | | | • Rough estimate is sufficient: only appropriate for watershed scale |

Adapted from Center for Watershed Protection 1998c.

Legend:

Best: Most accurate; least effort; can be used to forecast future impervious cover; can address better site design techniques.

Moderate

Worst

**Table 4-9**
**Percentage of Santa Clara Basin Watershed Imperviousness**
**Estimated from 1995 Land Use Data[1]**

| Watersheds | Land Uses | Impervious Acres | Percentage of Watershed Imperviousness |
|---|---|---|---|
| Adobe | Residential, 4+ DU/acre | 2,178.3 | 30.1 |
| | Commercial | 398.4 | 5.5 |
| | Residential, 1 to 3 DU/acre | 285.1 | 3.9 |
| | Public/Quasi-Public | 145.4 | 2.0 |
| | Heavy Industrial | 132.9 | 1.8 |
| | Transportation, Communication | 57.8 | 0.8 |
| | Forest | 26.3 | 0.4 |
| | Urban Recreation | 12.1 | 0.2 |
| | Agriculture | 0.4 | < 0.05 |
| | Vacant/Undeveloped | 1.2 | < 0.05 |
| | Rangeland | 1.9 | < 0.05 |
| Arroyo la Laguna | Residential, 4+ DU/acre | 9,137.2 | 19.2 |
| | Heavy Industrial | 2,166.0 | 4.6 |
| | Commercial | 1,953.2 | 4.1 |
| | Light Industrial | 1,653.6 | 3.5 |
| | Public/Quasi-Public | 759.4 | 1.6 |
| | Transportation, Communication | 552.2 | 1.2 |
| | Urban Recreation | 121.7 | 0.3 |
| | Rangeland | 93.2 | 0.2 |
| | Agriculture | 75.2 | 0.2 |
| | Wetlands | 60.4 | 0.1 |
| | Utilities | 27.4 | 0.1 |
| | Forest | 9.3 | < 0.05 |
| | Residential, 1 DU/2 to 5 acres | 5.3 | < 0.05 |
| | Mines, Quarries, Gravel Pits | 3.3 | < 0.05 |
| | Vacant/ Undeveloped | 7.5 | < 0.05 |
| Baylands | Residential, 4+ DU/acre | 1,612.5 | 7.9 |
| | Heavy Industrial | 923.2 | 4.5 |
| | Commercial | 808.1 | 3.9 |
| | Urban Recreation | 692.8 | 3.4 |
| | Utilities | 582.9 | 2.8 |
| | Public / Quasi-Public | 254.4 | 1.2 |
| | Transportation, Communication | 214.4 | 1.0 |
| | Light Industrial | 54.3 | 0.3 |
| | Wetlands | 52.6 | 0.3 |
| | Agriculture | 20.3 | 0.1 |
| | Residential, 1 to 3 DU/acre | 3.1 | < 0.05 |
| | Rangeland | 3.4 | < 0.05 |
| | Sanitary Landfills | 0.1 | < 0.05 |
| | Vacant/Undeveloped | 1.3 | < 0.05 |

**Table 4-9 (continued)**
**Percentage of Santa Clara Basin Watershed Imperviousness Estimated from 1995 Land Use Data[1]**

| Watersheds | Land Uses | Impervious Acres | Percentage of Watershed Imperviousness |
|---|---|---|---|
| Calabazas | Residential, 4+ DU/acre | 5,658.4 | 42.3 |
| | Heavy Industrial | 1,713.7 | 12.8 |
| | Commercial | 1,123.0 | 8.4 |
| | Public / Quasi-Public | 497.9 | 3.7 |
| | Transportation, Communication | 201.1 | 1.5 |
| | Residential, 1 to 3 DU/acre | 61.0 | 0.5 |
| | Urban Recreation | 28.5 | 0.2 |
| | Forest | 11.8 | 0.1 |
| | Residential, 1 DU/2 to 5 acres | 10.6 | 0.1 |
| | Rangeland | 7.0 | 0.1 |
| | Vacant/Undeveloped | 0.6 | < 0.05 |
| | Agriculture | 0.9 | < 0.05 |
| Coyote | Residential, 4+ DU/acre | 14,297.0 | 7.0 |
| | Commercial | 2,059.6 | 1.0 |
| | Public / Quasi-Public | 1,446.3 | 0.7 |
| | Heavy Industrial | 1,416.2 | 0.7 |
| | Light Industrial | 906.5 | 0.4 |
| | Transportation, Communication | 831.1 | 0.4 |
| | Rangeland | 610.9 | 0.3 |
| | Urban Recreation | 441.1 | 0.2 |
| | Forest | 373.0 | 0.2 |
| | Agriculture | 232.8 | 0.1 |
| | Utilities | 58.6 | < 0.05 |
| | Residential, 1 to 3 DU/acre | 22.8 | < 0.05 |
| | Vacant/Undeveloped | 16.9 | < 0.05 |
| | Mines, Quarries, Gravel Pits | 2.9 | < 0.05 |
| Guadalupe | Residential, 4+ DU/acre | 25,910.3 | 23.8 |
| | Commercial | 4,676.9 | 4.3 |
| | Heavy Industrial | 3,091.5 | 2.8 |
| | Public / Quasi-Public | 2,168.7 | 2.0 |
| | Light Industrial | 1,864.5 | 1.7 |
| | Transportation, Communication | 1,539.5 | 1.4 |
| | Forest | 378.0 | 0.4 |
| | Urban Recreation | 362.5 | 0.3 |
| | Rangeland | 168.5 | 0.2 |
| | Residential, 1 to 3 DU/acre | 100.7 | 0.1 |
| | Agriculture | 62.5 | 0.1 |
| | Utilities | 12.2 | < 0.05 |
| | Vacant/Undeveloped | 13.3 | < 0.05 |

**Table 4-9 (continued)**
**Percentage of Santa Clara Basin Watershed Imperviousness Estimated from 1995 Land Use Data[1]**

| Watersheds | Land Uses | Impervious Acres | Percentage of Watershed Imperviousness |
|---|---|---|---|
| | Mines, Quarries, Gravel Pits | 0.6 | < 0.05 |
| Matadero/Barron | Residential, 4+ DU/acre | 3,920.7 | 36.1 |
| | Public / Quasi-Public | 1,106.2 | 10.2 |
| | Residential, 1 to 3 DU/acre | 726.8 | 6.7 |
| | Commercial | 518.0 | 4.8 |
| | Transportation, Communication | 97.4 | 0.9 |
| | Heavy Industrial | 83.1 | 0.8 |
| . | Urban Recreation | 77.7 | 0.7 |
| | Forest | 7.9 | 0.1 |
| | Rangeland | 7.6 | 0.1 |
| | Utilities | 0.8 | < 0.05 |
| | Vacant/Undeveloped | 1.9 | < 0.05 |
| Lower Penitencia | Residential, 4+ DU/acre | 4,437.2 | 24.3 |
| | Light Industrial | 1,261.4 | 6.9 |
| | Commercial | 495.5 | 2.7 |
| | Heavy Industrial | 453.7 | 2.5 |
| | Public / Quasi-Public | 444.5 | 2.4 |
| | Transportation, Communication | 424.0 | 2.3 |
| | Urban Recreation | 169.2 | 0.9 |
| | Rangeland | 70.7 | 0.4 |
| | Residential, 1 to 3 DU/acre | 58.2 | 0.3 |
| | Agriculture | 10.2 | 0.1 |
| | Forest | 2.1 | < 0.05 |
| | Mines, Quarries, Gravel Pits | 1.2 | < 0.05 |
| | Utilities | 0.4 | < 0.05 |
| | Vacant/Undeveloped | 4.3 | < 0.05 |
| Permanente | Residential, 4+ DU/acre | 3,884.0 | 35.0 |
| | Public / Quasi-Public | 329.8 | 3.0 |
| | Commercial | 173.8 | 1.6 |
| | Light Industrial | 153.0 | 1.4 |
| | Heavy Industrial | 86.6 | 0.8 |
| | Residential, 1 to 3 DU/acre | 79.9 | 0.7 |
| | Transportation, Communication | 69.9 | 0.6 |
| | Forest | 38.9 | 0.4 |
| | Urban Recreation | 33.2 | 0.3 |
| | Residential, 1 DU/2 to 5 acres | 10.9 | 0.1 |
| | Mines, Quarries, Gravel Pits | 10.6 | 0.1 |
| | Rangeland | 3.0 | < 0.05 |
| | Vacant/Undeveloped | 0.8 | < 0.05 |

**Table 4-9 (continued)**
**Percentage of Santa Clara Basin Watershed Imperviousness Estimated from 1995 Land Use Data[1]**

| Watersheds | Land Uses | Impervious Acres | Percentage of Watershed Imperviousness |
|---|---|---|---|
| San Francisquito | Residential, 1 to 3 DU/acre | 2,551.3 | 9.3 |
| | Residential, 4+ DU/acre | 1,642.1 | 6.0 |
| | Public / Quasi-Public | 531.8 | 1.9 |
| | Commercial | 470.9 | 1.7 |
| | Transportation, Communication | 195.1 | 0.7 |
| | Forest | 122.6 | 0.5 |
| | Rangeland | 86.5 | 0.3 |
| | Urban Recreation | 65.0 | 0.2 |
| | Heavy Industrial | 16.7 | 0.1 |
| | Agriculture | 12.2 | < 0.05 |
| | Residential, 1 DU/2 to 5 acres | 1.7 | < 0.05 |
| | Utilities | 1.2 | < 0.05 |
| | Vacant/Undeveloped | 4.0 | < 0.05 |
| | Wetlands | 0.5 | < 0.05 |
| San Tomas | Residential, 4+ DU/acre | 12,365.8 | 43.1 |
| | Commercial | 1,627.4 | 5.7 |
| | Heavy Industrial | 1,554.2 | 5.4 |
| | Public / Quasi-Public | 1,187.8 | 4.1 |
| | Transportation, Communication | 283.7 | 1.0 |
| | Urban Recreation | 105.5 | 0.4 |
| | Forest | 68.1 | 0.2 |
| | Utilities | 27.7 | 0.1 |
| | Residential, 1 DU/2 to 5 acres | 11.2 | 0.0 |
| | Residential, 1 to 3 DU/acre | 12.5 | 0.0 |
| | Rangeland | 2.3 | 0.0 |
| | Freshwater | 0.0 | 0.0 |
| | Agriculture | 0.2 | < 0.05 |
| | Vacant/Undeveloped | 2.6 | < 0.05 |
| Stevens | Residential, 4+ DU/acre | 3,623.4 | 19.4 |
| | Heavy Industrial | 666.1 | 3.6 |
| | Commercial | 371.3 | 2.0 |
| | Public / Quasi-Public | 167.1 | 0.9 |
| | Transportation, Communication | 162.7 | 0.9 |
| | Urban Recreation | 96.6 | 0.5 |
| | Forest | 92.0 | 0.5 |
| | Utilities | 85.4 | 0.5 |
| | Residential, 1 to 3 DU/acre | 42.8 | 0.2 |
| | Rangeland | 23.3 | 0.1 |
| | Agriculture | 1.8 | < 0.05 |
| | Mines, Quarries, Gravel Pits | 1.2 | < 0.05 |

**Table 4-9 (concluded)**
**Percentage of Santa Clara Basin Watershed Imperviousness**
**Estimated from 1995 Land Use Data[1]**

| Watersheds | Land Uses | Impervious Acres | Percentage of Watershed Imperviousness |
|---|---|---|---|
| | Vacant/Undeveloped | 0.4 | < 0.05 |
| Sunnyvale East | Residential, 4+ DU/acre | 2,410.3 | 52.9 |
| | Commercial | 559.0 | 12.3 |
| | Heavy Industrial | 381.7 | 8.4 |
| | Public / Quasi-Public | 294.4 | 6.5 |
| | Transportation, Communication | 74.4 | 1.6 |
| | Urban Recreation | 23.5 | 0.5 |
| | Utilities | 3.5 | 0.1 |
| | Vacant/Undeveloped | 0.1 | < 0.05 |
| Sunnyvale West | Heavy Industrial | 1,091.7 | 22.5 |
| | Public / Quasi-Public | 1,028.2 | 21.2 |
| | Residential, 4+ DU/acre | 823.1 | 17.0 |
| | Commercial | 236.0 | 4.9 |
| | Light Industrial | 214.6 | 4.4 |
| | Urban Recreation | 58.4 | 1.2 |
| | Transportation, Communication | 52.1 | 1.1 |
| | Utilities | 11.7 | 0.2 |
| | Agriculture | 1.5 | < 0.05 |
| | Sanitary Landfills | 0.7 | < 0.05 |
| | Vacant/Undeveloped | 0.7 | < 0.05 |

[1] Analysis was completed prior to the provisional revision of the Baylands boundary. Therefore, values depicted for the Baylands and the Arroyo la Laguna watershed do not reflect the revised boundary.

Coefficients of imperviousness were identified for the ABAG land use data based on previous studies[7] (Bredehorst 1981; EOA 1999). Most imperviousness coefficients were drawn from Bredehorst (1981), who studied a statistically representative random sample of land use classes within the Los Angeles Flood Control District's jurisdiction (Appendix 4A, Table 4A-1). These coefficients were rounded to two significant digits for this analysis, per personal communication with District staff[8]. For land use classes that were not sampled by Bredehorst, we used coefficients developed by Eisenberg, Olivieri, and Associates (EOA 1999) to estimate imperviousness (Appendix 4A, Table 4A-1). Some coefficients from both studies were truthed in a GIS by overlaying land use data on orthophotographs and digitizing impervious areas on the computer screen for up to 5 polygons for selected land uses (Appendix 4A, Table 4A-1).

[7] A literature search was conducted to identify studies that (1) had the most accurate imperviousness estimates (based on their methods and data sources), and (2) were conducted in regions with similar climate and land use patterns.
[8] Iraj Nasseri, Chief Hydrologist, Los Angeles Flood Control District.

Once entered into a lookup table (Dbase format), imperviousness coefficients were linked to the land use GIS coverage. The imperviousness of land uses was estimated by multiplying land use acreages by imperviousness coefficients. Estimates of impervious watershed acreages were generated by intersecting existing[9] land uses with watersheds in a GIS (Table 4-9). The percentage of each watershed's area estimated to be impervious (Table 4-10) was calculated subsequently. Projected imperviousness for Basin watersheds (Table 4-10) was estimated by taking the difference between existing and projected land use acreages for each watershed (using the results of analyses described in Section 4.1); assigning coefficients of imperviousness to the projected land use classes (residential, 0.86; industrial/commercial, 0.91); and multiplying the coefficients by the differences between existing and projected land use acreages.

### 4.3.3 Results

Percent watershed imperviousness estimated for each watershed is listed for both existing and projected land uses (Table 4-9). Existing percent watershed imperviousness appears to correlate with the relative percent watershed developed. Table 4-9 illustrates that Coyote Creek watershed had the least impervious landscape (11.1 percent), and the least percent acreage existing as either residential (8.6 percent) or industrial/commercial (3.7 percent) land uses, and the greatest percent acreage existing as relatively undeveloped land uses (87.1 percent). Conversely, Sunnyvale East watershed had the most impervious landscape (82.2 percent), and the greatest percent residential (65.3 percent), the second greatest percent industrial/commercial (31.8 percent) land uses, and the least percent acreage existing as relatively undeveloped land uses (2.9 percent).

The projected increase in the percentage of watershed imperviousness (1995 – 2020) ranged from 0.03 percent to 6.9 percent (Table 4-9). Watersheds estimated to experience the greatest increase in impervious area were Arroyo la Laguna (6.9 percent), San Francisquito (5.3 percent), and Lower Penitencia (4.6 percent) (Table 4-9).

The relative contributions of individual existing land uses to the percentage of watershed imperviousness are described in Table 4-10. In most watersheds, residential land uses at 4+ DU/acre contributed the most to watershed imperviousness. Either industrial (mostly heavy), commercial, or public/quasi-public land uses typically contributed the next most to the percentage of watershed imperviousness. The Sunnyvale West watershed was an exception, in which heavy industry most contributed to watershed imperviousness.

Estimates of watershed imperviousness are sorted in descending order of relative contribution by land use in Table 4-9 (ABAG 1996 – see Section 4.2 for a description of this data source and analysis). Impervious acres and percentages were rounded to single digits; thus, percentages less than 0.05 are reported in this single value class. For total watershed imperviousness see Table 4-10.

[9] Existing as of 1995, based on ABAG land use data (1996). See Section 4.1 for complete description of how existing land use was analyzed.

**Table 4-10**
**Existing and Projected Percent Imperviousness for Watersheds in the Santa Clara Basin[1]**

| | | Existing (1995) | | Percent of Watersheds Occupied by Existing Land Uses | | | Projected (2020) | | |
|---|---|---|---|---|---|---|---|---|---|
| Watersheds | Total Acreage | Impervious Acreage | Percent Imperviousness | Residential | Industrial, Commercial | Agriculture, Open | Impervious Acreage | Percent Imperviousness | Percent Increase in Imperviousness |
| Coyote | 205,100 | 22,700 | 11.1 | 8.6 | 3.7 | 87.7 | 25,900 | 12.6 | 1.6 |
| San Francisquito | 27,400 | 5,700 | 20.8 | 29.6 | 5.2 | 65.1 | 7,200 | 26.1 | 5.3 |
| Baylands | 21,000 | 5,200 | 25.4 | 9.7 | 16.2 | 74.1 | 6,000 | 29.0 | 3.6 |
| Stevens | 18,700 | 5,300 | 28.6 | 24.5 | 9.0 | 66.5 | 5,400 | 28.9 | 0.4 |
| Arroyo la Laguna | 47,600 | 16,600 | 34.9 | 23.8 | 16.9 | 59.2 | 19,900 | 41.8 | 6.9 |
| Guadalupe | 108,900 | 40,400 | 37.1 | 29.6 | 13.6 | 56.8 | 41,700 | 38.3 | 1.2 |
| Lower Penitencia | 18,300 | 7,800 | 42.9 | 30.7 | 19.0 | 50.3 | 8,700 | 47.4 | 4.6 |
| Permanente | 11,100 | 4,900 | 43.9 | 46.3 | 13.1 | 40.5 | 4,900 | 44.3 | 0.3 |
| Adobe | 7,250 | 3,200 | 44.7 | 46.5 | 11.8 | 41.7 | 3,300 | 45.4 | 0.7 |
| San Tomas | 28,700 | 17,200 | 60.1 | 53.9 | 18.8 | 27.4 | 17,600 | 61.2 | 1.1 |
| Matadero/Barron | 10,900 | 6,500 | 60.3 | 60.5 | 20.1 | 19.4 | 6,600 | 61.0 | 0.7 |
| Calabazas | 13,400 | 9,300 | 69.7 | 54.5 | 29.4 | 16.1 | 9,500 | 71.1 | 1.4 |
| Sunnyvale West | 4,860 | 3,500 | 72.4 | 20.9 | 65.2 | 13.9 | 3,600 | 75.0 | 2.6 |
| Sunnyvale East | 4,560 | 3,700 | 82.2 | 65.3 | 31.8 | 2.9 | 3,800 | 83.4 | 1.2 |

[1] Analysis was completed prior to the provisional revision of the Baylands boundary. Therefore, values depicted for the Baylands and the Arroyo la Laguna watershed do not reflect the revised boundary.

Watersheds are sorted in ascending order by existing percent imperviousness. Also shown are total watershed acreages, number of existing[10] and projected[11] watershed acres estimated to be impervious, existing and projected percentage of watersheds estimated to be impervious, the difference between existing and projected watershed imperviousness and the percentage of watersheds occupied by grouped, land use categories[12]. Data sources included existing land use (ABAG 1996), projected land use (ABAG 1998), and coefficients of imperviousness (Bredehorst 1981; EOA 1999).

### 4.3.4 Discussion

#### *4.3.4.1 The Importance of Scale*

Imperviousness has been identified as a useful quantitative measure for evaluating effects of urbanization and land use planning practices on the health of aquatic ecosystems. This measurement has become popular because it provides a single, quantifiable measure that is easily understood by planners, engineers, landscape architects, scientists, local officials, and citizens (Schueler 1995a). It is important, however, to apply this measurement at appropriate spatial scales. Past studies have found that estimates of imperviousness best correlate with ecological indicators[13] at a subwatershed scale, typically those delineated at a third-order scale; for example, the area draining to the point where two second-order[14] streams merge (Center for Watershed Protection 1998c) (Figure 4-13).

The Basin's watersheds range from first to sixth order based on 1:24,000 scale mapping[15]. Several Basin watersheds are third order or smaller, and thus are suitable sizes for applying imperviousness statistics (Table 4-11). Others require delineation of subwatersheds to at least a third-order level. Because this tool is only appropriately applied to hydrologic units that are at most third-order in size, the analysis presented in this section is useful for general description and for regional planning, but is not appropriate as a basis for detailed subwatershed assessment or planning[16]. To assess the relationship between imperviousness and the aquatic ecosystem health, the WMI will need to estimate imperviousness for third-order (or smaller) subwatersheds within

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[10] Existing references the year 1995, used as a baseline date based on the currency of the ABAG land use data (1996).
[11] Time frame for projections is 1995 – 2020. See Section 4.1 for a complete description of how projected land use data (Projections '98) was analyzed.
[12] The grouped land use categories correspond to subtotals calculated for Table 4.3, Percent of Santa Clara Basin Watersheds as Existing (1995) Land Uses presented in Section 4.1 of Chapter 4. Note: the percentages in the Agriculture/Open category represent a combination of the surface water and the less developed land use categories.
[13] Including instream habitat structure, riparian buffer integrity, biological integrity of macroinvertebrate and fish communities.
[14] Strahler (1957).
[15] Note that the scale of data used to assign stream/drainage order influences the size of the hydrologic unit: larger scale mapping will include a greater number of streams than smaller scale mapping, thus hydrologic units mapped from larger scale data will be smaller than those mapped from smaller scale data.
[16] An initial assessment of subwatershed order was done to complete the analyses for this chapter, however, the source data available at the time analysis was initiated was not entirely suitable for this exercise: the data set used was developed by the Water District in 1985; their subwatershed boundaries were delineated to coincide with streamflow gage locations and features that influence streamflow, such as bridges. This method of delineation differs from one based on stream order.

the selected representative watersheds. Such analysis will require developing a creek data set with stream order as an attribute[17] and using it as a basis for delineating subwatershed boundaries.

**Table 4-11**
**Drainage Order for Basin Watersheds[1]**

| Watersheds | Area (mi$^2$) | Drainage Order |
|---|---|---|
| Guadalupe | 170 | 6 |
| Coyote | 321 | 5 |
| San Tomas | 45 | 5 |
| Arroyo la Laguna | 74 | 4 |
| Baylands | 33 | 4 |
| Lower Penitencia | 29 | 4 |
| San Francisquito | 43 | 4 |
| Matadero/Barron | 17 | 3 |
| Adobe | 11 | 3 |
| Permanente | 17 | 3 |
| Calabazas | 21 | 3 |
| Stevens | 29 | 3 |
| Sunnyvale West | 8 | 1 |
| Sunnyvale East | 7 | 1 |

[1] Sorted in descending order. Watershed area rounded to whole numbers.

#### *4.3.4.2 The Importance of the Spatial Distribution of Land Uses*

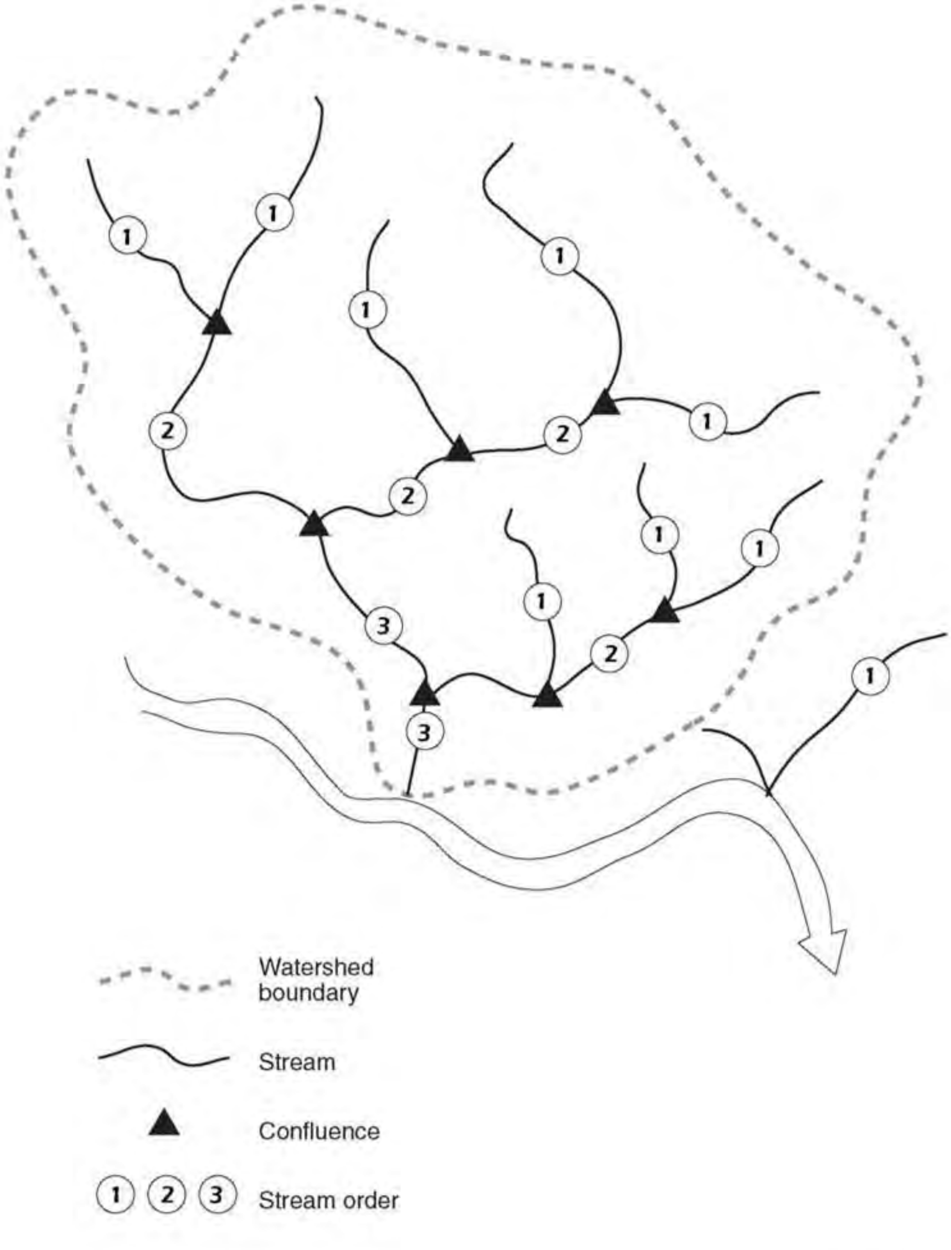
The percentage of watershed imperviousness is a metric that summarizes a complex mosaic of land uses. When interpreting imperviousness, it is essential to consider the spatial distribution of land uses within hydrologic units. The following examples illustrate this point.

As described in Section 4.2, the typical coarse-scale pattern of land use distribution in most Basin watersheds consists of steep uplands in relatively natural states that transition to urbanized lowlands adjacent to and on the valley floor. In general, the lower portions of these watersheds contain the majority of the impervious area, whereas the upper portions are relatively pervious. This pattern suggests that stream reaches in the upper watershed areas would be impacted less by impervious areas than streams in the lower watershed areas. This pattern, however, may not always be similarly interpreted for impacts to organisms. Anadromous fish, for example, may be affected by the conditions of lower reaches, which they must navigate to access their spawning and feeding habitat in upper reaches.

Figure 4-13 (front)

[17] No existing stream data set includes stream order as an attribute. Thus, it is recommended that the WMI fund a task to attribute a creek data set, of suitable scale, and delineate subwatershed boundaries based on it.

## Illustration of a Third-Order Watershed and Associated Stream Network




Source: Center for Watershed Protection, 1998

Lammert and Allan (1999) explored the relationship between land use and several ecological indicators (instream habitat structure, an index of biological integrity for fish, and two multimetric indices for macroinvertebrates) at three scales of measurement (subcatchments, 250-meter-wide riparian corridor, and a 100-meter-wide riparian corridor). They found that land use measured within riparian corridors better predicted aquatic biotic condition than land use measured within subcatchments. Local habitat variables, however, best explained the variability observed in fish and macroinvertebrate communities (Lammert and Allan 1999). Thus, for the watershed assessments, the WMI may want to consider (1) identifying patterns of land use within riparian corridors at a finer spatial resolution than exists in the ABAG land use data, and (2) identifying and obtaining data pertaining to local aquatic habitat variables.

#### *4.3.4.3 Correlating Imperviousness with Ecological Indicators*

Numerous studies have identified relationships between drainage basin imperviousness and the health of receiving waterbodies (May et al. 1997a, b; Arnold and Gibbons 1996; Schueler 1994). Schueler (1995a) summarized a large body of research that related imperviousness to changes in the hydrology, habitat structure, water quality, and biodiversity of aquatic ecosystems. He found that these studies reported occurrence of stream degradation at similar levels of imperviousness. Based on this finding, Schueler (1995a, 1996b; Center for Watershed Protection 1998c) developed a model for classifying urban stream quality (Table 4-12) and for setting restoration and management objectives.

While Schueler's work demonstrates an approach that could be applied when assessing and planning for the Basin's subwatersheds, May et al. (1997a) found that physical, chemical, and biological characteristics of streams change with increasing urbanization in a continuous manner rather than according to thresholds. Because the studies Schueler reviewed occurred in dissimilar, humid ecoregions distant from the Bay Area, the classification thresholds he describes may not apply well to the Basin's streams. Comparing imperviousness to aquatic characteristics in a continuous manner is a useful mechanism for evaluating the classification thresholds and determining which may be appropriate for Basin streams. The WMI's watershed assessments could examine the correlation between percent imperviousness and biological stream characteristics for Basin streams, and determine whether classification thresholds can be well-defined and how they compare to those described by Schueler (1995a, 1996b; Center for Watershed Protection 1998c).

Instream infrastructure associated with flood control and water supply, and extractive activities such as aggregate mining, can have a large impact on aquatic resources (Williams and Wolman 1984; Lignon et al. 1995), yet such activities are not directly measured by percent imperviousness. Thus, correlating only percent imperviousness with physical, biological, and chemical stream characteristics may not sufficiently measure nor characterize human-associated impacts on aquatic resources.

**Table 4-12**
**Model for Classifying Urban Streams and for Establishing Watershed Management Performance Criteria Based on Percent Subwatershed Imperviousness** [1, 2]

| Urban Stream Classification | Sensitive: 0-10% Imperviousness | Impacted: 11-25% Imperviousness | Nonsupporting: > 25% Imperviousness | Restorable: ≤ 11% Imperviousness |
|---|---|---|---|---|
| Indicators: | | | | |
| *Channel Stability* | Stable | Unstable | Highly Unstable | See previous two columns |
| *Water Quality* | Good-Excellent | Fair-Good | Fair-Poor | " |
| *Habitat Quality* | Good-Excellent | Fair-Good | Fair-Poor | " |
| *Stream Biodiversity* | Good-Excellent | Fair-Good | Poor | " |
| Performance Criteria: | | | | |
| *Goal* | Maintain predevelopment biodiversity | Limit degradation of stream habitat and quality | Minimize downstream pollutant loads | Restore stream biodiversity to impacted or sensitive levels |
| *Land Use* | Watershed and site impervious cover limits | Upper limit on subwatershed imperviousness | No watershed cap; redevelopment encouraged | Limited watershed redevelopment with full BMPs, some infill |
| *BMPs* | Maintain predevelopment hydrology and recharge | Emphasize pollutant removal and channel protection | Maximize removal of pollutants | Subwatershed restoration with stormwater retrofit ponds and wetland creation |
| *Buffers* | Wide riparian buffers to protect sensitive areas | Variable width riparian buffers | Greenway for recreation and flood protection | Acquisition or easements on stream corridors, riparian reforestation |
| *Monitoring* | Biological Indicators | Biological and physical indicators | Water quality trends and loads | Biological indicators, citizen monitoring |

[1] Adapted from Schueler 1995a, 1996b; Center for Watershed Protection 1998c.
[2] Restorable streams are identified after inventorying all subwatersheds (Schueler 1996b).

### *4.3.4.4 Measuring Imperviousness*

The methods used here to measure imperviousness could be modified to provide more accurate estimates applicable to hydrologic units smaller than watersheds; for example, equal to or less than 3rd order. For example, it would be useful to combine data describing actual road areas with the land use data employed for this analysis. The importance of the road-component of imperviousness is widely noted (Schueler 1994; Arnold and Gibbons 1996); roads are directly connected to stormdrain systems, and thus runoff contributed from their impervious area is quickly and completely transported. The ABAG data include few transportation routes due to the 2.5-acre spatial resolution of the data.

Several current projects within the Basin are estimating imperviousness using variations of the techniques presented above, and may provide methodologies and additional data that are useful for the WMI's assessments and watershed plans. The Stormwater Environmental Indicator Pilot Demonstration project is combining several data sources to estimate imperviousness for the Coyote Creek watershed. The Water District and the City of Mountain View are collaborating to estimate imperviousness by directly measuring from remotely sensed imagery.

# Analysis of Land Use, Other Special Features in Riparian Corridors

## 4.4.1 Introduction

### *4.4.1.1 Riparian Corridor Definition*

The term "riparian corridor" was developed to convey the importance of both aquatic and terrestrial resources that are ecologically linked to river systems. While no standard definition of a riparian corridor exists, one broadly accepted includes "banks and other adjacent terrestrial (as opposed to aquatic) environs of fresh waterbodies, watercourses, estuaries, and surface-emergent aquifers (springs, seeps, oases), whose transported freshwaters provide soil moisture sufficiently in excess of that otherwise available through local precipitation to potentially support growth of mesic vegetation" (Warner and Hendrix 1984). In some cases a riparian corridor is defined to include only area within the bank-to-bank stream channel (City of San Jose 1994).

Because no standard riparian corridor definition exists, municipalities have used one or more of the following approaches to identify riparian corridor boundaries: using physical attributes, including vegetation, stream morphology, or hydrology; assigning arbitrary widths; or mapping (City of San Jose 1994). The *Riparian Corridor Policy Study* (City of San Jose 1994) defined riparian corridors to include:

> "…any defined stream channels including the area up to the bankfull flow line, as well as all riparian (streamside) vegetation in contiguous adjacent uplands. Characteristic woody riparian vegetation species could include (but are not limited to): willow, *Salix* sp.; alder, *Alnus* sp.; box elder, *Acer negundo*; Fremont cottonwood, *Populus fremontii*; bigleaf maple, *Acer macrophyllum*; western sycamore, *Platanus racemosa*; and oaks, *Quercus* sp. Stream channels include all perennial and intermittent streams shown as a solid or dashed blue line on USGS topographic maps, and ephemeral streams or arroyos with well-defined channels and some evidence of scour or deposition."

#### *4.4.1.2 Importance of Riparian Corridors*

Riparian corridors provide a variety of ecosystem services that are important both for wildlife and for human societies; specifically, they:

- Provide food and habitat for aquatic and some terrestrial organisms
- Preserve water quality by filtering sediment from runoff before it enters surface waterbodies
- Protect streambanks from erosion
- Provide a storage area for floodwaters
- Preserve open space and aesthetic surroundings

#### *4.4.1.3 Potential Conflicts*

Preservation of riparian corridors often competes with other land uses, especially in growing urban areas. To address potentially incompatible land use development patterns in riparian corridors, many Basin municipalities have established riparian corridor policies that recommend either numeric or nonnumeric development setbacks. Numeric setbacks range from narrower, 100 feet from creek center beds, to wider, 100 feet from the edge of riparian vegetation or the top of streambank, whichever is wider. Nonnumeric setbacks include language that describes the establishment of buffers from adjacent land uses to protect natural creekside areas.

The size of riparian buffer needed to protect the ecological and functional integrity of stream systems is difficult to establish (Schueler 1995b). The minimum buffer width suitable for these purposes may be determined from the associated beneficial uses and from the quality of the existing riparian vegetation (Castelle et al. 1994). Increases in the percentage of watershed imperviousness (see Section 4.3) are often accompanied by proportionate increases in riparian buffer encroachment, contributing to the nonfunctional condition of riparian corridors (Castelle et al. 1994).

Maintaining the longitudinal connectivity of riparian corridors is at least as important as maintaining a riparian buffer width; however, it is often overlooked in riparian corridor policies. Riparian corridors in highly urbanized areas are often fragmented, particularly by road crossings, which disrupt habitat and introduce disturbances and pollutants to stream systems.

### 4.4.2 Methods

#### *4.4.2.1 Riparian Corridor Mapping*

For this analysis, the City of San Jose’s definition of riparian corridors was used. Where riparian vegetation data existed for streamside areas within the Basin, it was used to define riparian corridors; where riparian vegetation data was absent, riparian corridors were defined by a distance of 100 feet on either side of the creek centerline, or top of bank where available. This distance was chosen because most municipalities in the Basin have policies or ordinances requiring at least 100-foot setbacks from riparian vegetation or the top of streambanks  Multiple creek data sets were compiled to provide comprehensive coverage of creeks throughout the entire Basin.  The following lists the data used and the analyses conducted to develop a comprehensive data set of riparian corridors in the Basin:

### Riparian Vegetation Communities

Riparian vegetation communities were mapped separately by the Habitat Restoration Group for areas within the City of San Jose for the City of San Jose's Planning Department, and unincorporated areas of Santa Clara County for the Water District.  Vegetation mapping[18] was based on aerial photography from 1984 and 1990 for the City of San Jose, and from 1990 for the Water District.  Different vegetation community classifications were used for these studies (Water District 1996, 1998).

### Creeks Within Santa Clara Valley Water District Jurisdiction

The Water District maintains a GIS data set (Eircrks) that includes most creeks within their jurisdiction.  They also maintain a large database (Waterways Management Model, or WWMM) that describes all channel modifications they have undertaken, and is associated with the creeks GIS data set.  An attribute within the WWMM, width at the top of streambanks, was used to define the top of streambank edge.  For areas lacking riparian vegetation data but included in the WWMM, riparian corridor areas were defined as those extending 100 feet beyond the top of streambank edges.

### Canals and Reservoirs Within Santa Clara Valley Water District Jurisdiction

In addition to their creeks data set, the Water District maintains two other data sets that describe surface waterbodies: canals, and reservoirs.  Where vegetation mapping was unavailable for these surface waterbodies, riparian corridor areas were defined as those extending 100 feet beyond the perimeter of canals and reservoirs.

### Creeks in the Alameda and San Mateo County Portions of the Santa Clara Basin that were Outside Santa Clara Valley Water District Jurisdiction

Riparian corridors within the Basin and beyond the jurisdiction of the Water District were defined using a creeks data set (Reach File 3) compiled by the California Department of Fish and Game in cooperation with the California Rivers Assessment (CDFG 1999).  For these creeks, riparian corridors were defined as those areas extending 100 feet beyond the creek centerlines.

[18] Riparian vegetation was originally mapped on vellum and subsequently digitized and developed into GIS data by Thomas Reid and Associates.  None of the airphotos were orthocorrected prior to human interpretation, and none of the mapped vegetation data has been ground truthed. Due to manual digitizing tolerance and media stretching, there is unquantified positional error in the data.

#### *4.4.2.2 Identifying Land Uses in Riparian Corridors*

Land uses within riparian corridors were identified by overlaying the compiled riparian corridor data set with the existing land use data (ABAG 1996) as described in Section 4.2. The number and percentage of land use acreages within riparian corridors were summarized by watershed (Table 4-13).

**Defining and Identifying Special Features in Riparian Corridors**

Special features within riparian corridors were defined as:

- Structures established to manage aquatic resources: dams, gages, channel modifications, and fish passage structures
- Fixed-location activities established to exploit aquatic resources: instream quarry operations

Data describing the special features were compiled from the following sources: Water District World Wide Web site[19] (dams, Table 4-14; gages, Table 4-15); Water District Waterways Management Model (channel modifications, Table 4-16); and personal communication with Water District staff (fish passage structures[20], Table 4-17; instream gravel quarry operations[21], Table 4-18). The number of linear creek feet in each watershed for each channel type was calculated by using a GIS to identify which watersheds creeks belonged to, and summing by creek and by watershed, the length of creek occupied by each channel type.

### 4.4.3 Results

#### *4.4.3.1 Existing Land Use within Riparian Corridors*

The percentage of watersheds occupied by riparian areas ranged from about 3.5 percent (Sunnyvale East) to 72.5 percent (Baylands), and the median was 7.7 percent (Table 4-13). The percentage of riparian corridor in the Baylands was much greater than all other Basin watersheds due to the abundance of marshlands. Although these are predominantly saltwater marshlands, they were included in this analysis because Warner and Hendrix's definition (1984) includes estuaries. The percentage of riparian corridor in the Arroyo la Laguna watershed was also noticeably higher than other Basin watersheds because its watershed boundary currently includes a portion of the Baylands[22].

[19] www.Water District.dst.ca.us
[20] David Salsbery, Fisheries Biologist, Water District
[21] Ken Reiller, Associate Civil Engineer, Water District
[22] Bayland areas within the Arroyo la Laguna watershed boundary will be removed as part of a project funded by the Santa Clara Urban Runoff Pollution Prevention Program. Figure 4-3 shows the revised boundary.

**Table 4-13**
**Acreage and Percentage of Land Uses Within Riparian Corridors[1]**

| Watershed | Land Use | Acres | Percentage of Riparian Corridor | Percentage of Watershed |
|---|---|---|---|---|
| Adobe | Forest | 241 | 39.18 | 3.32 |
| | Residential, 4+ DU/acre | 183 | 29.79 | 2.53 |
| | Residential, 1 to 3 DU/acre | 116 | 18.92 | 1.60 |
| | Public/Quasi-Public | 34 | 5.46 | 0.46 |
| | Heavy Industrial | 12 | 2.01 | 0.17 |
| | Vacant/Undeveloped | 11 | 1.81 | 0.15 |
| | Urban Recreation | 6 | 1.04 | 0.09 |
| | Transportation, Communication | 4 | 0.70 | 0.06 |
| | Commercial | 3 | 0.55 | 0.05 |
| | Agriculture | 2 | 0.40 | 0.03 |
| | Rangeland | 1 | 0.15 | 0.01 |
| | ***Total*** | ***614*** | ***100.00*** | ***8.48*** |
| Arroyo la Laguna | Wetlands | 3,520 | 57.77 | 7.39 |
| | Residential, 4+ DU/acre | 736 | 12.07 | 1.54 |
| | Rangeland | 561 | 9.21 | 1.18 |
| | Bays and Estuaries | 339 | 5.57 | 0.71 |
| | Agriculture | 175 | 2.87 | 0.37 |
| | Light Industrial | 132 | 2.17 | 0.28 |
| | Commercial | 116 | 1.90 | 0.24 |
| | Heavy Industrial | 116 | 1.90 | 0.24 |
| | Urban Recreation | 89 | 1.46 | 0.19 |
| | Forest | 87 | 1.42 | 0.18 |
| | Vacant/Undeveloped | 81 | 1.33 | 0.17 |
| | Public/Quasi-Public | 59 | 0.98 | 0.12 |
| | Transportation, Communication | 54 | 0.88 | 0.11 |
| | Mines, Quarries, Gravel Pits | 21 | 0.35 | 0.04 |
| | Fresh Water | 5 | 0.08 | 0.01 |
| | Utilities | 3 | 0.05 | 0.01 |
| | ***Total*** | ***6,093*** | ***100.00*** | ***12.79*** |
| Baylands[2] | Wetlands | 9,910 | 66.60 | 48.25 |
| | Urban Recreation | 2,654 | 17.84 | 12.92 |
| | Utilities | 803 | 5.40 | 3.91 |
| | Heavy Industrial | 362 | 2.43 | 1.76 |
| | Commercial | 293 | 1.97 | 1.43 |
| | Rangeland | 216 | 1.45 | 1.05 |
| | Bays and Estuaries | 136 | 0.92 | 0.66 |
| | Residential, 4+ DU/acre | 128 | 0.86 | 0.62 |

**Table 4-13**
**Acreage and Percentage of Land Uses Within Riparian Corridors[1]**

| Watershed | Land Use | Acres | Percentage of Riparian Corridor | Percentage of Watershed |
|---|---|---|---|---|
| | Agriculture | 112 | 0.75 | 0.55 |
| | Transportation, Communication | 90 | 0.60 | 0.44 |
| | Vacant/Undeveloped | 79 | 0.53 | 0.39 |
| | Light Industrial | 40 | 0.27 | 0.19 |
| | Sanitary Landfills | 6 | 0.04 | 0.03 |
| | Fresh Water | 2 | 0.02 | 0.01 |
| | ***Total*** | ***4,970*** | ***100.00*** | ***24.20*** |
| Calabazas | Residential, 4+ DU/acre | 435 | 55.98 | 3.25 |
| | Commercial | 123 | 15.86 | 0.92 |
| | Heavy Industrial | 103 | 13.26 | 0.77 |
| | Forest | 41 | 5.25 | 0.31 |
| | Public/Quasi-Public | 28 | 3.64 | 0.21 |
| | Urban Recreation | 13 | 1.64 | 0.10 |
| | Rangeland | 12 | 1.53 | 0.09 |
| | Transportation, Communication | 10 | 1.23 | 0.07 |
| | Vacant/Undeveloped | 8 | 0.97 | 0.06 |
| | Residential, 1 DU/2 to 5 acres | 5 | 0.61 | 0.04 |
| | Agriculture | 0 | 0.02 | 0.00 |
| | Residential, 1 to 3 DU/acre | 0 | 0.02 | 0.00 |
| | ***Total*** | ***777*** | ***100.00*** | ***5.81*** |
| Coyote | Forest | 8,263 | 49.13 | 4.03 |
| | Rangeland | 3,777 | 22.46 | 1.84 |
| | Public/Quasi-Public | 1,511 | 8.98 | 0.74 |
| | Agriculture | 1,086 | 6.46 | 0.53 |
| | Residential, 4+ DU/acre | 943 | 5.61 | 0.46 |
| | Fresh Water | 437 | 2.60 | 0.21 |
| | Urban Recreation | 242 | 1.44 | 0.12 |
| | Vacant/Undeveloped | 226 | 1.34 | 0.11 |
| | Commercial | 106 | 0.63 | 0.05 |
| | Transportation, Communication | 93 | 0.56 | 0.05 |
| | Heavy Industrial | 74 | 0.44 | 0.04 |
| | Light Industrial | 31 | 0.18 | 0.01 |
| | Utilities | 16 | 0.10 | 0.01 |
| | Residential, 1 to 3 DU/acre | 12 | 0.07 | 0.01 |
| | Mines, Quarries, Gravel Pits | 2 | 0.01 | 0.00 |
| | ***Total*** | ***16,819*** | ***100.00*** | ***8.20*** |

**Table 4-13**
**Acreage and Percentage of Land Uses Within Riparian Corridors[1]**

| Watershed | Land Use | Acres | Percentage of Riparian Corridor | Percentage of Watershed |
|---|---|---|---|---|
| Guadalupe | Forest | 3,782 | 42.10 | 3.47 |
| | Rangeland | 1,545 | 17.20 | 1.42 |
| | Residential, 4+ DU/acre | 1,297 | 14.43 | 1.19 |
| | Vacant/Undeveloped | 994 | 11.07 | 0.91 |
| | Commercial | 516 | 5.74 | 0.47 |
| | Agriculture | 204 | 2.27 | 0.19 |
| | Urban Recreation | 194 | 2.16 | 0.18 |
| | Fresh Water | 126 | 1.40 | 0.12 |
| | Transportation, Communication | 112 | 1.24 | 0.10 |
| | Heavy Industrial | 74 | 0.83 | 0.07 |
| | Light Industrial | 70 | 0.78 | 0.06 |
| | Public/Quasi-Public | 49 | 0.55 | 0.05 |
| | Residential, 1 to 3 DU/acre | 16 | 0.18 | 0.01 |
| | Utilities | 4 | 0.04 | 0.00 |
| | Mines, Quarries, Gravel Pits | 1 | 0.01 | 0.00 |
| | ***Total*** | ***8,984*** | ***100.00*** | ***8.25*** |
| Lower Penitencia | Rangeland | 549 | 46.21 | 3.00 |
| | Residential, 4+ DU/acre | 321 | 26.99 | 1.75 |
| | Light Industrial | 104 | 8.79 | 0.57 |
| | Forest | 58 | 4.90 | 0.32 |
| | Public/Quasi-Public | 38 | 3.18 | 0.21 |
| | Urban Recreation | 35 | 2.95 | 0.19 |
| | Commercial | 30 | 2.51 | 0.16 |
| | Heavy Industrial | 16 | 1.32 | 0.09 |
| | Vacant/Undeveloped | 14 | 1.21 | 0.08 |
| | Residential, 1 to 3 DU/acre | 11 | 0.94 | 0.06 |
| | Transportation, Communication | 8 | 0.63 | 0.04 |
| | Mines, Quarries, Gravel Pits | 3 | 0.28 | 0.02 |
| | Agriculture | 1 | 0.08 | 0.01 |
| | ***Total*** | ***1,188*** | ***100.00*** | ***6.50*** |
| Matadero/Barron | Residential, 4+ DU/acre | 239 | 39.62 | 2.20 |
| | Residential, 1 to 3 DU/acre | 82 | 13.54 | 0.75 |
| | Forest | 71 | 11.80 | 0.65 |
| | Public/Quasi-Public | 60 | 9.95 | 0.55 |
| | Rangeland | 59 | 9.84 | 0.55 |
| | Commercial | 32 | 5.25 | 0.29 |

**Table 4-13**
**Acreage and Percentage of Land Uses Within Riparian Corridors[1]**

| Watershed | Land Use | Acres | Percentage of Riparian Corridor | Percentage of Watershed |
|---|---|---|---|---|
| | Transportation, Communication | 23 | 3.81 | 0.21 |
| | Urban Recreation | 16 | 2.60 | 0.14 |
| | Heavy Industrial | 14 | 2.31 | 0.13 |
| | Vacant/Undeveloped | 8 | 1.27 | 0.07 |
| | ***Total*** | ***602*** | ***100.00*** | ***5.54*** |
| Permanente | Forest | 473 | 57.26 | 4.26 |
| | Residential, 4+ DU/acre | 270 | 32.65 | 2.43 |
| | Mines, Quarries, Gravel Pits | 17 | 2.05 | 0.15 |
| | Vacant/Undeveloped | 14 | 1.70 | 0.13 |
| | Residential, 1 to 3 DU/acre | 11 | 1.32 | 0.10 |
| | Light Industrial | 9 | 1.08 | 0.08 |
| | Commercial | 8 | 0.92 | 0.07 |
| | Public/Quasi-Public | 5 | 0.66 | 0.05 |
| | Heavy Industrial | 5 | 0.65 | 0.05 |
| | Transportation, Communication | 5 | 0.63 | 0.05 |
| | Rangeland | 4 | 0.49 | 0.04 |
| | Residential, 1 DU/2 to 5 acres | 3 | 0.41 | 0.03 |
| | Urban Recreation | 1 | 0.18 | 0.01 |
| | ***Total*** | ***826*** | ***100.00*** | ***7.45*** |
| San Francisquito | Forest | 906 | 47.54 | 3.31 |
| | Residential, 1 to 3 DU/acre | 353 | 18.52 | 1.29 |
| | Residential, 4+ DU/acre | 208 | 10.93 | 0.76 |
| | Rangeland | 130 | 6.80 | 0.47 |
| | Vacant/Undeveloped | 75 | 3.96 | 0.28 |
| | Agriculture | 70 | 3.66 | 0.25 |
| | Urban Recreation | 50 | 2.64 | 0.18 |
| | Wetlands | 40 | 2.09 | 0.15 |
| | Public/Quasi-Public | 20 | 1.03 | 0.07 |
| | Commercial | 19 | 1.02 | 0.07 |
| | Transportation, Communication | 15 | 0.80 | 0.06 |
| | Fresh Water | 14 | 0.76 | 0.05 |
| | Heavy Industrial | 4 | 0.21 | 0.02 |
| | Residential, 1 DU/2 to 5 acres | 0 | 0.02 | 0.00 |
| | ***Total*** | ***1,906*** | ***100.00*** | ***6.95*** |
| San Tomas | Residential, 4+ DU/acre | 770 | 42.03 | 2.68 |
| | Forest | 745 | 40.65 | 2.60 |

**Table 4-13**
**Acreage and Percentage of Land Uses Within Riparian Corridors[1]**

| Watershed | Land Use | Acres | Percentage of Riparian Corridor | Percentage of Watershed |
|---|---|---|---|---|
| | Commercial | 111 | 6.07 | 0.39 |
| | Public/Quasi-Public | 76 | 4.17 | 0.27 |
| | Heavy Industrial | 56 | 3.04 | 0.19 |
| | Urban Recreation | 31 | 1.67 | 0.11 |
| | Vacant/Undeveloped | 21 | 1.14 | 0.07 |
| | Rangeland | 11 | 0.60 | 0.04 |
| | Transportation, Communication | 6 | 0.31 | 0.02 |
| | Fresh Water | 5 | 0.26 | 0.02 |
| | Utilities | 1 | 0.04 | 0.00 |
| | ***Total*** | ***1,832*** | ***100.00*** | ***6.39*** |
| Stevens | Forest | 1,168 | 64.36 | 6.25 |
| | Residential, 4+ DU/acre | 265 | 14.62 | 1.42 |
| | Rangeland | 158 | 8.72 | 0.85 |
| | Urban Recreation | 84 | 4.63 | 0.45 |
| | Utilities | 82 | 4.52 | 0.44 |
| | Commercial | 23 | 1.28 | 0.12 |
| | Transportation, Communication | 13 | 0.70 | 0.07 |
| | Heavy Industrial | 12 | 0.68 | 0.07 |
| | Vacant/Undeveloped | 5 | 0.28 | 0.03 |
| | Public/Quasi-Public | 2 | 0.12 | 0.01 |
| | Residential, 1 to 3 DU/acre | 1 | 0.07 | 0.01 |
| | Mines, Quarries, Gravel Pits | 0 | 0.00 | 0.00 |
| | Agriculture | 0 | 0.00 | 0.00 |
| | ***Total*** | ***1,815*** | ***100.00*** | ***9.71*** |
| Sunnyvale East | Residential, 4+ DU/acre | 106 | 65.31 | 2.33 |
| | Heavy Industrial | 26 | 15.84 | 0.57 |
| | Commercial | 13 | 7.86 | 0.28 |
| | Public/Quasi-Public | 9 | 5.42 | 0.19 |
| | Urban Recreation | 5 | 3.36 | 0.12 |
| | Transportation, Communication | 2 | 1.19 | 0.04 |
| | Utilities | 2 | 1.02 | 0.04 |
| | ***Total*** | ***163*** | ***100.00*** | ***3.57*** |
| Sunnyvale West | Urban Recreation | 159 | 40.90 | 3.28 |
| | Public/Quasi-Public | 102 | 26.29 | 2.11 |
| | Heavy Industrial | 61 | 15.60 | 1.25 |
| | Sanitary Landfills | 28 | 7.17 | 0.57 |

**Table 4-13**
**Acreage and Percentage of Land Uses Within Riparian Corridors[1]**

| Watershed | Land Use | Acres | Percentage of Riparian Corridor | Percentage of Watershed |
|---|---|---|---|---|
| | Commercial | 15 | 3.78 | 0.30 |
| | Vacant/Undeveloped | 12 | 2.98 | 0.24 |
| | Utilities | 8 | 1.99 | 0.16 |
| | Agriculture | 4 | 1.00 | 0.08 |
| | Light Industrial | 1 | 0.28 | 0.02 |
| | Rangeland | 0 | 0.02 | 0.00 |
| | ***Total*** | ***389*** | ***100.00*** | ***8.01*** |

[1] Analysis was completed prior to the provisional revision of the Baylands boundary. Therefore, values depicted for the Baylands and the Arroyo la Laguna watershed do not reflect the revised boundary.
[2] The percentage of riparian corridor in the Baylands is much greater than all other Basin watersheds due to the abundance of marshlands. Although these marshlands are predominately saltwater, they were included in this analysis because the definition given in *California Riparian Systems* (Warner and Hendrix 1984) includes estuaries. The percentage of riparian corridor in the Arroyo la Laguna watershed is also noticeably higher than in other Basin watersheds because its watershed boundary currently includes a portion of the Baylands.

Although the relative proportions of land uses varied within each watershed's riparian corridors, several patterns exist (Table 4-13):

- West-side watersheds that drain the upper elevation zone (see Section 4.2) of the Santa Cruz Mountains (San Francisquito, Adobe, Permanente, Stevens, San Tomas, and Guadalupe) had a high proportion (approximately 39 to 64 percent) of forested riparian corridors, occurring mostly in the upper watershed areas. The two west-side watersheds that minimally drain the upper elevation zone (Matadero/Barron and Calabazas), had a correspondingly lower proportion (5 to 12 percent) of forested riparian corridors.

- East-side watersheds that drain from the Diablo Range (Arroyo la Laguna, Lower Penitencia, and Coyote) had a high proportion (approximately 22 percent to 46 percent)[23] of rangeland, occurring mostly in upper watershed areas. Coyote was the only east-side watershed to have an even higher proportion of forested area (approximately 49 percent).

- For most west-side and east-side watersheds, 4+ DU/acre residential land use comprised the second greatest proportion of riparian corridors. Exceptions were: San Francisquito (3$^{rd}$), Guadalupe (3$^{rd}$), and Coyote (5$^{th}$).

- The two west-side, valley floor watersheds (Sunnyvale East and Sunnyvale West) both had moderately high proportions (approximately 15 percent) of heavy industrial land use in their riparian corridor areas. While a very high proportion of 4+ DU/acre residential land use (approximately 65 percent) existed in Sunnyvale East's riparian corridors, Sunnyvale West had none. Instead, Sunnyvale West had a high proportion of urban recreation (approximately 41 percent) and public/quasi-public (approximately 27 percent) land uses.

- The Baylands' riparian corridors were mostly occupied by wetlands (approximately 67 percent) and by urban recreational (approximately 18 percent) land uses.

All of the percentages discussed here and presented in Table 4-13 are based on land use data of relatively coarse spatial resolution; for example, the minimal mapping unit for the ABAG (1996) land use data is 2.5 acres. Thus, for the most part, the stream channels are not represented in the ABAG data. The land use acreages within riparian corridors presented here are therefore approximations of true riparian acreages. Moreover, these statistics do not represent the spatial distribution of land uses within riparian corridors, which greatly influences how land uses may affect aquatic resources. Table 4-13 provides the acreage and percentage of canal uses within riparian corridors (sorted in descending order; rounded to whole numbers; summarized by

[23] Due to known error in the Arroyo la Laguna watershed boundary, the relative percentages of land uses within riparian corridors was recalculated without considering wetland areas. The resulting proportion of rangeland in riparian corridors increased from 9.2 to 21.8 percent.

watershed; and calculated as the percentage of watershed area). Residential land uses definitions are 1 DU/2-5 acres, 1-3 DU/acre, and 4+ DU/acre.

### *4.4.3.2 Other Special Features within Riparian Corridors*

#### Dams

The Water District operates 44 dams throughout the Basin. These dams were constructed for water conservation (8 reservoir dams), groundwater recharge through diversion and percolation (35 spreader dams), and irrigation[24] through diversion (1 dam) (Table 4-14). Reservoir dams privately owned and operated include two operated by Stanford University, and one operated by the San Jose Water Company (Table 4-14). Additional existing water rights diversions on Basin streams are listed in Table 4-15.

The presence of dams on streams, especially those formed in alluvial deposits, can change mean channel-bed elevation, channel width, bed-material sizes, vegetation, water discharges, and sediment loads (Williams and Wolman 1984). The frequency and magnitude of such downstream changes, however, will vary depending on the dam size, whether its presence is seasonal, and the length of its operation time. In a study of 21 dams constructed on alluvial rivers in semiarid western United States, Williams and Wolman (1984) found that in all cases, flood peaks were decreased by the dams, but that other post-dam, water-discharge characteristics varied among rivers. Such variation likely occurred because the dams in their study were built for different purposes and thus released flows within a large range of magnitude and duration (Williams and Wolman 1984). Dams are listed in Table 4-14 by watershed and by creek. Also listed are dam purpose (WC = water conservation, P = percolation, D = diversion); and for spreader dams (e.g., percolation and diversion), the type (where data were available[25]), operation status[26], and date the dam was last installed (na = not available). Spreader dam overflows are thirty inches in diameter, located on the upstream dam lip, 3.5 feet below the top. Unless otherwise indicated, dams listed are operated by the Water District.

Listed below in Table 4-15 are the Water Rights Permittees (except the Water District, since Table 4-14 lists their water diversion facilities), the watershed and creek from which water is diverted, the intended water use (D = Domestic; M = Municipal; I = Industrial), and the number of water rights diversions permitted on each creek.

[24] Standish Dam was originally an earthen dam constructed for agricultural irrigation. As part of the mitigation for construction of the lower Coyote Creek flood control bypass project, the dam was reconstructed to additionally provide juvenile summer rearing habitat. However, through an agreement with the CDFG, the dam is not now in place and future reconstruction of the dam is subject to agency approval (see Section 7.2.2.10 for more information).

[25] Blank spreader dam type indicates no data available from the Water District World Wide Website.

[26] Water District spreader dams have not been installed since 1997; reinstallation/operation is subject to permit approval by the CDFG.

**Table 4-14**
**Dams Operated in the Santa Clara Basin[1]**

| Watershed | Dam Sites | Dam Purpose | Spreader Dams | | | |
|---|---|---|---|---|---|---|
| | | | Type | Status | Number Active | Date Last Installed |
| **COYOTE** | **Coyote Creek** | | | | | |
| | Anderson Reservoir | WC | | | | |
| | Coyote Reservoir | WC | | | | |
| | Burnett Ave. | P | | Active | 1 | Mar. 11, 1995 |
| | 2000' U/S Golf Course Entrance | P | | Active | 2 | Sep. 28, 1993 |
| | 1500' D/S Golf Course Entrance | P | | Active | 3 | Sep. 29, 1993 |
| | 2500' U/S Ford Rd. | P | Gravel | Active | 4 | Feb. 2, 1998 |
| | 1700' U/S Ford Rd. | P | Gravel | Active | 5 | Feb. 2, 1998 |
| | 900' U/S Ford Rd. | P | gravel | Active | 6 | Feb. 2, 1998 |
| | Coyote Canal Diversion | D | Board | Active | 7 | Nov. 16, 1998 |
| | Coyote Percolation Dam[2] | P | Steel | Active | 8 | Nov. 17, 1998 |
| | 50' U/S Tennant Ave. | P | | Abandoned | | |
| | Standish Dam | D | Steel | Active | 9 | 1997 |
| | **Upper Penitencia Creek** | | | | | |
| | Noble Ave. #1A | D | Board | Active | 10 | na |
| | Maybury Ave. #72 | D | Steel | Active | 11 | Nov. 9, 1998 |
| **GUADALUPE** | **Alamitos Creek** | | | | | |
| | Almaden Reservoir | WC | | | | |
| | Alamitos Dam | D | Board | Active | 12 | Feb. 25, 1999 |
| | **Arroyo Calero Creek** | | | | | |
| | Calero Reservoir | WC | | | | |
| | **Guadalupe Creek** | | | | | |
| | Guadalupe Reservoir | WC | | | | |
| | 160' U/S Meridian | P | | Active | 13 | Oct. 4, 1993 |
| | 1300' D/S Meridian | P | | Active | 14 | Oct. 5, 1993 |
| | 2270' D/S Meridian | P | | Active | 15 | Oct. 5, 1993 |
| | 500' U/S Almaden Expwy | P | | Active | 16 | Oct. 6, 1993 |
| | Masson Dam | D | Board | Active | 17 | Mar.12, 1999 |
| | **Guadalupe River** | | | | | |
| | D/S Alamitos Crk. Confluence | P | Board | Active | 18 | Feb. 25, 1999 |
| | 1600' D/S Blossom Hill Rd. [2] | P | | Active | 19 | Oct. 6, 1994 |
| | 900' U/S Branham Rd. [2] | P | | Active | 20 | Oct. 6, 1994 |
| | D/S Alamitos Crk. Confluence | P | Gravel | Abandoned | | |
| | 1800' D/S Branham Rd | P | | Abandoned | | |
| | 100' U/S Capitol Expswy | P | | Abandoned | | |
| | **Los Gatos Creek** | | | | | |
| | Lake Elsman[3] | WC | | | | |

**Table 4-14 (concluded)**
**Dams Operated in the Santa Clara Basin[1]**

| Watershed | Dam Sites | Dam Purpose | Spreader Dams | | | |
|---|---|---|---|---|---|---|
| | | | Type | Status | Number Active | Date Last Installed |
| | Lexington Reservoir | WC | | | | |
| | Vasona Reservoir | WC | | | | |
| | 300' U/S Hamilton | P | | Active | 21 | Oct. 3, 1994 |
| | 300' U/S Bascom Rd. [2] | P | | Active | 22 | Sep. 30, 1994 |
| | 1500' U/S Leigh[2] | P | | Active | 23 | Sep. 26, 1994 |
| | 100' D/S Leigh | P | | Active | 24 | Oct. 9, 1993 |
| | 1100' U/S Meridian | P | | Active | 25 | Oct. 9, 1993 |
| | Kirk Dam | D | Steel | Active | 26 | na |
| **SAN FRANCIS-QUITO** | **Bear Gulch Creek** | | | | | |
| | Bear Gulch Reservoir Diversion[4] | WC | | | | |
| | **Corte Madera Creek** | | | | | |
| | Searsville Lake[5] | WC | | | | |
| | **Los Trancos Creek** | | | | | |
| | Felt Lake[5] | WC | | | | |
| | **San Francisquito Creek** | | | | | |
| | Lake Lagunita | WC | | | | |
| **SAN TOMAS** | **Saratoga Creek** | | | | | |
| | 300' U/S Cox Ave. | P | | Active | 27 | Sep. 29, 1994 |
| | 150' U/S Prospect Ave. | P | | Active | 28 | Sep. 28, 1994 |
| | 3300' U/S Bollinger | P | | Active | 29 | Sep. 27, 1994 |
| | 2900' U/S Bollinger | P | | Active | 30 | Sep. 26, 1994 |
| | 2100' D/S Bollinger | P | | Active | 31 | Oct. 7, 1993 |
| | 2600' D/S Bollinger | P | | Active | 32 | Oct. 6, 1993 |
| | 1100' U/S Prospect Ave. | P | | Abandoned | | |
| | **Smith Creek** | | | | | |
| | Elam Ave. | P | Steel | Active | 33 | na |
| | San Tomas Aquino Rd. | P | Steel | Active | 34 | na |
| **STEVENS** | **Stevens Creek** | | | | | |
| | Stevens Creek Reservoir | WC | | | | |
| | 200' D/S Hwy. 280 | P | | Active | 35 | Oct. 1, 1992 |
| | 100' U/S Fremont | P | | Active | 36 | Oct. 3, 1994 |
| | 1200' U/S Homestead Rd. | P | | Proposed | | |
| | 1225' U/S Fremont | P | | Proposed | | |
| | U/S Stevens Crk. Blvd. | P | Board | Proposed | | |

Notes:
[1] Data posted to the Water District internet site are unedited, and should be considered preliminary.
[2] Indicates spreader dams with permanent riser overflows set one foot below the top of the dam.
[3] The dam at Lake Elsman is operated by the San Jose Water Company.
[4] The Bear Gulch Reservoir Diversion Dam is operated by the California Water Service Company.
[5] The dams on Felt Lake and Searsville Lake are operated by Stanford University.

## Hydrologic Gages

Since 1983, the Water District has constructed a series of gages that measure real-time streamflow, reservoir levels, and precipitation volume. Currently, they operate 51 streamflow gages and 8 reservoir gages (Table 4-16, Figure 4-14), as well as 40 precipitation gages in the Basin (Appendix 4A, Table 4A-2). The Water District uses streamflow information for flood protection management, to monitor hydrologic conditions in support of maintenance and operations functions, and to make flow projections on larger watersheds. These data27 are accessible through the Water District World Wide Web site (www.scvwd.dst.ca.us), and may be useful for the WMI's watershed assessments. The U.S. Geological Survey also maintains four streamflow gages in the Basin: on San Francisquito Creek at the Standord University Campus, on the Guadalupe River in downtown San Jose, on Coyote Creek above State Highway 237 in Milpitas, and on Saratoga Creek in Saratoga.

## Channel Modifications

As part of their flood protection and water supply programs, the Water District has modified the channel structure of some Basin streams. Stream channel modifications include creek bank and bottom stabilization, and construction of bypass channels, levees, floodwalls, and culverts. The Waterways Management Model maintained by the Water District describes the type and location of stream channel modifications (Table 4-17). The number of linear feet of modified stream channel is summarized by general and detailed channel type for Basin creeks in Appendix 4A, Table 4A-3.

## Fish Ladders and Passage Structures

Fish ladders and passage structures enable adult fishes to migrate upstream through reaches where modifications, such as dams, are otherwise migratory obstacles. Fish ladders and passage structures exist on several Basin creeks, and are listed by watershed and creek in Table 4-18. Also listed are location, type (TBD indicates proposed passage structure type is to be determined), and status (A = active; I = inactive; P = proposed) of fish passage structures (personal communication, David Salsbery, Fisheries Biologist, Water District).

[27] Installed since 1995 (original construction date unavailable).

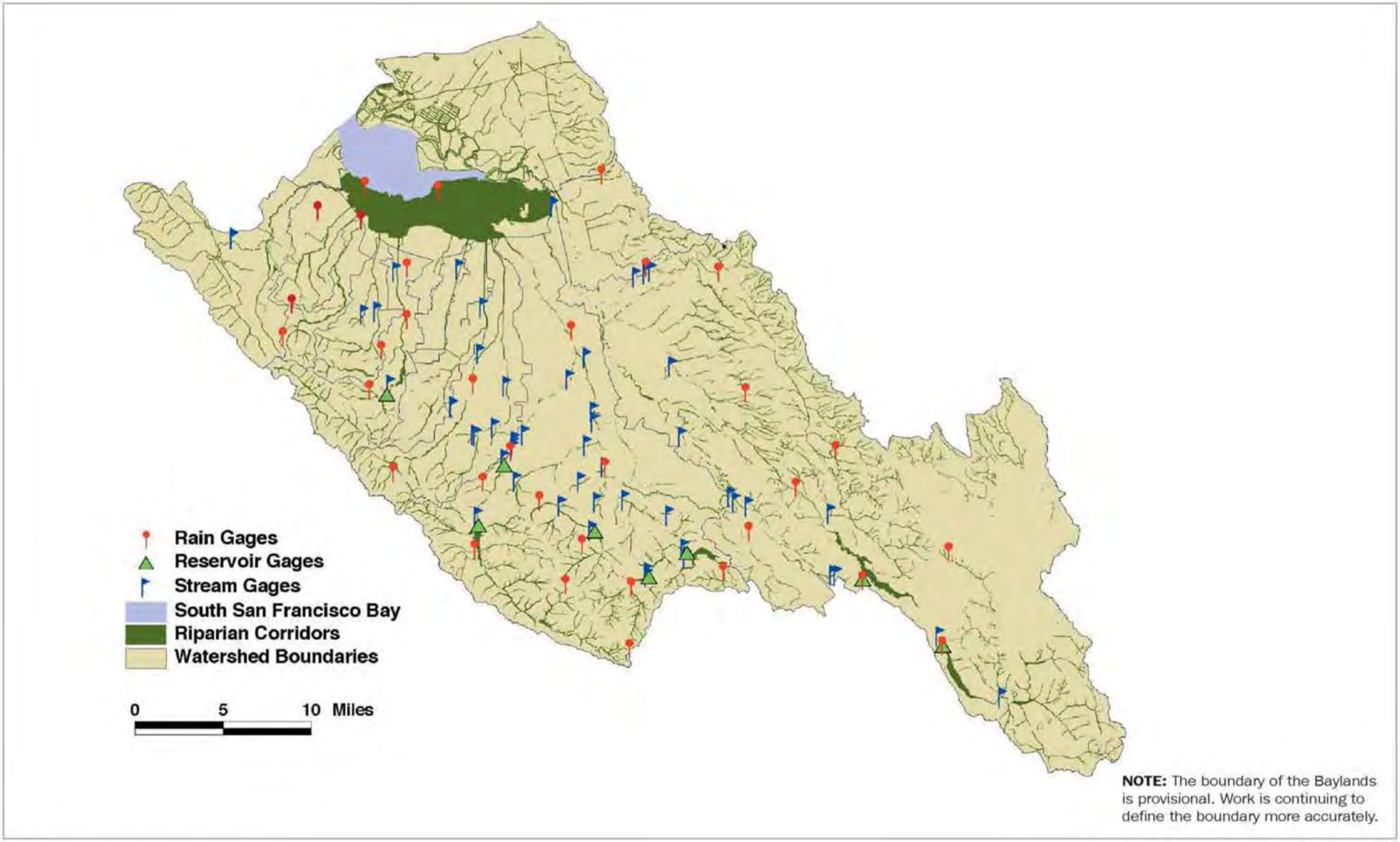
**Table 4-15**
**Water Rights Diversions[1]**

| Watershed | Creek | Use | Number |
|---|---|---|---|
| **California Water Service Company** | | | |
| San Francisquito | Bear Gulch Creek | M | 2 |
| **Private Individual** | | | |
| San Francisquito | Searsville Lake | D | 1 |
| | Unnamed (Tributary to Corte Madera Creek) | D | 1 |
| **San Jose Water Company** | | | |
| Guadalupe | Alamitos | | |
| | Burton | M | 1 |
| | Beardsley | M | 1 |
| | Briggs | M | 1 |
| | Hendry's | M | 1 |
| | Hooker | M | 1 |
| | Los Gatos | D, M, I | 2 |
| | Los Gatos | M | 1 |
| | Moody | M | 1 |
| | Soda Springs | M | 2 |
| | Trout | M | 1 |
| San Tomas Aquino | Saratoga | D, M, I | 1 |
| | Saratoga | M | 1 |
| | Unnamed (trib to San Tomas Aquino Crk) | M | 1 |
| **Santa Clara County Parks & Recreation Department** | | | |
| Coyote | Unnamed (trib to Arroyo Aguague) | S | 13 |
| | Unnamed (trib to South Babb Crk) | S | 1 |
| | Unnamed (trib to Bodfish Crk) | S | 1 |
| | House Spring #1 (trib to Coyote Lake) | S | 1 |
| | House Spring #2 (trib to Coyote Lake) | S | 1 |
| | Unnamed (trib to San Felipe Crk) | S | 22 |
| | Unnamed (trib to Smith Crk) | S | 2 |
| Guadalupe | Alamitos | S | 1 |
| | Unnamed (trib to Alamitos Crk) | S | 7 |
| | Unnamed (trib to Canoas Crk) | S | 1 |
| | Unnamed (trib to Calero Reservoir) | S | 7 |
| | Unnamed (trib to Guadalupe Resvr) | S | 1 |
| | Unnamed (trib to Los Capitancillos Crk) | S | 2 |
| | Unnamed (trib to Guadalupe Crk) | S | |
| San Tomas Aquino | Sanborn Crk | S | 2 |
| | Todd Crk | S | 2 |
| **Stanford University** | | | |
| San Francisquito | Los Trancos Creek | D | 2 |
| | San Francisquito Creek | D | 1 |
| **Unknown** | | | |
| San Francisquito | West Union Creek | D | 1 |

[1] Source: Water Rights Information Management System, State Water Resources Control Board, http://www.waterrights.ca.gov/program/wrims/default.htm.

**Table 4-16**
**Hydrologic Gages Operated by the Santa Clara Valley Water District on Surface Waterbodies in the Santa Clara Basin**

| Watershed | Surface Waterbody | Number of Stream Gages |
|---|---|---|
| Adobe | Adobe Creek | 1 |
| Coyote | Coyote Creek | 5 |
| | Coyote Canal | 2 |
| | Fisher Creek | 1 |
| | Kirk Ditch | 2 |
| | Las Animas | 1 |
| | Overfelt Recarge Pond Diversion | 1 |
| | Thompson Creek | 1 |
| | Upper Penitencia Creek | 2 |
| | Anderson Reservoir | 1 |
| | Coyote Reservoir | 1 |
| Guadalupe | Almaden-Calero Canal | 2 |
| | Alamitos Creek | 2 |
| | Calero Creek | 1 |
| | Canoas Creek | 1 |
| | Capitancillos Recharge system | 1 |
| | Guadalupe Creek | 2 |
| | Golf Creek | 1 |
| | Guadalupe River | 3 |
| | Los Gatos Creek | 3 |
| | Ross Creek | 2 |
| | Almaden Reservoir | 1 |
| | Calero Reservoir | 1 |
| | Guadalupe Reservoir | 1 |
| | Lexington Reservoir | 1 |
| | Vasona Reservoir | 1 |
| Matadero/Barron | Barron Creek | 1 |
| | Barron Debris Basin | 1 |
| | Matadero Creek | 1 |
| Permanente | Permanente Creek | 1 |
| | Hale Creek | 1 |
| San Francisquito | San Francisquito Creek | 1 |
| San Tomas | Calabazas Creek | 1 |
| | San Tomas Creek | 2 |
| | Saratoga Creek | 1 |
| | Smith Creek | 1 |
| | Upper Page Ditch | 2 |
| | Wildcat Creek | 1 |
| Stevens | Stevens Creek | 2 |
| | Stevens Reservoir | 1 |
| Sunnyvale East | Sunnyvale East Channel | 1 |
| Total | | 59 |




Source: EOA, Inc. for SCVURPPP

Watershed Characteristics Report

**FIGURE 4-14**
**Hydrologic Gages Within the Santa Clara Basin**

**Table 4-17**
**Channel Modifications Implemented by the Santa Clara Valley Water District**

| Detailed Channel Type | Generalized Channel Type | Channel Bottom | Hardscape |
|---|---|---|---|
| Earth Levees | Earth Levee | unfixed | soft |
| Excavated Earth | Earth Excavated | unfixed | soft |
| Widened Earth (one side) | none in analysis | unfixed | soft |
| Bypass Channel | Earth Excavated | unfixed | soft |
| Modified Floodplain | Natural Modified | unfixed | soft |
| Natural Unmodified | Natural Unmodified | unfixed | soft |
| Pipe Culvert | Concrete Channel | fixed | hard |
| Arch Culvert | Concrete Channel | fixed | hard |
| Box Culvert | Concrete Channel | fixed | hard |
| Bridge | Concrete Channel | fixed | hard |
| U-Frame Concrete | Concrete Channel | fixed | hard |
| Trapezoidal Concrete | Concrete Channel | fixed | hard |
| Concrete (bottom) | Excavated Earth | fixed | hard |
| Sack Concrete | Slope Concrete | unfixed | mixed |
| Articulated Concrete Blocks | Slope Rock | unfixed | mixed |
| Gabion (sides) | Slope Gabion | unfixed | mixed |
| Gabion (sides & bottom) | Concrete Channel | fixed | mixed |
| Rock Lined (sides) | Slope Rock | unfixed | mixed |
| Rock Lined (sides & bottom) | Concrete Channel | fixed | mixed |
| Floodwalls | Slope Concrete | unfixed | mixed |

Source: Thomas Reid and Associates 1995.

**Table 4-18**
**Number and Type of Fish Passage Structures Constructed or Proposed for Construction in Streams in the Santa Clara Basin**

| Watershed | Creek | Location | Type of Passage Structure | Status | Construction Date |
|---|---|---|---|---|---|
| Coyote | Coyote | Hwy 237 | Washington Baffle | A | Since 1995[1] |
| | | Ford Rd. | Flashboard Ladder | I | Since 1995[2] |
| | | Ford Rd. | Flashboard Ladder | I | Since 1995[2] |
| | | Ford Rd. | Flashboard Ladder | I | Since 1995[2] |
| | Upper Penitencia | Maybury Ave. | Flashboard Ladder | A | 1997 |
| | | Noble Ave. | Flashboard Ladder | A | 1999[3] |
| Guadalupe | Guadalupe River | Old Hillsdale Blvd. | Open-channel rock weir | A | 1999 |
| | | Branham Ln. | Open-channel rock weir | A | 1999 |
| | | Blossom Hill Rd. | Flashboard Ladder | A | 1999 |
| | Guadalupe Creek | Masson Dam | Open-channel rock weir | A | 2000 |
| | Los Trancos | Felt Lake Diversion Dam | Alaska steep-pass ladder w/ fish screen | A | 1995 |
| | San Francisquito Creek[4] | Lake Lagunita | Denil-style fishway | A | 1978 |
| Stevens | Stevens | Moffitt Blvd. | Denil Ladder | A | 1950s |
| | | Evelyn St. | Denil Ladder | A | 1950s |
| | | Central Ave. | TBD | P | 2000 |
| | | Fremont Ave. | Denil Ladder | A | 1950s |

[1]Installed since 1995 (original construction date unavailable).
[2] Installed since 1995 (original construction date unavailable); inactive since 1997.
[3] Reconstructed 1999; installed since 1995 (original construction date unavailable).
[4] The San Francisquito Creek CRMP is currently working on an assessment of barriers to fish passage and is expected to recommend remedial steps.

### Instream Quarries

Sand and gravel are common construction materials. The demand for such aggregate material has been high since the post World War II construction boom in California. Most sand and gravel are extracted from active river channels, and from alluvial deposits in adjacent floodplains (California State Lands Commission 1993).

Instream quarries have operated in Basin streams since the turn of the century (Table 4-19, Figure 4-15). Today, however, only one instream quarry may be active on Coyote Creek (Table 4-19). Extracting gravel from streambeds in excess of replenishment by upstream sources causes streambeds to lower (degrade) both upstream and downstream of the extraction area. Collins and Dunne (1990) have summarized the effects of bed degradation as follows:

- Undermine bridge supports, pipe lines, or other instream structures
- Impact aquatic habitat by changing channel morphology, changing channel substrate type, lowering the groundwater table, and subsequently destroying riparian vegetation
- Reduce flooding and flood heights, thereby reducing the supply of overbank sediments to floodplains
- Reduce size or height of bars, causing downstream bars to erode if they receive less bed material, and causing adjacent banks to erode more rapidly or to stabilize, depending on how much gravel is removed, the distribution of removal, and on channel geometry; especially rapid bed degradation induces bank collapse and erosion by increasing bank heights

## 4.4.4 Discussion

Relationships between patterns of land use and aquatic communities and instream habitat structure have been identified along gradients of urbanization (Limburg and Schmidt 1990; Richards and Host 1994; Lammert and Allan 1999). Lammert and Allan (1999) demonstrated how the scale of investigation influences the strength of such relationships. They found that land use immediate to tributaries (within 50 meters) correlated more closely with the health of biological communities and instream structure than land use measured within 125 meters or within entire subwatersheds.

As previously mentioned, the accuracy of the estimates of land use acreages and their distribution within riparian corridors could be improved by using higher accuracy data; for example finer spatial resolution for land use and creek data, and more complete creek attribute information. Finer resolution land use data would provide more precise estimates of land use acreages, notably for narrow linear features, such as streams and roads, that are underrepresented

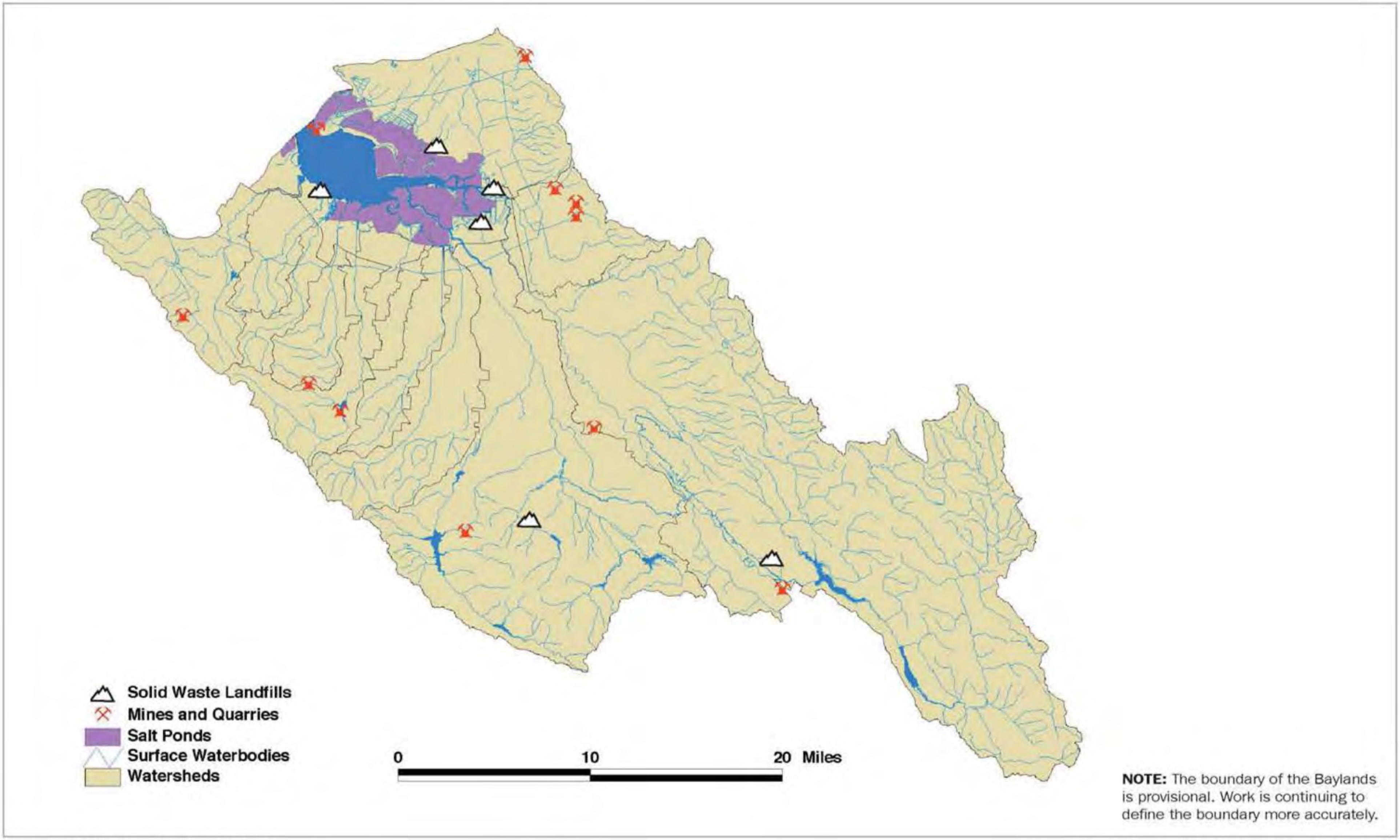
**Table 4-19**
**Status of Instream Quarries That Have Operated in the Santa Clara Basin**

| Watershed | Creek | Location | Status |
|---|---|---|---|
| Coyote | Coyote | Reach starting at Hellyer Avenue, extending approximately 2 miles downstream | Active[1]<br>No current (1998) record[2] |
| | Coyote | From U.S. Highway 101 overpass north of Morgan Hill to Ford Road | Abandoned: unreclaimed[1] |
| | Los Alamitos | Near Coleman Avenue | Abandoned: quarry reclaimed as Lake Almaden[2] |
| | Los Gatos | Lark Avenue to State Highway 85 | Reclaimed as mitigation for State Highway 85 construction[1] |

[1] Personal communication, Ken Reiller, Associate Civil Engineer, Water District.
[2] Personal communication, Tim Kustic, California Department of Conservation, Office of Mine Reclamation.

in the ABAG (1996) data. A comprehensive creek coverage mapped at fine spatial resolution, and including creek attributes such as creek name, would also help accurately map riparian corridors throughout the Basin. The Water District is currently working on developing a coverage that will include all creeks within the Basin at a 1:500 scale. In addition, the Water District is funding work being done by the USGS and the San Francisco Estuary Institute to complete the 1:24,000 scale national hydrographic data set for the Basin in 2000. This data set will provide the names of creeks and other surface water features and their associated reach codes (RP-3).

In addition to analyzing patterns of land uses within watersheds and riparian corridors for the WMI's watershed assessments, it will be useful to consider potential impacts associated with instream flood control and water supply infrastructure (e.g., dams, modified channels, and fish ladders), and with near- or instream quarrying.




Source: EOA, Inc. for SCVURPPP



**FIGURE 4-15**
**Quarries, Mines, Salt Ponds, and Solid Waste Disposal Sites in the Santa Clara Basin**

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# Appendix 4A
# Supplemental Data

| Table 4A-1<br>Coefficients of Imperviousness Estimated for the Association of Bay Area Governments Land Use Data (ABAG 1996) | | | | | |
|---|---|---|---|---|---|
| **Reclassified Land Use Category** | **Reclassified Land Use Code** | **ABAG Land Use Category** | **ABAG Land Use Code** | **Coefficient of Imperviousness** | **Source** |
| Agriculture | 20 | Agricultural Land | 2 | 0.02 | B |
| | 20 | Cropland and Pasture | 21 | 0.02 | B |
| | 20 | Orchards & Horticulture | 22 | 0.02 | B |
| | 20 | Farmsteads & Other Agriculture | 24 | 0.02 | B |
| | 20 | Orchards or Groves | 221 | 0.02 | B |
| | 20 | Irrigated Cropland | 2111 | 0.02 | B |
| | 20 | Greenhouses & Floriculture | 223 | 0.50 | E |
| Bays and Estuaries | 54 | Bays and Estuaries | 54 | 0.00 | A |
| Commercial | 121 | Commercial Outdoor Rec. | 122 | 0.66 | B |
| | 121 | Mixed Residential/Commercial | 16 | 0.91 | B |
| | 121 | Urban and Built-Up | 1 | 0.96 | B |
| | 121 | Commercial and Services | 12 | 0.96 | B |
| | 121 | Retail and Wholesale | 121 | 0.96 | B |
| | 121 | Transitional | 161 | 0.96 | B |
| | 121 | Military Hospital | 1254 | 0.96 | B |
| Forest | 42 | Forest | 42 | 0.01 | E |
| | 42 | Mixed Forest | 43 | 0.01 | E |
| | 42 | Redwood and Douglas Fir | 421 | 0.01 | E |
| | 42 | Evergreen Mix | 423 | 0.01 | E |
| Fresh Water | 50 | Streams and Canals | 51 | 0.00 | A |
| | 50 | Lakes | 52 | 0.00 | A |
| | 50 | Freshwater | 64 | 0.00 | A |
| | 50 | Reservoirs | 53 | 0.01 | E |
| Heavy Industrial | 132 | Mixed Industrial/Commercial | 15 | 0.91 | B |
| | 132 | Light Industry | 132 | 0.91 | B |
| Light Industrial | 131 | Industrial | 13 | 0.91 | B |
| | 131 | Heavy Industrial | 131 | 0.91 | B |

**Table 4A-1 (continued)**
**Coefficients of Imperviousness Estimated for the Association of Bay Area Governments Land Use Data (ABAG 1996)**

| Reclassified Land Use Category | Reclassified Land Use Code | ABAG Land Use Category | ABAG Land Use Code | Coefficient of Imperviousness | Source |
|---|---|---|---|---|---|
| Mines, Quarries, Gravel Pits | 75 | Mines/Quarries/Gravel Pits | 75 | 0.02 | B |
| Public Quasi-Public | 122 | Colleges and Universities | 1232 | 0.47 | B |
| | 122 | Education | 123 | 0.66 | B |
| | 122 | Stadium (Education) | 1233 | 0.66 | B |
| | 122 | Stadium (Public) | 1261 | 0.66 | B |
| | 122 | Long-Term Care Facilities | 1243 | 0.68 | B |
| | 122 | State Mental Health Facilities | 1248 | 0.68 | B |
| | 122 | Military Installations | 125 | 0.74 | B |
| | 122 | Hospital Trauma Centers | 1241 | 0.74 | B |
| | 122 | Community Hospitals | 1242 | 0.74 | B |
| | 122 | Out-Patient Surgery Centers | 1246 | 0.74 | B |
| | 122 | Other Public Facilities | 126 | 0.82 | B |
| | 122 | Elementary/Secondary Schools | 1231 | 0.82 | B |
| | 122 | Churches and Synagogues | 1262 | 0.82 | B |
| | 122 | Fire Station | 1263 | 0.82 | B |
| | 122 | Police Station | 1264 | 0.82 | B |
| | 122 | County Government Center | 1265 | 0.82 | B |
| | 122 | Emergency Operations Center | 1266 | 0.82 | B |
| | 122 | Jails & Rehabilitation Centers | 1267 | 0.82 | B |
| | 122 | Convention Centers | 1268 | 0.82 | B |
| | 122 | Offices | 128 | 0.91 | B |
| | 122 | Research Centers | 127 | 0.96 | B |
| Rangeland | 30 | Herbaceous Rangeland | 31 | 0.01 | E |
| | 30 | Shrub & Brush Rangeland | 32 | 0.01 | E |
| | 30 | Mixed Rangeland | 33 | 0.01 | E |
| | 30 | Coastal Shrub | 322 | 0.01 | E |
| | 30 | Chaparral | 321 | 0.01 | E |
| Residential | 113 | 4+ DU/acre | 113 | 0.81 | B |
| | 113 | Mobile Home Parks | 114 | 0.81 | B |
| | 113 | Military Residential | 1251 | 0.81 | B |
| Residential | 111 | 1 DU/2 to 5 acres | 111 | 0.07 | B |
| Residential | 112 | 1 to 3 DU/acre | 112 | 0.42 | B |
| | 112 | University Housing | 1234 | 0.42 | B |
| Sanitary Landfills | 78 | Sanitary Landfills | 761 | 0.02 | B |

**Table 4A-1 (concluded)**
**Coefficients of Imperviousness Estimated for the Association of Bay Area Governments Land Use Data (ABAG 1996)**

| Reclassified Land Use Category | Reclassified Land Use Code | ABAG Land Use Category | ABAG Land Use Code | Coefficient of Imperviousness | Source |
|---|---|---|---|---|---|
| Transportation, Communication | 14 | Commercial Airport - Other | 1436 | 0.66 | B |
| | 14 | Public Airfield | 1437 | 0.66 | B |
| | 14 | Highways and Interchanges | 1411 | 0.90 | E[2] |
| | 14 | Park and Ride Lots | 1413 | 0.90 | E[2] |
| | 14 | Truck/Bus Maintenance Yard | 1414 | 0.90 | B |
| | 14 | Rail Passenger Stations | 1421 | 0.95 | E |
| | 14 | Rail Yards | 1422 | 0.95 | E |
| | 14 | Commercial Airport Terminal | 1431 | 0.96 | B |
| | 14 | Commercial Airport Runway | 1434 | 0.99 | B |
| Urban Recreation | 17 | Transitional Areas | 76 | 0.02 | B |
| | 17 | Other Transitional | 762 | 0.02 | B |
| | 17 | Golf Courses (Extensive Rec.) | 1711 | 0.03 | B |
| | 17 | Other Urban & Built-up Land | 17 | 0.20 | E[1] |
| | 17 | Parks | 173 | 0.20 | E[1] |
| | 17 | Cemeteries | 172 | 0.28 | E[1] |
| | 17 | Extensive Recreation | 171 | 0.66 | B |
| | 17 | Racetracks | 1712 | 0.66 | B |
| Utilities | 19 | Electricity - Other | 1453 | 0.47 | B |
| | 19 | Wastewater Treatment Plant | 1461 | 0.70 | E[2] |
| | 19 | Wastewater Pumping Station | 1462 | 0.70 | E[2] |
| | 19 | Wastewater Treatment-Filtration | 1471 | 0.70 | E[2] |
| | 19 | Water Storage (covered) | 1473 | 0.70 | E[2] |
| | 19 | Water Storage (open) | 1474 | 0.70 | E[2] |
| | 19 | Electricity - Substation | 1452 | 0.95 | E |
| Vacant Undeveloped | 18 | Open Space - Urban | 174 | 0.01 | B |
| | 18 | Urban Vacant Land | 175 | 0.01 | B |
| Wetlands | 60 | Forested Wetlands | 61 | 0.01 | E |
| | 60 | Nonforested Wetlands | 62 | 0.01 | E |
| | 60 | Salt Evaporation Ponds | 63 | 0.01 | E |

Note: ABAG land use data classes and codes, associated land use classes and codes as reclassified for the purpose of mapping and describing the distribution of land uses in the Basin (see Section 4.1.6), and a list of impervious coefficients derived from the following sources: Bredehorst (B) (1981); EOA (E) (1999) are included. For several surface water land uses, 0 percent imperviousness was assumed (A). Superscripts indicate that imperviousness coefficients were truthed by overlaying land use data on orthophotographs in a GIS: (1) estimates were the same; (2) modified previous study estimate.

**Table 4A-2**
**Precipitation Gages Operated by the Water District in the Basin[1,2]**

| Station Number | Number | Station Name |
|---|---|---|
| 2065 | 1 | Alamitos |
| 2080 | 4 | Almaden |
| 1517 | 8 | Biel Ranch |
| 1508 | 15 | Castro Valley |
| 2053 | 16 | Guadalupe Slough |
| 2079 | 17 | Coe Park |
| 1519 | 18 | Coit Ranch |
| 2075 | 21 | Coyote |
| 1514 | 23 | Curtner Ranch |
| 2096 | 24 | Dahl Ranch |
| 2069 | 34 | Haskins Ranch |
| 2066 | 36 | Johnson Ranch |
| 1520 | 37 | Laguna Seca |
| 2073 | 41 | Anderson |
| 2068 | 42 | Lexington |
| 2072 | 44 | Loma Prieta |
| 1521 | 48 | Sunnyvale WTP |
| 1522 | 53 | Maryknoll |
| 1512 | 67 | Mt. Hamilton |
| 2081 | 69 | Mt. Umunhum |
| 523 | 75 | Peabody |
| 509 | 77 | Valley Christian |
| 524 | 79 | Rinconada WTP |
| 518 | 98 | Shanti Ashrama |
| 070 | 99 | Penitencia |
| 510 | 100 | Stevens Creek |
| 067 | 102 | UTC |
| 511 | 108 | West Yard |
| 515 | 121 | Mt. View Corp Yard |
| 526 | 123 | Guadalupe Watershed |
| 1527 | 125 | Vasona Pump Station |
| 2071 | 127 | Cow Ridge |
| 1513 | 128 | Calero |
| 2099 | 129 | Palo Alto |
| 1453[2] | 131 | City of San Jose |
| 516 | 132 | Evergreen |
| 529 | 134 | Church Ave Perc. Ponds |
| 503 | 136 | Morgan Hill |

[1] Locations of all precipitation gages are shown on Figure 4-14.
[2] The City of Palo Also operates three precipitation gages: at the Municipal Service Center (3201 E. Bayshore Road), in Foothills Park (3300 Page Mill Road), and at the Fire Station at 799 Embarcadero Road. The last of these is nonautomated.
[3] Indicates gages that are not owned by the Water District.

**Table 4A-3**
**Linear Feet of Modified Stream Channel in the Santa Clara Basin**
**Summarized by General and Detailed Channel Type[1]**

| Watersheds | Creeks | Length (feet) | General Channel Type | Detailed Channel Type |
|---|---|---|---|---|
| Adobe | Adobe Creek | 2,094 | Concrete Channel | Box Culvert |
| | Adobe Creek | 4,972 | Concrete Channel | Bridge |
| | Adobe Creek | 164 | Concrete Channel | Pipe Culvert |
| | Adobe Creek | 500 | Concrete Channel | Rock Lined -side/bottom |
| | Adobe Creek | 4,518 | Concrete Channel | Trapezoidal Concrete |
| | Adobe Creek | 6,705 | Concrete Channel | U-Frame Concrete |
| | Adobe Creek | 13 | Earth Levee | Earth Levee |
| | Adobe Creek | 1,241 | Excavated Earth | Concrete (bottom) |
| | Adobe Creek | 36,189 | Natural Unmodified | Natural Unmodified |
| | Barron Creek | 16 | Earth Levee | Earth Levee |
| | Purissima Creek | 1,986 | Natural Unmodified | Natural Unmodified |
| Arroyo la Laguna | Coyote Creek | 9,274 | Natural Unmodified | Natural Unmodified |
| | Lower Penitencia Creek | 130 | Concrete Channel | Trapezoidal Concrete |
| Baylands | Adobe Creek | 12,906 | Earth Levee | Earth Levee |
| | Calabazas Creek | 106 | Earth Levee | Earth Levee |
| | Coyote Creek | 5,053 | Natural Unmodified | Natural Unmodified |
| | Guadalupe River | 3,178 | Earth Levee | Earth Levee |
| | Guadalupe River | 18,507 | Natural Unmodified | Natural Unmodified |
| | Guadalupe Slough | 29,674 | Earth Levee | Earth Levee |
| | Matadero Creek | 292 | Concrete Channel | Rock Lined -side/bottom |
| | Matadero Creek | 575 | Earth Excavated | Bypass Channel |
| | Matadero Creek | 8,400 | Earth Levee | Earth Levee |
| | Palo Alto Flood Basin | 27,277 | Earth Levee | Earth Levee |
| | Permanente Creek | 50 | Concrete Channel | Box Culvert |
| | Permanente Creek | 12,379 | Earth Levee | Earth Levee |
| | San Francisquito Creek | 2,736 | Earth Levee | Earth Levee |
| | San Tomas Aquino Creek | 29 | Concrete Channel | Bridge |
| | San Tomas Aquino Creek | 2,508 | Earth Levee | Earth Levee |
| | Stevens Creek | 15 | Concrete Channel | Bridge |
| | Stevens Creek | 21 | Concrete Channel | Trapezoidal Concrete |
| | Stevens Creek | 13,587 | Earth Levee | Earth Levee |
| | Stevens Creek | 176 | Slope Concrete | Sack Concrete |
| | Stevens Creek | 343 | Slope Rock | Rock Lined (sides) |
| | Sunnyvale East Outfall | 3,720 | Earth Levee | Earth Levee |
| | Sunnyvale West Outfall | 3,636 | Earth Levee | Earth Levee |

**Table 4A-3 (continued)**
**Linear Feet of Modified Stream Channel in the Santa Clara Basin**
**Summarized by General and Detailed Channel Type[1]**

| Watersheds | Creeks | Length (feet) | General Channel Type | Detailed Channel Type |
|---|---|---|---|---|
| Calabazas | Calabazas Creek | 2,172 | Concrete Channel | Pipe Culvert |
| | Calabazas Creek | 3,806 | Concrete Channel | Box Culvert |
| | Calabazas Creek | 759 | Concrete Channel | Bridge |
| | Calabazas Creek | 16,727 | Concrete Channel | Trapezoidal Concrete |
| | Calabazas Creek | 680 | Concrete Channel | U-Frame Concrete |
| | Calabazas Creek | 794 | Earth Excavated | Excavated Earth |
| | Calabazas Creek | 10,000 | Earth Levee | Earth Levee |
| | Calabazas Creek | 67 | Excavated Earth | Concrete (bottom) |
| | Calabazas Creek | 131 | Natural Modified | Modifies Floodplain |
| | Calabazas Creek | 34,711 | Natural Unmodified | Natural Unmodified |
| | Calabazas Creek | 289 | Slope Concrete | Sack Concrete |
| | El Camino Stormdrain | 600 | Concrete Channel | Box Culvert |
| | El Camino Stormdrain | 3,469 | Concrete Channel | Pipe Culvert |
| | El Camino Stormdrain | 8,167 | Concrete Channel | Trapezoidal Concrete |
| | El Camino Stormdrain | 50 | Concrete Channel | U-Frame Concrete |
| | Junipero Serra Channel | 736 | Concrete Channel | Box Culvert |
| | Junipero Serra Channel | 2,396 | Concrete Channel | Trapezoidal Concrete |
| | Junipero Serra Channel | 15 | Concrete Channel | U-Frame Concrete |
| | Junipero Serra Channel | 2,034 | Earth Excavated | Excavated Earth |
| | Prospect Creek | 40 | Concrete Channel | Arch Culvert |
| | Prospect Creek | 428 | Concrete Channel | Box Culvert |
| | Prospect Creek | 280 | Concrete Channel | Pipe Culvert |
| | Prospect Creek | 1,239 | Earth Excavated | Excavated Earth |
| | Prospect Creek | 5,005 | Natural Unmodified | Natural Unmodified |
| | Prospect Creek | 35 | Slope Concrete | Sack Concrete |
| | Regnart Creek | 472 | Concrete Channel | Box Culvert |
| | Regnart Creek | 2,410 | Concrete Channel | Pipe Culvert |
| | Regnart Creek | 420 | Concrete Channel | Trapezoidal Concrete |
| | Regnart Creek | 600 | Concrete Channel | U-Frame Concrete |
| | Regnart Creek | 6,245 | Earth Excavated | Excavated Earth |
| | Regnart Creek | 4,792 | Natural Unmodified | Natural Unmodified |
| | Regnart Creek | 20 | Slope Concrete | Floodwalls |
| | Regnart Creek | 271 | Slope Rock | Rock Lined (sides) |
| | Rodeo Creek | 316 | Concrete Channel | Box Culvert |
| | Rodeo Creek | 2,412 | Concrete Channel | Pipe Culvert |
| | Rodeo Creek | 70 | Concrete Channel | Rock Lined -side/bottom |
| | Rodeo Creek | 562 | Concrete Channel | Trapezoidal Concrete |
| | Rodeo Creek | 96 | Concrete Channel | U-Frame Concrete |
| | Rodeo Creek | 2,053 | Earth Excavated | Excavated Earth |
| | Rodeo Creek | 4,242 | Natural Unmodified | Natural Unmodified |
| | Rodeo Creek | 64 | Slope Concrete | Sack Concrete |

**Table 4A-3 (continued)**
**Linear Feet of Modified Stream Channel in the Santa Clara Basin**
**Summarized by General and Detailed Channel Type[1]**

| Watersheds | Creeks | Length (feet) | General Channel Type | Detailed Channel Type |
|---|---|---|---|---|
| | Sunnyvale East Outfall | 753 | Concrete Channel | Box Culvert |
| | Sunnyvale East Outfall | 558 | Concrete Channel | Pipe Culvert |
| | Sunnyvale East Outfall | 227 | Concrete Channel | Trapezoidal Concrete |
| | Sunnyvale East Outfall | 40 | Concrete Channel | U-Frame Concrete |
| | Sunnyvale East Outfall | 6,688 | Earth Excavated | Excavated Earth |
| Coyote | Arroyo Aguague Creek | 43,539 | Natural Unmodified | Natural Unmodified |
| | Cochran Channel | 1,347 | Concrete Channel | Trapezoidal Concrete |
| | Coyote Creek | 801 | Concrete Channel | Bridge |
| | Coyote Creek | 22,478 | Earth Excavated | Excavated Earth |
| | Coyote Creek | 18,418 | Earth Levee | Earth Levee |
| | Coyote Creek | 136,195 | Natural Unmodified | Natural Unmodified |
| | Cribari Creek | 1,299 | Concrete Channel | Pipe Culvert |
| | Evergreen Creek | 220 | Concrete Channel | Box Culvert |
| | Evergreen Creek | 14,281 | Concrete Channel | Rock Lined -side/bottom |
| | Evergreen Creek | 33 | Concrete Channel | Trapezoidal Concrete |
| | Fisher Creek | 839 | Concrete Channel | Box Culvert |
| | Fisher Creek | 11,460 | Earth Excavated | Excavated Earth |
| | Fisher Creek | 7,400 | Earth Levee | Earth Levee |
| | Fisher Creek | 18,335 | Natural Unmodified | Natural Unmodified |
| | Flint Creek | 20 | Concrete Channel | Box Culvert |
| | Flint Creek | 5,250 | Concrete Channel | Pipe Culvert |
| | Flint Creek | 1,350 | Earth Excavated | Excavated Earth |
| | Flint Creek | 11,508 | Natural Unmodified | Natural Unmodified |
| | Flint Creek | 381 | Slope Gabion | Gabion (sides) |
| | Fowler Creek | 2,070 | Concrete Channel | Pipe Culvert |
| | Fowler Creek | 13,180 | Natural Unmodified | Natural Unmodified |
| | Lower Penitencia Creek | 54 | Earth Levee | Earth Levee |
| | Lower Silver Creek | 2,065 | Concrete Channel | Box Culvert |
| | Lower Silver Creek | 4,980 | Concrete Channel | Pipe Culvert |
| | Lower Silver Creek | 2,079 | Concrete Channel | Trapezoidal Concrete |
| | Lower Silver Creek | 28,691 | Earth Excavated | Excavated Earth |
| | Lower Silver Creek | 211 | Slope Rock | Rock Lined (sides) |
| | Miguelita Creek | 1,005 | Concrete Channel | Box Culvert |
| | Miguelita Creek | 13,480 | Concrete Channel | Pipe Culvert |
| | Miguelita Creek | 4,550 | Natural Unmodified | Natural Unmodified |
| | North Babb Creek | 155 | Concrete Channel | Box Culvert |
| | North Babb Creek | 3,821 | Concrete Channel | Pipe Culvert |
| | North Babb Creek | 1,850 | Concrete Channel | Trapezoidal Concrete |
| | North Babb Creek | 345 | Slope Concrete | Sack Concrete |
| | North Babb Creek | 300 | Slope Gabion | Gabion (sides) |

| Table 4A-3 (continued)<br>Linear Feet of Modified Stream Channel in the Santa Clara Basin<br>Summarized by General and Detailed Channel Type[1] | | | | |
|---|---|---|---|---|
| **Watersheds** | **Creeks** | **Length (feet)** | **General Channel Type** | **Detailed Channel Type** |
| | Norwood Creek | 90 | Concrete Channel | Box Culvert |
| | Norwood Creek | 9,459 | Concrete Channel | Pipe Culvert |
| | Norwood Creek | 146 | Concrete Channel | Rock Lined -side/bottom |
| | Norwood Creek | 26 | Concrete Channel | Trapezoidal Concrete |
| | Norwood Creek | 51 | Concrete Channel | U-Frame Concrete |
| | Norwood Creek | 3,028 | Earth Excavated | Excavated Earth |
| | Norwood Creek | 3,649 | Natural Unmodified | Natural Unmodified |
| | Quimby Creek | 175 | Concrete Channel | Box Culvert |
| | Quimby Creek | 1,056 | Concrete Channel | Pipe Culvert |
| | Quimby Creek | 3,644 | Earth Excavated | Excavated Earth |
| | Quimby Creek | 6,025 | Natural Unmodified | Natural Unmodified |
| | Ruby Creek | 60 | Concrete Channel | Box Culvert |
| | Ruby Creek | 7,281 | Concrete Channel | Pipe Culvert |
| | Ruby Creek | 1,058 | Earth Excavated | Excavated Earth |
| | South Babb Creek | 270 | Concrete Channel | Box Culvert |
| | South Babb Creek | 4,490 | Concrete Channel | Trapezoidal Concrete |
| | South Babb Creek | 300 | Earth Excavated | Excavated Earth |
| | South Babb Creek | 14,076 | Natural Unmodified | Natural Unmodified |
| | Thompson Creek | 343 | Concrete Channel | Box Culvert |
| | Thompson Creek | 105 | Concrete Channel | Rock Lined -side/bottom |
| | Thompson Creek | 58 | Concrete Channel | Trapezoidal Concrete |
| | Thompson Creek | 133 | Concrete Channel | U-Frame Concrete |
| | Thompson Creek | 805 | Earth Excavated | Excavated Earth |
| | Thompson Creek | 4,895 | Natural Modified | Modifies Floodplain |
| | Thompson Creek | 19,867 | Natural Unmodified | Natural Unmodified |
| | Thompson Creek | 1,020 | Slope Rock | Rock Lined (sides) |
| | Upper Penitencia Creek | 72 | Concrete Channel | Arch Culvert |
| | Upper Penitencia Creek | 593 | Concrete Channel | Box Culvert |
| | Upper Penitencia Creek | 7,088 | Earth Levee | Earth Levee |
| | Upper Penitencia Creek | 49,297 | Natural Unmodified | Natural Unmodified |
| | Upper Silver Creek | 204 | Concrete Channel | Box Culvert |
| | Upper Silver Creek | 300 | Concrete Channel | Pipe Culvert |
| | Upper Silver Creek | 5,981 | Concrete Channel | Trapezoidal Concrete |
| | Upper Silver Creek | 151 | Concrete Channel | U-Frame Concrete |
| | Upper Silver Creek | 19,278 | Natural Unmodified | Natural Unmodified |
| | Willow Springs Creek | 4,926 | Natural Unmodified | Natural Unmodified |
| | Yerba Buena Creek | 9,492 | Natural Unmodified | Natural Unmodified |
| | Unnamed | 1,426 | Earth Excavated | Excavated Earth |
| Guadalupe | Alamitos Creek | 202 | Concrete Channel | Bridge |
| | Alamitos Creek | 545 | Concrete Channel | Rock Lined -side/bottom |

**Table 4A-3 (continued)**
**Linear Feet of Modified Stream Channel in the Santa Clara Basin**
**Summarized by General and Detailed Channel Type[1]**

| Watersheds | Creeks | Length (feet) | General Channel Type | Detailed Channel Type |
|---|---|---|---|---|
| | Alamitos Creek | 1,078 | Earth Excavated | Excavated Earth |
| | Alamitos Creek | 11,697 | Earth Levee | Earth Levee |
| | Alamitos Creek | 189 | Natural Modified | Modifies Floodplain |
| | Alamitos Creek | 30,382 | Natural Unmodified | Natural Unmodified |
| | Alamitos Creek | 2,537 | Slope Concrete | Floodwalls |
| | Alamitos Creek | 56 | Slope Gabion | Gabion (sides) |
| | Alamitos Creek | 246 | Slope Rock | Rock Lined (sides) |
| | Almendra Creek | 122 | Concrete Channel | Box Culvert |
| | Almendra Creek | 934 | Concrete Channel | Pipe Culvert |
| | Almendra Creek | 338 | Concrete Channel | Trapezoidal Concrete |
| | Almendra Creek | 145 | Natural Unmodified | Natural Unmodified |
| | Almendra Creek | 249 | Slope Rock | Rock Lined (sides) |
| | Barrett Canyon | 2,040 | Natural Unmodified | Natural Unmodified |
| | Calero Creek | 40 | Concrete Channel | Arch Culvert |
| | Calero Creek | 30,311 | Natural Unmodified | Natural Unmodified |
| | Canoas Creek | 2,398 | Concrete Channel | Box Culvert |
| | Canoas Creek | 1,797 | Concrete Channel | Gabion (sides & bottom) |
| | Canoas Creek | 648 | Concrete Channel | Trapezoidal Concrete |
| | Canoas Creek | 25 | Concrete Channel | U-Frame Concrete |
| | Canoas Creek | 33,938 | Excavated Earth | Concrete (bottom) |
| | Daves Creek | 149 | Concrete Channel | Arch Culvert |
| | Daves Creek | 6,025 | Concrete Channel | Pipe Culvert |
| | Daves Creek | 1,015 | Concrete Channel | Trapezoidal Concrete |
| | Daves Creek | 15 | Concrete Channel | U-Frame Concrete |
| | Daves Creek | 239 | Earth Excavated | Excavated Earth |
| | Daves Creek | 923 | Natural Unmodified | Natural Unmodified |
| | East Ross Creek | 95 | Concrete Channel | Box Culvert |
| | East Ross Creek | 5,792 | Natural Unmodified | Natural Unmodified |
| | Golf Creek | 260 | Concrete Channel | Box Culvert |
| | Golf Creek | 2,792 | Concrete Channel | Pipe Culvert |
| | Golf Creek | 1,113 | Concrete Channel | Rock Lined -side/bottom |
| | Golf Creek | 84 | Concrete Channel | Trapezoidal Concrete |
| | Golf Creek | 320 | Concrete Channel | U-Frame Concrete |
| | Golf Creek | 4,236 | Earth Excavated | Excavated Earth |
| | Golf Creek | 137 | Earth Levee | Earth Levee |
| | Golf Creek | 2,823 | Slope Concrete | Sack Concrete |
| | Golf Creek | 27 | Slope Rock | Rock Lined (sides) |
| | Greystone Creek | 49 | Concrete Channel | Arch Culvert |
| | Greystone Creek | 328 | Concrete Channel | Box Culvert |
| | Greystone Creek | 64 | Concrete Channel | Pipe Culvert |

**Table 4A-3 (continued)**
**Linear Feet of Modified Stream Channel in the Santa Clara Basin**
**Summarized by General and Detailed Channel Type[1]**

| Watersheds | Creeks | Length (feet) | General Channel Type | Detailed Channel Type |
|---|---|---|---|---|
| | Greystone Creek | 2,558 | Concrete Channel | Trapezoidal Concrete |
| | Greystone Creek | 2,642 | Concrete Channel | U-Frame Concrete |
| | Greystone Creek | 2,028 | Earth Excavated | Excavated Earth |
| | Greystone Creek | 345 | Slope Concrete | Sack Concrete |
| | Guadalupe Creek | 11,451 | Earth Excavated | Excavated Earth |
| | Guadalupe Creek | 28,574 | Natural Unmodified | Natural Unmodified |
| | Guadalupe River | 1,134 | Concrete Channel | U-Frame Concrete |
| | Guadalupe River | 25,576 | Earth Excavated | Excavated Earth |
| | Guadalupe River | 25,004 | Earth Levee | Earth Levee |
| | Guadalupe River | 16,933 | Natural Unmodified | Natural Unmodified |
| | Guadalupe River | 3,796 | Slope Concrete | Sack Concrete |
| | Guadalupe River | 5,848 | Slope Gabion | Gabion (sides) |
| | Herbert Creek | 4,222 | Natural Unmodified | Natural Unmodified |
| | Jacques Gulch | 4,913 | Natural Unmodified | Natural Unmodified |
| | Larabee Gulch | 4,672 | Natural Unmodified | Natural Unmodified |
| | Lone Hill Creek | 865 | Concrete Channel | Box Culvert |
| | Lone Hill Creek | 2,729 | Concrete Channel | Pipe Culvert |
| | Lone Hill Creek | 1,235 | Concrete Channel | U-Frame Concrete |
| | Los Gatos Creek | 1,076 | Concrete Channel | Box Culvert |
| | Los Gatos Creek | 2,030 | Concrete Channel | Rock Lined -side/bottom |
| | Los Gatos Creek | 9,501 | Concrete Channel | Trapezoidal Concrete |
| | Los Gatos Creek | 10,520 | Concrete Channel | U-Frame Concrete |
| | Los Gatos Creek | 25,537 | Earth Excavated | Excavated Earth |
| | Los Gatos Creek | 11,251 | Natural Unmodified | Natural Unmodified |
| | Los Gatos Creek | 740 | Slope Gabion | Gabion (sides) |
| | McAbee Creek | 2,156 | Concrete Channel | Pipe Culvert |
| | Pheasant Creek | 2,278 | Natural Unmodified | Natural Unmodified |
| | Randol Creek | 324 | Concrete Channel | Box Culvert |
| | Randol Creek | 417 | Concrete Channel | Pipe Culvert |
| | Randol Creek | 1,614 | Concrete Channel | Rock Lined -side/bottom |
| | Randol Creek | 564 | Concrete Channel | Trapezoidal Concrete |
| | Randol Creek | 1,360 | Concrete Channel | U-Frame Concrete |
| | Randol Creek | 5,883 | Earth Excavated | Excavated Earth |
| | Ross Creek | 6,238 | Concrete Channel | Box Culvert |
| | Ross Creek | 4,095 | Concrete Channel | Pipe Culvert |
| | Ross Creek | 7,376 | Concrete Channel | Trapezoidal Concrete |
| | Ross Creek | 1,494 | Concrete Channel | U-Frame Concrete |
| | Ross Creek | 10,318 | Earth Excavated | Excavated Earth |
| | Ross Creek | 320 | Slope Concrete | Sack Concrete |
| | Ross Creek | 2,106 | Slope Rock | Articulated Concrete Block |

**Table 4A-3 (continued)**
**Linear Feet of Modified Stream Channel in the Santa Clara Basin**
**Summarized by General and Detailed Channel Type[1]**

| Watersheds | Creeks | Length (feet) | General Channel Type | Detailed Channel Type |
|---|---|---|---|---|
| | Santa Teresa Creek | 100 | Concrete Channel | Arch Culvert |
| | Santa Teresa Creek | 50 | Concrete Channel | Box Culvert |
| | Santa Teresa Creek | 9,858 | Natural Unmodified | Natural Unmodified |
| | Shannon Creek | 5,940 | Natural Unmodified | Natural Unmodified |
| | Short Creek | 2,392 | Natural Unmodified | Natural Unmodified |
| | Unnamed | 1,640 | No Data | No Data |
| Matadero/Barron | Arastradero Creek | 5,200 | Natural Unmodified | Natural Unmodified |
| | Barron Creek | 584 | Concrete Channel | Box Culvert |
| | Barron Creek | 1,038 | Concrete Channel | Bridge |
| | Barron Creek | 7,319 | Concrete Channel | Pipe Culvert |
| | Barron Creek | 8,545 | Concrete Channel | Trapezoidal Concrete |
| | Barron Creek | 38 | Concrete Channel | U-Frame Concrete |
| | Barron Creek | 2,196 | Earth Excavated | Excavated Earth |
| | Barron Creek | 19 | Earth Levee | Earth Levee |
| | Barron Creek | 1,311 | Natural Modified | Modifies Floodplain |
| | Barron Creek | 5,077 | Natural Unmodified | Natural Unmodified |
| | Deer Creek | 13,878 | Natural Unmodified | Natural Unmodified |
| | Matadero Creek | 239 | Concrete Channel | Box Culvert |
| | Matadero Creek | 522 | Concrete Channel | Bridge |
| | Matadero Creek | 17,991 | Concrete Channel | Trapezoidal Concrete |
| | Matadero Creek | 798 | Concrete Channel | U-Frame Concrete |
| | Matadero Creek | 13,007 | Natural Unmodified | Natural Unmodified |
| | Matadero Creek | 983 | Slope Rock | Rock Lined (sides) |
| | Stanford Channel | 360 | Concrete Channel | Box Culvert |
| | Stanford Channel | 6,758 | Concrete Channel | Pipe Culvert |
| | Stanford Channel | 1,300 | Concrete Channel | Trapezoidal Concrete |
| Lower Penitencia | Berryessa Creek | 938 | Concrete Channel | Box Culvert |
| | Berryessa Creek | 1,600 | Concrete Channel | Trapezoidal Concrete |
| | Berryessa Creek | 438 | Concrete Channel | U-Frame Concrete |
| | Berryessa Creek | 12,909 | Earth Excavated | Excavated Earth |
| | Berryessa Creek | 6,950 | Earth Levee | Earth Levee |
| | Berryessa Creek | 4,699 | Natural Modified | Modifies Floodplain |
| | Berryessa Creek | 21,339 | Natural Unmodified | Natural Unmodified |
| | Berryessa Creek | 1,499 | Slope Concrete | Sack Concrete |
| | Calera Creek | 1,025 | Concrete Channel | Box Culvert |
| | Calera Creek | 378 | Concrete Channel | U-Frame Concrete |
| | Calera Creek | 2,311 | Earth Excavated | Excavated Earth |
| | Calera Creek | 1,950 | Natural Modified | Modifies Floodplain |
| | Calera Creek | 10,269 | Natural Unmodified | Natural Unmodified |
| | Calera Creek | 50 | Slope Concrete | Sack Concrete |

**Table 4A-3 (continued)**
**Linear Feet of Modified Stream Channel in the Santa Clara Basin**
**Summarized by General and Detailed Channel Type[1]**

| Watersheds | Creeks | Length (feet) | General Channel Type | Detailed Channel Type |
|---|---|---|---|---|
| | Crosley Creek | 6,648 | Natural Unmodified | Natural Unmodified |
| | Los Buellis Creek | 3,912 | Natural Unmodified | Natural Unmodified |
| | Los Coches Creek | 762 | Concrete Channel | Box Culvert |
| | Los Coches Creek | 2,886 | Concrete Channel | Trapezoidal Concrete |
| | Los Coches Creek | 795 | Concrete Channel | U-Frame Concrete |
| | Los Coches Creek | 1,818 | Earth Excavated | Excavated Earth |
| | Los Coches Creek | 10,614 | Natural Unmodified | Natural Unmodified |
| | Lower Penitencia Creek | 994 | Concrete Channel | Box Culvert |
| | Lower Penitencia Creek | 313 | Concrete Channel | Bridge |
| | Lower Penitencia Creek | 10 | Concrete Channel | Rock Lined -side/bottom |
| | Lower Penitencia Creek | 1,700 | Concrete Channel | Trapezoidal Concrete |
| | Lower Penitencia Creek | 282 | Concrete Channel | U-Frame Concrete |
| | Lower Penitencia Creek | 5,774 | Earth Excavated | Excavated Earth |
| | Lower Penitencia Creek | 4,492 | Earth Levee | Earth Levee |
| | Lower Penitencia Creek | 1,331 | Natural Modified | Modifies Floodplain |
| | Lower Penitencia Creek | 6,182 | Slope Concrete | Floodwalls |
| | Lower Penitencia Creek | 286 | Slope Concrete | Sack Concrete |
| | Penitencia East Channel | 198 | Concrete Channel | Box Culvert |
| | Penitencia East Channel | 26 | Concrete Channel | Trapezoidal Concrete |
| | Penitencia East Channel | 3,284 | Earth Excavated | Excavated Earth |
| | Penitencia East Channel | 71 | Slope Concrete | Sack Concrete |
| | Piedmont Creek | 479 | Concrete Channel | Box Culvert |
| | Piedmont Creek | 3,341 | Concrete Channel | Pipe Culvert |
| | Piedmont Creek | 2,280 | Concrete Channel | U-Frame Concrete |
| | Piedmont Creek | 1,540 | Earth Excavated | Excavated Earth |
| | Sierra Creek | 180 | Concrete Channel | Box Culvert |
| | Sierra Creek | 3,854 | Concrete Channel | Pipe Culvert |
| | Sierra Creek | 1,619 | Concrete Channel | U-Frame Concrete |
| | Sierra Creek | 5,402 | Earth Excavated | Excavated Earth |
| | Sierra Creek | 1,286 | Natural Unmodified | Natural Unmodified |
| | Sierra Creek | 44 | Slope Concrete | Sack Concrete |
| | Tularcitos Creek | 672 | Concrete Channel | Box Culvert |
| | Tularcitos Creek | 2,603 | Concrete Channel | Pipe Culvert |
| | Tularcitos Creek | 3,374 | Earth Excavated | Excavated Earth |
| Permanente | Hale Creek | 50 | Concrete Channel | Arch Culvert |
| | Hale Creek | 3,005 | Concrete Channel | Box Culvert |
| | Hale Creek | 30 | Concrete Channel | Bridge |
| | Hale Creek | 1,673 | Concrete Channel | Pipe Culvert |
| | Hale Creek | 3,066 | Concrete Channel | Trapezoidal Concrete |
| | Hale Creek | 50 | Concrete Channel | U-Frame Concrete |

**Table 4A-3 (continued)**
**Linear Feet of Modified Stream Channel in the Santa Clara Basin**
**Summarized by General and Detailed Channel Type[1]**

| Watersheds | Creeks | Length (feet) | General Channel Type | Detailed Channel Type |
|---|---|---|---|---|
| | Hale Creek | 3,203 | Earth Excavated | Excavated Earth |
| | Hale Creek | 5,419 | Natural Unmodified | Natural Unmodified |
| | Hale Creek | 255 | Slope Concrete | Sack Concrete |
| | Loyola Creek | 3,867 | Natural Unmodified | Natural Unmodified |
| | Magdalena Creek | 2,350 | Concrete Channel | Pipe Culvert |
| | Magdalena Creek | 776 | Earth Excavated | Excavated Earth |
| | Ohlone Creek | 5,266 | Natural Unmodified | Natural Unmodified |
| | Permanente Creek | 3,952 | Concrete Channel | Box Culvert |
| | Permanente Creek | 1,912 | Concrete Channel | Bridge |
| | Permanente Creek | 200 | Concrete Channel | Pipe Culvert |
| | Permanente Creek | 1,369 | Concrete Channel | Trapezoidal Concrete |
| | Permanente Creek | 8,100 | Concrete Channel | U-Frame Concrete |
| | Permanente Creek | 278 | Earth Levee | Earth Levee |
| | Permanente Creek | 35,662 | Natural Unmodified | Natural Unmodified |
| | Permanente Div. Channel | 153 | Concrete Channel | Box Culvert |
| | Permanente Div. Channel | 101 | Concrete Channel | Bridge |
| | Permanente Div. Channel | 5,030 | Concrete Channel | Trapezoidal Concrete |
| | Permanente Div. Channel | 998 | Concrete Channel | U-Frame Concrete |
| | Permanente Div. Channel | 200 | Slope Concrete | Floodwalls |
| | Summerhill Creek | 988 | No Data | No Data |
| | West Branch Permanente Creek | 10,408 | Natural Unmodified | Natural Unmodified |
| San Francisquito | Los Trancos Creek | 34,553 | Natural Unmodified | Natural Unmodified |
| | San Francisquito Creek | 100 | Concrete Channel | Box Culvert |
| | San Francisquito Creek | 5,189 | Earth Levee | Earth Levee |
| | San Francisquito Creek | 31,774 | Natural Unmodified | Natural Unmodified |
| | San Francisquito Creek | 3,305 | Slope Concrete | Sack Concrete |
| | San Francisquito Creek | 3,130 | Slope Rock | Rock Lined (sides) |
| San Tomas | Bonjetti Creek | 7,730 | Natural Unmodified | Natural Unmodified |
| | Booker Creek | 3,177 | Natural Unmodified | Natural Unmodified |
| | Mistletoe Creek | 1,446 | Natural Unmodified | Natural Unmodified |
| | Mistletoe Creek | 25 | Slope Concrete | Sack Concrete |
| | Page Ditch | 42 | Concrete Channel | Box Culvert |
| | Page Ditch | 1,988 | Concrete Channel | Pipe Culvert |
| | Page Ditch | 30 | Concrete Channel | Trapezoidal Concrete |
| | Page Ditch | 3,549 | Earth Excavated | Excavated Earth |
| | Page Ditch | 11 | Slope Concrete | Sack Concrete |
| | San Andreas Creek | 3,056 | Natural Unmodified | Natural Unmodified |
| | San Tomas Aquino Creek | 18,849 | Concrete Channel | Box Culvert |
| | San Tomas Aquino Creek | 2,291 | Concrete Channel | Bridge |
| | San Tomas Aquino Creek | 25 | Concrete Channel | Pipe Culvert |

**Table 4A-3 (continued)**
**Linear Feet of Modified Stream Channel in the Santa Clara Basin**
**Summarized by General and Detailed Channel Type[1]**

| Watersheds | Creeks | Length (feet) | General Channel Type | Detailed Channel Type |
|---|---|---|---|---|
| | San Tomas Aquino Creek | 4,133 | Concrete Channel | Rock Lined –side/bottom |
| | San Tomas Aquino Creek | 18,800 | Concrete Channel | Trapezoidal Concrete |
| | San Tomas Aquino Creek | 3,493 | Concrete Channel | U-Frame Concrete |
| | San Tomas Aquino Creek | 4,669 | Earth Excavated | Excavated Earth |
| | San Tomas Aquino Creek | 9,749 | Earth Levee | Earth Levee |
| | San Tomas Aquino Creek | 18,150 | Natural Unmodified | Natural Unmodified |
| | San Tomas Aquino Creek | 46 | Slope Concrete | Sack Concrete |
| | San Tomas Aquino Creek | 1,821 | Slope Gabion | Gabion (sides) |
| | San Tomas Aquino Creek | 1,214 | Slope Rock | Rock Lined (sides) |
| | Sanborn Creek | 2,283 | Natural Unmodified | Natural Unmodified |
| | Saratoga Creek | 1,330 | Concrete Channel | Box Culvert |
| | Saratoga Creek | 909 | Concrete Channel | Bridge |
| | Saratoga Creek | 1,686 | Concrete Channel | Trapezoidal Concrete |
| | Saratoga Creek | 659 | Concrete Channel | U-Frame Concrete |
| | Saratoga Creek | 1,853 | Earth Excavated | Excavated Earth |
| | Saratoga Creek | 6,263 | Natural Modified | Modifies Floodplain |
| | Saratoga Creek | 42,757 | Natural Unmodified | Natural Unmodified |
| | Saratoga Creek | 4,284 | Slope Concrete | Sack Concrete |
| | Saratoga Creek | 10,953 | Slope Gabion | Gabion (sides) |
| | Saratoga Creek | 104 | Slope Rock | Rock Lined (sides) |
| | Smith Creek | 303 | Concrete Channel | Box Culvert |
| | Smith Creek | 3,023 | Concrete Channel | Pipe Culvert |
| | Smith Creek | 37 | Concrete Channel | Trapezoidal Concrete |
| | Smith Creek | 3,110 | Concrete Channel | U-Frame Concrete |
| | Smith Creek | 669 | Earth Excavated | Excavated Earth |
| | Smith Creek | 2,229 | Natural Unmodified | Natural Unmodified |
| | Vasona Creek | 80 | Concrete Channel | Box Culvert |
| | Vasona Creek | 191 | Concrete Channel | Pipe Culvert |
| | Vasona Creek | 2,255 | Natural Unmodified | Natural Unmodified |
| | Wildcat Creek | 16 | Concrete Channel | Arch Culvert |
| | Wildcat Creek | 337 | Concrete Channel | Box Culvert |
| | Wildcat Creek | 248 | Concrete Channel | Pipe Culvert |
| | Wildcat Creek | 52 | Concrete Channel | Trapezoidal Concrete |
| | Wildcat Creek | 199 | Concrete Channel | U-Frame Concrete |
| | Wildcat Creek | 532 | Earth Excavated | Excavated Earth |
| | Wildcat Creek | 17,686 | Natural Unmodified | Natural Unmodified |
| | Wildcat Creek | 156 | Slope Concrete | Floodwalls |
| | Wildcat Creek | 43 | Slope Gabion | Gabion (sides) |
| Stevens | Heney Creek | 6,776 | Concrete Channel | Pipe Culvert |
| | Montebello Creek | 8,350 | Natural Unmodified | Natural Unmodified |

| Table 4A-3 (concluded)<br>Linear Feet of Modified Stream Channel in the Santa Clara Basin<br>Summarized by General and Detailed Channel Type1 | | | | |
|---|---|---|---|---|
| **Watersheds** | **Creeks** | **Length (feet)** | **General Channel Type** | **Detailed Channel Type** |
| | Permanente Diversion Channel | 182 | Concrete Channel | Box Culvert |
| | Permanente Diversion Channel | 432 | Concrete Channel | Trapezoidal Concrete |
| | Stevens Creek | 30 | Concrete Channel | Arch Culvert |
| | Stevens Creek | 285 | Concrete Channel | Box Culvert |
| | Stevens Creek | 2,355 | Concrete Channel | Bridge |
| | Stevens Creek | 136 | Concrete Channel | Rock Lined –side/bottom |
| | Stevens Creek | 790 | Concrete Channel | Trapezoidal Concrete |
| | Stevens Creek | 759 | Concrete Channel | U-Frame Concrete |
| | Stevens Creek | 1,983 | Earth Excavated | Excavated Earth |
| | Stevens Creek | 675 | Earth Levee | Earth Levee |
| | Stevens Creek | 149 | Excavated Earth | Concrete (bottom) |
| | Stevens Creek | 17,100 | Natural Modified | Modifies Floodplain |
| | Stevens Creek | 75,925 | Natural Unmodified | Natural Unmodified |
| | Stevens Creek | 1,675 | Slope Concrete | Sack Concrete |
| | Swiss Creek | 8,857 | Natural Unmodified | Natural Unmodified |
| Sunnyvale East | Junipero Serra Channel | 571 | Concrete Channel | Pipe Culvert |
| | Junipero Serra Channel | 7,533 | Concrete Channel | Trapezoidal Concrete |
| | Junipero Serra Channel | 10 | Concrete Channel | U-Frame Concrete |
| | Sunnyvale East Outfall | 3,193 | Concrete Channel | Box Culvert |
| | Sunnyvale East Outfall | 2,858 | Concrete Channel | Pipe Culvert |
| | Sunnyvale East Outfall | 146 | Concrete Channel | Trapezoidal Concrete |
| | Sunnyvale East Outfall | 408 | Concrete Channel | U-Frame Concrete |
| | Sunnyvale East Outfall | 12,753 | Earth Excavated | Excavated Earth |
| | Sunnyvale East Outfall | 2,360 | Earth Levee | Earth Levee |
| Sunnyvale West | Sunnyvale West Outfall | 1,042 | Concrete Channel | Box Culvert |
| | Sunnyvale West Outfall | 2,316 | Concrete Channel | Pipe Culvert |
| | Sunnyvale West Outfall | 200 | Concrete Channel | Trapezoidal Concrete |
| | Sunnyvale West Outfall | 203 | Concrete Channel | U-Frame Concrete |
| | Sunnyvale West Outfall | 2,730 | Earth Excavated | Excavated Earth |
| | Sunnyvale West Outfall | 6,590 | Earth Levee | Earth Levee |
| | Sunnyvale West Outfall | 37 | Slope Concrete | Sack Concrete |

Source: Waterways Management Model, Santa Clara Valley Water District

[1] Analysis was completed prior to the provisional revision of the Baylands boundary. Therefore, values depicted for the Baylands and the Arroyo la Laguna watershed do not reflect the revised boundary.

# Appendix 4B
# Process of Analyzing Projected Land Use Data

## 4B.1 Introduction

This appendix describes the data and procedures used to analyze projected development (residential and industrial/commercial) for hydrologic units in the Basin. The following references procedures executed using a GIS. The term “coverage”, as used below, connotes a common term used to refer to individual GIS data sets.

## 4B.2 Methods

Projected land use data (ABAG 1998) were transformed from their native MS Excel format to a Dbase format that was linked to a GIS coverage of U.S. Census tracts using the Tract-id.

Census tract boundaries were clipped to the Basin boundary using a GIS; thus, some tract areas were reduced. For such tracts, the acreage projected to be available for development, and to be developed for each land use (residential and industrial/commercial) was corrected by multiplying the projected acreages by a fraction representing the percent of the tract’s original size existing in the Basin. Small slivers (N = 45; median = 6 ac) were created by the process of clipping tracts to a redefined Basin boundary and were not included in the calculations of projected land uses for hydrologic units. They are distributed around the north and west perimeter of the Basin boundary; thus, the area per watershed attributable to such areas is minimal.

The percent of type of projected development was calculated for Basin watersheds using the following steps:

- The Census tract coverage (as clipped to the Basin) was intersected with the coverage of Basin watersheds using a GIS.
- Acreages for each type of development were summed by watershed, and results were exported to an MS Excel spreadsheet.
- The following calculations were made and presented in Table 4-7 and on Figures 4-10 through 4-12: the acreage of each watershed projected to be *available for development*, the acreage of each watershed projected *to be developed*, the percent of the available area projected to be developed, the percent of each watershed projected to be developed, and the percent increase (between 1995 and 2020) in the area of each watershed projected to be developed for each land use.

For some Census tracts, the acreage projected for development exceeded the available acreage. For such cases, the percentage of the tract projected as developed was reported as 100 percent. Most such cases occurred in very small Census tracts on the northwest border of the Basin (within Menlo Park’s jurisdiction); thus, their proportional effect on watershed area is minimal.

Volume One Unabridged
**Watershed Characteristics Report**

# Chapter 5
# Organizational Setting

**Prepared for the**
**Santa Clara Basin Watershed Management Initiative**

**by**

**Communication and Outreach Subgroup**

**Revised August 2003**

# Watershed Characteristics Report
# Chapter 5: Organizational Setting

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**Revised August 2003**

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# Chapter 5
# Organizational Setting

Santa Clara Basin (the Basin) is home to more than 1.9 million people and the thriving economic region of Silicon Valley. Among the people that live and work in Basin communities are members of local government and regulatory agencies; environmental, business, and community groups; and others who have general and specific interests in Santa Clara Basin Watershed Management Initiative (WMI) issues and activities.

The interaction of these communities is nearly as complex as the Basin's many natural ecosystems. Portions of three counties—Santa Clara, San Mateo, and Alameda—are part of the Basin, as are more than 20 cities and towns. Numerous languages are spoken by people who have come here from all over the world, and many cultures add to the area's character. Likewise, nearly every type of business is represented, from high-tech industries to organic farms. The Basin is an area of opportunity and growth, accompanied by significant challenges including threats to the watershed's natural environment and source water quality. In response, regional, state, and federal entities continue to enact and implement numerous regulations designed to protect the environment and quality of life.

The WMI is committed to protecting the Basin watershed, as well as coordinating and streamlining the approach to watershed-related regulations. To meet these and other WMI goals, improving communication between Basin communities is critical. In particular, WMI participants must foster and maintain communication between groups and individuals that have a strong interest in watershed protection. The entities listed in this chapter (see Table 5-1 for detailed information) share many priorities that intersect with those of the WMI; these organizations thus represent potential partnerships for delivering information and instituting positive change in the Basin watershed.

Table 5-1 is intended to be used by WMI participants and others interested in watershed protection as a resource guide and planning tool. It is anticipated that Table 5-1 will grow in size and complexity as new groups are added and existing organizations are changed; a yearly update will likely be necessary. Contact information is provided in Table 5-1 for groups listed in each section, along with organizational missions and funding sources where available.

## 5.1 Environmental Organizations

Communities in the Basin are known for their support of environmental issues involving watershed protection. Many environmental groups and public agencies in the Basin share overlapping areas of interests, outreach, and activities; these groups are key to implementation of recommended actions based on assessments of the watershed. A wide list of local environmental organizations with interests in watershed issues is presented in Table 5-1 under the following subcategories: Organization List, Adopt-A-Creek Groups, and Coordinated Resource Management Plan Groups.

## 5.2 Environmental Education Resources

For effective watershed protection and management, a broad public understanding of watershed issues is essential. Many educational organizations and groups are currently teaching and promoting watershed-based programs in the Basin. These programs are an excellent resource for educators, planners, public resource management agencies, and the general public, for content, program development, and funding information. Environmental Education Resources are described in Table 5-1 in two subsections: Centers, and Organizations and Programs.

## 5.3 San Francisco Bay Estuary-Wide Organizations

The Basin watershed drains into South San Francisco Bay. In turn, the South Bay is a part of the greater San Francisco Bay, into which flow the waters of the Sacramento-San Joaquin River Delta. The entire Bay-Delta Estuary is simultaneously a state and local water supply resource, an invaluable natural habitat for thriving and threatened wildlife species, a recreation hub, and next-door neighbor to several major Bay Area cities. Estuary-wide organizations, as listed in Table 5-1, provide information on a key piece of the Basin watershed, which is necessary for studying the Basin as a whole. These organizations also bring critical scientific data and information to discussions of the Basin, and provide an estuary-based environmental perspective on issues.

## 5.4 Universities and Colleges

Important work on environmental issues, including watershed studies and management, is continually underway at various colleges and universities throughout the Basin watershed. Students, faculty, and staff from these institutions are an excellent resource for WMI research and activities.

## 5.5 Business and Industry Trade Organizations

For the WMI to meet its objectives, all community sectors must be represented. An important sector is business/industry. Input from these stakeholders benefits overall development of a future watershed management plan; in addition, participation allows business sector representatives to help achieve a balance of objectives and formulate solutions to issues facing the Basin. Business and trade organizations are listed in Table 5-1 under the following categories: Chambers of Commerce, Labor Groups, and Business Groups and Associations.

## 5.6 Community Organizations and Foundations

Along with environmental and business groups, community organizations and foundations represent a significant sector with abilities to organize and influence public opinion, develop positions on various issues, and provide or locate possible sources of funding. In Table 5-1, this section includes information on voting, taxpayer, advisory, and neighborhood association organizations and is organized as follows: Community Organizations and Foundations.

## 5.7 Water Sport and Recreation Groups

The Basin boasts many recreational opportunities including hiking, fishing, boating, bicycling, waterskiing, and more. Because recreation is one of the beneficial uses being studied and evaluated for the WMI's Watershed Assessment Report, the perspective of recreation and water sports stakeholders is particularly important.

## 5.8 Agricultural Organizations

Before it was called "Silicon Valley," Santa Clara Valley was known as "The Valley of Heart's Delight." Its fertile soil and miles of fruit orchards and fields yielded tons of produce shipped around the world. The Santa Clara Valley farms were some of the preeminent agricultural producers in the state, nation, and world. Although the valley and most of the Basin is now urbanized, agriculture still plays a significant role in terms of land and water use. Agricultural land is viewed in many ways, including green space or agricultural "reserve" areas, and as a potential user for recycled water. In addition, the farmers, growers, and ranchers that make up the agricultural community constitute a key audience concerning watershed and groundwater protection, and are key stakeholders with the opportunity to contribute to significant improvements in the watershed.

## 5.9 Government Agencies

Coordination between local municipalities and agencies in the Basin is a central element of the WMI; local government support and involvement in the WMI is key to successful implementation of WMI outcomes. Many local government officials are WMI signatories and stakeholders. Likewise, the WMI relies on and uses data and research from state and federal agencies; such agencies are also likely to use WMI assessment information for future work. For the WMI to reach its goals, ongoing WMI communication to local, state, and federal government entities is of utmost importance. In Table 5-1, this section is organized as follows: City Governments, County Governments, Special Districts, and Regional/State/Federal Nonregulatory Agencies.

## 5.10 Media

The WMI engages in its own outreach and coordinates with related agencies and programs. However, as WMI assessment work is completed, focus and attention from local news media will greatly assist in promoting WMI goals and bringing watershed protection issues to a larger public audience. In addition, information from the Watershed Assessment Report will also likely be of interest to environmental and business media. Ongoing media outreach, and a strategic plan for implementing it, are key to the WMI's acceptance and effectiveness in the greater Basin community. In Table 5-1, this section is organized as follows: Newspaper Media, Radio Media, Television Media, and Local Public Information Officers.

**Table 5-1**
**Resource Guide**

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| **Table 5-1 (continued)<br>Resource Guide** | |
|---|---|
| **Organization/Agency** | **Contact** |
| **Environmental Organizations**<br><br>**Organizations** | |
| ***Alameda Creek Alliance***<br>P.O. Box 192<br>Canyon, CA 94516<br>www.formulate.com/AlamedaCreek<br><br>***Mission***: Preserve and restore the natural ecosystems of the Alameda Creek drainage basin. Protect and improve habitat for local species that are native to the area. Threatened and endangered species are the first priority. | Jeff Miller<br>Phone: (510) 845-4675<br>Fax: (510) 848-5499<br>E-mail: AlamedaCreek @formulate.com |
| ***Audubon Society – Santa Clara Valley Chapter***<br>22221 McClellan Road<br>Cupertino, CA 95014<br>www.scvas.org<br><br>***Mission***: Preserve and protect native plant and animal habitats - especially concerning birds - in the San Francisco Bay Area. Focus is on the protection of creek habitats, wetlands, and riparian corridors through environmental education on the importance of waterbodies and their surrounding plant communities. Also ducate planners and developers, partly by suggesting alternatives during review of building plans.<br>***Funding***: Predominately through member support, both locally and nationally, and a few small foundation grants. | Craig Breon<br>Environmental Advocate<br>Phone: (408) 252-3748<br>Fax: (408) 252-2850 |
| ***Audubon Society – Sequoia Chapter***<br>30 W. 39th Ave. #202<br>San Mateo, CA 94403<br>www.audubon.org/chapter/ca/sequoia<br><br>***Mission***: Participate actively in environmental education, conservation, and in the restoration, preservation, protection, and enjoyment of our native natural resources with emphasis on birds and their habitats.<br>***Funding***: A nonprofit organization. | Phone: (650) 345-3724<br>Fax: (650) 345-3748<br>E-mail:<br>sasoffice@neteze.com |

| **Table 5-1 (continued)<br>Resource Guide** | |
|---|---|
| **Organization/Agency** | **Contact** |
| ***Bay Area Action***<br>265 Moffett Blvd.<br>Mountain View, CA 94043-4723<br>www.baaction.org<br><br>***Mission***: Help people discover and strengthen their connection and concerns towards the natural environment through education and action-oriented activities. Particularly interested in habitat restoration along San Francisquito Creek, and in getting kids out to the Arastradero Preserve as part of their Adopt-A-Watershed program.<br>***Funding***: From memberships, personal donations, some corporate donations, fundraising events, and a City of Palo Alto grant at the Arastradero Preserve. | Phone: (650) 625-1994<br>Fax: (650) 625-1995 |
| ***Bay Area Ridge Trail Council***<br>26 O'Farrell St. Suite 400<br>San Francisco, CA 94108<br>www.ridgetrail.org<br><br>***Mission***: Plans, promotes, and constructs the Bay Area Ridge Trail, a 400-mile multiple-use trail connecting parks and preserved open spaces along the ridgelines surrounding San Francisco Bay. More than half of the trail is complete, open to the public, and in use.<br>***Funding***: A nonprofit organization offering outings, volunteer opportunities, and membership benefits. | Clifford Janoff<br>Executive Director<br>Phone: (415) 391-9300<br>Fax: (415) 391-2649<br>E-mail:<br>ridgetrail@aol.com |

**Table 5-1 (continued)**
**Resource Guide**

| Organization/Agency | Contact |
|---|---|
| ***The Bay Trail***<br>Association of Bay Area Governments<br>P.O. Box 2050<br>Oakland, CA 94604-2050<br>www.abag.ca.gov/bayarea/baytrail<br><br>***Mission***: The Bay Trail is a proposed 400-mile network of multiple-use pathways that one day will circle San Francisco and San Pablo bays, passing through all nine Bay Area counties and 42 of its 98 cities. Currently, one-third is complete. The Trail will serve walkers, runners, cyclists, nature lovers, and hikers of every age and cultural background.<br>***Funding***: Raised by the Bay Trail Project, a nonprofit organization. | Phone: (510) 464-7900<br>Fax: (510) 464-7970<br>E-mail: info@abag.ca.gov |
| ***California Native Plant Society-Santa Clara Valley***<br>3921 East Bayshore Road<br>Palo Alto, CA 94303<br>www.stanford.edu/~rawlings/blazcon.html<br><br>***Mission***: Preserve California native flora in its native habitat, with a focus on conservation through legal action and publicity. In addition, promote interest in native plants through outings and gardening with native plants.<br>***Funding***: Through member dues, grants, and gifts. | Don Mayall<br>Phone: (650) 856-7579 |
| ***California Trails and Greenways Foundation***<br>PO Box 183<br>Los Altos, CA 94023<br><br>***Mission***: Promote support for nonmotorized trails and greenways. Focus is on educating the public concerning all aspects of trails and encouraging the environmentally responsible use, stewardship, and development of trails.<br>***Funding***: Through memberships, gift donations, and foundation grants. | Tony Look<br>Phone: (650) 948-1829 |

| **Table 5-1 (continued)<br>Resource Guide** | |
|---|---|
| **Organization/Agency** | **Contact** |
| ***Citizens Committee to Complete the Refuge***<br>453 Tennessee Lane<br>Palo Alto, CA 94306<br>www.refuge.org<br><br>***Mission***: Protect and preserve all remaining wetlands in the South Bay and place them under public stewardship as part of the Don Edwards San Francisco Bay Wildlife Refuge.<br>***Funding***: From donations by private individuals. Land purchases are made through the Land and Water Conservation Fund (funded through offshore oil leases) and other state and federal funding. | Florence La Riviere<br>Phone: (650) 493-5540<br>Fax: (650) 494-7640<br>florence@refuge.org |
| ***CLEAN South Bay***<br>527 Rhodes Drive<br>Palo Alto, CA 94303<br><br>***Mission***: Work with others to protect the South Bay and its tributary creeks and watershed from toxic pollution, to protect wetlands and streamside riparian habitat, and to help plan and implement the Santa Clara Basin Watershed Management Initiative.<br>***Funding***: From member group donations and foundation and community grants for technical support, communications and coordination, and legal advice and advocacy. Most work is volunteer-based, in-kind, or pro bono. | Trish Mulvey<br>Co-Founder<br>Phone: (650) 326-0252<br>Fax: (650) 326-8919<br>mulvey@ix.netcom.com |
| ***Committee for Green Foothills***<br>3921 East Bayshore Road<br>Palo Alto, CA 94303<br>www.greenfoothills.org<br><br>***Mission***: Protect habitat protection and preserve open space, water, and wetlands. Current issues involve land use development around the Stanford hills and stream studies in San Mateo County. Other areas of focus include protection of open space, acquisition of parklands, monitoring of development proposals, and public education.<br>***Funding***: Through member dues and donations. | Denice Dade<br>Phone: (650) 968-7243 |

**Table 5-1 (continued)**
**Resource Guide**

| Organization/Agency | Contact |
|---|---|
| ***Communities for a Better Environment***<br>1611 Telegraph Avenue, #450<br>Oakland, CA 94612<br>www.igc.apc.org/cbe/cbe.html<br><br>***Mission***: Prevent industrial pollution and promote urban environmental health by empowering communities to participate in environmental decisions.<br>***Funding***: Supported by member contributions and donors. | Greg Karras<br>Phone: (510) 302-0430<br>Fax: (510) 302-0437 |
| ***Earthwatch California***<br>360 South San Antonio, Mailstop F-2<br>Los Altos, CA 94022<br>www.earthwatch.org<br><br>***Mission***: Promote sustainable conservation of natural resources and build partnerships with others that do so, focusing on biodiversity, endangered species, and issues of global change.<br>***Funding***: Through donors, corporate members, and foundations. | Linda Knight<br>Phone: (650) 917-8186<br>Phone: (800) 776-0188 |
| ***Friends of Stevens Creek Trail***<br>22221 McClellan Road<br>Cupertino, CA 95014<br>www.stevenscreek.com/friends<br><br>***Mission***: Support local community efforts to preserve and restore the wildlife corridor along Stevens Creek. Focus is on fostering neighborhood, business, government, and nonprofit support for the project. To accelerate completion of the trail, funds are raised to complement government allocations and coordinate volunteer cleanup and creek corridor landscaping.<br>***Funding***: From the annual Trailblazer Run and other fundraising events, volunteer time, and supporter donations. Cities sponsor and build sections of the trail along portions of the creek in their respective jurisdictions. | Emmy Arcolino<br>Office Manager<br>Phone: (408) 255-5780<br><br>Jim Stallman<br>Director<br>Phone: (408) 867-9797 |

**Table 5-1 (continued)**
**Resource Guide**

| Organization/Agency | Contact |
| --- | --- |
| ***Greenbelt Alliance (South Bay Office)***<br>1922 The Alameda, Suite 213<br>San Jose, CA 95126<br>www.greenbelt.org<br><br>***Mission***: Protect remaining open space lands. Main areas of concern are open space preservation, transportation, and urban planning.<br>***Funding***: From members and foundation grants. | Autumn Bernstein<br>Phone: (408) 983-0539<br>Fax: (408) 983-1001<br>abernstein@greenbelt.org |
| ***Guadelupe River Park and Gardens***<br>50 W. San Fernando Street, Suite 1100<br>San Jose, CA 95113<br>www.grpg.org<br><br>***Mission:*** Provide community leadership for the development and active use of Guadelupe Park and Gardens through education, advocacy, and stewardship.<br>***Funding:*** Nonprofit organization. | Kathleen Muller<br>Executive Director<br>Phone: (408) 277-4744<br>Fax: (408) 277-3153 |
| ***Land Trust for Santa Clara County***<br>6140 Camino Verde Drive, Suite K<br>San Jose, CA 95119<br><br>***Mission***: Protect, promote, and enhance the preservation of open space by raising and receiving contributions of land or money to be used to acquire real property or partial interests, including conservation easements, to create volunteer programs for the preservation of open space, and to encourage outdoor recreation and continuing agricultural activities and preservation.<br>***Funding***: Nonprofit organization. | Nancy Richardson<br>Executive Director<br>Phone: (408) 224-0114 |

| **Table 5-1 (continued)<br>Resource Guide** | |
|---|---|
| **Organization/Agency** | **Contact** |
| ***National Fish and Wildlife Foundation (California branch)***<br>28 Second Street, 6th Floor<br>San Francisco, CA 94105<br>www.nfwf.org<br><br>***Mission***: Dedicated to the conservation of fish, wildlife, and plants, and the habitat upon which they depend.<br>***Funding***: By creating partnerships between the public and private sectors and strategically investing in conservation and sustainable use of natural resources. | Phone: (415) 778-0999<br>Fax: (415) 778-0998 |
| ***Our City Forest***<br>595 Park Avenue, Suite 100<br>San Jose, CA 95110<br><br>***Mission***: Include residents in planting and maintaining our urban forest, focusing on promoting urban trees along waterways. Support planting of new trees throughout all of Santa Clara County and provide training as well as post-planting tree care.<br>***Funding***: From donations, grants, and local government (City of San Jose) grants. | Rhonda Berry<br>Phone: (408) 998-7337 |
| ***Peninsula Conservation Center Foundation***<br>3921 East Bayshore Road<br>Palo Alto, CA 94303-4303<br>www.pccf.org<br><br>***Mission***: Provide environmental information and resources to students, activists, business, and the general public. Support emerging environmental organizations through fiduciary sponsorship, house several environmental organizations at its site, facilitate the San Francisquito Creek Coordinated Resource Management and Planning process, conduct educational seminars, and present business environmental awards.<br>***Funding***: From individual and corporate memberships, grants, and events fees. | Executive Director<br>Phone: (650) 962-9876<br>Fax: (650) 962-8234<br>E-mail: Library@pccf.org |

**Table 5-1 (continued)**
**Resource Guide**

| Organization/Agency | Contact |
|---|---|
| ***Peninsula Open Space Trust***<br>3000 Sand Hill Road, Bldg. 4, Suite 135<br>Menlo Park, CA 94025<br>www.openspacetrust.org<br><br>***Mission***: Preserve the beauty, character, and diversity of the San Francisco Peninsula. Founded in 1977 on two basic principles: that open lands are necessary for a quality life, and that we must care for the land today so that future generations may enjoy its physical and spiritual benefits tomorrow. Since its founding, the Trust has protected more than 38,000 acres of San Francisco Peninsula open space.<br>***Funding***: A nonprofit organization. | Audrey Rust, President<br>Phone: (650) 854-7696<br>Fax: (650) 854-7703 |
| ***Responsible Organized Mountain Pedalers (ROMP)***<br>P.O. Box 1723<br>Campbell, CA 95009-1723<br>www.romp.org<br><br>***Mission***: The oldest offroad cycling advocacy group in the Bay Area, over 300 members who are concerned with trail access in the South Bay and Peninsula regions. Lead the participation of mountain cyclists in the trail community, by working with local cycling industry leaders, government agencies, and other trail user groups. Such work is necessary to protect our rights to our public parks and open space. | E-mail: info@romp.org |
| ***San Francisco Bay Bird Observatory***<br>PO Box 247<br>Alviso, CA 95002<br>www.sfbbo.org<br><br>***Mission***: Advance knowledge about birds and their habitats through research, monitoring, and educational activities. Focus is on providing scientific information to government agencies, industry, and the public to support informed resource management decisions.<br>***Funding***: Through contracts, grants, fund raising, memberships, and donations. | Janet T. Hanson<br>Director<br>Phone: (408) 946-6548<br>Fax: (408) 946-9279<br>jthanson@sfbbo.org |

**Table 5-1 (continued)**
**Resource Guide**

| Organization/Agency | Contact |
| --- | --- |
| ***San Francisco Bay Wildlife Society***<br>P.O. Box 524<br>Newark, CA 94560<br>www.sfbws.org<br><br>***Mission***: Promote public awareness and appreciation of San Francisco Bay and its natural history, and conserve and preserve the remaining baylands as essential wildlife habitat. In addition, improve opportunities for low-impact public use, operate bookstores in visitor centers, and fund educational events, research, and exhibits in cooperation with local, regional, and state agencies.<br>***Funding***: A nonprofit organization. | Phone: (510) 792-0222<br>Fax: (510) 792-5828 |
| ***Santa Clara County Streams for Tomorrow***<br>P.O. Box 1409<br>San Martin, CA 95046<br><br>***Mission***: Promote the preservation, conservation, and restoration of Santa Clara County's stream and riparian resources. Focus is on advocating protection of habitat and fish and wildlife resources through oversight and involvement in the environmental review and regulatory permitting processes for projects and activities impacting streams and riparian corridors. Additional advocacy achieved through participation in environmental stakeholder efforts and monitoring project compliance with environmental protection regulations and permit requirements.<br>***Funding***: From Executive Committee contributions, donations by individuals, and endowments. | Keith R. Anderson<br>Environmental Advocate<br>Phone: (408) 683-4330<br>Fax: (408) 683-4330<br>streams42morrow@<br>earthlink.net |
| ***Save the Bay (Save San Francisco Bay Association)***<br>1600 Broadway, Ste. 300<br>Oakland, CA 94612<br>www.savesfbay.org<br><br>***Mission***: Seeks to preserve, restore, and protect San Francisco Bay and the Sacramento-San Joaquin River Delta Estuary as a healthy and biologically diverse ecosystem essential to the well-being of the human and natural communities it sustains.<br>***Funding***: A nonprofit organization. | Phone: (510) 452-9261<br>Fax: (510) 452-9266<br>E-mail:<br>savebay@savesfbay.org |

**Table 5-1 (continued)**
**Resource Guide**

| Organization/Agency | Contact |
|---|---|
| ***Save the Redwoods League***<br>114 Sansome St. Room 605<br>San Francisco, CA 94104-3814<br>www.savetheredwoods.org<br><br>***Mission***: Rescue from destruction representative areas of primeval redwood forests, and cooperate with state and national park services in establishing redwood parks.<br>***Funding***: A nonprofit organization. | Richard C. Otter<br>President<br>Phone: (415) 362-2352<br>Fax: (415) 362-7017<br>E-mail:<br>saveredwoods@igc.org |
| ***Sempervirens Fund***<br>Drawer BE<br>Los Altos, CA 94023<br>www.sempervirens.org<br><br>***Mission***: Purchase and preserve redwood forests in the Santa Cruz Mountains. The fund restores areas that have suffered from extensive logging and removes nonnative exotic plants that damage native plant life.<br>***Funding***: From donations. | Brian Steen<br>Executive Director<br>Phone: (650) 968-4509 |
| ***Silicon Valley Bicycle Coalition***<br>P.O. Box 831<br>Cupertino, CA 95015-0831<br>www.svbcbikes.org<br><br>***Mission***: Provide a forum for cyclists to organize, discuss common concerns, and take action concerning cycling issues related to safe trails, bike security at public sites, and peaceful coexistence with motorists. The coalition partners with organizations that focus on expanding trails along the creeks and throughout the area.<br>***Funding***: From membership dues and gift donations. | Jim Stallman<br>President<br>Phone: (408) 867-9797 |

**Table 5-1 (continued)**
**Resource Guide**

| Organization/Agency | Contact |
|---|---|
| ***Silicon Valley Toxics Coalition***<br>760 North First Street<br>San Jose, CA 95112<br>www.svtc.org<br><br>***Mission***: Document the location of toxic chemical hazards, empower citizens to hold decision makers accountable, and educate the community about toxic hazards. Also work extensively to shift industrial and governmental priorities towards pollution prevention and the development of environmentally beneficial technologies and alternatives.<br>***Funding***: From individual donations and foundations. | Michael Stanley-Jones<br>Phone: (408) 287-6707<br>Fax: (408) 287-6771<br>msjones@svtc.org |
| ***The Silicon Valley Pollution Prevention Center***<br>351 Brookwood Dr.<br>San Jose, CA 95116<br><br>***Mission:*** Identify what the people who live and work in Silicon Valley need to know about pollution in the watershed, including the creeks and Bay, and how we all can help prevent that pollution.<br><br>***Funding:*** The Center needs to become sustainable by long-term commitments by local and other funders. Currently, the Center is operating on the residual funds of the 1994 CLEAN South Bay lawsuit settlement agreement. Funds have been allocated by the Santa Clara Valley Water District for fiscal year 2000-01 and matching funds through the City of San Jose Environmental Services Department are also expected to be appropriated. Operating and program grants are solicited from government and foundation grant programs when funders' goals and Center programs are in alignment. | Pat Ferraro,<br>Executive Director<br>Phone: (408) 291-0131<br>Fax: (408) 294-1239<br>svp2center@aol.com |

**Table 5-1 (continued)**
**Resource Guide**

| Organization/Agency | Contact |
|---|---|
| ***The Trail Center***<br>3921 E. Bayshore Road<br>Palo Alto, CA 94303<br>www.trailcenter.org<br><br>***Mission***: Provide and promote quality nonmotorized trail opportunities for all people in San Mateo, Santa Clara, Santa Cruz, and San Francisco counties. The center focuses on creating and managing an interconnected network of trails, and advocates issues affecting trails and open space.<br>***Funding***: From memberships, donations, and grants. | Janet Clark<br>Phone: (650) 968-7065 |
| ***United New Conservationists***<br>PO Box 362<br>Campbell, CA 95009-0362<br><br>***Mission***: Locally support environmentally helpful practices and challenge environmentally harmful ones. Focus is on urban waterways, such as the Guadalupe River, and the restoration of salmon runs. | Lilyann Brannon<br>Phone: (408) 241-5769<br>Fax: (408) 249-7932 |
| **Adopt-A-Creek Groups** | |
| ***Santa Clara Valley Water District: Adopt-A-Creek Program***<br>5750 Almaden Expressway<br>San Jose, CA 95118<br>www.scvwd.dst.ca.us<br><br>***Mission***: Promote community stewardship of creeks, with a focus on environmental awareness and family education. The Water District provides groups, individuals, and organizations with materials for trash pickup along the creeks, as well as signage honoring them for sponsoring a section of creek cleanup.<br>***Funding***: From the District's maintenance budget. | Gerry Uenaka<br>Phone: (408) 265-2607, ext. 2237 |

| **Table 5-1 (continued)<br>Resource Guide** | |
|---|---|
| **Organization/Agency** | **Contact** |
| ***Santa Clara Valley Water District: Creek Connections Action Group***<br>5750 Almaden Expressway<br>San Jose, CA 95118<br>www.scvwd.dst.ca.us<br><br>***Mission***: Formed in 1995, this coalition of local government and nonprofit agencies seeks to mobilize Santa Clara County residents to protect the county's creeks and waterways, primarily through twice-yearly Creek Cleanup Days. Participating agencies are the cities of San Jose and Sunnyvale, Santa Clara County Parks and Recreation Department, the Santa Clara Valley Water District, Santa Clara Valley Urban Runoff Pollution Prevention Program, and Loma Prieta Resource Conservation District. Supporting agencies have included Children's Discovery Museum of San Jose, Bay Area Action, and Santa Clara Valley Audubon Society. | Phone: (408) 265-2600 |
| **Coordinated Resource Management and Planning Groups** | |
| ***San Francisquito Creek***<br>***Coordinated Resource Management and Planning (CRMP)***<br>3921 East Bayshore Road<br>Palo Alto, CA 94303-4303<br>www.pccf.org/crmp<br><br>***Mission***: Foster a diverse and healthy watershed, valued as a natural and community resource, in a manner consistent with public health and safety and respecting property rights.<br>***Funding***: From grants, a state bill, support from participating cities, and For the Sake of Salmon, an Oregon-based environmental organization. | Pat Showalter<br>Susan Fizzell<br>Jim Johnson<br>Phone: (650) 962-9876<br>Fax: (650) 962-8234<br>crmp@pccf.org |

**Table 5-1 (continued)**
**Resource Guide**

| Organization/Agency | Contact |
|---|---|
| **Environmental Education Resources**<br><br>**Centers** | |
| ***Biodiversity Resource Center***<br>California Academy of Sciences<br>Golden Gate Park<br>San Francisco, CA 94118<br>www.calacademy.org/research/library/biodiv/<br><br>***Mission***: The Biodiversity Resource Center is an environmental library on the exhibit floor of the California Academy of Sciences open from 10 a.m. to 5 p.m., 7 days a week. Target Audience: teachers, students, researchers, and environmentalists. | Phone: (415) 750-7361<br>Fax: (415) 750-7106<br>E-mail: biodiversity@<br>calacademy.org |
| ***Browning-Ferris Industries - The Recyclery***<br>1601 Dixon Landing Road<br>Milpitas, CA 95035<br>www.bfipeninsula.com<br><br>***Mission***: An integrated resource recovery facility designed to take visitors through the world of recycling. Includes interactive displays at the Public Buy Back Center for recycled materials. | Jennifer Chan<br>Phone: (408) 945-2807<br>Fax: (408) 262-0603 |
| ***Children's Discovery Museum of San Jose***<br>180 Woz Way<br>San Jose, CA 95110<br>www.cdm.org<br><br>***Mission***: Offers activity sets for prefield trip use in the classroom. Also currently directs the BioSITE (Students Investigating Their Environment) program, combining water quality research with an interactive science curriculum for 3$^{rd}$ and 6$^{th}$ grades focused on the Guadalupe River. | Sandy Derby<br>Phone: (408) 298-5437<br>Fax: (408) 298-6826<br>e-mail: sderby@cdm.org |

| **Table 5-1 (continued)<br>Resource Guide** | |
|---|---|
| **Organization/Agency** | **Contact** |
| ***Common Ground Organic Garden Supply***<br>2225 El Camino Real<br>Palo Alto, CA 94306<br><br>***Mission***: This nonprofit organic garden supply and education center is part of Ecology Action of the Mid-Peninsula. Supplies for organic gardens, a library, garden advice, and weekend gardening classes are offered. | Kevin Stevens<br>Phone: (650) 328-6752 |
| ***Coyote Point Museum***<br>1651 Coyote Point Drive<br>San Mateo, CA 94401-1097<br>www.coyoteptmuseum.org<br><br>***Mission***: Offers on-site guided tours, foothill and tidepool tours, outreach and afterschool programs, teacher in-services, and environmental education resources and curricula. Focus is on ecological principles, Bay Area natural history and animal communities, and the interaction of people and the environment. | Cathy Rodamer<br>Phone: (650) 342-7755<br>Fax: (650) 342-7853<br>E-mail:<br>crodame@nueva.pvt.K12.ca.us |
| ***Deer Hollow Farm***<br>City of Mountain View Community Service Department<br>P.O. Box 7540<br>Mountain View, CA 94039<br>www.openspace.org/deerhollow.html<br><br>***Mission***: An historical working farm and environmental education center located on Big Green Moose Creek in Rancho San Antonio Open Space Preserve in Los Altos. | Mary Gilman<br>Phone: (650) 903-6430<br>Fax: (650) 903-6112 |

**Table 5-1 (continued)**
**Resource Guide**

| Organization/Agency | Contact |
|---|---|
| ***Don Edwards San Francisco Bay National Wildlife Refuge***<br>U.S. Fish and Wildlife Service<br>P.O. Box 524<br>Newark, CA 94560<br>www.r1.fws.gov/sfbnwr<br><br>***Environmental Education Center***<br>1751 Grand Blvd<br>Alviso, CA<br><br>At the southern end of San Francisco Bay surrounded by uplands, marshes, salt ponds, and a freshwater tidal slough, the building, designed for education, contains two classrooms, an auditorium, and an enclosed observation tower. Trails and a boardwalk through the seasonal wetland habitat make it easy to see and explore the natural wonders of the South Bay. The building and portions of the trails are accessible to people with disabilities. The Environmental Education Center is available by reservation for workshops and meetings of educational and environmental organizations.<br><br>***The Visitor Center***<br>South of the Dumbarton Bridge Toll Plaza off of Thornton Avenue, Fremont, CA<br><br>The Visitor Center is perched on a hillside above miles of salt marsh, tidal sloughs, mudflats, and salt ponds. The Pumphouse, our environmental education "outpost," along with an amphitheater and Environmental Education Pavilion, serves as the hub of an extensive system of bridges, boardwalks, and trails that make it easy to see and explore the San Francisco Bay habitats. The Visitor Center also has wildlife exhibits, an observation deck, a bookstore, and an auditorium. The Visitor Center is available by reservation for workshops and meetings of educational and environmental organizations. | Visitor Center<br>Phone: (510) 792-0222<br><br>Environmental Ed. Center<br>Phone: (408) 262-5513<br>Fax: (408) 262-2867 |

**Table 5-1 (continued)**
**Resource Guide**

| Organization/Agency | Contact |
|---|---|
| ***Emma Prusch Farm Park***<br>647 South King Road<br>San Jose, CA 95116<br>www.ci.san-jose.ca.us/prns/parks.htm<br><br>***Mission***: The land for this 42-acre farm park was donated by Emma Prusch to the City of San Jose to keep for agricultural purposes and provide an introduction to farm life. The park is operated as a small farm, with barn animals maintained by 4H and Future Farmers of America. The farm also has a rare fruit orchard, a deciduous fruit orchard, and two community gardens. | Alex Pearson<br>Phone: (408) 926-5555; *or*<br>Phone: (408) 277-4567 |
| ***Hayward Area Recreation and Park District***<br>Hayward Shoreline Interpretive Center<br>4901 Breakwater Avenue<br>Hayward, CA 94545<br>www.hard.dst.ca.us/hayshore<br><br>***Mission***: Fosters the connection between people and the San Francisco Bay by providing environmental education and recreational programs. Our goal is to inspire a sense of appreciation, respect, and stewardship for the estuary, its inhabitants, and the services they provide. | Kelly Davidson<br>Phone: (510) 881-6751<br>Fax: (510) 881-6763<br>e-mail:<br>hayshore@aol.com |
| ***Hidden Villa***<br>26870 Moody Road<br>Los Altos Hills, CA 94022<br>www.earthlink.net/~hveep/<br><br>***Mission***: Offers experiential tours of a farm for preschool through 1$^{st}$ grade students, including visiting farm animals and an organic education garden. For 2$^{nd}$ through 6$^{th}$ grade students, this sensory experience includes a wilderness segment, in addition to the time spent on the farm. | Chris Overington<br>Phone: (650) 949-8643<br>Fax: (650) 948-1916<br>E-mail:<br>hveep@earthlink.net |

| **Table 5-1 (continued)<br>Resource Guide** | |
|---|---|
| **Organization/Agency** | **Contact** |
| ***Jasper Ridge Biological Preserve***<br>Stanford University<br>Stanford, CA 94305-5020<br>jasper1.stanford.edu<br><br>***Overview***: Located near Stanford University 's campus in the eastern foothills of the Santa Cruz Mountains, the Preserve, an undeveloped jewel set amidst a rapidly urbanizing area, provides refuge to native plants and animals, rich educational experiences to students and docent-led visitors, and a rare natural laboratory for researchers from all over the world. | Phone: (650) 723-1589<br>Fax: (650) 723-1580 |
| ***Marine Science Institute***<br>500 Discovery Parkway<br>Redwood City, CA 94063<br>www.sfbaymsi.org<br><br>***Mission***: Provide interdisciplinary science programs to help students develop a responsibility for the natural environment and our human communities. Programs include outreach programs at the school site with live animals from various aquatic habitats, shoreside programs at Redwood City, and research cruises on San Francisco Bay. | Jeffrey Rutherford<br>Phone: (650) 364-2760<br>Fax: (650) 364-0416<br>E-mail:<br>Jeff@sfbaymsi.org |
| ***Palo Alto Baylands Park***<br>East end of Embarcadero Road, Palo Alto<br>www.city.palo-alto.ca.us/depts/commservice/parks&rec/open_space/baylands<br><br>***Mission***: Preserve the wildlife, wetlands, and health of the Bay. Offers miles of trails for hiking and biking along the salt marshes and sloughs. Trails connect with Shoreline Park in Mountain View providing the opportunity for even longer hikes and rides. Prime Area for bird-watching. Also visit the Palo Alto Duck Pond and explore the San Francisco Bay ecosystem with the assistance of The Lucy Evans Baylands Nature Preserve Interpretive Center. Boardwalk runs over the tidal salt marsh.<br>***Funding***: Through the City of Palo Alto. | Deborah Bartens,<br>Resident Naturalist<br>Phone: (650) 329-2506<br>Fax: (650) 493-5239<br>e-mail: deborah_bartens@<br>city.palo-alto.ca.us |

**Table 5-1 (continued)**
**Resource Guide**

| Organization/Agency | Contact |
|---|---|
| ***Peninsula Conservation Center Foundation***<br>3921 East Bayshore Road<br>Palo Alto, CA 94303-4303<br>www.pccf.org<br><br>***Mission***: An environmental information and resource center, the Center operates a lending library and offers lectures and public education programs. The environmental library offers an extensive collection of environmental information containing environmentally focused curriculum guides, videos, wildlife and endangered species information, and trail/parks guides. The library is open to the public, Monday-Friday, 9-5, and Saturdays by appointment. | Executive Director<br>Phone: (650) 962-9876<br>Fax: (650) 962-8234<br>e-mail: Library@pccf.org |
| ***San Francisco Bay Model Visitor Center***<br>U.S. Army Corps of Engineers<br>2100 Bridgeway<br>Sausalito, CA 94965-1764<br>www.spn.usace.army.mil/bmvc<br><br>***Mission***: Features The Bay Model, a three-dimensional representation of San Francisco Bay and the Sacramento/San Joaquin River Delta, which simulates tides, currents, river inflows, and other variables affecting estuary water quality. | Chris Gallagher<br>Phone: (415) 332-3871<br>Fax: (415) 332-0761 |
| ***Sulphur Creek Nature Center***<br>Hayward Area Recreation and Park District<br>1801 D Street<br>Hayward, CA 94541<br>www.hard.dst.ca.us/hayshore<br><br>***Mission***: A wildlife education and rehabilitation center operated by the Hayward Area Recreation and Park District, the Center offers a series of science programs that focus on the natural history and ecology of wildlife. | Carol Schupbach, Wildlife Education Director<br>Phone: (510) 881-6747<br>Fax: (510) 881-6763 |

| **Table 5-1 (continued)<br>Resource Guide** | |
|---|---|
| **Organization/Agency** | **Contact** |
| ***Technology Museum of Innovation***<br>145 West San Carlos Street<br>San Jose, CA 95113<br>www.thetech.org<br><br>***Mission***: In addition to museum exhibits, the Technology Museum has several programs that teach about science and environmental issues. The Museum runs a multimedia computer lab related to environmental topics, as well as science workbench labs with hands on activities for biology and chemistry. | Barbara Schrag<br>Phone: (408) 279-7173<br>Fax: (408) 279-7167<br>e-mail:<br>barbaras@thetech.org |
| ***Tri-City Ecology Center***<br>Recycling Center<br>43770 Grimmer Blvd.<br>Fremont, CA<br>www.refuge.org/subgroups/tricityec.html<br><br>***Mission***: The cities of Fremont, Union City, and Newark are rapidly growing communities in the South Bay. Natural habitats within their boundaries range from hills and rivers to wetlands and the Bay. The Center is working to preserve and maintain these unique natural resources, as well as clean water, clean air, and a high-quality environment. | Phone: (510) 793-6222 |
| **Organizations and Programs** | |
| ***Adopt-A-Watershed***<br>731 Market Street, Suite 600A<br>San Francisco, CA 94103<br><br>***Mission***: Inspire students from K-12 with a sense of place in nature and in their community, an awareness that they can make a difference, and a lifelong quest for knowledge about the environment. Provide schools with an integrated sequential K-12 science curriculum focused on the local environment and emphasizing service in partnership with the community.<br>***Funding***: Through fundraisers. | Jesse Miller<br>Phone: (415) 541-9657<br>Fax: (415) 541-9653<br>e-mail: jmiller@adopt-a-watershed.org |

**Table 5-1 (continued)**
**Resource Guide**

| Organization/Agency | Contact |
|---|---|
| ***Adopt-A-Watershed***<br>P.O. Box 1850<br>98 Clinic Avenue, Suite B<br>Hayfork, CA 96041<br><br>***Mission***: K-12 science curriculum and professional development for educators, using local watersheds as focal points and living laboratories. | Kim Stokely,<br>Executive Director<br>Phone: (530) 628-5334<br>Fax: (530) 628-4212<br>E-mail: kim@adopt-a-watershed.org |
| ***Bay Area Action***<br>265 Moffett Blvd.<br>Mountain View, CA 94043-4723<br>www.baaction.org<br><br>***Mission***: The group's Youth Environmental Action (YEA!) project goes into grade schools with science/environmental curricula developed by Stanford interns. Target Audience: elementary school, ages/grade levels, with special focus on Grades 4-5. | Amy Hill<br>Phone: (650) 625-1994<br>Fax: (650) 625-1995 |
| ***The Bio-Integral Resource Center***<br>P.O. Box 7414<br>Berkeley, CA 94707<br>www.igc.org/birc<br><br>***Mission***: Offers a secondary school curriculum entitled Integrated Pest Management (IPM) in Agriculture, which teaches students about integrated pest management, a decision-making process that considers the whole ecosystem in determining the best methods for managing pests. | Irene Juniper<br>Phone: (510) 524-2567<br>Fax: (510) 524-1758<br>e-mail: birc@igc.apc.org |

| **Table 5-1 (continued)<br>Resource Guide** | |
|---|---|
| **Organization/Agency** | **Contact** |
| ***California Coastal Commission: Adopt-A-Beach***<br>45 Fremont St., Suite 2000<br>San Francisco, CA 94105<br>www.ceres.ca.gov/coastalcomm/web/publiced/aab/<br><br>***Mission***: Focus is on engaging students in the ocean with beach cleanups and the Save Our Seas curriculum. Save Our Seas is an interactive science based curriculum designed to bring ocean issues into the classroom. Marine and Coastal Education Resource Directory of San Francisco and Monterey Bay Areas is a comprehensive listing of marine institutes, programs, and organizations involved in education. | Amy Weins<br>Phone: (800) Coast-4-U |
| ***California Department of Fish and Game***<br>2 Day Island<br>Novato, CA 94945<br>www.dfg.ca.gov<br><br>***Mission***: "Fishing in the City" program; watershed education and recreational sport fishing provided by a consortium of local agencies. Target Audience: families, ages/grade levels: K-12. | Ethan Rotman<br>Phone: (415) 892-0460<br>e-mail:<br>ethanrotman@dfg2.ca.gov |
| ***California Department of Fish and Game - Project WILD***<br>1416 Ninth Street<br>Sacramento, CA 94814<br>www.dfg.ca.gov<br><br>***Mission***: An environmental education program for educators (both formal and informal) of students in Grades K-12. The Project WILD activity guides are available, free of charge, upon attendance of a Project WILD training workshop. | Phone: (916) 657-2672 or (888) WILD-DFG<br>Fax: (916) 653-3772<br>e-mail:<br>rmiller@hq.dfg.ca.gov |

| Table 5-1 (continued)<br>Resource Guide | |
|---|---|
| **Organization/Agency** | **Contact** |
| ***The Center for Development of Recycling***<br>San Jose State University<br>One Washington Square<br>San Jose, CA 95192-0204<br><br>***Mission***: Operates Santa Clara County's recycling hotline: (800) 533-8414. Creates and shares information about integrated waste management throughout the 16 jurisdictions of Santa Clara County. The Center's database, the Recyclopedia, contains information about recycling, reuse, and resale centers in the South Bay. The Center also houses a reference library, which contains information about recycling programs within the county and city, a recycled-content products directory, and recycling curriculum. | Bruce Olszewski<br>Phone: (408) 924-5453 or<br>Phone: (800) 533-8414<br>Fax: (408) 924-5477<br>e-mail:<br>cdrsjsu@email.sjsu.edu |
| ***City of Cupertino Public Works & Parks and Recreation Departments***<br>10300 Torre Ave.<br>Cupertino, CA 95014<br>www.cupertino.org<br><br>***Mission***: Lists of in-class and field trip activities, science kit materials list, in-class creek education overheads, Streamwalkers Game, and a list of literature included in teacher training folder. | Pam Ledesma<br>Phone: (408) 777-3241<br>Fax: (408) 777-3333<br>e-mail:<br>paml@cupertino.org |
| ***Environmental Volunteers***<br>3921 E. Bayshore Road<br>Palo Alto, CA 94303<br>www.evols.org<br><br>***Mission***: Promote understanding of and responsibility for the environment through hands-on science education. Programs include water science and conservation, marine ecology, baylands ecology, and foothills ecology.<br>***Funding***: From volunteer services, contributions, some foundation and corporate grants, minimal classroom fees, and sale of educational materials. | Susanne Mulcahy<br>Executive Director<br>Phone: (650) 961-0545<br>Fax: (650) 961-0548<br>E-mail:<br>susanne@evals.org |

**Table 5-1 (continued)**
**Resource Guide**

| Organization/Agency | Contact |
|---|---|
| ***Green City Project***<br>Planet Drum Foundation<br>P.O. Box 31251<br>San Francisco, CA 94131<br><br>***Mission***: The Green City Project's Education+Action program (E+A) is a free service linking Bay Area teachers and students with "service learning" opportunities in their communities. E+A combines a classroom presentation by an ecological expert with a hands-on environmental service project on or around the school's campus. E+A projects have included recycling, urban gardening and composting, urban planning, native plant restoration, alternative transportation, urban forestry, bioregionalism, and more. | Simon Hurd<br>Phone: (415) 285-6556<br>Fax: (415) 285-6563<br>e-mail:<br>planetdrum@igc.apc.org |
| ***GreenTeam of San Jose***<br>1333 Oakland Road<br>San Jose, CA 95112<br>www.greenteam.com<br><br>***Mission***: Collects curbside recycling and garbage for San Jose residents. To help San Jose residents learn about their recycling program, how things are recycled into new products, and resources saved by recycling efforts, presentations and tours are offered for community groups, neighborhood and home owners associations, and youth groups. In addition, offers Recycle Plus curriculum packets, classroom presentations, school assemblies, and tours of the GreenTeam Materials Recovery Facility for grades 3+. | Phone: (408) 283-8500<br>Fax: (408) 283-8509 |
| ***GreenWaste Recovery, Inc.***<br>625 Charles Street<br>San Jose, CA 95112<br><br>***Mission***: Collects yard trimmings for the City of San Jose. Its Education Program focuses on recycling, why it's important, and how it benefits the community. | Stacey August<br>Phone: (408) 283-4811, 283-4800<br>Fax:(408) 287-3108 |

**Table 5-1 (continued)**
**Resource Guide**

| Organization/Agency | Contact |
|---|---|
| ***Hidden Villa Environmental Education Program***<br>26870 Moody Road<br>Los Altos Hills, CA 94022<br>www.earthlink.net/~hveep/<br><br>***Mission***: Conduct environmental education, preserve land, and promote multiculturalism. With a 1600-acre ranch used for teaching, field trips, and a summer camp, focuses on the preservation of Adobe Creek.<br>***Funding***: Provided by industry, corporations, and foundations. | Betsy Garties<br>Phone: (650) 949-9700<br>E-mail:<br>hveep@earthlink.net |
| ***Home Composting Education Program for Santa Clara County***<br>1553 Berger Dr., Bldg. 1<br>San Jose, CA 95112<br>www.reducewaste.org<br><br>***Mission***: This volunteer-based educational program teaches Santa Clara County residents how to start and maintain a home compost system for their landscape, garden, and food wastes. Two-hour workshops are available at no charge throughout Santa Clara County. Bin sales are offered twice a year, and volunteer training is offered once a year. Also offers presentations on how to compost at school. Compost and worm bins are available for schools at no charge. | Ken Kelly, Sarah Smith, Co-Directors<br>Phone: (408) 299-4147<br>Fax: (408) 298-0876<br>e-mail:<br>sarah_smith@mail.era.ca.santa-clara.ca.us |
| ***Marine Science Institute (MSI)***<br>500 Discovery Parkway<br>Redwood City, CA 94063<br>www.sfbaymsi.org<br><br>***Mission***: Offers hands-on, marine science programs to all grade levels and ages. Programs include Discovery Voyages on the Bay, onshore programs at MSI, outreach programs to schools, tide pool expeditions, teacher workshops, and summer marine camps. Although most participants are school groups, MSI also offers voyages and shoreside programs for the general public. | Jeffrey Rutherford<br>Phone: (650) 364-2760<br>Fax: (650) 364-0416<br>e-mail: Jeff@sfbaymsi.org |

**Table 5-1 (continued)**
**Resource Guide**

| Organization/Agency | Contact |
|---|---|
| ***Mid-Peninsula Regional Open Space District***<br>330 Distel Circle<br>Los Altos, CA 94022<br>www.openspace.org<br><br>***Mission***: Create a regional greenbelt of open-space lands, linking District preserves with other public parklands. Offers educational programs, such as "Spaces and Species: Exploring Natural Communities," a hands-on, outdoor field trip program designed for Grades 4-6. The 4-hour field trip to open space preserves includes a "Habitat Hike," "Pond Prowl," and an "Aquatic Lab." | Cheryl Solomon<br>Phone: (650) 691-1200, ext. 536<br>Fax: (650) 691-0485 |
| ***National Audubon Society***<br>Richardson Bay Audubon Center<br>376 Greenwood Beach Road<br>Tiburon, CA 94920<br>www.audubon.ca.org<br><br>***Mission***: Offers education programs such as "Adopt-a-Species," a project of the California Endangered Species Education Program, where students become part of an exciting, project-based education program that gets them involved in adopting a native endangered species. | Meryl Sundove<br>Phone: (415) 388-2525<br>Fax: (415) 388-0717 |
| ***Our City Forest***<br>595 Park Avenue Suite 100<br>San Jose, CA 95110<br>www.ourcityforest.org<br><br>***Mission***: Dedicated to involving citizens in local environmental projects such as tree planting and tree care. | Rhonda Berry<br>Phone: (408) 998-7337<br>Fax: (408) 998-1078<br>E-mail: rberry@ourcityforest.org |

**Table 5-1 (continued)**
**Resource Guide**

| Organization/Agency | Contact |
|---|---|
| ***Palo Alto Regional Water Quality Control Plant***<br>2501 Embarcadero Way<br>Palo Alto, CA 94303<br>www.city.palo-alto.ca.us/cleanbay<br><br>***Education Programs Offered***:<br>✓ Elementary: Presentations include "Flo" the life-sized raccoon (2nd-3rd), a watershed model (2nd-5th), and a video program (4th-5$^{th}$). All are interactive programs about storm drain pollution, wastewater treatment, and how students can protect the Bay.<br>✓ Junior High: Watershed model and a microscope lab to view wastewater treatment organisms.<br>✓ High School: Designing wastewater treatment lab, integrating biology, chemistry, and physics. | Plant tour/info:<br>Phone: (650) 329-2598 |
| ***San Francisco Bay Savers Program***<br>1996 Holmes St.<br>Livermore, CA 94550<br>www.baysavers.org/education/baysavers.html<br><br>***Mission***: A free watershed education program offered to 4$^{th}$ grade classes throughout Alameda County.<br>***Funding***: Funded by the Alameda Countywide Clean Water Program and presented by the Alameda County Resource Conservation District. | Christie Johnson, Education/Outreach Coord.<br>(925) 371-0154 ext. 42 |
| ***San Francisco Estuary Institute***<br>1325 South 46th Street, Building 180<br>Richmond, CA 94804<br>www.sfei.org<br><br>***Mission***: Foster development of the scientific understanding needed to protect and enhance the San Francisco Estuary through research, monitoring, and communications. Current issues include a regional monitoring program focused on pollutants, biological invasions data management and reporting for the “Grasslands Bypass Project,” regional wetlands planning and monitoring, and watershed assessment projects. | Rainer Hoenicke, Environmental Scientist<br>Phone: (510) 231-9539<br>Fax: (510) 231-9414 |

**Table 5-1 (continued)**
**Resource Guide**

| Organization/Agency | Contact |
|---|---|
| ***City of San Jose Environmental Services Department***<br>777 North First Street, #450<br>San Jose, CA 95112-6311<br>www.ci.san-jose.ca.us/esd<br><br>***Mission***: Award-winning video/teacher's packet, "It's Wet, It's Wild, It's Water!" provides an up-to-date look at local water issues and aims to promote stewardship of the South Bay watershed to Grades 3-6. The Ranger Water Awareness Program is offered to San Jose teachers of Grades 5-7. San Jose Park Rangers visit classrooms and conduct exciting activities focused on preventing pollution to our neighborhood creeks. | Tamara Gilbert<br>Phone: (408) 277-5533<br>Fax: (408) 278-1068<br>e-mail:<br>tamara.gilbert@ci.sj.ca.us |
| ***City of San Jose, San Jose Regional Parks***<br>1300 Senter Road<br>San Jose, CA 95112<br>www.ci.san-jose.ca.us/prns/<br><br>***Mission***: Regional Park Rangers visit classrooms or host classes at their parks about local wildlife that live in the parks and open spaces. The Water Awareness Program is offered for San Jose teachers of Grades 5-7. Park Rangers visit classrooms and provide hands-on activities focused on preventing pollution in our neighborhood creeks. Call 277-5254 to arrange a presentation. | Alex Pearson<br>Phone: (408) 277-5254<br>Fax: (408) 277-3270<br><br>Almaden Lake Park<br>(408) 277-5130<br>Alum Rock Park<br>(408) 277-4539<br>Guadalupe River Pk.<br>(408) 277-5984<br>Kelly Park and Japanese Friendship Garden<br>(408) 277-5254<br>Lake Cunningham Park<br>(408) 277-4319<br>Overfelt Gardens<br>(408) 251-3323 |

**Table 5-1 (continued)**
**Resource Guide**

| Organization/Agency | Contact |
|---|---|
| ***Santa Clara County Household Hazardous Waste Program***<br>P.O. Box 28070<br>San Jose, CA 95159-8070<br>www.hhw.org<br><br>***Mission***: Protect the public health and environment of Santa Clara County. Educational information resources include Countywide Household Hazardous Waste Disposal Program (408) 299-7300, Small Business Hazardous Waste Disposal Program (408) 299-7300, and Toxic Tip Line (408) 299-8477. | Sharon Dowell<br>Phone: (408) 299-7300<br>Fax: (408) 280-6479 |
| ***Santa Clara County Integrated Waste Management Program***<br>1735 North First Street, Suite 275<br>San Jose, CA 95112<br>www.reducewaste.org<br><br>***Mission***: Conserve resources and protect the environment through effective programs to reduce, reuse, recycle, Shop Smart, and dispose of discarded materials. The following educational programs and materials are available:<br>✓ Used Oil Recycling Lesson Plan/Teacher's Kit/ Video (408) 441-1198 for grades 3,4,5<br>✓ High School Information on Recycling Resource Materials (408) 441-1198<br>✓ Countywide Home Composting Education Program (408) 299-4147 (speakers, teacher training, how-to information)<br>✓ Santa Clara County Recycling Hotline (800) 533-8414 | Carol Berg<br>Phone: (408) 441-1198<br>Fax: (408) 441-0365 |
| ***Santa Clara County Parks and Recreation***<br>298 Garden Hill Drive<br>Los Gatos, CA 95030<br>www.parkhere.org<br><br>***Mission***: Offer many facilities for field trip experiences, interpretive programs by Park Rangers, and classroom visits by staff on environmental education topics and park career opportunities. | Robin Schaut<br>Phone: (408) 354-2752<br>Fax: (408) 354-6657 |

**Table 5-1 (continued)**
**Resource Guide**

| Organization/Agency | Contact |
|---|---|
| ***Santa Clara County Pollution Prevention Program***<br>1735 North First Street, Suite 275<br>San Jose, CA 95112<br><br>***Mission***: Provides a variety of educational materials related to hazardous waste management and pollution prevention for teachers, industry, and public. | Carol Berg<br>Phone: (408) 441-1195<br>Fax: (408) 441-0365 |
| ***Santa Clara Valley Audubon Society***<br>22221 McClellan Road<br>Cupertino, CA 95014<br>www.scvas.org<br><br>***Mission***: Wetlands Discovery Program includes classroom activities and a field trip to the wetlands. Audubon Adventures is a classroom newspaper for students that covers topics such as Trees, Migration and Butterflies. Creeks In The Classroom and bird programs are also available for all grade levels. | Phone: (408) 252-3747<br>Fax: (408) 252-2850<br>e-mail: scvas@scvas.org |
| ***Santa Clara Valley Environmental Partners (SCVEP)***<br>***c/o Santa Clara County Office of Education***<br>1290 Ridder Park Drive<br>San Jose, CA 95131-2398<br><br>***Mission***: SCVEP is a group of environmental educators and school districts in Santa Clara County who have joined together to promote environmental education in the South Bay. Composed of teachers, educators, nonprofit organizations, local public service agencies, and environmental businesses, SCVEP's mission is to help educators become aware of local resources they can use to teach environmental education. The Environmental Partners organize the annual Santa Clara Valley Resources in Environmental Education Fair. In addition, regular meetings are held bimonthly to discuss how best to meet teacher needs, methods of disseminating curriculum, and plans for future projects. Everyone is invited to attend these meetings. | Maureen West<br>Phone: (408) 453-6692<br>Fax: (408) 453-6905<br>e-mail:<br>mawest@cello.gina.<br>calstate.edu |

| **Table 5-1 (continued)<br>Resource Guide** | |
|---|---|
| **Organization/Agency** | **Contact** |
| ***Santa Clara Valley Urban Runoff Pollution Prevention Program***<br>699 Town & Country Village<br>Sunnyvale, CA 94086<br><br>***Mission***: An association of 13 cities in Santa Clara Valley, Santa Clara County, and the Santa Clara Valley Water District ("Co-permittees') that share a common permit to discharge stormwater to the South Bay. "To assist in the protection of beneficial uses of receiving waters by preventing pollutants generated from activities in urban service areas from entering runoff to the maximum extent practicable." In addition to assisting the Co-permittees with permit compliance and reporting, the Program conducts countywide public education and outreach activities on pollution prevention and funds various monitoring projects, including activities of the Watershed Management Initiative.<br>***Funding***: By annual contributions from the Co-permittees according to an established cost-share agreement. | Jill Bicknell<br>Phone:<br>Public Information<br>(800) 794-2482<br>Program Staff direct line<br>(408) 720-8811<br>Fax: (408) 720-8812<br>e-mail:<br>jcbicknell@eoainc.com |
| ***Santa Clara Valley Water District***<br>5750 Almaden Expressway<br>San Jose, CA 95118-3686<br>www.scvwd.dst.ca.us<br><br>***Mission***: The educational program for K-12 includes facility tours, classroom presentations, free water curriculum materials, teacher training, and access to water and environmental resources throughout Santa Clara County. For the general public, the District also provides numerous outreach materials on water conservation, supply, quality and flood protection, as well as community events, a website and a speakers' bureau. | Kathy Machado<br>Phone: (408) 265-2607, ext.2331<br>e-mail:<br>kathmach@scvwd.dst.ca.us<br><br>Alison Russell<br>Phone: (408) 265-2607, ext. 2389<br>e-mail:<br>aliruss@scvwd.dst.ca.us<br><br>Fax: (408) 267-9843 |
| ***Sempervirens Fund***<br>P.O. Drawer BE<br>Los Altos, CA 94023-4054<br>www.sempervirens.org<br><br>***Educational materials***: Informational materials on coastal redwood forests are available. | Brian Steen<br>Executive Director<br>Phone: (415) 968-4509<br>Fax: (415) 968-0713<br>e-mail:<br>semperfund@aol.com |

| Table 5-1 (continued)<br>Resource Guide | |
|---|---|
| **Organization/Agency** | **Contact** |
| ***Sierra Club – Loma Prieta Chapter***<br>3921 East Bayshore Road<br>Palo Alto, CA 94303<br>www.sierraclub.org/chapters/lomaprieta<br><br>***Mission***: Provides access to the John Muir Day Study Guide, a launching pad for environmental education based on the writings and adventures of John Muir. Also provides a resource list of current activities, such as Earth Day, issues in the legislative arena, and specific volunteer opportunities. | Eben Schwartz<br>Phone: (415) 390-8411<br>Fax: (415) 390-8497<br>e-mail:<br>loma.prieta.chapter@sierraclub.org |
| ***City of Sunnyvale Baylands Park***<br>City of Sunnyvale Parks and Recreation Department<br>P.O. Box 3707<br>Sunnyvale, CA 94088-3707<br>www.ci.sunnyvale.ca.us/baylands<br><br>***Mission***: This unique regional park provides open space for the South Bay. Over 70 acres of developed parkland offers active recreation, pathways and picnic areas for families and large groups. An additional 105 acres is protected as a Wetlands Preserve where seasonal wetlands provide habitat for plants and wildlife. | Phone: (408) 730-7709<br>Fax: (408) 745-7116 |
| ***City of Sunnyvale, Water Pollution Control Plant***<br>P.O. Box 3707<br>1444 Borregas Avenue<br>Sunnyvale, CA 94088-3707<br>www.ci.sunnyvale.ca.us<br><br>***Mission***: The City of Sunnyvale's Environmental Education Program has a variety of resources available for educators, designed to support and promote environmental education in the classroom. The goal is to enhance environmental awareness of pollution, its prevention, and water issues. | Kristy McCumby<br>Phone: (408) 730-7274<br>Fax: (408) 747-1139<br>E-Mail:<br>kmccumby@ci.sunnyvale.ca.us |

**Table 5-1 (continued)**
**Resource Guide**

| Organization/Agency | Contact |
|---|---|
| ***University of California Cooperative Extension Master Gardeners of Santa Clara County***<br>1005 Timothy Drive<br>San Jose, CA 95133<br>www.mastergardeners.org/scc.html<br><br>***Mission***: Form a School Garden Response Team, available to help guide teachers with school garden projects, including site selection, design, and plan selection. | Nancy Garrison<br>Phone: (408) 299-2538<br>Fax: (408) 298-5160 |
| ***University of California Cooperative Extension Urban Horticulture***<br>68 North Winchester<br>Santa Clara, CA 95050<br><br>***Mission***: Offers horticultural information free of charge through its Master Gardeners, volunteers trained by the University of California Cooperative Extension. | Nancy Garrison<br>Phone: (408) 299-2635<br>Fax: (408) 246-7016 |
| ***USA Waste Management of San Jose***<br>1675 Rogers Avenue<br>San Jose, CA 95112<br><br>*Mission**:*** Serves San Jose residents' curbside recycling and garbage collection needs through the Recycle Plus program. Also offers and participates in a variety of educational programs for all ages, including assemblies, presentations, fairs, and tours. Groups (third grade and above) are also invited to visit the Materials Recovery Facility. | Monica Yadegar<br>Phone: (408) 451-0520<br>Fax: (408) 451-0530<br>e-mail:<br>yadegar@ix.netcom.com |

**Table 5-1 (continued)**
**Resource Guide**

| Organization/Agency | Contact |
|---|---|
| ***Walden West Outdoor School***<br>Santa Clara County Office of Education<br>15555 Sanborn Road<br>Saratoga, CA 95070<br><br>***Mission***: A state-accredited residential outdoor science school serving $5^{th}$ and $6^{th}$ grade students in Santa Clara County. Each session spans 5 days and 4 nights during which students, accompanied by their classroom teacher, live and learn about natural sciences in an outdoor environment. The program is operated on the premise that students learn best through hands-on activities and was established because of the need to educate students about the environment. | Anita Parsons,<br>Director<br>Al Saxe, Facility Mgr.<br>Phone: (408) 867-5950<br>Fax: (408) 867-9667 |
| ***Water Education Foundation***<br>717 K Street, Ste. 317<br>Sacramento, CA 95814<br>www.water-ed.org<br><br>***Mission***: Materials on a wide variety of water-related topics for both adults and children. | Judy Wheatley<br>Phone: (916) 444-6240<br>Fax: (916) 448-7699<br>e-mail: jwheatley@water-ed.org |
| ***Water Education Foundation: Project WET***<br>717 K Street, Ste. 517<br>Sacramento, CA 95814<br>www.water-ed.org/projectwet.htm<br><br>***Mission***: Project WET (Water Education for Teachers) is an exciting environmental education program for students grades K-12 of all learning abilities and styles. The 92 activities are interdisciplinary, fun, and excellent "diving platforms" for more in-depth study of water topics. | Judy Wheatley<br>Phone: (916) 444-6240<br>Fax: (916) 448-7699<br>e-mail: jwheatley@water-ed.org |

| **Table 5-1 (continued)<br>Resource Guide** | |
|---|---|
| **Organization/Agency** | **Contact** |
| ***Wildlife Education and Rehabilitation Center***<br>P.O. Box 1105<br>Morgan Hill, CA 95038-1105<br><br>***Mission***: Offers a variety of educational programs that focus on local native wildlife, habitat, owls, ecology, wildlife rehabilitation, and California Native American culture. Programs are designed to inspire peaceful coexistence with the natural environment. Offers both outreach programs held in the classroom and field programs held at designated parks. All presentations provide exciting hands-on opportunities for the participants. Programs may be adapted to fit grade levels. | Sue Howell or Elena Macias<br>Phone: (408) 779-WERC (9372)<br>Fax: (408) 779-9372 |
| ***Youth Science Institute***<br>296 Garden Hill Dr., Los Gatos, CA 95032<br>16055 Sanborn Road, Saratoga, CA 95070<br>16260 Alum Rock Ave., San Jose, CA 95127<br>www.ysi-ca.org<br><br>***Mission***: Provides a variety of hands-on science, nature, and natural history programs for school groups from pre-K to 12th grade. Seventeen different programs are offered and cover a wide range of topics, including Ohlone Native Americans; Insects and Spiders; Animals and Adaptations; Creek Exploration; Bird Talk; Moving Exploding Earth; Pioneer Organic Garden; Nature Walks; Outdoor Environmental Awareness; Dinosaurs and Fossils; Chemistry; Physics; Life in a Pond; Roots, Shoots, Seeds, and Leaves; and California Plants and Animals. The Institute has three nature centers within the Santa Clara Valley and some programs are provided in the classroom. | Bonnie LeMat<br>Phone: (408) 356-4945<br>Fax: (408) 358-3683 |

**Table 5-1 (continued)**
**Resource Guide**

| Organization/Agency | Contact |
|---|---|
| **San Francisco Bay Estuary-Wide Organizations** | |
| ***Aquatic Outreach Institute***<br>1327 South 46th Street #155<br>Richmond, CA 94804<br>www.aoinstitute.org<br><br>***Mission***: Creates and carries out involvement and outreach programs on creeks, wetlands, and watersheds for the general public and educators in the Bay Area. Offers various programs and workshops for educators as they are requested and funded. Also holds conference field trips for educators and the general public, and offers an activities and resource guide and a software package. The general public is served primarily through several Watershed Awareness programs. | BC Capps<br>Phone: (510) 231-5655<br>Fax: (510) 231-5703<br>E-mail:<br>staff@aoinstitute.org |
| ***Bay Area Stormwater Management Agencies Association***<br>518 Central Avenue<br>Menlo Park, CA 94025-2807<br>www.basmaa.org<br><br>***Mission***: A consortium of seven Bay Area municipal stormwater programs, the association grew from the bottom (local) up to focus on regional challenges and opportunities for improving the quality of stormwater runoff to the Bay and Delta. | Geoff Brosseau,<br>Executive Director<br>Phone: (650) 322-3070<br>Fax: (650) 322-5147 |
| ***CALFED Bay-Delta Program***<br>1416 Ninth Street, Suite 1155<br>Sacramento, CA 95814<br>www.calfed.ca.gov<br><br>***Mission***: Initiated in 1995, CALFED is a collaborative effort by state and federal agencies and California's leading urban, agricultural, and environmental interests to address and resolve the environmental and water management problems of the San Francisco Bay-Sacramento/San Joaquin River Delta Estuary. Develop a long-term comprehensive plan that will restore ecological health and improve water management for beneficial uses of the Bay-Delta system.<br>***Funding:*** State and federal budget appropriations**.** | John Lowrie,<br>Watershed Program Mgr.<br>Phone: (916) 657-2666<br>Fax: (916) 653-5699<br>E-mail:<br>lowrie@water.ca.gov |

**Table 5-1 (continued)**
**Resource Guide**

| Organization/Agency | Contact |
|---|---|
| ***Friends of the Estuary***<br>PO Box 791<br>Oakland, CA 94604<br>www.abag.ca.gov/bayarea/sfep/about/friends.html<br><br>***Mission***: A nonprofit California corporation that is a coalition of environmentalists, business and industry representatives, state and local government agencies, elected officials, and other community members dedicated to protecting, restoring, and enhancing the San Francisco Bay-Delta Estuary. Friends carries out its mission by assisting the San Francisco Estuary Project implement its Comprehensive Conservation and Management Plan (CCMP) for the Estuary. | Steve Cochrane<br>Phone: (510) 622-2337<br>Fax: (510) 622-2501<br>sc@rb2.swrcb.ca.gov |
| ***San Francisco Estuary Project***<br>1515 Clay Street, Suite 1400<br>Oakland, CA 94612<br>sfep.abag.ca.gov<br><br>***Mission***: Implement a CCMP to restore and enhance the San Francisco Delta Estuary. CCMP priorities include the water quality of the estuary, freshwater diversion, and dredging related issues.<br>***Funding***: Primarily through EPA grants. | Marcia Brockbank<br>Phone: (510) 622-2321<br>Fax: (510) 622-2501<br>mlb@rb2.swrcb.ca.gov |
| **Universities & Colleges** | |
| ***California State University, San Jose***<br>One Washington Square<br>Dept. of Geography and Dept. of Environmental Studies<br>WSQ-118<br>San Jose, CA 95192-0116<br>www.sjsu.edu/depts/envstudies | Prof. Frank Schiavo<br>Phone: (408) 924-5550 |

**Table 5-1 (continued)**
**Resource Guide**

| Organization/Agency | Contact |
| --- | --- |
| ***Foothill-De Anza Community College District***<br>www.fhda.edu<br><br>***Foothill College***<br>12345 El Monte Road<br>Los Altos Hills, CA 94022<br><br>***De Anza College***<br>21250 Stevens Creek Blvd.<br>Cupertino, CA 95014 | *Foothill College*<br>Dr. Leo E. Chavez,<br>Chancellor<br>Phone: (650) 949-7200<br>Dr. Bernadine Fong,<br>President<br>Phone: (650) 949-7777<br><br>*De Anza College*<br>Martha J. Kanter,<br>President<br>Phone: (408) 864-5678 |
| ***San Jose-Evergreen Community College District***<br>4750 San Felipe Road<br>San Jose, CA 95135-1599<br>www.sjeccd.cc.ca.us<br><br>***Evergreen Valley College***<br>3095 Yerba Buena Road<br>San Jose, CA 95135<br><br>***San Jose City College***<br>2100 Moorpark Avenue<br>San Jose, CA 95128 | *San Jose-Evergreen Community College District*<br>Geraldine A. Evans,<br>Chancellor<br>Phone: (408) 274-6700<br><br>*Evergreen Valley College*<br>Geraldine A. Evans,<br>Interim President<br>Phone: (408) 274-7900<br><br>*San Jose City College*<br>Chui Tsang,<br>President<br>Phone: (408) 298-2181 |
| ***Santa Clara University***<br>Environmental Studies Program<br>Santa Clara, CA 95053<br>www.scu.edu<br><br>***Mission***: Seeks to educate students about the complex interrelationship between human beings and nature and to inspire students to become concerned citizens influencing sound environmental policy decisions. | Martha Smith<br>Environmental Studies<br>Phone: (408) 554-4799 |

**Table 5-1 (continued)**
**Resource Guide**

| Organization/Agency | Contact |
|---|---|
| ***Stanford University***<br>Center for Conservation Biology<br>Department of Biological Sciences<br>Stanford, CA 94305-5020<br>www.stanford.edu | Alan Launer<br>Phone: (650) 725-1854<br>Fax: (650) 723-6150<br>E-mail: aelauner@leland.<br>stanford.edu |
| ***University of California at Berkeley***<br>Department of Agriculture Resource Economics<br>207 Giannini Hall<br>Mail Stop #3310<br>Berkeley, CA 94720-3310<br>www.berkeley.edu | Michael Hanemann<br>Phone: (510) 642-2670<br>E-mail: hanemann@are.<br>berkeley.edu |
| ***University of California at Santa Cruz***<br>Environmental Studies Department<br>339 Natural Sciences 2<br>Santa Cruz, CA 95064<br>zzyx.ucsc.edu<br><br>***Mission***: The Environmental Studies Board offers a major that focuses on the sustainability of cultural and ecological systems through planned actions (conservation, management, agriculture, planning, policy, development, and restoration). There is a geographical emphasis at the regional level; a focus on nonurban and wild lands; and a concern about biodiversity and environmental, social, and economic well being. | Dr. Daniel Press<br>Phone: (831) 459-3263 |

| **Table 5-1 (continued)<br>Resource Guide** | |
|---|---|
| **Organization/Agency** | **Contact** |
| ***West Valley-Mission Community College District***<br>14000 Fruitvale Avenue<br>Saratoga, CA 95070<br>www.wvmccd.cc.ca.us<br><br>***Mission College***<br>3000 Mission College Boulevard<br>Santa Clara, CA 95054<br><br>***West Valley College***<br>14000 Fruitvale Avenue<br>Saratoga, CA 95070 | *West Valley-Mission Community College District*<br>Dr. Rose Tseng, Chancellor<br>Phone: (408) 867-2200<br><br>*Mission College*<br>Michael Rao, President<br>Phone: (408) 988-2200<br><br>*West Valley College*<br>Marchelle Fox, President<br>Phone: (408) 867-2200 |
| **Business and Industry Trade Organizations**<br><br>**Chambers of Commerce** | |
| ***Campbell Chamber of Commerce***<br>1628 West Campbell Avenue<br>Campbell, CA 95008<br><br>***Mission***: Promote business in the Campbell community. Focus is on traffic, maintaining the quality of life, and strong support for the community.<br>***Funding***: Through membership dues and fundraisers. | Betty Deal,<br>Executive Director<br>Phone: (408) 378-6252 |
| ***Cupertino Chamber of Commerce***<br>20455 Silverado Avenue<br>Cupertino, CA 95014<br>www.cupertino-chamber.org<br><br>***Mission***: Promote and enhance the business environment of the Cupertino community.<br>***Funding***: Through membership dues and activities. | Linda Asbury,<br>Executive Director<br>Phone: (408) 252-7054 |

| **Table 5-1 (continued)<br>Resource Guide** | |
|---|---|
| **Organization/Agency** | **Contact** |
| ***Filipino American Chamber of Commerce***<br>1046 W. Taylor Street, Suite 206<br>San Jose, CA 95126<br>www.filchamber.org<br><br>***Mission***: Assist and promote Filipino and other minority owned businesses and promote and develop business skills. Focus is to uphold high ethical standards in the community, act as a medium for communication and information sharing, and promote participation in civic/community service.<br>***Funding***: Through memberships and grants. | Elvira De La Vega,<br>Executive Director<br>Phone: (408) 283-0833 |
| ***Fremont Chamber of Commerce***<br>39488 Stevenson Place, #100<br>Fremont, CA 94538<br>www.fremontbusiness.com<br><br>***Mission***: To promote, support, and enhance a positive business environment. | Cindy Bonior,<br>President and Chief Executive Officer<br>Phone: (510) 795-2244<br>Fax: (510) 795-2240<br>E-mail:<br>fmtcc@fremontbusiness.com |
| ***Hispanic Chamber of Commerce of Santa Clara Valley***<br>1376 N. Fourth Street<br>San Jose, CA 95112<br>www.hccscv.com<br><br>***Mission***: Maximize Hispanic participation in the economy of Santa Clara County. Focus is on advocacy and resource provision.<br>***Funding***: Through membership dues. | Alex C. Torres,<br>President<br>Phone: (408) 467-9890 |
| ***Indo-American Chamber of Commerce--Northern California***<br>3095 Greentree Way<br>San Jose, CA 95128<br>scuish.scu.edu/SCU/Programs/Diversity/icc.html<br><br>***Mission***: Advance the commercial, financial, and civic interests of the Indo-American community and to increase participation in mainstream America. Focus is on small business issues.<br>***Funding***: Through membership dues. | Vimu Rajdev,<br>President<br>Phone: (408) 261-6400 |

| Table 5-1 (continued)<br>Resource Guide | |
|---|---|
| **Organization/Agency** | **Contact** |
| ***Korean American Chamber of Commerce of Silicon Valley***<br>PO Box 49048<br>San Jose, CA 95161<br>www.kaccsv.org | Phone: (408) 975-2730 |
| ***Los Altos Chamber of Commerce***<br>321 University Avenue<br>Los Altos, CA 94022<br>www.losaltoschamber.org | Julie Rose<br>Phone: (650) 948-1455 |
| ***Los Gatos Chamber of Commerce***<br>333 North Santa Cruz Avenue<br>Los Gatos, CA 95030<br>www.losgatosweb.com | Sheri Lewis<br>Phone: (408) 354-9300 |
| ***Menlo Park Chamber of Commerce***<br>1100 Merrill St.<br>Menlo Park, CA 94025<br>www.mpchamber.com<br><br>***Mission****:* To create an atmosphere in which business prospers and the community thrives. | Phone: (650) 325-2818<br>Fax: (650) 325-0920<br>E-mail: mpchamber@<br>worldnet.att.net |
| ***Milpitas Chamber of Commerce***<br>138 N. Milpitas Boulevard<br>Milpitas, CA 95035<br>www.milpitas-chamber.com<br><br>***Mission***: Be a business resource, working to ensure a healthy economic environment for the Milpitas community through business to business interaction.<br>***Funding***: Through membership dues. | Gayle Morando,<br>Executive Director<br>Phone: (408) 262-2613 |
| ***Morgan Hill Chamber of Commerce***<br>25 West First Street<br>Morgan Hill, CA 95037<br>www.morganhill.org/mhcc | Sunday Minnich<br>Phone: (408) 779-9444<br>Fax: (408) 779-5405<br>E-mail:<br>mhcc@morganhill.org |

| **Table 5-1 (continued)<br>Resource Guide** | |
|---|---|
| **Organization/Agency** | **Contact** |
| ***Mountain View Chamber of Commerce***<br>580 Castro Street<br>Mountain View, CA 94041<br>www.mountainviewchamber.org | Carol Olson<br>Phone: (650) 968-8378<br>Fax: (650) 968-5668 |
| ***Newark Chamber of Commerce***<br>6066 Cir. Terrace Ave., Suite 8<br>Newark, CA 94560<br>www.newark-chamber.com | John Copley,<br>Chief Executive Officer<br>Phone: (510) 744-1000<br>E-Mail: jcopley@newark-chamber.com |
| ***Palo Alto Chamber of Commerce***<br>325 Forest Avenue<br>Palo Alto, CA 94301<br>Www.batnet.com/pace | Phone: (650) 324-3121 |
| ***Portugese Chamber of Commerce***<br>1115 East Santa Clara Street<br>San Jose, CA | Fernando Espinola<br>Phone: (408) 288-7655 |
| ***San Jose Japanese Chamber of Commerce***<br>95 South Market Street<br>San Jose, CA 95112<br><br>***Mission***: Be an information and contact resource, promoting understanding of the Japanese-American culture; exchange ideas and instill community participation; and bring more businesses to Japantown, promoting Japanese businesses.<br>***Funding***: Through membership dues. | Steve Nakano,<br>President<br>Phone: (408) 298-7551 |

**Table 5-1 (continued)**
**Resource Guide**

| Organization/Agency | Contact |
|---|---|
| ***San Jose/Silicon Valley Chamber of Commerce***<br>310 S. First Street<br>San Jose, CA  95113<br>Www.sjchamber.com<br><br>***Mission***: Improve the success of the business community in general, and of our members in particular.<br>***Funding***: Nonprofit organization, funding from membership, special events, and publications. | Steve Tedesco,<br>President and CEO<br>Phone: (408) 291-5277 |
| ***Santa Clara Chamber of Commerce***<br>1850 Warburton Avenue<br>Santa Clara, CA  95050<br>www.santaclara.org/chamber | Betty Hangs<br>Phone: (800) 272-6822 |
| ***Santa Clara County Black Chamber of Commerce***<br>50 East St. John Street<br>San Jose, CA 95113<br>www.netusa.com/sccbcc<br><br>***Mission***: Develop and maintain a strong and positive alliance between the public and private sector, provide technical assistance, and enhance the growth of black business and community organizations. Focus is to become more visible to the community so that the community is aware of its services.<br>***Funding***: Partially funded by the City of San Jose, with the balance coming from membership and advertising fees. | Maxine Washington,<br>Special Projects Director<br>Phone: (408) 294-6583 |
| ***Saratoga Chamber of Commerce***<br>20460 Saratoga-Los Gatos Road<br>Saratoga, CA 95070<br>www.saratoga-ca.com/chamber<br><br>***Mission***: Improve business to the betterment of the community.<br>***Funding***: Through membership dues and fund-raising. | Sheila Arthur,<br>Executive Director<br>Phone: (408) 867-0753 |
| ***Sunnyvale Chamber of Commerce***<br>499 South Murphy Street<br>Sunnyvale, CA  94088 | Suzi Blackman<br>Phone: (408) 736-4971 |

| Table 5-1 (continued)<br>Resource Guide | |
|---|---|
| **Organization/Agency** | **Contact** |
| **Labor Groups** | |
| ***South Bay Central Labor Council***<br>2102 Almaden Road Suite 107<br>San Jose, CA | Amy Dean<br>(408) 266-3790<br>Christina Uribe<br>(408) 266-3790 |
| **Business Groups and Associations** | |
| ***Alameda Business Association***<br>P.O. Box 26183<br>San Jose, CA | Nancy Truillo<br>Phone: (408) 287-3914 |
| ***American Electronic Association***<br>5201 Great America Parkway Suite 520<br>Santa Clara, CA 95054<br>www.aeanet.org | Grace Davis<br>Phone: (408) 987-4280<br>Fax: (408) 986-1247<br>grace_davis@aeanet.org |
| ***California Avenue Area Development Association***<br>P.O. Box 60583<br>Palo Alto, CA 94306<br>www.californiaavenue.com<br><br>***Mission***: Provide a pleasant place for people to shop.<br>***Funding***: 225 members – voluntary annual fee. | Ronna Devincenzi<br>Phone: (650) 688-6295 |
| ***California Restaurant Association***<br>1011 10th Street<br>Sacramento, CA 95814<br>www.calrest.org<br><br>Mission: Be the most recognizable and definitive voice representing the California foodservice industry. | John D. Dunlap,<br>President and CEO<br>Phone: (800) 765-4842<br>Fax: (916) 447-6182 |
| ***Gilroy Foundation***<br>P.O. Box 774<br>Gilroy, CA 95021 | Donna Pray<br>Phone: (408) 842-3727<br>Fax: (408) 842-8767 |

| **Table 5-1 (continued)<br>Resource Guide** | |
|---|---|
| **Organization/Agency** | **Contact** |
| ***Home Builders Association of Northern California***<br>675 North First Street, #620<br>San Jose, CA 95112<br>www.hbanc.org<br><br>***Mission***: A professional association comprised of home builders, developers, trade contractors, suppliers, and related industry specialists dedicated to the advancement of the home building industry.<br><br>***Funding:*** Membership dues. | Amy Glad,<br>Executive Director<br>Phone: (408) 977-1490<br>Fax: (408) 977-1493 |
| ***Japantown Business Association***<br>565 North Sixth Street, Ste. G<br>San Jose, CA 95112<br>www.japantownsanjose.org<br><br>***Mission***: Promote Japantown.<br>***Funding***: Assessment district. | Connie Shaw<br>Phone: (408) 298-4303 |
| ***Joint Venture Economic Development Roundtable***<br>500 Castro Street<br>Mountain View, CA 94041<br>www.jointventure.org<br><br>***Mission***: Bring people together from business, government, education, and the community to identify and to act on regional issues effecting economic vitality and quality of life.<br>***Funding***: Businesses, local government, professional associations, labor organizations. | Barney Burke<br>Phone: (650) 903-6454<br>Darious Jones<br>Phone: (408) 938-1525 |
| ***Joint Venture: Silicon Valley Network***<br>99 Almaden Blvd., Suite 700<br>San Jose, CA 95113-1605<br>www.jointventure.org<br><br>***Mission***: Promote quality of life and economic vitality in Silicon Valley.<br>***Funding***: Investors. | Ruben Barrales,<br>President and CEO<br>Phone: (408) 271-7213 |

**Table 5-1 (continued)**
**Resource Guide**

| Organization/Agency | Contact |
|---|---|
| ***Landscape Advisory Committee***<br>Santa Clara Valley Water District<br>5750 Almaden Expressway<br>San Jose, CA 95118<br>www.scvwd.dst.ca.us | Lowell Cordas,<br>Chair<br>Phone: (408) 847-5584 |
| ***Los Altos Board of Realtors***<br>321 Second Street<br>Los Altos, CA 94022 | Ellen Ashley<br>Phone: (650) 948-8219 |
| ***San Jose Downtown Association***<br>28 North First Street #1000<br>San Jose, CA 95112<br>www.sj-downtown.com<br><br>***Mission***: Represents business and property owners and works to enhance downtown's vitality and livability.<br>***Funding***: Private sponsors, contributing members, the Business Improvement District, and fee-for-service contracts with the San Jose Redevelopment Agency and the City of San Jose. | Kim Smith or<br>Scott Knies<br>Phone: (408) 279-1775 |
| ***Santa Clara and San Benito Counties***<br>***Building and Construction Trades Council***<br>2102 Almaden Road, Suite 101<br>San Jose, CA 95125<br><br>***Mission***: Support construction unions and supply sites with trainers and supplies. | John Neece<br>Chief Executive Officer<br>Phone: (408) 265-7643<br>Fax: (408) 265-2080 |
| ***Santa Clara County Association of Realtors***<br>1525 Meridian Ave., Ste. 101<br>San Jose, CA 95125<br>www.sjrealtor.com<br><br>***Mission***: Meet the business, professional, and political needs of real estate professionals and protect private property rights. | Rebecca Elliot<br>Phone: (408) 445-8500<br>ext.261 |

| **Table 5-1 (continued)<br>Resource Guide** | |
|---|---|
| **Organization/Agency** | **Contact** |
| ***Semiconductor Industry Association***<br>181 Metro Drive, Ste 450<br>San Jose, CA 94301<br>www.semichips.org<br><br>***Mission***: Provide leadership for U.S. chip manufacturers on the critical issues of trade, technology, environmental protection, and worker health and safety.<br>***Funding***: Annual dues. | Daven Oswalt,<br>Dir. of Communications<br>Chuck Fraust,<br>Dir. of Environmental Health and Safety<br>Phone: (408) 436-6600<br>Fax: (408) 436-6646<br>E-mail:<br>doswalt_sia@ibm.net |
| ***Silicon Valley Manufacturing Group***<br>226 Airport Parkway, Ste 190<br>San Jose, CA 95112<br>www.svmg.org<br><br>***Mission***: Involves principal officers and senior managers of member companies in a cooperative effort with government officials to address public policy. | Carl Guardino,<br>President<br>Phone: (408) 501-7864<br><br>Justin Bradley,<br>Director of Environmental Programs<br>Phone: (408) 501-7852 |
| ***Story Road Business Association***<br>1960 Story Road<br>San Jose, CA | Bob Johnson<br>Phone: (408) 272-1211 |
| ***Tri-County Apartment Association***<br>792 Meridian Way Ste. A<br>San Jose, CA 95126<br>www.tcaa.org<br><br>***Mission***: A large nonprofit trade organization that advances the general welfare of the rental housing industry and provides programs and services to enable our members to operate successfully.<br>***Funding***: By membership dues. | Mary Liz Cortez<br>Phone: (408) 297-0483<br>E-mail:<br>marylizc@tcaa.org |
| ***Willow Glen Business and Professional Association***<br>1275 Lincoln Avenue<br>San Jose, CA 95125<br>www.willowglen.org<br><br>***Mission***: Formed as a Business Improvement District. | Dimitri Rizos<br>Phone: (408) 298-2100 |

| Table 5-1 (continued)<br>Resource Guide | |
|---|---|
| **Organization** | **Contact** |
| **Community Organizations and Foundations**<br><br>**Community Organizations** | |
| ***Leagues of Women Voters of Santa Clara County***<br>(Various addresses – see "Contact")<br>www.lwvla-ca.org<br>www.lwvpaloalto.org<br>www.losaltosonline.com/lwv<br><br>***Mission:*** A nonpartisan political organization that encourages the informed and active participation of citizens in government and influences public policy through education and advocacy. Does not support or oppose any political party or any candidate, but does take action on selected government issues in the public interest.<br>***Funding:*** Membership dues and contributions from interested members of the community**.** | *County Council Chair*<br>Crownie Billik<br>Phone: (650) 948-0936<br>*LWV of Cupertino/Sunny.*<br>Francis Grabau, President<br>Phone: (408) 733-0454<br>*LWV of Los Altos-M.V.*<br>Carol Watts, President<br>Phone: (650) 941-4846<br>*LWV of Los Gatos, Saratoga & Monte Sereno*<br>Pat Kahn, President<br>Phone: (408) 867-VOTE<br>*LWV of Palo Alto*<br>Sally Probst, President<br>Phone: (650) 327-9148<br>*LWV of San Jose/S. Clara*<br>Brenda McHenry, Pres.<br>Phone: (408) 271-7163<br><br>*LWV Contacts for WMI*:<br>Ann Coombs<br>Phone: (650) 941-2684<br>Libby Lucas<br>Phone: (650) 941-4846<br>Vivian Blomenkamp<br>Phone: (650) 322-7782<br>Nancy Hobbs<br>Phone: (408) 395-4045<br>Sue Swackhammer<br>Phone: (408) 365-3979 |

**Table 5-1 (continued)**
**Resource Guide**

| Organization | Contact |
|---|---|
| ***Santa Clara County Taxpayers Association***<br>4718 Meridian Ave<br>San Jose, CA 95118<br>www.webpage.com/taxpayer<br><br>***Mission***: Inform its members and the public at large of the costs and relative value of the various services and functions of local governments through research and analysis of the revenues and expenditures thereof, and to promote accountability and the reduction of local, regional, and state taxes and federal unfunded mandates. | Donna Courtright<br>Phone: (408) 279-5000 |
| ***Santa Clara Valley Water Commission***<br>Santa Clara Valley Water District<br>5750 Almaden Expressway<br>San Jose, CA 95118<br>www.scvwd.dst.ca.us<br><br>***Mission***: Assist the Santa Clara Valley Water District and its Board of Directors by convening from time to time to consider and advise on subjects relating to the business of the District. | Cynthia Cook,<br>Chairperson<br>Don Burnett,<br>Vice-Chair<br>Phone: (408) 265-2600<br>ext. 2327 |
| ***Santa Clara Valley Water District***<br>5750 Almaden Expressway<br>San Jose, CA 95118<br>www.scvwd.dst.ca.us<br><br>***Mission***: Each of the District's Flood Control Zones - Northwest, North Central, Central, East, and South - is a separate entity with its own flood management program and with its own budget for revenues and expenditures. An advisory committee for each zone keeps the Board apprised of local flood concerns and carries information of District flood management activities to their communities. The District's flood management project priorities are set by the District in conjunction with the advisory committees. Advisory committee members review and make recommendations to the Board on flood management policies, projects and schedules, and budgets and financing. | Phone: (408) 265-2600<br><br>*Northwest Flood Control Zone Advisory Comm.*<br>Chairperson: Jack Walker<br><br>*North Central/Central Flood Control Zone Advisory Comm.*<br>Chairperson: Don Burnett<br><br>*East Flood Control Zone Advisory Comm.*<br>Chairperson: Mike McNeely |

**Table 5-1 (continued)**
**Resource Guide**

| Organization | Contact |
|---|---|
| ***United Neighborhoods of Santa Clara County***<br>2150 Alum Rock Avenue<br>San Jose, CA 95116<br>www.unscc.org<br><br>***Mission***: Bring together a coalition of 29 neighborhood associations from throughout Santa Clara County for the purposes of education, communication, and common action.<br>***Funding***: A 501(c)(3) nonprofit corporation; funding from grants and donations. | Miguel A. Guerra-Ressi,<br>Executive Director<br>Phone: (408) 937-9661 |
| **Foundations** | |
| ***AT&T Foundation***<br>795 Folsom Street, Suite 120<br>San Francisco, CA 94107<br>www.att.com/foundation/<br><br>***Mission***: Provide financial resources and people to enhance the quality of life in the communities where our employees and customers live and work. By developing programs that address community needs through the use of communications and information technology, AT&T has long been a catalyst towards encouraging employees to commit to community service. | *Contact by mail or e-mail* |
| ***Ben & Jerry's Foundation***<br>30 Community Drive<br>So. Burlington, VT 05403-6828<br>www.benjerry.com/foundation<br><br>***Mission***: Make the world a better place by empowering its employees to use available resources to support and encourage organizations that are working towards eliminating the underlying causes of environmental and social problems. | Rebecca Golden,<br>Foundation Director<br>Phone: (802) 846-1500 |

**Table 5-1 (continued)**
**Resource Guide**

| Organization | Contact |
|---|---|
| ***Columbia Foundation***<br>One Lombard Street, Suite 305<br>San Francisco, CA 94111<br>www.columbia.org<br><br>***Mission***: Established in 1940 by Madeleine Haas Russell and her brother, William Haas, "for the furtherance of the public welfare." The Foundation's broad philanthropic purpose has given it flexibility to respond to changing social conditions. Long-standing interests in world peace, human rights, the environment, cross-cultural and international understanding, the quality of urban life, and the arts have evolved to reflect current conditions and opportunities. | Susan R. Clark,<br>Executive Director<br>Phone: (415) 986-5179 |
| ***Common Counsel Foundation***<br>1221 Preservation Park Way, Ste. 101<br>Oakland, California 94612-1206<br>www.commoncounsel.org<br><br>***Mission***: Common Counsel Foundation's consortium of family foundations and individual donors are committed to funding economic, environmental, and social justice initiatives. While each member fund guides its own grantmaking program, all members seek to give voice to the needs of low-income people, women, youth, people of color, and others working for justice, equity, and a healthy, sustainable environment. Common Counsel members share a special interest in organizations that are committed to the empowerment of their members through community organizing. | Elizabeth Wilcox,<br>Executive Director<br>Phone: (510) 834-2995<br>Fax: (510) 834-2998<br>E-mail: ccounsel@igc.org |
| ***Community Foundation of Silicon Valley***<br>111 W. Saint John Street Suite 230<br>San Jose, California 95113<br>www.cfsv.org<br><br>***Mission***: Promote philanthropy and build community by connecting people with opportunities. Involve many sectors of the community in our work. | Susan Luenberger<br>Phone: (408) 278-0270 |

**Table 5-1 (continued)**
**Resource Guide**

| Organization | Contact |
|---|---|
| ***Compton Foundation***<br>545 Middlefield Road, Suite 178<br>Menlo Park, CA  94025<br><br>***Mission***: Prevention of war and the amelioration of world conditions that tend to cause conflict.  The Foundation categorizes these global human survival problems into the areas of Peace and World Order, Population, and the Environment. | Edith T. Eddy,<br>Executive Director<br>Phone: (650) 328-0101 |
| ***Fred Gellert Foundation***<br>One Embarcadero Center Suite 2480<br>San Francisco, CA  94111<br><br>***Mission***: Awards grants to projects involving health care, social services, community services, education, arts, youth and senior, and environmental programs.  As of 1992, one fourth of funding will support organizations working to make environmental quality a national priority.  The Foundation awards 112 grants annually, with a range of $1,000 - $10,000.  To apply, call, or send a letter or a proposal to the Foundation. | Phone: (415) 433-6174 |
| ***Knight Foundation***<br>John S. and James L. Knight Foundation<br>One Biscayne Tower, Suite 3800<br>2 S. Biscayne Blvd.<br>Miami, Fla. 33131-1803<br>www.knightfdn.org<br><br>***Mission***: Further the founder's ideals of service to community, the highest standards of journalistic excellence, and the defense of a free press. To heighten the impact of their grant making, Foundation trustees focus on four programs: Community Initiatives, Journalism, Education, and Arts and Culture.<br>***Funding*****:** From investment management of Foundation assets. | Phone: (305) 908-2600 |

**Table 5-1 (continued)**
**Resource Guide**

| Organization | Contact |
|---|---|
| ***The David and Lucile Packard Foundation***<br>300 Second Street, Suite 200,<br>Los Altos, California 94022<br>www.packfound.org<br><br>***Mission***: Support nonprofit organizations with the hope that we can help people through the improvement of scientific knowledge, education, health, culture, employment opportunities, the environment, and quality of life. | Jeanne Sedgwick<br>Phone: (650) 948-7658 |
| ***The Hewlett Foundation***<br>525 Middlefield Road, Suite 200<br>Menlo Park, CA  94025<br>www.hewlett.org<br><br>***Mission***: Promote the well-being of mankind by supporting selected activities of a charitable nature, as well as organizations or institutions engaged in such activities. | Phone: (650) 329-1070 |
| **Water Sport and Recreation Groups** | |
| ***Bay Area Sea Kayakers***<br>229 Courtright Rd.<br>San Rafael, CA  94901<br>www.bask.org<br><br>***Mission***: Provide a forum for people to meet other paddlers, generate ideas for new trips, and promote safe sea kayaking and establish a feeling of community among Bay Area sea kayakers. | E-Mail: bask@bask.org |
| ***California Fisheries Restoration Foundation***<br>1146 Pulora Court<br>Sunnyvale, CA 94087<br><br>***Mission***: Preserve California fisheries and restore the habitats that support them. Focus is on the protection and restoration of habitat and pollution prevention.<br>***Funding***: Through private donations. | Marty Seldon,<br>President<br>Phone: (408) 736-5631 |

**Table 5-1 (continued)**
**Resource Guide**

| Organization | Contact |
|---|---|
| ***California Trout***<br>870 Market Street #859<br>San Francisco, CA 94102<br>www.caltrout.org<br><br>***Mission***: Seek to protect and preserve wild trout and native steelhead in their natural habitat. Focus is on San Francisquito Creek and its watershed, as well as projects related to steelhead, trout, and salmon habitat restoration.<br>***Funding***: Through donations, grants, and contracts. | Michael Bowen<br>Phone: (650) 392-8887<br>Jerome Yesavage, MD.<br>Phone: (650) 852-3287<br>Fax: (650) 852-3297 |
| ***California Waterfowl Association***<br>4630 Northgate Blvd. #150<br>Sacramento, CA 95834<br>www.calwaterfowl.org<br><br>***Mission***: Provide hands-on experiences with nature, the California Waterfowl Association hosts youth fairs, family field days, and a weekend Youth Camp. Youth groups can also build wood duck nest boxes and place them on local wetlands. Publish a quarterly junior newsletter as well. | Rebecca Easter<br>Phone: (916) 648-1406<br>Fax: (916) 648-1665 |
| ***Ducks Unlimited***<br>Western Regional Office<br>3074 Gold Canal Dr.<br>Rancho Cordova, CA 95670<br>www.ducks.org<br><br>***Mission***: Fulfill the annual life cycle needs of Northern American waterfowl by protecting, enhancing, restoring, and managing important wetlands and associated uplands.<br>***Funding***: Nonprofit organization; volunteers raise funds. | Ron Stromstad,<br>Director of Operations<br>Phone: (916) 852-2000 |

| **Table 5-1 (continued)<br>Resource Guide** | |
|---|---|
| **Organization** | **Contact** |
| ***Salmon and Steelhead Restoration Group***<br>1596 Ivy Creek Circle<br>San Jose, CA 95121<br>www.silichip.org<br><br>***Mission***: Restore river habitat for salmon and steelhead. Focus is on restoring the Guadalupe River, including taking an active role in future river development and the preserving salmon habitat.<br>***Funding***: S. | Roger Castillo<br>Phone: (408) 238-2040 |
| ***San Jose Flycasters***<br>(Local chapter of Northern California Council Federation of Fly Fishers)<br>P. O. Box 821<br>Campbell, CA 95009<br><br>***Mission***: Promote flycasting as a way of fishing. Focus is on trout, steelhead, and salmon habitat and the restoration of runs, as well as rivers.<br>***Funding***: Through membership dues. | Jean Gomes<br>Phone: (408) 445-0636 |
| ***Santa Clara County Horsemen's Association***<br>20350 McKean Road<br>San Jose, CA 95160<br>www.horsemens.com<br><br>***Mission***: Promote good fellowship among horsemen (and women) and a greater understanding of horses. Members are actively involved in local land use planning and trail building and keep abreast of legal issues pertaining to their area of interest. | Phone: (408) 268-6155 |
| ***Santa Clara Valley Waterski Club***<br>P.O. Box 24622<br>San Jose, CA  95154<br><br>***Mission***:  Recreational/competitive.<br>***Funding***: Membership fees. | Larry Goodwin<br>Phone: (408) 268-9695 |

| **Table 5-1 (continued)**<br>**Resource Guide** | |
|---|---|
| **Organization** | **Contact** |
| ***Trout Unlimited***<br>828 San Pablo Ave. #208<br>Albany, CA 94706<br>www.tu.org<br><br>***Mission***: Conserve coldwater fisheries. Focus is on the restoration of salmon, steelhead and trout, as well as the restoration and preservation of rivers.<br>***Funding***: Through donations and dues received through Trout Unlimited's national office. | Steve Trafton<br>Phone: (510) 528-4772 |
| ***United Anglers of California***<br>15572 Woodard Road<br>San Jose, CA 95124<br>www.unitedanglers.org<br><br>***Mission***: Protect and encourage recreational fishing opportunities in California. Focus is on the protection and restoration of fish and their habitats. Also aims to manage resources at sustainable levels.<br>***Funding***: Through memberships. | Bob Strickland,<br>President<br>Phone: (408) 371-0031<br>Fax: (408) 371-9459<br>E-mail: BobStrickland@<br>unitedanglers.org |
| ***Western Waters Canoe Club***<br>712 Coakley Drive<br>San Jose, CA 95117-2105<br>(Affiliate member of the American Canoe Association, est. 1880)<br>www.westernwaterscanoeclub.org<br><br>***Mission***: Promote the sport of canoeing, water safety, waterway access rights for manually powered recreational boating, the protection/restoration of our waterways, and the concepts of clean, free-flowing rivers and streams. Provide support to our membership in organizing and conducting canoe-related events, share our canoeing and river knowledge, go on canoe trips, and have fun. | Nicole Jorgensen<br>Phone: (408) 299-4813<br>Larry Johmann<br>Phone: (408) 371-5809 |

**Table 5-1 (continued)**
**Resource Guide**

| Organization | Contact |
|---|---|
| **Agricultural Organizations** | |
| ***Cattleman's Association***<br>102 D Mt. Hamilton Road<br>San Jose, CA 95140 | Mike Miller<br>Phone: (408) 274-2359 |
| ***Santa Clara County Farm Bureau***<br>605 Tennant Avenue, Unit B<br>Morgan Hill, CA 95037<br>www.cfbf.com<br><br>***Mission***: A voluntary, nongovernmental, nonpartisan, organization of farm and ranch families seeking solutions to the problems that affect their lives, both socially and economically.<br>***Funding***: Membership dues. | Phone: (408) 776-1684<br>E-Mail:<br>agbureau@ix.netcom.com |
| ***Santa Clara Valley Water District***<br>***Agricultural Water Advisory Committee***<br>5750 Almaden Expressway<br>San Jose, CA 95118<br>www.scvwd.dst.ca.us | Mr. Jan Garrod,<br>Chair<br>Phone: (408) 265-2600 |
| **Government Agencies**<br><br>**City Governments** | |
| **City Office** | **Contact** |
| ***Campbell City Council***<br>70 North First Street<br>Campbell, CA 95008<br>www.ci.campbell.ca.us | Phone: (408) 866-2125 |
| ***Cupertino City Council***<br>10300 Torre Avenue<br>Cupertino, CA 95014<br>www.cupertino.org | Phone: (408) 777-3200 |
| ***Los Altos City Council***<br>1 North San Antonio Road<br>Los Altos, CA 94022<br>www.ci.los-altos.ca.us | Phone: (650) 948-1491 |

| Table 5-1 (continued)<br>Resource Guide | |
|---|---|
| **City Office** | **Contact** |
| ***Los Altos Hills Town Council***<br>26379 Fremont Road<br>Los Altos Hills, CA 94022 | Phone: (650) 941-7222 |
| ***Los Gatos Town Council***<br>110 East Main Street<br>Los Gatos, CA 95030<br>www.wwwebport.com/<br>citygates/lg | Phone: (408) 354-6834 |
| ***Milpitas City Council***<br>455 East Calaveras Boulevard<br>Milpitas, CA 95035<br>www.ci.milpitas.ca.us | Phone: (408) 942-2310 |
| ***Monte Sereno City Council***<br>18041 Saratoga Los Gatos Rd.<br>Monte Sereno, CA 95030 | Phone: (408) 354-7635 |
| ***Morgan Hill City Council***<br>17555 Peak Ave.<br>Morgan Hill, CA 95037-4128<br>www.morgan-hill.ca.gov | Phone: (408) 779-7271 |
| ***Mountain View City Council***<br>500 Castro Street<br>Mountain View, CA 94041<br>www.ci.mtnview.ca.us | Phone: (650) 903-6300 |
| ***Palo Alto City Council***<br>250 Hamilton Avenue<br>Palo Alto, CA 94301<br>www.city.palo-alto.ca.us | Phone: (650) 329-2571 |
| ***San Jose City Council***<br>801 North First Street<br>San Jose, CA 95110<br>www.ci.san-jose.ca.us | Phone: (408) 277-4241 |
| ***Santa Clara City Council***<br>1500 Warburton Avenue<br>Santa Clara, CA 95050<br>www.ci.santa-clara.ca.us | Phone: (408) 984-3250 |

| **Table 5-1 (continued)<br>Resource Guide** | |
|---|---|
| **City Office** | **Contact** |
| ***Saratoga City Council***<br>13777 Fruitvale Avenue<br>Saratoga, CA 95070<br>www.saratoga.ca.us | Phone: (408) 868-1200 |
| ***Sunnyvale City Council***<br>456 West Olive Avenue<br>Sunnyvale, CA 94086<br>www.ci.sunnyvale.ca.us | Phone: (408) 730-7480 |
| **County Governments** | |
| **County Office** | **Contact** |
| ***Alameda County Board of Supervisors***<br>Clerk of the Board:<br>(510) 272-6347<br>www.co.alameda.ca.us | Clerk of the Board<br>Phone: (510) 272-6347 |
| ***San Mateo County Board of Supervisors***<br>Clerk of the Board:<br>(650) 363-4653<br>www.co.sanmateo.ca.us | Clerk of the Board<br>Phone: (650) 363-4712 |
| ***Santa Clara County Board of Supervisors***<br>70 West Hedding Street<br>San Jose, CA  95110<br>claraweb.ca.santa-clara.ca.us/bos | Clerk of the Board<br>Phone: (408) 299-4321 |

**Table 5-1 (continued)**
**Resource Guide**

**Special Districts**

| Organization | Contact |
|---|---|
| ***Alameda County Resource Conservation District***<br>1996 Holmes St.<br>Livermore, CA 94550<br>www.baysavers.org<br><br>***Mission***: In cooperation with the Natural Resources Conservation Service, provides assistance to local landowners on reducing soil erosion, conserving and protecting water quality, and solving other natural resource problems.<br>***Funding***: From local property tax, contracts, and grants. Many District activities are coordinated with other local, state, and federal agencies and groups. | Sheila Barry,<br>District Manager<br>Phone: (925) 371-0154<br>Fax: (925) 371-0155 |
| ***Alameda County Water District***<br>43885 S. Grimmer Blvd.<br>Fremont, CA 94538<br>www.acwd.org<br><br>***Mission***: Provides over 45 million gallons of water a day to over 73,000 residential, commercial, and municipal customers in Fremont, Newark, and Union City. Committed to providing a reliable, high-quality water supply at a reasonable cost. | Paul Piraino,<br>General Manager<br>Phone: (510) 659-1970<br>Fax: (510) 770-1793<br>E-mail:<br>acwd@infolane.com |
| ***Council of Bay Area Resource Conservation Districts***<br>***Alameda County Resource Conservation District***<br>1996 Holmes St.<br>Livermore, CA 94550<br>www.baysavers.org<br><br>***Mission*****:** Elevate and strengthen the effectiveness of member Resource Conservation Districts by sharing information coordinating common objectives and fostering partnerships to achieve common objectives for improving the stewardship of all natural resources. | Sheila Barry,<br>District Manager<br>Phone: (925) 371-0154<br>Fax: (925) 371-0155 |

**Table 5-1 (continued)**
**Resource Guide**

| Organization | Contact |
|---|---|
| ***East Bay Regional Park District***<br>P.O. Box 5381<br>Oakland, CA 94605-0381<br>www.ebparks.org<br><br>***Mission***: Acquire, develop, manage, and maintain a high quality diverse system of interconnected parklands that balances public usage and education programs with protection and preservation of our natural and cultural resources. | Pat O'Brien,<br>General Manager<br>Phone: (510) 635-0135<br>24-hour info: (510) 562-PARKS |
| ***Guadalupe-Coyote Resource Conservation District***<br>888 North First Street, Rm.204<br>San Jose, CA 95112-6314<br>http://home.pacbell.net/gered<br><br>***Mission***: To achieve conservation of resources in accordance with Division 9 of the Public Resources Code, the District promotes sustainable agriculture. Supports well-defined urban boundaries for the preservation of open space and farm lands and for the proper long-term redevelopment of our cities into sustainable partners in their bioregions. Promotes proper rangeland management practices for the preservation of species diversity and proper watershed management of wetlands and riparian corridors for the protection of wildlife, aquatic resources, and water quality. The District believes that biodiversity and habitat preservation for other species is of crucial importance for future generations. | Larry Johmann<br>Nancy Bernardi<br>Phone: (408) 288-5888<br>Fax: (408) 993-8788<br>E-mail: gcrcd@pacbell.net |

| Table 5-1 (continued)<br>Resource Guide | |
|---|---|
| **Organization** | **Contact** |
| ***Loma Prieta Resource Conservation District***<br>8010 Wayland Lane, Suite D<br>Gilroy, CA 95020<br><br>***Mission***: Develop and administer a program of soil, water, and related resource conservation in southern Santa Clara County. Advises and assists individuals and public agencies in preventing soil erosion, controlling runoff, water use, land planning, and conservation of wildlife and other natural resources. Expert assistance is provided to landowners and land users to plan and use conservation practices.<br>***Funding***: Provided by self-taxation of over 220,000 acres of undeveloped properties. | Emily Baird, Director<br>Phone: (408) 847-4171<br>Fax: (408) 847-1521 |
| ***Mid-Peninsula Regional Open Space District***<br>330 Distel Circle<br>Los Altos, CA 94022<br>www.openspace.org<br><br>***Mission***: Acquire and preserve a regional greenbelt of open space land in perpetuity, protect and restore the natural environment, and provide opportunities for ecologically sensitive public enjoyment and education.<br>***Funding***: The primary revenue source is a share of the annual total property tax collected within the District. Other revenue sources can include federal and state grants, interest and rental income, and donations and note issues. | Mr. L. Craig Britton<br>General Manager<br>Phone: (650) 691-1200<br>E-mail:<br>cbritton@openspace.org |
| ***Palo Alto Regional Water Quality Control Plant***<br>2501 Embarcadero Way<br>Palo Alto, CA 94303<br>www.city.palo-alto.ca.us/depts/pubworks/waterquality<br><br>***Mission***: Operates 24 hours a day, in a cooperative approach, to provide uninterrupted services for a clean environment. The Plant's mission is high quality wastewater treatment through source control, treatment, and beneficial reuse. | Phone: (650) 329-2598<br>Fax: (650) 494-3531 |

| **Table 5-1 (continued)<br>Resource Guide** | |
|---|---|
| **Organization** | **Contact** |
| ***Purissima Hills Water District***<br>26375 Fremont Rd.<br>Los Altos Hills, CA 94022<br><br>***Mission***: Serves the northern two-thirds of Los Altos Hills and 2020 meters including Foothill College, its major user. Created in 1955, the District has seven employees and operates on an annual budget of $2.9 million. | Patrick Walter<br>General Manager<br>Phone: (650) 948-1217<br>Fax: (650) 948-0961 |
| ***San Jose/Santa Clara Water Pollution Control Plant***<br>4245 Zanker Road<br>San Jose, CA 95134<br>www.ci.san-jose.ca.us/esd/wpcp.htm<br><br>***Mission***: Treats wastewater from San Jose, Santa Clara, Milpitas, Campbell, Cupertino, Los Gatos, Monte Sereno, and Saratoga. | Phone: (408) 945-3000 |
| ***San Mateo County Resource Conservation District***<br>788 Main Street<br>Half Moon Bay, CA 94019<br><br>***Mission***: Authorized by the State of California to "save basic resources – soil, air, water – from unreasonable and economically preventable waste and destruction." Achieved through helping and working with landowners, groups, and government agencies to manage, conserve, and restore natural resources effectively. | Christina Fischer<br>Phone: (650) 726-4660 |
| ***San Mateo County Transit District***<br>P.O. Box 3006<br>San Carlos, CA 94070<br>www.samtrans.com<br><br>***Mission***: Meet the needs of Peninsula travelers with hundreds of daily trips along the bayshore corridor between Palo Alto and downtown San Francisco.<br>***Funding***: Through state and federal grants. | Gerald Haugh<br>Phone: (650) 508-6848 |

| **Table 5-1 (continued)<br>Resource Guide** | |
|---|---|
| **Organization** | **Contact** |
| ***Santa Clara County Open Space Authority***<br>6146 Camino Verde Dr. Ste.P<br>San Jose, CA 95119-1460<br><br>***Mission***: Preserve, protect, and manage, for the use and enjoyment of all people, a well-balanced system of urban and nonurban areas of outstanding scenic, recreational, and agricultural importance.<br>***Funding***: From a benefit assessment district within the Authority's boundaries. This funding was approved by the Board after an advisory ballot measure in 1994. The Authority strives to leverage its funds through grants, joint projects with other agencies, and private donations. | Lloyd Wagstaff<br>General Manager<br>Phone: (408) 224-7476<br>Fax: (408) 224-7548<br>E-mail: info@<br>openspaceauthority.org |
| ***Santa Clara Valley Transportation Authority***<br>3331 North First Street, Building B<br>San Jose, CA 95134<br>www.vta.org<br><br>***Mission***: Provide the public with a safe and efficient countywide transportation system.<br>***Funding***: Publicly funded. | Peter Cipolla<br>Phone: (408) 321-5559<br>Kurt Evans<br>Phone: (408) 321-5556 |

**Table 5-1 (continued)**
**Resource Guide**

| Organization | Contact |
|---|---|
| ***Santa Clara Valley Water District***<br>5750 Alameda Expressway<br>San Jose, CA 95118<br>www.scvwd.dst.ca.us<br><br>***Mission***: The Santa Clara Valley Water District, created through public action in 1929, is rare in having two primary missions: (1) to provide high-quality water at the wholesale level in sufficient quantity for beneficial uses by the county's lands and population, and (2) to manage floodwaters and stormwaters, thereby providing for public safety and the protection of property and natural resources. The District also is increasingly involved in stream and watershed management throughout its service area, which is the 1,300 square miles of Santa Clara County. The District's customers are the nearly 1.7 million residents of the county, retail water agencies, and private and agricultural water users.<br>***Funding:*** Primarily from three sources: a percentage of the countywide 1 percent ad valorem property tax, voter-approved benefit assessments, and water revenue. | Jim Fiedler<br>Phone: (408) 265-2607 ext.2736<br>Beau Goldie<br>Phone: (408) 265-2607 ext.2634 |
| **Regional/State/Federal Nonregulatory Agencies** | |
| ***Association of Bay Area Governments (ABAG)***<br>P.O Box 2050<br>Oakland, CA 94604-2050<br>www.abag.ca.gov<br><br>***Mission***: ABAG is one of more than 560 regional planning agencies across the nation working to help solve problems in areas such as land use, housing, environmental quality, and economic development. ABAG is owned and operated by the cities and counties of the San Francisco Bay Area. It was established in 1961 to protect local control, plan for the future, and promote cooperation on area-wide issues. In recent years, ABAG has answered the needs of its members by providing low-cost services that save the taxpayers millions of dollars. | Phone: (510) 464-7900<br>Fax: (510) 464-7970<br>E-mail: info@abag.ca.gov |

| Table 5-1 (continued)<br>Resource Guide | |
|---|---|
| **Organization** | **Contact** |
| ***California Department of Fish and Game (Marine Region)***<br>20 Lower Ragsdale Road, Ste. 100<br>Monterey, CA 93940<br>www.dfg.ca.gov/org/regions/html#marine<br><br>***Mission***: Manage California's diverse fish, wildlife, and plant resources and the habitat upon which they depend for their ecological values and for their use and enjoyment by the public. | DeWayne Johnston<br>Regional Manager<br>Phone: (831) 649-2870<br>Fax: (831) 649-2894 |
| ***San Francisco Bay Regional Water Quality Control Board***<br>1515 Clay Street, 14th floor<br>Oakland, CA 94612<br>www.rwqcb2.com<br><br>***Mission***: Part of the California EPA, the Board's overall mission is to protect surface waters and groundwaters of the San Francisco Bay Region. | Phone: (510) 622-2300<br>Fax: (510) 622-2460 |
| ***U.S. Army Corps of Engineers***<br>333 Market Street<br>San Francisco, CA 94105<br>www.spn.usace.army.mil<br><br>***Mission***: The civil works missions include navigation and coastal maintenance and improvements to ports and harbors, regulatory compliance and permit activities, flood control planning activities, emergency management, and mobilization. The San Francisco District's operation and maintenance program includes dredging projects totaling 4 1/2 million cubic yards annually in the Bay Area navigation channels. Debris collection in San Francisco Bay, which averages 90 tons per month, is another high visibility mission. | Phone: (415) 977-8658<br>Fax: (415) 977-8657 |

**Table 5-1 (continued)**
**Resource Guide**

| Organization | Contact |
|---|---|
| ***U.S. Department of Agriculture***<br>***Natural Resources Conservation Service***<br>2337 Technology Pkwy Suite C<br>Hollister, CA 95023<br>www.nrcs.usda.gov<br><br>***Mission***: Help local people to conserve land, water, forests, wildlife, and related natural resources. | Bruce Eisenman<br>Phone: (831) 637-4360<br>E-mail: Bruce.Eisenman@ ca.usda.gov |
| ***U.S. Environmental Protection Agency, Region 9***<br>75 Hawthorne Street<br>San Francisco, CA 94105<br>www.epa.gov/region09<br><br>***Mission***: Work to protect public health and the environment in the southwestern U.S. | Public Information Center<br>Phone: (415) 744-1500 |
| ***U.S. Geological Survey***<br>345 Middlefield Road<br>Menlo Park, CA 94025<br>www.usgs.gov<br><br>***Mission***: Provide the nation with reliable, impartial information to describe and understand the earth. | Christine Ashrada<br>Phone: (650) 329-4008 |

| Table 5-1 (continued)<br>Resource Guide | |
|---|---|
| **Agency** | **Fax** |
| **Media** | |
| **Newspaper Media** | |
| Associated Press | (415) 552-9430 |
| Bay City News | (408) 294-7745 |
| El Observador | (408) 295-0188 |
| La Oferta Review | (408) 436-7861 |
| Los Altos Town Crier | (650) 948-6647 |
| Los Gatos Weekly | (408) 354-3917 |
| Metro Newspapers | (408) 298-0602 |
| Milpitas Post | (408) 263-9710 |
| Morgan Hill Times | (408) 779-3886 |
| Mountain View Voice | (650) 964-0294 |
| Palo Alto Daily | (650) 327-0676 |
| Palo Alto Weekly | (650)326-3928 |
| San Francisco Chronicle<br>South Bay Bureau | (650) 961-5023<br>(408) 287-8361 |
| San Francisco Examiner | (415) 543-3392 |
| San Jose Business Journal | (408) 295-5028 |
| San Jose Mercury<br>South County Bureau<br>Peninsula Bureau | (408) 288-8060<br>(408) 847-2282<br>(650) 688-7555 |
| Santa Clara Valley Weekly | (408) 243-1408 |
| Saratoga News | (408) 867-1010 |
| Spartan Daily | (408) 924-3237 |
| The Almanac (Menlo Park) | (650) 854-2626 |
| The Argus (Fremont/Newark) | (510) 661-2600 |
| The Dispatch (Gilroy) | (408) 842-7105 |
| Times Newspaper Group | (408) 494-7078 |
| **Radio Media** | |
| KBAY | (408) 364-4545 |
| KCBS | (408) 295-8794 |
| KGO | (408) 441-8701 |
| KKUP | (408) 260-2999 (phone) |
| KLIV | (408) 995-0823 |
| KPFA | (510) 848-3812 |
| KQED | (415) 553-2241 |

**Table 5-1 (concluded)**
**Resource Guide**

| Agency | Fax |
|---|---|
| **Television Media** | |
| Bay TV | (408) 294-5184 |
| KDTV 14 | (408) 437-1510 |
| KGO TV 7 | (408) 261-6413<br>(415) 956-6402 |
| KICU TV 36 | (408) 993-9136 |
| KION (Salinas) | (408) 422-9365 |
| KNTV 11 | (408) 286-1530 |
| KPIX TV 5 | (408) 436-2094 |
| KRON TV 4<br>San Francisco | (408) 294-5184<br>(415) 561-8136 |
| KSBW (Gilroy) | (408) 842-3163 |
| KSBW (Salinas) | (408) 422-0124 |
| KSTS 48 | (408) 434-1046 |
| KTEH 54 | (408) 995-5446 |
| KTVU 2 | (408) 287-5888 |
| **Local Public Information Officers** | |
| CalTrans | (510) 286-6299 |
| City of Campbell | (408) 374-6889 |
| City of Cupertino | (408) 777-3366 |
| City of Gilroy | (408) 842-2409 |
| City of Los Altos | (650) 941-7419 |
| City of Milpitas | (408) 262-3772 |
| City of Monte Sereno | (408) 395-7653 |
| City of Morgan Hill | (408) 779-3117 |
| City of Mountain View | (650) 962-0384 |
| City of Palo Alto (Public Works Department) | (650) 329-2299 |
| City of San Jose | (408) 277-3131<br>(408) 277-3606<br>(408) 277-3755 |
| City of Santa Clara | (408) 241-6771 |
| City of Saratoga | (408) 868-1280 |
| City of Sunnyvale | (408) 730-7274 |
| County Office of Emergency Services | (408) 294-4851 |
| Santa Clara County Parks and Recreation | (408) 358-3245<br>(408) 463-0193 |
| Town of Los Altos Hills | (650) 941-3160 |
| Town of Los Gatos | (408) 354-8431 |

Volume One Unabridged

# Watershed Characteristics Report

# Chapter 6
# Regulatory Setting

**Prepared for the**
**Santa Clara Basin Watershed Management Initiative**

**by**

**Regulatory Subgroup and**
**Land Use Subgroup**

**Revised July 2003**

# Watershed Characteristics Report
# Chapter 6:  Regulatory Setting

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Funded by:
Palo Alto Regional Water Quality Control Plant
and
Santa Clara Valley Urban Runoff Pollution Prevention Program
(SC18.10)

*Revised July 2003*

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# Chapter 6
# Regulatory Setting

A wide variety of activities that are conducted in the Santa Clara Basin may have an impact on the water environment and are, therefore, subject to a variety of environmental regulations and programs. Activities ranging from construction to industrial operations to commercial activities to habitat restoration projects may require permits, depending on the nature and location (e.g., near a streambank, in a wetlands area) of the proposed activity. This chapter discusses the existing institutional and legal framework within which decisions about water-related resources are made. In addition, the pertinent regulatory authorities are presented as they relate to watershed management. Regulation of the following areas is discussed:

- Water quality
- Drinking water quality
- Water rights
- Wetlands and riparian zones
- Endangered species
- Fisheries
- Land use
- Transportation
- Vector control
- Pesticides
- Air quality
- Local agency formation

## 6.1 Regulation of Water Quality

Federal and state laws and regulations have been enacted to protect water quality in California from sources of pollution. The California Porter-Cologne Water Quality Control Act of 1969 (Porter-Cologne Act) and the Federal Water Pollution Control Act of 1972 (commonly referred to as the Clean Water Act [CWA]) regulate water pollution primarily through the control of municipal and industrial wastewater discharges. The Water Quality Act of 1987 amended the CWA to provide, among other things, a framework for addressing other sources of pollution, including runoff. In addition, Congress reauthorized the Coastal Zone Management Act (CZMA) in 1990, directing states to develop pollution control programs targeting diffuse sources of pollution (known as nonpoint sources) in watersheds draining to coastal areas. In California, the authority for implementing water quality control programs is delegated from the U.S. Environmental Protection Agency (EPA) to the state and implemented through the Porter-Cologne Act by the State Water Resources Control Board (State Board). In addition, the California Fish and Game Code contains provisions regarding water pollution and resulting impacts to aquatic life and waterfowl. An overview of these laws and regulations and the implementing agencies is presented below. These laws and regulations are discussed in more detail in *Regulatory Analysis for the San Francisco Estuary* (SFEP 1992).

### 6.1.1 Laws and Regulations

The objective of the CWA is to restore and maintain the chemical, physical, and biological integrity of the nation's waters. The CWA sets up a framework under which EPA and the states evaluate water quality and regulate discharges. The heart of these programs is the designation of "beneficial uses" of the waters (see below) and the criteria that must be met to protect them. These designations set the standards for judging the health of a given waterbody. Each state must have a continuing planning process, including a water quality control plan with steps for carrying it out (in California this is done by Basin Plans). The plans prescribe how water quality standards are met and effluent limits are established, provide authority for intergovernmental cooperation, and require an inventory and ranking of needed wastewater treatment works.

The CWA (33 United States Code [USC] Section 1251 et seq.) and its amendments in 1977 established two programs to regulate water quality from discrete, defined sources of pollution (known as point sources): the National Pollutant Discharge Elimination System (NPDES) program, and the National Pretreatment Program. The NPDES program controls discharges by incorporating water quality standards and technology-based effluent limitations in discharge permits. The National Pretreatment Program controls discharges to Publicly Owned Treatment Works (POTWs) using technology-based effluent limitations. The adoption of the CWA resulted in few changes in the regulatory strategies implemented under the Porter-Cologne Act, except that the EPA now had the responsibility to oversee the water quality control activities of the state. EPA has delegated this authority to the State of California and State Board as the California Water Quality Agency.

CWA Section 402 addresses discharges. The 1987 Amendments to the CWA added Section 402(p), which established a framework for regulating municipal and industrial stormwater discharges as point sources under the NPDES program. In November 1990, EPA published final regulations that established application requirements for NPDES stormwater permits. Municipalities with populations over 100,000 were required to obtain NPDES permits for stormwater discharges.

Discharges that are not specifically defined under Section 402 are considered nonpoint sources. Regulation of these sources is covered by CWA Section 319, the CZMA, and the Coastal Zone Act Reauthorization Amendments of 1990 (CZARA).

Congress amended the CWA in 1987 to establish the Section 319 Nonpoint Source Management Program because it recognized the need for greater federal leadership to help focus state and local pollution control efforts. Under Section 319, States, Territories, and Indian Tribes (hereinafter referred to as "States") receive grant money that supports a wide variety of activities, including technical assistance, financial assistance, education, training, technology transfer, demonstration projects, and monitoring to assess the success of specific implementation projects. States follow a two-step process to qualify for grant money under Section 319(h). First, States must complete an assessment report, identifying water quality problems resulting from diffuse sources of pollution. Second, States are to develop management programs describing what they are going to do about their runoff-related water quality problems over the next 4 years. Portions of the Section 319 grant funds have been used by States to support implementation of source controls in watersheds (both urban and nonurban) and to monitor the effectiveness of such controls. The State Board developed its first source assessment report in 1988, identifying runoff-related water quality problems. The State Board's WMI is an outgrowth of this approach. Section 319 funds for project implementation in California are available for implementation and restoration activities – planning, research, and/or assessment projects are not eligible. Eligible activities may include the implementation of best management practices (BMPs), total maximum daily load (TMDL) implementation, technology transfer, demonstration projects, pollution prevention, technical assistance, volunteer monitoring, and public education.

The 1990 Reauthorization of the CZMA added the Coastal Nonpoint Source Pollution Control Program. This program required EPA to publish guidelines for states to develop and implement coastal nonpoint source pollution controls programs. Section 319, along with Section 6217 of CZARA, forms the basis for non-NPDES runoff-related pollution control programs in California. They encourage the state to assess water quality problems associated with this pollution, and to develop programs to address these challenging problems. In response to CZARA, California undertook activities beginning in 1994 to enhance the state's program, while satisfying the CZARA requirements. California decided to develop a program capable of meeting the CZARA requirements on a statewide basis, rather than limiting the program to coastal watersheds only. The resulting plan for the state's Nonpoint Pollution Control Program was formally adopted in early 2000.

The following paragraphs describe the specific statutory requirements of CWA Sections 208, 303(d), 303(e), and 305(b) as they relate to water quality.

CWA Section 208 required States to identify areas that have substantial water quality control problems for the purpose of creating areawide waste treatment management plans. These plans were to identify and prioritize treatment needs for all wastes generated within the area involved.

Under CWA Section 303(d), States are required to identify waters within their boundaries for which technology-based effluent limitations are not stringent enough to meet the applicable water quality standard for the receiving water. Once these waters are identified, States must then prioritize these waters, taking into account the severity of the pollution and the uses to be made of the identified waters.

For all waters identified by States pursuant to the 303(d) listing process, States are required to establish TMDLs. TMDLs set the total amount of each pollutant that can be "loaded" or discharged into a particular waterbody that will protect the applicable water quality standards, taking into account seasonal variations and a margin of safety.

Numerous lawsuits have been filed nationwide against States and EPA for failing to list impaired waters or to adopt TMDLs for those waters. As an indirect response to the TMDL litigation, EPA has set forth TMDL guidance, and plans to adopt new TMDL regulations for all States. EPA anticipates it will take between 8 and 13 years to finalize TMDLs nationwide.

Section 303(e) requires that each State have a continuing planning process (CPP) for all navigable waters within the State. The CPP must include provisions for effluent limitations and schedules of compliance, areawide waste management plans and basin plans, TMDLs, procedures for revision, adequate authority for intergovernmental cooperation, a water quality standards implementation plan, residual waste controls, and an inventory and ranking of needed waste treatment works.

CWA Section 305(b) requires that, in every even-numbered year, each State submit to EPA a description of the quality of the State's waters. States must also submit an analysis of what would be required to meet desired water quality standards, the environmental and economic costs and benefits of such actions, and the date such water quality objectives will be achieved.

The California Legislature enacted the Porter-Cologne Act in 1969 (California Water Code Section 13000 et seq.) to implement federal directives requiring classification of state waters by beneficial use, to adopt water quality objectives to ensure the beneficial uses are met, and to formulate plans to achieve the adopted objectives. The Porter-Cologne Act provides a comprehensive management system that relies on the issuance of waste discharge requirements (WDRs) as its control mechanism.

The Porter-Cologne Act applies to all pollutant discharge sources to surface waters and groundwaters, and to waste discharges to land. The Porter-Cologne Act creates a water quality control program administered regionally, yet overseen through statewide coordination and policy. The State Board provides program guidance and oversight to the Regional Water Quality Control Boards (Regional Boards) through adoption of statewide regulations, plans, policies, and administrative procedures. The State Board and Regional Boards carry out their water protection authority through specific Water Quality Control Plans, or "Basin Plans," which (1) designate beneficial uses, (2) set water quality objectives to protect beneficial uses, and (3) establish programs to achieve these objectives. Such plans may include prohibitions against the discharge of certain types of waste in specified areas under specified conditions. Discharge prohibitions may be adopted for indirect discharges to waterbodies, such as surface runoff or waste discharge to land, or for direct discharges to surface water or groundwater. The Porter-Cologne Act also requires the State Board to adopt a "State Policy for Water Quality Control," including water quality objectives directly affecting water projects.

Chapter 5.5 of the Porter-Cologne Act authorizes the State Board and Regional Boards to regulate activities affecting water quality, and implement water quality control plans through the issuance of WDRs for any discharge to surface waters or to land, and federal NPDES permits for wastewater discharges to surface water. Any person discharging waste or proposing to discharge waste that could affect the quality of waters of the state, other than discharge into a community sewer system, must submit a Report of Waste Discharge (ROWD) to the Regional Boards, unless the Regional Boards waive the filing of a report. Chapter 5.5 also authorizes regulation of sewage sludge use and disposal, disposal of pollutants into wells, and pretreatment of waste.

The Porter-Cologne Act provides Regional Boards with additional enforcement powers to address unauthorized discharges, discharges violating NPDES permit requirements or prohibitions of discharge, violations of reporting or monitoring requirements, or other activities that threaten water quality. The State Board may use its water rights authority to enforce requirements for the protection of water quality that may be impacted by water use.

In addressing diffuse runoff-related problems, the State Board and Regional Boards generally use a three-tiered approach: (1) voluntary implementation of BMPs, (2) regulatory-based encouragement of BMP implementation, and (3) issuance of WDRs and NPDES permits as applicable. The Regional Boards have the discretion to apply this approach in a site-specific manner, and generally refrain from imposing WDRs on dischargers that implement BMPs in accordance with a State Board or Regional Board order.

### 6.1.2 Beneficial Uses

A complete discussion of existing and potential beneficial uses designated by the Regional Board for significant surface water and groundwater bodies in the state is provided in Section 7.3 of this report.

### 6.1.3 Implementing Agencies

At the federal level, EPA has the primary management responsibility for control of water pollution through the CWA. EPA delegated the authority to implement the sections of the CWA discussed above to the States. The State Board and the Regional Boards have regulatory and enforcement authority at the state level over programs for sources of water pollution. Division 7 of the Porter-Cologne Act assigns overall responsibility for water quality protection to the State Board, and directs the Regional Boards to establish and enforce water quality standards within their individual regions. The San Francisco Bay Regional Board regulates surface water and groundwater quality in the greater San Francisco Bay basin.

Other implementing agencies include local governments and the National Oceanic and Atmospheric Administration (NOAA). Authority to enforce the National Pretreatment Program was delegated by EPA to individual POTWs. Local governments have the responsibility to implement stormwater management programs in their municipalities following federal guidelines as stated in their NPDES permits. NOAA has joint responsibility with EPA for the Coastal Nonpoint Source Pollution Control Program. In addition, the California Department of Fish and Game (CDFG) has some enforcement authority through Fish & Game Code Section 5650, which prohibits the discharge of any substance or material that may adversely impact fish, plant life, or bird life.

## 6.2 Regulation of Drinking Water Quality

Several federal and state laws have been enacted to protect drinking water sources. At the federal level, Congress enacted the federal Safe Drinking Water Act (SDWA) in 1974, which required EPA to establish national drinking water standards and to regulate state underground injection control programs. The federal SDWA is implemented in California through the California SDWA and Title 22 of the California Code of Regulations. In addition, the Safe Drinking Water and Toxic Enforcement Act of 1986, also known as Proposition 65, is a state law designed to protect drinking water sources.

### 6.2.1 Laws and Regulations

The federal SDWA, the California SDWA, and Title 22 govern drinking water quality in California. Amendments to the federal SDWA, 42 USC, Section 300f et seq. were adopted in 1996 and integrated into California regulations set up new and stronger protective measures to keep contaminants out of water sources and to enhance water system management. They also required the setting of new drinking water standards based on better science and risk assessment. Source water protection involves preventing entry of possible contaminants into waters that are eventually treated by drinking water systems. The source water protection approach requires states to delineate the areas that supply public drinking water and complete assessments for all public water supply sources evaluating water system susceptibility to contamination.

In the standards setting area, EPA was required to publish, within 18 months of the enactment of the SDWA amendments, a list of potential contaminants of concern in drinking water that are not currently regulated, but which may require regulation in the future. Contaminants of concern to drinking water suppliers that may adversely affect human health include pathogens (e.g., parasites, viruses, enteric bacteria), natural organic matter (precursors for disinfection by-products), and other constituents (e.g., trace organics, arsenic). After a decision has been made to regulate a contaminant, EPA has 3½ years to publish a final primary drinking water standard for that contaminant.

EPA is in the process of redesigning key portions of the drinking water regulatory protocol to respond to the 1996 SDWA amendments. On October 6, 1997, EPA's drinking water program published a draft list of 58 chemicals and 13 microbial contaminants that are candidates for regulation. The proposed list signals a turning point for the agency because of the list's greater emphasis on microbes. EPA published the final Drinking Water Contaminant Candidate List, required under the 1996 SDWA amendments, in the Federal Register on March 2, 1998 (see 63 Fed. Reg. 10,273). This final list contained 10 microbiological contaminants and 50 chemical contaminants.

The SDWA amendments also require EPA to implement two new public-right-to-know activities. First, community drinking water system operators must provide public notification of acute drinking water contamination with potential to have serious adverse effects on human health with short exposure (such as nitrates, fecal coliform, waterborne disease outbreaks) within 24 hours of discovery. Second, all public water systems must produce and publicize to their customers an annual Consumer Confidence Report (CCR) that details the source of their water, how it is treated, what regulated constituents are detected in the treated supply, and whether state/federal standards have been violated. California public water systems already provide an Annual Water Quality Report (AWQR) to customers that substantially meet the new EPA regulations. In the year 2000, California water systems must reformat the AWQR to fully conform to the new EPA CCR model.

The California Safe Drinking Water and Toxic Enforcement Act (Proposition 65, California Health & Safety Code Section 25249.5 et seq.) applies to certain listed chemicals and to defined business activities. Regulations implementing the Act were first promulgated in 1988, and have been amended numerous times since then. Proposition 65 has two substantive provisions: (1) businesses must warn people prior to exposure to certain amounts of any listed chemical, and (2) businesses are prohibited from discharging significant amounts of listed chemicals into sources of drinking water.

### 6.2.2 Implementing Agencies

At the federal level, EPA has primary responsibility for enforcement and oversight of the SDWA. In California, EPA has delegated this authority to the California Department of Health Services.

The California Environmental Protection Agency (Cal-EPA) has been designated by the governor as the lead governmental agency to implement Proposition 65's provisions. Within Cal-EPA, the Office of Environmental Health Hazard Assistance (OEHHA) is responsible for Proposition 65 enforcement. Drinking water systems are also regulated by the California Department of Health Services, Division of Drinking Water and Environmental Management.

## 6.3 Regulation of Water Rights

Management of California's water systems incorporates three elements: the regulatory framework establishing the right to use water, cooperative ventures, and economic incentives (i.e., water banking, water marketing). An overview of the regulatory framework for water rights and the implementing agencies is presented below. A more comprehensive discussion of all three elements pertaining to managing California's water systems can be found in *Regulatory Analysis for the San Francisco Estuary* (SFEP 1992).

### 6.3.1 Laws and Regulations

Freedom of navigation and the public's right to use rivers is guaranteed by the Commerce Clause of the U.S. Constitution. The congressional Act Admitting States to the Union requires that "all the navigable waters within said state shall be common highways and forever free." The California State Constitution forbids individual, joint, and corporate landowners from obstructing free navigation. Important legislative codes affirming the rights to waterway navigation, public access, and use of waterways include the California Public Resources Code, Section 6301, the California Civil Code, Section 830, and the California Harbors and Navigation Code, Section 100.

California operates under a dual system of water rights recognizing both riparian and appropriative rights. Riparian rights are based on the principle that those who own land adjacent to water possess the right to use the water. The process for obtaining appropriative rights was formally established in 1872 for lands that were not adjacent to water. In 1928, California amended its constitution [California Constitution Article X, Section 2] to add that both systems of water rights were subject to the principle that the use of water must be reasonable and beneficial.

Other governing principles that affect water rights are the public trust doctrine, water contracts, water reclamation, and conservation. The public trust doctrine holds that certain resources, including water and the natural resources that depend on it, belong to the public and are, therefore, held in trust by the state for future generations. It restricts the kinds of uses for which state lands may be utilized. These uses typically include public uses of waterways for navigation, commerce, fisheries, recreation, and environmental protection. The State Lands Commission reviews projects affecting tidal and nontidal waterways for consistency with the public trust doctrine.

### 6.3.2 Implementing Agencies

Federal and state governments, local municipalities, and private entities operate water storage and diversions. At the federal level, the Bureau of Reclamation, which manages the Central Valley Project, has the largest role. At the state level, the California Department of Water Resources (DWR), which manages the California State Water Project, plays a key role. At the local level, water supply districts and irrigation districts are instrumental in the management of water.

The State Board is the regulator of water rights in California. The Regional Board has a responsibility to comment on water quality aspects of water rights decisions. Other state agencies involved in water rights issues include the CDFG, the Public Utilities Commission, and the California Department of Health Services. Federal agencies involved in water rights issues include the U.S. Army Corps of Engineers (ACOE), the U.S. Fish and Wildlife Service (USFWS), National Marine Fisheries Service (NMFS), and the U.S. Geologic Survey. Local water supply districts and irrigation districts are responsible for supplying water directly to California residents.

## 6.4 Regulation of Wetlands and Riparian Zones

The primary federal regulation of wetlands exists under the CWA. An overview of the regulatory framework for wetland protection and the implementing agencies is presented below.

A more comprehensive discussion of regulation protecting wetlands can be found in *Regulatory Analysis for the San Francisco Estuary* (SFEP 1992).

### 6.4.1 Laws and Regulations

CWA Section 404 represents the principal federal program regulating activities affecting the integrity of wetlands. Section 404 requires that a permit be obtained prior to the discharge of dredged or fill material into U.S. waters, including wetlands. Several types of projects affecting wetlands require permits; however, certain farming, maintenance, and construction activities that are conducted without discharging dredged or fill material are exempt from Section 404 requirements. In addition, Section 404(e) authorizes nationwide "general permits" for categories of activities that are similar in nature. This allows the ACOE to approve such activities without case-by-case permit reviews. Permit applications are reviewed by the ACOE, and accepted if they are determined to comply with Section 404(b)(1) Guidelines and have undergone a public review. CWA Section 401 requires that the State certify that ACOE permits will not result in activities that will adversely impact water quality in wetlands that are considered “waters of the United States.”

Projects affecting fish and wildlife habitats also require permits from the CDFG. The Lake and Streambed Alteration Program requires, under Fish and Game Code Section 1600, that the CDFG be notified regarding proposed projects that will change the natural flow or other aspects of a waterbody or use materials from a streambed. If the CDFG determines that the proposed project may adversely affect existing fish or wildlife resources, a Lake or Streambed Alteration Agreement must be obtained from them.

Projects affecting waterways may also require permits from the California State Lands Commission, the State Board, ACOE, and/or the San Francisco Bay Conservation and Development Commission (BCDC). Examples of activities occurring in wetlands that require permits include: commercial, industrial and residential development; power plants and transmission lines; construction of pipelines and railroad crossings. Agencies responsible for these permits include local governments, the State Lands Commission, the California Reclamation Board, the California Energy Commission, the California Public Utilities Commission, and the California Department of Housing and Community Development.

Within the Basin, the Santa Clara Valley Water District (Water District) has local permitting jurisdiction around watercourses through its Ordinance 83-2. This ordinance was developed to minimize impacts to watercourses, creeks, streams, lakes, ponds, and reservoirs. It requires a project review and permitting process for any project or works that are planned within 50 feet of any watercourse within the District’s service area that drains more than 320 acres.
Another important component of wetlands regulation is the definition of “wetlands.” Three federal definitions of wetlands are used in the U.S. today. One was developed for inventory purposes (USFWS) and the other two have direct regulatory significance under the CWA and the Food Security Act. Definitions used by EPA, the ACOE, and the USFWS vary, but all are based on three conditions: (1) a hydrologic regime typified by standing water, (2) hydric or saturated

soils, and (3) the presence of plants adapted to water-logged soils. The USFWS definition also recognizes nonvegetated wetlands (e.g., mudflats, rocky shores, and sandbars). Other state, regional, and local agencies may have formal definitions of the term "wetland" as well. However, the majority of these have roots in one of the federal definitions (see Table 6-1).

### 6.4.2 Implementing Agencies

The ACOE and the EPA both have regulatory responsibilities relating to wetlands. CWA Section 404 requires the ACOE to regulate the discharge of dredged and fill material in waters of the U.S., including wetlands. The ACOE and EPA are jointly responsible for preventing the degradation and destruction of wetland resources resulting from disposal of dredged spoil or fill. The State Board, following recommendations from the Regional Board, is responsible for certifying through CWA Section 401 that ACOE activities will not adversely impact water quality. This authority may be delegated to the Regional Board in the near future. The Regional Board imposes waste discharge requirements on wetlands fill and waterway modification projects. Other agencies with jurisdiction include the State Lands Commission, State Board, ACOE, and/or the BCDC, CDFG, and Water District. Municipalities can enact ordinances for local wetland protection as well.

## 6.5 Regulation of Endangered Species

Activities that could jeopardize the continued existence of threatened and endangered species are regulated under federal and California endangered species protection laws as described below. Generally, threatened and endangered species are placed on a list. When a species is "listed," federal agencies are required to undertake programs to conserve this species and develop recovery plans that would allow it to be removed from the list. Agencies are prohibited from authorizing or implementing any action that would jeopardize a listed species or modify its "critical habitat."

### 6.5.1 Laws and Regulations

The federal Endangered Species Act (ESA) protects species of fish, wildlife, and plants that are in danger of, or threatened with, extinction. Federal ESA Section 7 requires the USFWS or NMFS to be consulted before actions are taken that may adversely affect designated critical habitat. In order to protect listed species, NPDES, 404, or other permitting requirements may be adjusted to promote species recovery and protection. In addition, the implementation of this law by the federal government may affect or limit the quantity of water diverted under a state-issued water right permit. Federal ESA Section 9 prohibits taking of listed animals without

**Table 6-1**
**Federal Wetlands Definitions**

| Federal Definition | Institutional Use of Definitions | Legislative Origin and Purpose |
|---|---|---|
| **USFWS (Cowardin et al. 1979):**<br>*"Wetlands are lands transitional between terrestrial and aquatic systems where the water table is usually at or near the surface or the land is covered by shallow water. For purposes of this classification wetlands must have one or more of the following three attributes: (1) at least periodically, the land supports predominantly hydrophytes; (2) the substrate is predominantly undrained hydric soil; (3) the substrate is nonsoil and is saturated with water or covered by shallow water at some time during the growing season of each year."*<br><br>*"drained hydric soils that are now incapable of supporting hydrophytes because of a change in water regime are not considered wetlands by our definition."* [1] | Federal:<br>USFWS<br>State:<br>CDFG[2]<br>Local:<br>San Francisco Estuary Institute[3]<br>San Francisco Estuary Project[4] | No direct legislative origin or authority.[5]<br><br>Developed to conduct the National Wetlands Inventory (1981) |
| **ACOE/EPA, 1977:**<br>Those areas that are inundated or saturated by surface or ground water at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands generally include swamps, marshes, bogs, and similar areas.[6] | Federal:<br>ACOE<br>EPA<br>State:<br>State/Regional Water Quality Control Boards<br>CDFG[2]<br>Local:<br>Santa Clara Valley Water District | Clean Water Act as amended (1977): Section 404 regulation of dredge and fill activities within "waters of the United States" (including wetlands) |
| **Natural Resources Conservation Service, 1985:**<br>The Food Security Act contains the following definition:<br>*The term "wetland", except when such term is part of the term "converted wetland", means land that—*<br>*(A) has a predominance of hydric soils;*<br>*(B) is inundated or saturated by surface or ground water at a frequency and duration sufficient to support a prevalence of hydrophytic vegetation typically adapted for life in saturated soil conditions; and*<br>*(C) under normal circumstances does support a prevalence of such vegetation.*<br>*For the purposes of this Act and any other Act, this term shall not include lands in Alaska identified as having high potential for agricultural development which have a predominance of permafrost soils.*[7]<br>Hydric soils and hydrophytic vegetation are further defined. | Federal:<br>Natural Resources Conservation Service<br>ACOE<br>State: none<br>Local: none | 1985 Food Security Act as amended (1990)<br><br>Primary method used to delineate wetlands on agricultural lands<br><br>Originally intended for "swampbuster" provisions of Food Security Act, but now also used to delineate wetlands on agricultural lands for CWA purposes[9] |

[1] Cowardin, Lewis M., Carter, Virginia, Golet, Francis C., and LaRoe, Edward T. 1979. *Classification of Wetlands and Deepwater Habitats of the United States.* U.S. Fish and Wildlife Service, Biological Services Program. U.S. Government Printing Office, Washington, D.C.

[2] CDFG recommends using the Cowardin classification system, but in practice they typically accept the ACOE/EPA definition for wetland delineation (personal communication, Carl Wilcox, CDFG, Yountville office).

[3] Major data source for the EcoAtlas was the USFWS National Wetlands Inventory information.

[4] Definition was used in San Francisco Estuary Project. 1991. *Status and Trends Report on Wetlands and Related Habitats in the San Francisco Estuary.* Prepared under Cooperative Agreement #815406-01-0 with the U.S. Environmental Protection Agency by the Association of Bay Area Governments, Oakland, California, p. 124.

[5] *Ibid*., p. 2.

[6] National Research Council. 1995. *Wetlands: Characteristics and Boundaries.* National Academy Press, Washington, D.C., p. 51.

[7] *Ibid.*, p. 56.

[8] In most areas of the United States (the Bay Area is the sole exception—see note 5) the National Resources Conservation Service is responsible for delineating wetlands on agricultural lands for both the purposes of the Food Security Act and the Clean Water Act. In instances where Section 404 permits are required on agricultural lands, the ACOE will accept the National Resources Conservation Service wetlands definition.

[9] The Bay Area is the sole exception to this procedure. In the nine Bay Area counties, the ACOE retains its authority to delineate wetlands on all lands, including those defined as agricultural, for the purposes of the Clean Water Act.

authorization. Incidental take permits were developed under Section 10 to allow nonfederal projects to be conducted that may result in the taking of listed species.

California's endangered species statute (Fish and Game Code Section 2050 et seq.) contains provisions for adding and removing species from the California's list of threatened, endangered or candidate species. The California law, as with the federal law, prohibits the import, export, taking, or possessing of listed species without an incidental take permit, and requires consultation with the California lead agency for projects that may jeopardize a listed species.

As more aquatic species that inhabit the San Francisco Bay and the Delta system are placed on the threatened or endangered species lists, more restrictions may be placed on local activities, even those designed to improve the aquatic habitat for these species. In recent years, the EPA has attempted to promulgate water quality standards to regulate the quantity of flows into the Delta in order to protect listed species. If necessary to ensure the continued survival of these species, it is conceivable that additional, more stringent restrictions (i.e., more stringent water quality criteria) could be imposed on entities regulated under a federal program, such as the NPDES program. These restrictions could include additional monitoring to determine the effects of pollutants on the endangered or threatened species.

When no federal action or approval is necessary, authorization for an incidental take is required under Section 10, which describes the Habitat Conservation Plan (HCP) process (McCutchen et al. 1996a). Implementation of the federal ESA and California ESA is moving more towards HCPs and natural community conservation planning (NCCP) and may serve as useful models for watershed management planning purposes. These concepts allow for protection of critical habitats over a long time period (approximately half a century), which can include protecting nonsensitive species. Via a legal agreement, these concepts allow landowners assurance that no additional mitigation commitments will be necessary and that incidental takes are permitted. As in watershed planning, HCPs do not focus on parcel-by-parcel planning, but rather look at obtaining conservation goals through a larger perspective, recognizing that impacts will occur in some areas, while other critical areas are preserved and enhanced.

### 6.5.2 Implementing Agencies

The USFWS and the NMFS have regulatory authority over the federal ESA. The CDFG is the California regulatory agency in charge of implementing the California ESA statute.

## 6.6 Regulation of Fisheries

### 6.6.1 Laws and Regulations

The Magnuson-Stevens Fishery Conservation and Management Act of 1976 (Magnuson Act) sets forth a national program for the conservation and management of the fishery resources of the U.S. to prevent overfishing, to rebuild overfished stocks, to ensure conservation, to facilitate long-term protection of fish habitat, and to realize the full potential of the nation's fishery resources. The emphasis of the Magnuson Act is on coastal fisheries and anadromous fish populations.

Under the Magnuson Act, fisheries conservation plans and management measures will:

- Prevent overfishing while achieving, on a continuing basis, the optimum yield from each fishery for the U.S. fishing industry.
- Be based upon the best scientific information available.
- Take into account and allow for variations among, and contingencies in, fisheries, fishery resources, and catches.
- Where practicable, minimize costs and avoid unnecessary duplication.

The Magnuson Act may bring NMFS into the NPDES permit review process where discharges are deemed to have a potential to affect an "essential fish habitat." As with the federal ESA, this Act may also result in a tightening of wastewater discharge restrictions or additional monitoring requirements in order to protect anadromous fish in the Bay and the Delta.

The Fish and Game Code contains several provisions designed to protect fisheries, including the Anadromous Fisheries Program Act (Fish & Game Code Section 6900 et seq.) and Part 1.7, Conservation and Management of Marine Living Resources. As stated in Fish and Game Code Section 1700, it is the policy of the state to promote the development of local fisheries and distant-water fisheries based in California. Elements of the policy include:

- The maintenance of sufficient populations of all species of aquatic organisms to ensure their continued existence

- The recognition of the importance of the aesthetic, educational, scientific, and nonextractive recreational uses of the living resources of the California Current

- The maintenance of a sufficient resource to support sport fishing

- The growth of local commercial fisheries and the development of distant-water fishery enterprises

- The management, on a basis of adequate scientific information promptly promulgated for public scrutiny, of the fisheries under the state's jurisdiction, and the participation in the management of other fisheries in which California fishermen are engaged, with the objective of maximizing the sustained harvest

- The development of commercial aquaculture

The Fish and Game Code also protects fish habitat under Section 5930, which requires that dams do not obstruct fish passage ways. The owner of any dam must allow sufficient water to pass through a fishway at all times, or in the absence of a fishway, allow sufficient water to pass over, around or through the dam, to protect any fish that are present below the dam.

### 6.6.2 Implementing Agencies

The NMFS has primary responsibility for implementing the Magnuson Act. The CDFG also has jurisdiction regarding fisheries.

## 6.7 Regulation of Land Use

The principal tool for managing generalized effects of land use change on estuarine systems is land use planning and regulation. Land use planning in California has been carried out through the use of three basic tools: general plans, zoning ordinances, and subdivision ordinances. In addition, the California Environmental Quality Act (CEQA) of 1970 and growth control and management have become instrumental in the management of land use (see Table 6-2). An overview of land use planning and regulation at the state, regional, and local levels is presented below with a more detailed discussion (including information on state laws and enabling legislation and regional plans and planning agencies) presented in *Regulatory Analysis for the San Francisco Estuary* (SFEP 1992).

| **Table 6-2<br>Summary of Land Use Regulations** | | | |
|---|---|---|---|
| **Land Use Regulation** | **Description** | **Potential Support** | **Potential Hindrance** |
| **California Environmental Quality Act** | Examine potential environmental impacts of projects, and mitigation for such. | Forces examination of environment. Can lead to avoidance or mitigation of impacts. Master Environmental Impact Reports could be useful with respect to cumulative impacts. | Thresholds of significance need to be defined. Project-by-project analysis by itself generally does not identify or plan for minimizing cumulative impacts as well as watershed or regional analyses do. |
| **General Plan Law** | Constitution/overview plan of municipal planning. | If watershed management objectives are included here, other regulations must comply; opportunity to work out conflicting policies. Good tool to house watershed strategy. | Very broad; no teeth in itself. Requires enforceable implementing ordinances to be effective in actual practice. Except housing element, no set time to update. |
| **Specific Plan Law** | More detailed plan for subareas. | If watershed management objectives are included here, other regulations must comply; opportunity to work out conflicting policies. Ability to include more specific techniques. Good tool to house watershed strategy. | No teeth in itself. Requires enforceable implementing ordinances to be effective in actual practice. |
| **Subdivision Map Act** | Regulates subdivision land use access and design. | Allows control of land use access and density. Allows project denial based on environmental impact. | Subdivisions < five parcels; vested tentative maps – measures not on tentative map cannot be placed on subsequent permits. |
| **Zoning Regulations** | Separates cities into districts to regulate land use, and building type and design. | Allows control of land use type and design such as building footprint and setbacks. Must take into account general and specific plans, California Environmental Quality Act, and impacts to surrounding areas. | Because zoning regulations tend to be amended more often than other land use regulations, more time and resources may be needed to track proposed amendments to ensure that they support, or at least do not conflict with, watershed planning efforts. |

**Table 6-2 (concluded)**
**Summary of Land Use Regulations**

| Land Use Regulation | Description | Potential Support | Potential Hindrance |
|---|---|---|---|
| **Wetland Regulations** | Protects waterways. | Assists to protect riparian corridors. | Can be used only under specific situations. Additional coordination with federal and state government probable. |
| **Endangered Species Regulations** | Protects fish, wildlife, and vegetation species. | Assists to protect sensitive species. Potential for Habitat Conservation Plans or ecosystem management. | Can be used only under specific situations. Additional coordination with federal and state government probable. |
| **Community Redevelopment Law** | Corrects urban blight. | Very powerful; can acquire property. Focus on reviving urban core areas; can help reduce sprawl. | Limits on use for open-space/public improvements. |

### 6.7.1 Laws and Regulations

Watershed planning in urbanized and urbanizing watersheds is important to avoid exacerbating the hydrologic changes that are created as a result of the landscape alterations and increased imperviousness associated with development. However, watershed management planning strategies must comply with existing laws, respect private property rights, and justly compensate landowners as appropriate. Section 6.7.1.1 examines land use regulations within California, and the regulatory controls they provide to local municipal governments to implement watershed management strategies. Because several of the tools and objectives could result in potential "takings" cases, the concept of takings is explored at the end of Section 6.7.1.1. Section 6.7.1.2 discusses how specific watershed management strategies may be successfully implemented using existing regulations. Case studies are used to depict examples of strategy implementation.

#### *6.7.1.1 Governing Land Use – Municipal Powers for Managing Watersheds*

This section summarizes the powers that several state and federal land use regulations bestow to California municipalities that may influence how watershed management strategies are implemented. In general, municipalities gain the legal authority for regulatory land use from their police powers to protect the public health, safety, and general welfare of the residents within the municipality's territories (*Berman v. Parker*, *348 U.S. 26 (1954))* (Curtin 1999a). Specifically, this section discusses CEQA, general plan and specific plan law, zoning regulations, the Subdivision Map Act, and the Community Redevelopment Law (see also Table 6-2).

Wetland regulations and endangered species regulations may also directly influence how watershed management land use strategies are implemented (see Sections 6.4 and 6.5). Other federal statutes that relate to land use planning but not discussed further here include CWA Section 401 (33 USC Section 1341); National Environmental Policy Act (NEPA) (42 USC Sections 4321-4347); Fish and Wildlife Act of 1956 (16 USC Section 742a et seq.); Fish and Wildlife Coordination Act (16 USC Sections 661-666c); Marine Protection, Research, and Sanctuaries Act of 1972 Section 302 (16 USC Section 1432); National Historic Preservation Act of 1966 (16 USC Section 470); Interstate Land Sales Full Disclosure Act (15 USC Section 1701 et. seq.); and the CZMA (16 USC Section 1456(c)).

### California Environmental Quality Act

**Overview**. CEQA was created to provide public information about possible environmental impacts from a project, and measures that could avoid, prevent, or mitigate for the potential impacts.[1] CEQA requires the lead public agency—often the municipality—to prepare an initial study, and if necessary, an Environmental Impact Report (EIR) for projects that may significantly impact the environment (Public Resources Code Sections 21000-21177).[2]

CEQA requires changes in projects to prevent environmental impacts that are avoidable. Mitigation measures created by municipalities to protect watershed resources can be used in the CEQA process; however, projects that impact the environment can be approved if economic, social, or other conditions make mitigation efforts infeasible, and if the public agency prepares a Statement of Overriding Considerations, according to CEQA Guidelines Sections 15091, 15093, (Curtin 1999a). A watershed plan that includes quantifiable cost information on the impacts of development can help offset the number of projects where mitigation efforts are deemed economically infeasible.

**Exemptions**. Four types of exemptions exist under CEQA: statutory, categorical, general rule, and disapproved project. Additionally, certified regulatory programs can obtain a partial exemption (CEQA Guidelines Sections 15250-15253) (Bass et al. 1999). The California Legislature can exempt activities even if they may potentially significantly impact the environment. Such statutory exemptions include ministerial projects (e.g., most building permits, final subdivision maps), emergency projects, and feasibility or planning studies for future actions (not including municipal general plans) (Bass et al. 1999). The California Legislature has also exempted certain projects categorically. Categorical exemptions include:

- Maintenance, repair, and minor alteration of existing facilities

[1] Projects funded in part or whole with federal funds also require compliance with NEPA, which requires that an Environmental Impact Statement (EIS) be prepared. Unlike CEQA, NEPA does not require evaluation of growth inducement factors and mitigation measures (Curtin 1999a).

[2] Activities that may directly or indirectly change the physical environment are considered “projects.” Effects that will have a real or potentially substantial adverse impact on the environment are considered “significant” (Curtin 1999a).

- Replacement or reconstruction of existing structures if they are at the same site for the same purpose and substantially the same capacity as the original
- New construction of or conversion of small facilities (e.g., less than or equal to three single-family residences in an urbanized area)
- Minor alteration to land, water, or vegetation (including grading on slopes less than 10 percent), land use limitations, regulatory agency actions to protect the environment and natural resources
- Inspections (CEQA Guidelines Sections 15301-15332) (Bass et al. 1999)

General rule exemptions are for those activities that obviously will have no significant environmental effect. Disapproved projects are those that a public agency has disapproved during their initial screening process.

Because CEQA allows for categorical exemptions, some development activities (e.g., single-family residences) that could affect watershed planning objectives may escape the CEQA process. CEQA cannot therefore be used alone to assist with the implementation of watershed planning objectives. If, however, an activity clearly may have a significant environmental effect, case law has shown that categorical exemptions are improper (EOA 1995). The municipality may consider defining "substantially the same capacity" for replacement structures to consider the amount of additional impervious cover allowed for replacement or reconstruction of existing structures, especially since recent development trends have led to the increase in building footprint when replacing residences.

**Initial Studies**. For projects not categorically exempt from CEQA, an initial study is prepared to determine if the project may significantly impact the environment. A municipality may use any of the following tools to determine findings of mandatory significance during the CEQA process:

- Model initial study checklist
- CEQA's mandatory finding of significance (including projects that achieve short-term goals to the disadvantage of long-term goals)
- Agency-adopted regulatory standards
- Consultation with other agencies
- Agencies' thresholds of significance (Bass et al. 1999)

An initial study may result in either: a negative declaration that indicates no potential substantial adverse impact on the environment would occur; a mitigated negative declaration, which indicates that implementation of mitigation measures would reduce any substantial adverse effects to a less-than-significant impact; or an EIR, if the project may have a significant environmental impact.

**Environmental Impact Reports**. EIRs examine potentially significant impacts in detail. An EIR compels the public agency to consider qualitative, technical, and economic factors; balance competing objectives; disclose information; and consider the effects on the environment before the project is decided upon. Cumulative impacts must be discussed when they are significant, and should consider "past, present and reasonably anticipated future projects"(CEQA Guidelines Sections 15130, 15065(e), 15130), (Public Resources Code Sections 21083, 21100) (Curtin 1999a).

Changes to CEQA in 1993 under Assembly Bill 1888 have allowed for the development of Master EIRs for different projects (e.g., general plan, general plan element or amendment, specific plan, phased projects, projects involved in redevelopment plans) (Public Resources Code Section 21157) (Curtin 1999a). The Master EIR is written to evaluate cumulative or growth-inducing impacts, and irreversible significant effects on the environment of anticipated projects as much as possible (Bass et al. 1999; Curtin 1999a). The Master EIR contains the type, location, and intensity of expected future projects, as well as the schedule for capital improvements and alternative site locations; the evaluation of future impacts and mitigation measures for specific projects; cumulative and growth-inducing impacts; and significant permanent environmental impacts (Bass et al. 1999).

A first-level tiered EIR, the Master EIR can be used for 5 years (Public Resources Code Section 21157.6) to streamline the approval process of subsequent projects. Once a Master EIR is prepared, a new EIR or findings are not required for related subsequent projects if the lead agency: (1) incorporates all feasible mitigation measures or alternatives indicated in the Master EIR; and (2) prepares an initial study that determines the project was described within the Master EIR's scope, would not result in additional significant impacts, and needs no additional measures or alternatives to mitigate or avoid impacts (Bass et al. 1999). If subsequent projects under a Master EIR may have added significant impacts then the project needs only a focused EIR that analyzes added significant impacts, and any additional mitigation measures. This allows for review and incorporation of additional mitigation measures as specific projects are defined. Under a Master EIR, the tiered process will be less susceptible to legal challenges, but the procedures for the second-tier review of future projects is complicated (Bass et al. 1999). The lead agency may set up a fee to cover the cost of a Master EIR (Public Resources Code Sections 21157(a),(c)) (Bass et al. 1999).

Thus, a municipality may use a Master EIR to review cumulative and growth-inducing impacts, and to set forth preferred mitigation measures. It is a useful tool for examining impacts of development projects from a larger perspective.

Other tiered EIRs include Program EIRs for a series of actions that are seen as one large project; a Staged EIR for large, phased projects; Community Plan EIR or Zoning Ordinance EIR; a General Plan or Specific Plan or Coastal Program EIR; or a Redevelopment Plan EIR (Bass et al. 1999). A focused EIR may be used for small multiple-family or mixed-use projects not analyzed in a Master EIR, and for projects created solely for the installation of pollution control equipment (Bass et al. 1999).

**Monitoring Programs**. Because public agencies must ensure that a project's incorporated mitigation measures are implemented, municipalities must adopt a reporting or monitoring program (Public Resources Code Section 21081.6; CEQA Guidelines Section 15091) (Curtin 1999a). Thus, municipalities have the power to require long-term monitoring and inspection programs, which can be useful to help monitor changes to and the appropriateness of specific mitigation measures within the watershed.

**Relationship to Watershed Management**. The CEQA process in general focuses on a project-by-project analysis; however, tiered EIRs can help to analyze impacts on the watershed or subwatershed level. CEQA documentation for proposed development projects could refer to specific watershed management plans or assessments to help evaluate cumulative impacts of urbanization. Watershed management plans could also identify a menu of appropriate mitigation measures and define thresholds of significance appropriate to meeting the goal of the plan. This information can be used during the CEQA process to determine and address the impacts of additional planned development on a parcel-by-parcel basis. CEQA provides useful powers and responsibilities to municipalities to promote watershed management objectives in several ways.

- Municipalities can expand the model initial study checklist to include questions pertaining to watershed/hydrologic cycle impacts, and to add questions for assessing the cumulative environmental impacts on the South Bay when adopting or reviewing General Plans or Specific Plans.

- The appropriate sections of the watershed resource inventories that designate, among other things, sensitive areas, can be incorporated into the environmental setting section of the initial study or EIR.

- Lead agencies (municipalities) are also encouraged to define thresholds of significance for proposed project impacts within a watershed (Bass et al. 1999). If a well-documented, scientifically sound strategy is included in a watershed management plan, the municipality should be able to define different thresholds of significance for different areas within a watershed. These could focus on cumulative effects, such as defining thresholds for impervious surface area.

- The public is given opportunities to comment on the negative declarations and EIRs of proposed projects.

- For projects requiring mitigation measures via a Mitigated Negative Declaration or an EIR, municipalities must adopt a reporting or monitoring program, the results of which can be reviewed to ensure mitigation implementation or to increase knowledge of the watershed. Reporting is often made up of a compliance review for projects that have quantifiable or otherwise easy-to-measure mitigation activities. Monitoring is more often continual oversight for more complex mitigation measures, such as wetland restoration. CEQA requires monitoring the success of mitigation measures only if success monitoring is included as part of the mitigation measures (CEQA Guidelines Section 15097(e)(6)) (Bass et al. 1999). Therefore, to help ensure monitoring success, municipalities should specify the need for success monitoring, and detailed mitigation measures, including performance criteria by which success can be determined.

- At their decision, municipalities can adopt comprehensive monitoring programs within their jurisdictional boundaries to establish a basic framework for monitoring. This comprehensive program may include standard policies and requirements – such as standard enforcement procedures, processes for monitoring success, and methods for regularly improving recommended mitigation measures upon review of monitoring results—for project-specific monitoring or reporting programs (CEQA Guidelines Section 15097(e)) (Bass et al. 1999).

- Finally, Master EIRs could be prepared for projects on a subwatershed level, as well as for general, specific, and redevelopment plans. Master EIRs can be used to bring more attention to cumulative impacts and to set forth preferred mitigation measures based on a broader perspective. Tiered EIRs are a useful tool for examining impacts of development projects from a larger perspective.

An important watershed management tool, CEQA can be complex, requiring public hearings, notification requirements, and findings. There also is the potential for legal action. CEQA mitigation measures must also reasonably relate to the actions they are mitigating (*Santa Monica Beach, Ltd. v. Superior Court (Santa Monica Rent Control Board*) (Curtin 1999b).

### General Plan Law

**Overview**. Using text and approximate diagrams, the general plan covers physical land development for land both within and outside the municipality's boundaries that relates to the municipality's planning (California Government Code Sections 65300, 65302). Therefore, municipalities can comment on lands outside their territorial boundaries, but within the geographic boundaries of the watershed. Considered the "constitution for all future developments" by the California Supreme Court (Curtin 1999a), the general plan is used not only to outline future development but also to balance competing needs within the community (see Table 6-2).

Solely an advisory document before 1971, the general plan has become a significant tool for directing future land use, thanks to legislation[3] that requires all land use approvals be consistent with the municipality's general plan. Each land use decision (e.g., zoning ordinance, tentative map, growth control initiative, development decision) must be consistent with a legal, and current, general plan or it is considered "invalid at the time it is passed" (*Lesher Communications, Inc. v. City of Walnut Creek*, 52 California 3d 544 (1990)) (Curtin 1999a). Thus, having specific watershed management goals and objectives included in the general plan is a basis for effective watershed management. Anyone challenging a land use approval by arguing that a general plan is not adequate must show a nexus between the claimed deficiency in the general plan and the land use approval (Curtin 1999a). This can affect land use decisions, including conditional use permits (CUPs), zoning ordinances, building permits, subdivision approvals, and environmental review under CEQA (*Neighborhood Action Group v. County of Calaveras*, 156 Cal. App. 3d 1175 (1984); *Garat v. City of Riverside*, 2 Cal. App. 4th at 259; *Flavell v. City of Albany*, 19 Cal. App. 4th 1846 (1993)) (Curtin 1999a). Although state law requires municipalities to make land use decisions based on the plan, the municipalities maintain great decision-making leeway in determining the actions taken under the general plan.

**Elements**. California Planning, Zoning, and Development Law requires that each county and general law city develop a general plan, and that this plan includes, at a minimum, the following seven basic elements: land use, circulation, housing, conservation, open space, noise, and safety. Municipalities can include other elements or subjects that the city council or board of supervisors consider to be associated with physical development. Each general plan element (even the optional ones) is required to hold equal weight under the law (*Sierra Club v. Board of Supervisors*, 126 Cal. App. 3d at 708), and must correlate with one another (Government Code Section 65302, subd. (b)) (Curtin 1999a). The general plan is therefore a good venue in which to balance competing objectives. Those general plan elements that most pertain to watershed management are briefly described below.

The **land use element** describes how and to what intensity land will be distributed for residential, commercial and industrial, open space, natural resources, institutional, and other land use categories. This element must include population forecasts, building intensity (e.g., site coverage, floor-to-area ratio, building type and size, units per acre), and flood-prone and timber areas (*Twain Harte Homeowners Association v. County of Tuolumne*, 128 Cal. App. 3d 664, 696-97 (1982); *Camp v. Board of Supervisors*, 123 Cal. App. 3d 334, 349 (1981) (Curtin 1999a). Because building intensity directly relates to impervious cover, objectives for reducing impervious area may best be incorporated into the land use element.

The **circulation element** is an infrastructure plan showing the planned major thoroughfares, transportation ways and terminals, and other public utilities and facilities, including public transit, bicycle facilities, drainage facilities, and waterways (Government Code Section 65302 (b)). Watershed planning should consider coordinating with transportation planning to avoid

[3] Chapter 1446, Statutes of 1971 and its amendments.

migration corridors and minimize trip lengths. Watershed management objectives for creating drainage facilities that help slow and infiltrate stormwater flows could also be included here.

The **housing element** projects the amount of needed housing; and considers economic, environmental, and fiscal factors, as well as community goals. This element includes goals, policies, objectives, and scheduled programs for preserving, improving, and developing housing (Government Code Sections 65583, 65302(c)) (Curtin 1999a). The Legislature considers suitable housing for every California family "a priority of the highest order" (*Committee for Responsible Planning v. City of Indian Wells*, 209 Cal. App. 3d 1005 (1989); Government Code Section 65580 (a)) (Curtin 1999a). While most of the general plan needs to be reviewed periodically, the housing element must be revised as necessary, or at least every 5 years. Detailed provisions apply to housing needs within the coastal zone (Government Code Sections 65588(d), 65590, 65590.1) (Curtin 1999a). Discussion of watershed planning objectives in the housing element could lead to improved designs, such as considering density on a subwatershed level, and reductions in building footprint area to help minimize impervious surface area.

The **conservation element** should house most watershed-related objectives and goals because it focuses on identifying, conserving, developing, and using natural resources (e.g., water, soils, wildlife and fisheries) (Government Code Section 65302 (d)) (Curtin 1999a). Flood control, water pollution control, erosion control, and endangered species issues are included in this element. Government Code Section 65302(d) states that the water issues section of the general plan's conservation element must be created with all local water-related agencies' participation (Curtin 1999a).

With the intent to discourage both premature conversion of land to urban uses and "noncontiguous development patterns…"(Government Code Section 65561(b)), the **open-space element** is a required general plan element that gives municipalities power to support watershed management goals (Curtin 1999a). Open-space plans are powerful because, under Government Code Section 65563, each municipality is required to plan for long-range conservation of open-space land for natural resources, for managing resource production, for outdoor recreation, and for public health and safety (Government Code Sections 65302(e), 65560-65568) (Curtin 1999a). With the provision for outdoor recreation, some jurisdictions include parks and golf courses as open space; therefore, open-space designations are not necessarily solely comprised of undisturbed, natural landscape.

The open-space element must include an action program to implement specific programs such as adopting an open-space zoning ordinance that designates agriculture, large-lot, and other zones. The designation cannot result in a taking or damaging of private property without compensation (Government Code Sections 65564, 65910, 65912) (Curtin 1999a).[4] Government Code Section 65567 disallows building permits, subdivision maps, and open-space zoning ordinances that are not consistent with the open-space plan (Curtin 1999a).

[4] See discussion under "Takings Case Law" for more information on takings.

The **safety element** creates programs to protect residents and property from risks from geologic hazards, floods, and wildfires. Some municipalities expand the element to include locally relevant issues such as hazardous materials transport, vegetation density and slope combinations for fire risk. Flood issues, vegetation density, wildfire, landslides, and slope considerations apply to watershed management planning.

**Approval**. Before a general plan can be approved, it must complete review under CEQA, and must be consistent with state laws and policies, including the California Coastal Act, Surface Mining and Reclamation Act (SMARA), and regulations for open-space, housing, and airport land use plans. Furthermore, Government Code Section 65352 advises that any proposal to adopt or significantly amend a general plan be referred to specific agencies, including immediately adjacent counties or cities, and any affected areawide planning agency, for a 45-day comment period before adoption.

Local Agency Formation Commissions (LAFCOs) have a pivotal role in approving general plans and general plan amendments. For more information on LAFCOs, see Section 6.12.

**Influence on Implementing Watershed Management Objectives**. In addition to policy statements, general plans can be used to illustrate a long-term vision of watershed renewal that maps areas for intense development and other areas for preservation or restoration. This strategy can assist balancing objectives of water supply management, habitat protection, flood management and land use, and can also help streamline the regulatory process for specific projects. Additionally, effective implementation of the watershed management plan will require that general plan policies have clear implementation measures and performance criteria.

General plan law gives municipalities the following powers and responsibilities:

- Comment on proposed actions on watershed lands outside their urban boundaries, but that relate to their planning area.

- Include in the general plan watershed protection plans, containing watershed goals and objectives to protect wetlands and stream environments and reduce pollutants in runoff. These plans provide a basis for an effective watershed management program because all land use decisions that are inconsistent with the general plan are invalid. This can impact zoning ordinances, tentative maps, growth control initiatives, and development decisions.

- General plan amendments can change goals and objectives, and municipalities must provide interested agencies with the opportunity to comment on proposed changes.

- Attach growth management objectives to general plans. To be appropriate, the growth control program must be shown to advance the community's general welfare. A growth management program that is included in the general plan is less likely to face legal challenge than one not included as part of the general plan. General plan information and objectives can act as the rationale for the growth control program (Curtin 1999a).

- Most watershed management strategy goals and objectives could be included in the conservation element, but could also be addressed as appropriate in the other elements. The general plan offers municipalities the opportunity to balance competing objectives within and among these elements.

- Watershed management strategies must comply with the requirements for municipalities to meet regional housing needs, although there is some mechanism for transference of shares of the regional housing needs.

- LAFCOs have influence over a municipality's general plan. LAFCOs have the power to set municipal spheres of influence (SOIs), and to approve or disapprove annexations and incorporations. These powers and others can be used to limit urban sprawl development.

## Specific Plan Law

**Overview**. Governed by the same set of regulations as general plan law, specific plans are used to implement general plans in specific areas (Government Code Section 65450) (Curtin 1999a). Specific plans must be consistent with general plans and county airport land use plans. Zoning, subdivisions, public works, and developments must be consistent with the specific plan for the particular area. Specific plans are adopted like general plans, except no restrictions exist on the number of times specific plans may be amended (see Table 6-2).

The specific plan uses texts and diagrams to detail at least the following:

- Location and extent of land use and open space

- Proposed locations, extent, and intensity of major public facilities and transportation areas within, and needed to support, the plan

- Standards and criteria for how development will proceed, and standards applicable to natural resources

- An implementation program that includes regulations, programs, public works projects, and financing needed to implement the above

- A statement of relationship to the general plan (Curtin 1999a)

With some exceptions, residential development projects are exempt from CEQA requirements if they are implementing and are consistent with a specific plan for which an EIR has been certified (Government Code Section 65457) (Curtin 1999a).

**Influence on Implementing Watershed Management Objectives**. Specific plan regulations are actually a part of general plan law, so their influence is similar to that of general plans. Specific plans offer municipalities another useful tool for watershed management planning, especially detailing objectives and implementation measures on the subwatershed level. Specific plans can provide more detailed planning objectives and implementation program with which other land use decisions must comply. However, specific plans are not limited in the number of proposed amendments they must consider.

## Subdivision Map Act

**Overview**. The ability to regulate the design of subdivisions can be important for incorporating site design measures that reduce the amount of impervious surface area. Under the Subdivision Map Act, municipalities are given the ability to regulate the land use type and design of subdivisions within municipal boundaries (Government Code Section 66411) (Curtin 1999a). Government Code Section 66418 defines design to include street alignments, grades, and widths; drainage and sanitary facilities, including alignments and grades thereof; location and size of rights-of-way, fireroads, and firebreaks; lot size and configuration; traffic access; grading; park and recreational land dedications; and other requirements and configurations "to ensure consistency with or implementation of, the general plan or any applicable specific plan" (Curtin 1999a). Municipalities must adopt ordinances regulating subdivisions that require a tentative and final or parcel map under the Map Act. In general, subdivisions of five or more parcels fall under the Map Act requirements to complete a tentative and final map. In most cases however, a municipality may regulate, via an ordinance, those subdivisions not covered under the Map Act if the regulations are as restrictive or less restrictive than those for Map Act subdivisions (see Table 6-2) (Government Code Section 66411; *City of Tiburon v. Northwestern Pacific Railroad Co.*, 4 Cal. App. 3d 160 (1970) (Curtin 1999a).

Second units may increase the amount of impervious surface area in a subdivision; however, they can also be useful for increasing density in built-out areas planned for higher density. "Granny" or second units are exempt from the Map Act until the unit is sold or transferred (Government Code Section 66412.2) (Curtin 1999a).

Even for map waivers, the Act has conditions to ensure environmental protections are met. For a parcel map or condominium project's tentative and final maps to be waived, a municipality must have an ordinance that allows for the waiver, and that includes a finding that the land division complies with the Map Act and other local ordinances, including floodwater drainage control, water supply, and environmental protection (Government Code Section 66428) (Curtin 1999a).

As long as they do not contradict the Map Act's specific provisions, municipal regulations can affect the subdivision process when the Map Act is not explicit (*Shelter Creek Development Corp. v. City of Oxnard*, 34 Cal. 3d 733 (1983), *Soderling v. City of Santa Monica*, 142 Cal. App. 3d 501 (1983) (Curtin 1999a).

**Conditions for Map Approval and Denial**. Before approving a tentative parcel map, the municipality must find that the maps are consistent with the general plan and specific plan. In *Sequoyah Hills Homeowners Association v. City of Oakland*, 23 Cal. App. 4th 704 (1993), the court held that maps that are "in agreement with or in harmony with the general plan" are acceptable (Curtin 1999a). A map can be denied approval if it is not consistent with general and specific plans, is not physically suited to the site, may cause substantial environmental damage or serious public health problems, or does not allow for public access easements (Curtin 1999a). Additionally, a municipality may deny the map if the subdivision does not allow for future passive or natural heating and cooling opportunities, or if waste discharge from the subdivision would not meet Regional Board requirements (Curtin 1999a). In an appeal, the city council or board of supervisors is not tied to the findings of its advisory agency, so it can make its own decisions anew (*Cohan v. City of Thousand Oaks*, 30 Cal. App. 4th 547 (at 557) (1995).

A tentative map may be automatically approved if a municipality does not act within the Map Act's time limits, except in certain cases (Curtin 1999a). In *Woodland Hills Residents Association, Inc. v. City Council*, 44 Cal. App. 3d 825 (1975), the court found that consistency must be found with the general plan before a tentative map can be approved.

**Parcel Maps**. Except where explicitly provided for in the Map Act (Government Code Section 66463), municipalities have power over determining the parcel map procedures via ordinances. The municipality must comply with notice and hearing requirements (*Horn v. County of Ventura* 24 Cal. 3d 605 (1979)) (Curtin 1999a). The municipality does not have as much leeway with a parcel map to require fees and exactions as it does with a tentative or final map. With a parcel map, the municipalities can require rights-of-way, easements, and "construction of reasonable offsite and onsite improvements for the parcels which are being created" (Government Code Section 66411.1(a)) (Curtin 1999a).

As per Government Code Section 66418.2, until January 1, 2003, regardless of how many parcels are created, only a parcel map is necessary for a division which is used to create an environmental subdivision of at least 20 acres[5] (Curtin 1999a). Such a subdivision "allows a landowner to sell property for offsite mitigation based on defined criteria such as a subdivision for biotic and wildlife purposes" (Curtin 1999a).

**Tentative Maps**. Under Government Code Section 66426 of the Map Act, tentative maps are necessary if a final map is required, but not necessary for parcel maps unless the local subdivision ordinance requires such (Curtin 1999a). A typical 2-year tentative map life is extended by 36 months if the subdivider must build, improve, or finance public improvement

[5] Multiple owners with contiguous land could combine to meet the 20-acre size minimum.

projects of $125,000 or more that are outside the tentative map's boundaries. When a tentative map's life is extended, the extension applies to state agencies' approvals as well (Coastal Commission, CDFG, Regional Board).

Certain properties may not need to meet subsequent watershed-related land use initiatives if they have a previously approved vested tentative or final map. Under Government Code Section 66498.1-66598.9, a "Vesting Tentative Map" can be approved, which provides the applicant the vested right to develop in compliance with the regulations and standards in effect at the time of application for approval (Curtin 1999a). The only exceptions are if the municipality determined that residents would otherwise be in risk to health or safety, or if a condition or denial is necessary to meet state or federal law (Government Code Section 66498.1(c)) (Curtin 1999a). The vesting tentative map will likely govern over any land use initiatives adopted afterwards, and an approved final map will govern if an unincorporated subdivision is annexed to a city. This does not hold true for a tentative or vesting tentative map, or for parcel maps that are not finalized (Government Code Section 66413) (Curtin 1999a).

Conditions need to be placed on the tentative map. Unless a new condition is necessary to protect public health and safety, to comply with state or federal law, or to comply with applicable zoning ordinances, a condition that could have been placed on a tentative map cannot be added later to the building or other type of permit for residential constructions unless five years have passed since the final map was approved and recorded (Government Code 65961, *Beck Development Co. v. Southern Pacific Transportation Co.*, 44 Cal. App. 4$^{th}$ 1160, 1199-1200 (1996)) (Curtin 1999a).

Moreover, municipalities cannot add additional conditions to tentative map extensions (*El Patio v. Permanent Rent Control Bd*., 110 Cal. App. 3d 915 (1980). A municipality could deny the extension if it could justify that the development without the condition would be harmful to public health, safety, or welfare. The subdivider would then have to apply for another tentative map.

If the general plan requires improvements, the subdivisions must provide conditions in order for the Subdivision Map Act to be consistent with the general plan (Government Code Section 66474) (Curtin 1999a). Under the Quimby Act (Government Code Section 66477), upon meeting certain criteria, a municipality can enact an ordinance to require land dedications or fees for parkland dedications, recreation, fire stations or other similar uses (*Associated Home Builders, Inc. v. City of Walnut Creek*, 4 Cal. 3d 633 (1971) (Curtin 1999a). The dedication/fee in general should provide 3 acres of park per 1,000 subdivision residents (Government Code Section 66477; *Associated Home Builders Inc. v. City of Walnut Creek,* 4. Cal. 3d 633 (1971)) (Curtin 1999a). The location of land or amount of fees should be set so that the future subdivision inhabitants may benefit.

Additionally, under Government Code Sections 66474-66475, municipalities can adopt ordinances that impose, among other things:

- Dedications for streets, alleys, access and abutter's rights, drainage, public utility, and other public easements (Government Code Section 66475). Bicycle paths can be required if the subdivision contains over 200 parcels (Government Code Section 66475.1).
- Local transit facility dedications (for subdivisions with potential for over 200 dwelling units, or if developed to maximum density) (Government Code Section 66475.2).
- Drainage and sewer facilities fees (to defray actual or estimated capital improvement costs for local areas if the municipality has a general drainage or sanitary sewer plan) (Government Code Section 66483)[6].
- Bridge and thoroughfare fees (Government Code Section 66484).
- Groundwater recharge (Government Code Section 66485.5).
- Supplemental improvements (sized to benefit neighboring subdivisions) (Government Code Sections 66585-66489).
- Soils investigations and reports (Government Code Sections 66490, 66491).
- Grading and erosion control requirements (Government Code Section 66411).
- Public access to public resources and dedication of public easements along river and streambanks (Government Code Section 66478.1-66478.14).
- Energy conservation (passive or natural heating or cooling opportunities) (Government Code Section 66473.1).
- Dedication for solar access easements (Government Code Section 66475.3).
- Offsite improvements (Government Code Section 66462.5). A final map cannot be postponed or refused if offsite improvements on land owned by someone else are not constructed or installed. The municipality must start the process to acquire the land within 120 days or the condition is waived. Municipalities can impose private condemnation of sewer or stormdrain easements as a tentative map condition of approval (*L&M Professional Consultants, Inc. v. Ferreira,* 146 Cal. App. 3d 1038 (1983)).
- Standards for public improvements in residential subdivisions (Government Code Section 65913.2). The standards a municipality imposes on a developer may not exceed the municipality's own standards for the same improvements (Curtin 1999a).

[6] If the municipality decides to use this section and not some other authority or power, the municipality must comply with the requirements that the local ordinance meet the following criteria: the municipality must have a general drainage or sanitary sewer plan; the fees be paid into a "planned drainage/sanitary sewer fund"; and the fees be apportioned fairly to areas based on benefits or needs. Surplus money must be disposed as per Government Code Section 66483.1-66483.2. The total acreage of the drainage area is the basis for calculating the maximum drainage fee (66 Ops. Cal Atty. Gen. 120 (1983)) (Curtin 1999a).

A municipality may require a dedication when an applicant proposes to convert a condominium or stock cooperative, even if no new dwelling units are added (*Norsco Enterprises v. City of Fremont*, 54 Cal. App. 3d 488 (1976)) (Curtin 1999a).

**Final Maps**. For a final map to be approved, the map must contain statements certifying dedication; all conditions must be satisfied, and improvement agreements entered into; and the municipality must require a performance security for improvement agreements (Curtin 1999a). The performance security will help ensure that the mitigation measures will be performed.

**Beyond Municipal Boundaries**. The Map Act allows municipalities to make recommendations on Map Act proposals outside the municipality's boundaries. This can be used to take watershed planning beyond urban jurisdictional boundaries. Government Code Sections 66453 and 66455 indicates that "if an adjoining local agency or the California Department of Transportation files a map with the city indicating territory in which it desires to make a recommendation, the city must refer maps to the local agency or the Department of Transportation for their comments…" (Curtin 1999a).

**Relationship to California Environmental Quality Act**. Whereas CEQA does not give a municipality power to place conditions of approval under Public Resources Code Section 21004, the municipality may place conditions of approval based on the subdivision approval process under Government Code Section 66474 (e) (Curtin 1999a). Government Code Section 66474 (e) states: "…a city shall deny a subdivision if it finds that the design of the subdivision or the proposed improvements are likely to cause substantial environmental damage or substantially injure fish or wildlife or their habitats" (Curtin 1999a). The EIR would be the basis for such a finding. The environmental impact review in Government Code Section 66474 (e) is separate from the CEQA review (*Topanga,* 214 Cal. App. 3d at 1348). Under Government Code Section 66474 (e), "substantial environmental damage" is defined the same as "significant effect" under CEQA.

In *Topanga*, the fact that a project was not located in a Significant Ecological Area was one reason the courts used to determine the subdivision would not substantially harm the environment (at 1356). Therefore, municipalities should designate sensitive areas if additional measures are needed to protect the areas.

**Exclusions and Reversions**. Municipalities can remove subdivision lands via rarely used exclusions, which require judicial action to remove land from a subdivision. A reversion removes the entire subdivision.

**Map Act Violations**. When the Map Act is violated, the municipality can sue in Superior Court for declaratory relief or to stop action; can request criminal charges be filed; or can withhold other necessary permits and approval (Government Code Section 66499.3).

**Influence on Implementing Watershed Management Objectives**. The Subdivision Map Act allows municipalities to regulate and control the design and improvements of subdivisions that are generally greater than or equal to five parcels. With these powers, municipalities can determine street widths, grades, and alignments; land dedications; and other requirements or configurations to implement the general or specific plan. Subdivision Map Act regulations can empower the municipality to make changes in the amount of impervious surface allowed on developing properties so as to reduce runoff rates and volumes. Additional powers and responsibilities bestowed upon municipalities are listed below:

- Municipal regulations can influence the subdivision process as long as they do not contradict the Map Act's specific provisions.
- Landowners may sell property for offsite mitigation based on defined criteria until January 1, 2003.
- Tentative maps must comply with the general plan.
- Municipalities must provide some protection for the environment even if the parcel, tentative, or final map is waived.
- Municipalities can make recommendations on Map Act proposals outside of their territorial boundaries, provided that the proposals potentially impact the municipality's planning area.
- Vested rights may limit the reach of new land use regulations.
- Under most circumstances, conditions must be placed on the tentative map.
- A municipality can use the Subdivision Map Act to attach conditions of approval based on the results of the CEQA review, even though CEQA does not give the municipality direct powers to attach conditions of approval. Based on findings made during the CEQA process, a municipality can deny subdivisions if they may cause substantial environmental damage.
- Municipalities must require a performance security fee for improvement agreements for a final map to be approved.
- Municipalities can require reasonable offsite and onsite improvements, but are limited in requiring fees or exactions for parcel maps.
- Municipalities can withhold necessary permits and approvals if the Map Act is violated.
- Municipalities cannot add additional conditions to tentative map extensions.

The Map Act also allows a municipality, with an appropriate ordinance, to implement public improvement standards in residential subdivisions if the standards do not surpass the municipality's own standards. This can be a useful tool for implementing watershed management goals once municipalities require better design standards for their own capital improvement projects. Currently, municipal standards often require offsite drainage and restrict innovative design solutions that would reduce the amount of disturbed and impervious areas. For municipalities using watershed-friendly design solutions, the Map Act provides a useful opportunity to require better drainage designs in residential subdivisions.

## Zoning Regulations

**Overview**. Zoning ordinances are designed to translate the general plans broad policies into specific requirements for individual parcels of land. Zoning can be used to separate a city into districts within which the city regulates the land use, and the type and design (in terms of height, bulk, and density) of the buildings (see Table 6-2). Zoning regulations can be applied citywide as well. Whereby the California Zoning Law (Government Code Sections 65800-65912) applies to counties and general law cities, it applies to charter cities only in specific sections or to the degree that the municipality adopts the law by ordinance or charter (Government Code Section 65803) (Curtin 1999a).

A developer does not have a vested right to develop solely upon approval of a final or parcel map, until building or other like permits have been issued and a large proportion of work has been performed (*Avco Community Developers, Inc. v. South Coastal Regional Commission*, 17 Cal. 3d 785 (1976) (Curtin 1999a). Until then, the city can still change the zoning or other police power ordinances.

Zoning ordinances can be vague so long as their meaning does not need to be guessed. This allows governments to delegate widespread discretionary powers to administrative bodies (*Cal. Zoning Practice* (Cont. Ed. Bar), *supra,* at 148) (Curtin 1999a). Municipalities have a great deal of control over zoning issues as long as the city holds public zoning and planning hearings (*Beck Development Co. v. Southern Pacific Transportation Co.*, 44 Cal. App. $4^{th}$ 1160 (1996)) (Curtin 1999a). Under judicial review, a zoning ordinance is lawful if it can be “reasonably related to the public welfare” of the citizens and the affected region.

Because a zoning ordinance is a legislative act, explicit findings are not required (Curtin 1999a). Therefore, the party challenging the constitutionality of an ordinance has the burden of proof, except if the ordinance—adopted either by the city council or through the initiative process—directly limits the number of dwelling units. In this case, the municipality has the burden of proof to justify the ordinance (Evidence Code Section 669.4; *Associated Home Builders, Inc. v. City of Livermore*, 18 Cal. 3d 582 (1976), *Lee v. City of Monterey Park*, 173 Cal. App. 3d 798 (1985); *Building Industry Association v. City of Camarillo*, 41 Cal. 3d 810 (1986)) (Curtin 1999a). The case of *Hernandez v. City of Encinitas*, 28 Cal. App. $4^{th}$ 1048 (1994) found that Evidence Code Section 669.4 does not apply to challenges of the housing element (or regulations to implement the element) (Curtin 1999a). California law, however, requires findings by a city if it limits the number of housing units through the general plan or zoning adoption (Government Code Sections 65302.8, 65863.6) (Curtin 1999a).

**Amendments**. City councils or boards of supervisors can make amendments to zoning ordinances either via reclassification of the zoning district called “rezoning,” or by changing the uses or regulations within a zone called "text amendments." Because both are legislative acts, findings are not necessary unless required by a state law or local ordinance (*Arnel Development Co. v. City of Costa Mesa*, 28 Cal. 3d 511 (1980)) (Curtin 1999a). Before amending an ordinance, the municipality must consider whether the amendment is consistent with the general and specific plan and with CEQA; and the impact on the welfare of the municipality and the surrounding region. In addition, all zoning ordinances can be changed via the initiative and referendum process (*Arnel*, 28 Cal. 3d at 511) (Curtin 1999a).

**Variances and Conditional Use Permits**. For fairness, if a landowner would "otherwise suffer unique hardship under the general zoning regulations because his particular parcel is different from the others to which the regulation applies…," a variance can be issued under Government Code Section 65906 (Curtin 1999a). The variance allows activities that are basically consistent with the zoning regulations but with minor alterations (generally to certain development standards of the zoning code) that allow the owner to overcome the unique hardship (Curtin 1999a).

CUPs can also be used to overcome hardship resulting from comprehensive zoning ordinances. CUPs provide flexibility, and allow for additional land uses, with conditions to minimize potential impacts on the surrounding neighborhood (Campbell 1999). Local ordinances, not the California Zoning Law, as is the case with variances, establish the criteria for issuing or denying a CUP (Government Code Section 65901) (Curtin 1999a).

CUPs and variances could be used in limited circumstances to skirt or assist watershed management strategies incorporated into zoning regulations. For example, a CUP for a three-story home in a single-family zone was not upheld in court due to "view impairment and towering effect" (*Saad v. City of Berkeley*, 24 Cal. App. 4$^{th}$ 1206 (1994)) (Curtin 1999a).

The Legislature supports second units, and under Government Code Section 65852.2, a municipality that had not developed an ordinance to permit them must provide a CUP or special permit to allow the use if the applicant meets the state criteria (*Wilson v. City of Laguna Beach*, 6 Cal. App. 4$^{th}$ 543 (1992), Government Code Section 65852.150) (Curtin 1999a). This could affect areas designated for low imperviousness in a watershed management plan by increasing the amount of impervious surface areas, but it could be useful in areas where higher densities are encouraged. Under some circumstances and once a city has adopted an ordinance that makes the necessary findings, a municipality can disallow second units (Government Code Section 65852.2(c)) (Curtin 1999a).

**Prezoning**. As long as it is consistent with the general plan, a city can prezone unincorporated areas to determine the zoning if the land were annexed, under Government Code Section 65859. This could assist overall planning within watersheds that extend beyond municipal boundaries.

**Interim Ordinances**. In an emergency, a city can adopt interim ordinances that permit uses that would conflict with a general or specific plan or zoning proposal that is currently under consideration. In such cases, the municipalities do not need to comply with the notice or hearing requirements typically necessary to approve a zoning ordinance. Watershed management goals, objectives, and implementation measures could be left out of interim ordinances.

**Conditional Zoning**. Conditional zoning allows a use of a specific property if it follows conditions that are not typically applied to other land in a similar zone (*Scrutton v. County of Sacramento*, 275 Cal. App. 2d 412, 417 (1969)) (Curtin 1999a)[7]. In this case, the court allowed the county to approve a property rezoning with conditions under the police power rationale, but indicated that the new zoning could not revert to the old zoning if the conditions were not met because the reversion would be a zoning amendment without the proper notice and hearings required under the California Zoning Law (Curtin 1999a). Conditional zoning could be used as a watershed management tool, but requires trust on behalf of the municipality.

**Community Redevelopment Law's Influence on Zoning Regulations**. Municipalities that redevelop areas using the California Community Redevelopment Law (Health & Safety Code Sections 33000-33490) need to comply with both the redevelopment and the land use law (Curtin 1999a) (see discussion under "Community Redevelopment Law" elsewhere in this section). The redevelopment plan must be consistent with the general plan and have building use limitations (Health & Safety Code Sections 33331, 33333(b)), but it does not need to conform to zoning classifications (Curtin 1999a). Therefore, the redevelopment plan can be more restrictive than the zoning ordinance allows (Curtin 1999a). The California Community Redevelopment Law is superior to local building and zoning ordinances that conflict with it, and the redevelopment plan cannot be amended by either of the controlled ordinances (Curtin 1999a).

**Density Bonus**. Municipalities are required under Government Code Sections 65915-65918 (referring to California's Housing Policy) to provide a density bonus or other like incentive to developers that construct housing affordable to lower incomes. Section 65915(a) requires municipalities to adopt ordinances that distinguish how such incentives will be provided. Courts have found that zoning initiatives that restrict growth through a numerical cap conflict with this section (*Building Industry Association v. City of Oceanside*, 27 Cal. App. 4$^{th}$ 744 (1994)) (Curtin 1999a). Incentives provided to developers could include reductions in site development standards; modification of zoning code requirements such as reducing setbacks, square footage requirements or parking places, or certain architectural design requirements; and approval of compatible mixed-use zoning if it reduces the development cost. Such affordable housing projects must still comply with the Congestion Management Program, the California Coastal Act, CEQA, and other state or local requirements (Government Code Section 65589.5) (Curtin 1999a). Municipalities may need to address the conflicts with watershed management objectives (e.g., reducing setbacks) as appropriate. Potential benefits to watershed planning included mixed-use development and higher densities in particular areas.

**Zoning as Applied to Federal, California, and Other Lands**. Federal laws preempt state and local laws, but NEPA and the Intergovernmental Coordination Act of 1968, and the

[7] Conditional zoning should not be confused with "contract zoning," which does not hold up under the law, but is a term that refers to land use reclassification where the owner agrees to perform conditions not imposed on other landowners (Curtin 1999a).

Intergovernmental Coordination Executive Order require federal agencies to ask for and consider local views on their projects. Furthermore, the U.S. Supreme Court decided that states may require environmental controls on activities on federal lands (*California Coastal Commission v. Granite Rock Company*, 480 U.S. 572 (1987)).

The state is not required to meet a municipality's (charter city or not) zoning regulations (*Hall v. City of Taft,* 47 Cal. 2d 177 (1956), but generally a municipality's subdivision laws apply if they do not impact the basic purposes and functions of the state (62 Ops. Cal. Atty. Gen. 410 (1979); see also 75 Ops. Cal. Atty. Gen. 98 (1992). All local agencies must comply with local zoning ordinances except the state, a city, county, or other specified agencies named in the Government Code (e.g., Bay Area Rapid Transit) (Government Code Sections 53090-53096) (Curtin 1999a).

**Congestion Management**. Proposition 111, adopted in 1990, created the regional Congestion Management Agency that requires urbanized counties to prepare a Congestion Management Program that municipalities must implement to get their gas tax revenues. To do so, the municipalities must maintain explicit levels of service on the roadways. A Congestion Management Program must be created and biennially updated in every county with an "urbanized area" of 50,000 or more people (Government Code Section 65089). The Agency must develop the plan with input from the transportation planning agency, regional transportation providers, local governments, the Transportation Department, and the air pollution control district (APCD) or air quality management district (AQMD) (Curtin 1999a). When coordinating with the Congestion Management Agency, municipalities may want to consider watershed management objectives and planning strategies, such as allowing for mitigation corridors when planning for reduced congestion. The knowledge of the level of service on thoroughfares throughout the watershed can help focus the placement of some types of watershed protection measures.

**Influence on Implementing Watershed Management Objectives**. Zoning regulations can influence the implementation of watershed management objectives in the following ways:

- Municipalities can use zoning regulations to regulate the land use and design of buildings, and can indirectly influence the type of buildings in an area. This ability can be used by municipalities to help protect sensitive watershed areas from land uses that may be more likely to pollute or harm the sensitive areas. Zoning regulations can also be used to increase density in some regions, and reduce density in other, more protected areas. The ordinances allow municipalities to provide widespread discretionary powers to administrative bodies that could incorporate watershed management objectives in their decisions.
- California Zoning Law does not apply to charter cities unless the charter city has adopted the law by ordinance or charter. Charter cities that have not adopted the zoning law have one less tool to control land use type and design, such as building footprint and setbacks.

- Municipalities can change zoning ordinances after approval of a final or parcel map (if not a vesting map) until building and similar permits have been issued and a good proportion of the work has been completed. Therefore, upon changing a zoning ordinance, several projects in the application and review phase can be required to comply with watershed-management-related regulations in the revised zoning regulations.
- If the number of dwelling units is directly limited, the municipality has the responsibility to provide justification. This can influence the implementation of watershed objectives by requiring additional work by municipalities to justify protection of certain sensitive areas of a watershed, which under a watershed approach would best be kept at lower population densities.
- Zoning ordinances must be consistent with the general and specific plans, and must consider CEQA and the impacts on the municipality and surrounding regions. Zoning ordinances must therefore be created to take into account environmental concerns, such as watershed management objectives (especially if they are included in the general and/or specific plan).
- Variances and CUPs can be used to help landowners overcome hardships from zoning regulations. Because CUPs allow conditions to minimize potential impacts on the surrounding neighborhoods, CUPs give municipalities flexibility to require alternative watershed protection measures on projects where standard comprehensive measures may be onerous.
- Interim ordinances could influence watershed goals, as they can conflict with general or specific plans or zoning proposals. In emergencies, watershed management objectives could be superseded by an interim ordinance. Depending on the nature of the ordinance and the uses it allows, progress toward watershed objectives could be temporarily set back.
- Municipalities can zone for cluster developments, also known as planned-unit developments (PUDs). This gives municipalities regulatory power to use an important watershed management tool (See discussion in Section 6.7.1.2).
- The California Community Redevelopment Law is superior to zoning and building ordinances, and therefore a redevelopment plan cannot be amended by such ordinances (*Kehoe v. City of Berkeley*, 67 Cal. App. 3d 666 (1977)) (Curtin 1999a). The influence that this has on watershed objectives depends on the situation. A redevelopment plan could be developed that can provide more watershed-beneficial restrictions than the existing zoning ordinance allows, and those beneficial restrictions would need to be followed.
- Density bonuses could either positively or negatively influence implementation of watershed objectives. Density bonuses could work in parallel to watershed management objectives of increasing density in portions of the watershed, and reducing density in other sensitive portions of the watershed. A potential negative impact would occur if a municipality's incentives ordinance allowed for

reduced setbacks to sensitive areas. Municipalities should ensure that the incentives ordinance is created with attention to watershed management objectives as well.

- Zoning ordinances can play a role in the implementation of Transfers of Development Rights (TDRs). An effective approach to using TDRs is to specify goals and policies in the general plan and place implementation measures in the zoning ordinance (See also Section 6.7.1.2).

### Community Redevelopment Law

**Overview**. The California Community Redevelopment Law (Health and Safety Code Section 33000 et. seq.) has provided municipalities with the ability to create redevelopment agencies that address urban blight and can apply for federal grants and loans to fund redevelopment projects (Beatty et al. 1995). A municipality can create a redevelopment agency by enacting an ordinance declaring the need for one (see Table 6-2). The redevelopment agency can be governed by the municipality itself, a separate governing body, or a community development commission (Beatty et al. 1995). Redevelopment agencies can:

- Buy real estate and use eminent domain.
- Develop properties (but not construct on them).
- Sell real estate without bidding.
- Move people who are interested in acquired properties.
- Borrow from federal and state government.
- Sell lands.
- Institute land use and development controls based on a comprehensive redevelopment plan (Beatty et al. 1995).

Redevelopment law places restrictions on acquiring property. The redevelopment agencies must obtain consent of the applicable public agency before obtaining public property or private property using eminent domain (Section 33395). If an existing building will not be removed, the redevelopment agency cannot acquire the property without the owner’s consent, unless the building needs structural changes or if the owner refuses to pay for any standards or site restrictions and controls placed on the property by the redevelopment plan (Section 33394). Finally, the eminent domain process must start within 12 years of the adoption of the redevelopment plan (Beatty et al. 1995).

Under Community Redevelopment Law Section 33421, a redevelopment agency can also provide offsite public improvements such as streets, parks, playgrounds, and those other improvements in the project area necessary to implement the redevelopment plan (Beatty et al. 1995). Redevelopment projects can include mixed-use projects that involve master developers and provide open-space and recreational facilities. Examples of such projects include the

California Center Project in Los Angeles and the Yerba Buena Gardens Project in San Francisco (Beatty et al. 1995). However, due to an increase in project area sizes, the state passed legislation (Section 33320.1) that requires that 80 percent of a project's privately owned lands be developed for urban uses (Beatty et al. 1998). Furthermore, "enforceably restricted"[8] agricultural and open-space lands cannot be included in redevelopment project areas (Beatty et al. 1998). Other restrictions are placed on inclusion of agricultural lands larger than 2 acres (Beatty et al. 1998).

Projects in a redevelopment plan can meet CEQA requirements through preparation of a Master EIR (Curtin 1999a). Because all projects in a redevelopment plan are considered one project under CEQA, they are approved once the redevelopment plan has complied with the CEQA process and been adopted (Bass et al. 1999). In some cases, a subsequent or supplemental EIR will be necessary to address additional impacts (Public Resources Code Section 21090, Guidelines Section 15180) (Bass et al. 1999).

**Influence on Implementing Watershed Management Objectives**. Incorporating watershed-management-oriented land use and development controls in a comprehensive redevelopment plan can be an effective strategy for subwatershed-level, specific areas:

- Mixed-use projects can be incorporated into redevelopment planning.
- Redevelopment plans can provide for open spaces as long as 80 percent of a redevelopment project's privately owned lands are developed for urban uses.
- Redevelopment planning can simplify the CEQA process because all projects within a redevelopment plan are considered one project under CEQA, for which a Master EIR can be prepared.

## Takings Case Law

When a law or ordinance places restrictions on a property that impacts that property's development potential or property value, the owner must be justly compensated for the "taking" (*Hansen Brothers Enterprises v. Board of Supervisors*, 12 Cal. 4$^{th}$ 533, 551 (1996)) (Curtin 1999a). Property owners are protected from unjust takings under 42 USC Section 1983 (civil rights), the 14$^{th}$ Amendment of the U.S. Constitution (due process and equal protection), and the 5$^{th}$ Amendment of the U.S. Constitution (taking) (Curtin 1999a). The civil rights legislation has opened up police power and zoning regulations to scrutiny with regard to takings (Curtin 1999b). Takings can occur either through land use regulations or via development conditions (e.g., development impact fees). In *Monterey vs. Del Monte Dunes at Monterey*, 97-1235, the Supreme Court ruled that, under the Fifth Amendment's "just compensation," federal court plaintiffs that sue over local government land use regulations can receive a trial by jury (Carelli 1999).

[8] As defined in the Revenue and Taxation Code Sections 422 and 422.5.

In *Kavanau v. Santa Monica Rent Control Board* (16 Cal. 4th 761, 774 (1997)), the California Supreme Court found that an owner must be justly compensated for a taking even if the action or regulation still allows the landowner “some economically beneficial use” of the property. The determination of whether a taking has occurred is performed on a case-by-case basis in the courts. No set standards are available, although basic legal tests exist, as described below.

**Agins Test**. The U.S. Supreme Court found that general zoning law as applied to specific properties can be a taking if the ordinance either:

(1) “does not substantially advance legitimate state interest” or

(2) “denies an owner economically viable use of his land” (*Agins v. City of Tiburon*, 447 U.S. 255 (1980) at 260) (Curtin 1999a).

In *Agins*, the City of Tiburon modified its existing zoning ordinance and placed the Agins land in a Residential Planned Development and Open Space zone that permitted single-family residential dwellings. The Aginses sued, saying the action destroyed their property values. The U.S. Supreme Court supported open-space ordinances, stating that discouraging conversion of open space to land use prematurely and that protecting the city’s residents from urbanization are legitimate governmental goals (Curtin 1999a). The court stated that, although the ordinance limited development, it did not prevent the land’s best use or destroy the owners’ property value.

In other cases, the U.S. Supreme Court found that for the first prong of the Agins test, some government interests have higher legitimacy than others and are therefore more defensible, and that the type of alleged taking is critical in determining whether a take occurred (e.g., physical invasion versus public programs promoting common good) (*Keystone Bituminous Coal Association v DeBenedictis*, 480 U.S. 470 (1987)); (*Penn Central Transportation Co. v. New York City*, 438 (104, 124) (1978)) (Curtin 1999a). To determine if a landowner’s economically viable use was taken, the court examines the remaining property value, not the taken property value (Curtin 1999a).

**Nollan-Dolan Tests**. In *Nollan,* the U.S. Supreme Court indicated that a nexus, or connection between the imposed action and its ability to substantially advance a legitimate state interest is necessary. In *Dolan v. City of Tigard*, 512 U.S. at 374, the U.S. Supreme Court found that for adjudicative decisions, municipalities must show a “rough proportionality” between the impact of the development and the conditions imposed, where otherwise they would just need to show a “reasonable relationship” (Holloway and Guy 1994; Zischke 1994). *Dolan* does not apply to general legislative acts (e.g., zoning regulations) (*San Mateo County Coastal Landowners Assn. v. County of San Mateo,* 38 Cal. App. 4th 523 (1995)) (Curtin 1999a).

In *Santa Monica Beach, Ltd. v. Superior Court (Santa Monica Rent Control Board),* the California Supreme Court found that as long as a regulation supports some, not necessarily a specific, legitimate interest, then it passes the first prong of the takings tests. Furthermore, the court found that land use ordinances and other legislative acts do not need to meet the higher standards of *Nollan-Dolan*. The *Nollan-Dolan* standards should be applied to adjudicative decisions, such as ad hoc dedication conditions or individually tailored development fees (Curtin 1999b).

Similarly, *Ehrlich v. City of Culver City*, 12 Cal. $4^{th}$ 854 (1996), found that legislative acts and fees that apply, or are applied, in general are not subjected to the increased *Nollan/Dolan* standard, but fees that are placed on an individual ad hoc basis are subject to the increased standards. The decision resulted in the following:

- Developers wishing to challenge ad hoc fees must file a written protest, pay the fee under protest, and bring suit within 180 days as prescribed by the Mitigation Fee Act (Government Code Sections 66000 – 66025).
- If a fee passes the *Nollan-Dolan* test, municipalities can impose mitigation fees as a condition of a land use change (e.g., general or specific plan, zoning) if the change from the original private land use will have public consequences.
- Municipalities may adopt ordinances to protect aesthetics (Curtin 1999a).

#### *6.7.1.2 Strategies for Incorporating Watershed Management Planning on the Local Level*

Overall strategies for watershed management involve assessing a watershed to determine sensitive and critical areas and the level of degradation. Based upon this assessment, a watershed management plan can be developed that discusses objectives and implementation measures to protect and enhance the watershed. Specific objectives and mitigation measures could focus on different areas, depending on how the areas were rated as a result of the watershed assessment. Several tools exist to protect and enhance the sensitive and critical areas and otherwise meet the objectives of the watershed management plan. These tools can be used as a watershed management plan in operation. These tools are discussed below in relation to the land use regulations that may influence their use. Then suggestions for using the tools to meet specific watershed objectives are provided (see also Table 6-3).

### Strategy Tools

**Specific Plans**. After scientifically assessing the watershed and creating a watershed management plan that defines the objectives to be applied to specific watershed areas, specific plans can be developed that include the objectives for specific subwatersheds or other watershed areas. Using conditions of approval and CEQA documentation, specific requirements for

**Table 6-3**
**List of Regulations Applicable to Specific Watershed Objectives**

| Objective | Land Use Regulation | Potential Tools |
|---|---|---|
| **Watershed-Wide Planning** | General & Specific Plan, Map Act, California Environmental Quality Act (Master Environmental Impact Report), Zoning Regulations | Specific Plans, Habitat Conservation Plans/Natural Community Conservation Plans, Transfers of Development Rights, Planned-Unit Developments, Conservation Credits, Purchases of Development Rights |
| **Different Habitat Goals Within the Same Watershed** | General & Specific Plans, Map Act, California Environmental Quality Act (Master Environmental Impact Report), Zoning Regulations | Specific Plans, Development Permits, Habitat Conservation Plans, Transfers of Development Rights, Conservation Credits, Mitigation Banking, Purchases of Development Rights, Local Land Trusts |
| **Policies for Remodeling & Expansion of Buildings** | General and Specific Plan, Zoning Regulations | Development Permits, Dedication and Impact Fees, Mitigation Banking |
| **Acquiring "Sensitive" Watershed Lands** | General and Specific Plan, California Environmental Quality Act, Endangered Species Regulations, Redevelopment Planning Act | Purchases of Development Rights, Planned-Unit Developments, Development Permits, Conservation Credits |
| **Restoration Through Redevelopment** | Redevelopment Law, General Plan & Specific Plan, California Environmental Quality Act, Wetland Regulations, Endangered Species Regulations | Redevelopment Plans, Planned-Unit Developments, Purchases of Development Rights |
| **Restoration of Creeks and Floodplains** | General & Specific Plan, Subdivision Map Act, California Environmental Quality Act, Zoning Regulations, Redevelopment Planning Act | Transfers of Development Rights, Conservation Banking, Purchases of Development Rights, Dedication and Impact Fees, Mitigation Bank, Local Land Trusts, Redevelopment Plans |
| **Growth Management** | General Plan, Specific Plan, Map Act, Zoning Regulations | Specific Plans, Development Permits, Transfers of Development Rights |

subwatersheds or project sites can be stated. Specific plans are governed by the general plan regulations and allow for planning on a subwatershed level. They can be implemented using open space, dedications, and impact fees. Their acceptance is generally quite high, and can be initiated by either the local municipality or a group of landowners (Glickfeld 1996). These often result in a development agreement and a vesting map. The property owners involved benefit from the economies of scale of shared planning costs.

Because specific plans must include necessary implementation measures such as regulations, programs, and finance measures, specific plans can define open-space protection and other land use goals. Also, specific plans can designate programs—such as TDRs, described below—and regulations to meet the goals (Pruetz 1993).

Specific plans can target the important issues of distinct portions of a municipality and better focus watershed planning strategies to fit local areas. Also, developers whose projects implement the mitigations in, and are consistent with specific plans may not need to undergo CEQA review, as the specific plan has already gained CEQA approval. If the project has additional impacts not addressed in the specific plan, it may require a separate focused EIR. Either way, the costs in time and money are reduced.

Case Study: City of Claremont. The City of Claremont is implementing an approved specific plan for its undeveloped hillside areas that it seeks to protect. The specific plan includes objectives to cluster development in the valleys while preserving the hillsides for open space. The city's general plan does not allow any additional subdivisions of the undeveloped hillsides (Pruetz 1993).

Case Study: City of San Jose's Evergreen Specific Plan. In late 1989, the San Jose City Council amended their general plan to create the Evergreen Planned Residential Community. The City Council required a specific plan be created before the 865-acre area was developed. In July 1991, a specific plan, which focused on a multidensity residential area (80 percent, 700 acres) that contained commercial and public support services and amenities, was adopted (City of San Jose 1991). The Evergreen Planned Residential Community lies within the Thompson Creek watershed.

The specific plan contains decisions made by the Evergreen Specific Plan Task Force on land use, circulation, public services, design standards, and phased developments. For open space and recreation, the plan focused on yards, pocket parks, trail systems and landscaped boulevards with bicycle lanes. Hillside areas incorporate narrower streets with no sidewalks. Commercial land was planned so as to maximize accessibility and minimize the need to travel by automobile. The plan encouraged:

- Planned development zoning whose design techniques include clustering and variable lot size or setbacks to maximize densities
- Construction techniques that work with the terrain

- The preservation of existing trees and other features
- Minimization of street grading
- Shared parking to reduce total parking areas needed

The plan also discouraged development on steep slopes (greater than 30 percent). Creek areas were planned to be maintained in a natural state and to allow for recreational use. The storm drainage plan called for low flows to divert to natural creeks before exiting to flood control facilities located underneath the area's planned water features. The water features also serve as stormwater detention basins (City of San Jose 1991). Although not included in the Evergreen Specific Plan, flood control/recreational Lake Cunningham provides flood protection for the area.

**Redevelopment Plans**. Redevelopment plans are a popular tool because the costly infrastructure is already in place, so development is less expensive. Meanwhile, the goals of redeveloping existing urban areas are generally supported by local officials, and the redevelopment process allows for quick response to proposed projects (Beatty et al. 1995). Since redevelopment plans undergo their own CEQA review process, including a Master EIR, redevelopment projects that are consistent with the general plan will see cost and time savings from a less intensive CEQA process.

Case Studies: Davis, Santa Rosa, Sacramento. Redevelopment plans are prevalent throughout California and can inject new vitality into city core areas, which can help relieve urban sprawl. Examples of redevelopment projects in California that have helped protect watersheds include:

- City of Davis, CA. The parking lot for a multiscreen movie theater was built atop the cinema, reducing the site's building footprint and, thus, the amount of impervious area needed.
- City of Santa Rosa, CA. A main street in town, Fourth Street, was narrowed to curb recreational driving (cruising); and semipermeable cobblestone crosswalks were added.
- Sacramento, CA. The Riverview plaza, a high-rise building, was constructed to provide high-density, affordable housing to senior citizens in the downtown area (Beatty et al. 1995).

**Planned-Unit Developments**. A PUD, also known as a cluster development, is a type of development and a zoning classification that can be used to allow many different types of land uses (residential, commercial, industrial) within the same zoning district (Curtin 1999a). Typically, a PUD is designed to include separately owned lots that share common areas such as recreation, open-space, or street improvements. Depending on the local ordinance allowing a PUD, either the approved general or precise development plan could be used for the zoning restrictions for the property, for which any significant changes could require a rezoning, or the plan could be adopted by a quasi-judicial permit process, which means it could not be amended by ordinance (Curtin 1999a).

California courts support PUDs (*Orinda Homeowners Comm. v. Board of Supervisors*, 11 Cal. App. 3d 768 (1970)) (Curtin 1999a).

<u>Case Study: Gurnee Village Hall (Illinois).</u> The Gurnee Village Board approved the annexation and planned unit development for a 68-acre site that includes a lake. On 30 percent of the site, 300 apartments will be constructed, along with recreation facilities. A wooded area will be protected, a berm and retention pond will offer stormwater treatment, and a land bank will be provided on part of the property for future parking, if needed (Gurnee Village Board 1996).

**Transfers of Development Rights**. To preserve open space, views, ridgelines, agricultural lands, and other resources, municipalities have begun using TDRs in general plans, specific plans, and/or zoning ordinances. Under these, future development rights are transferred from one property to another. The property that sent its future development rights to the other is legally restricted from development, while the receiving site can be developed with added floor area, units or parking spaces (Curtin 1999a). California statutory law has not yet addressed TDRs.

The U.S. Supreme Court upheld the use of TDRs to protect Grand Central Station in *Penn Central Transportation Company v. City of New York*, 438 U.S. 104 (1978) (Curtin 1999a). The Court held that the TDR was not considered a "taking." In *Suitum v. Tahoe Regional Planning Agency* (520, U.S. 725 (1997)), the Supreme Court determined that a TDR could form part or all of the compensation required for a taking and may help mitigate the loss from property restrictions that are not to the level of compensable taking (Curtin 1997). In *Barancik v. County of Marin*, 872 F. 2d 834 (9$^{th}$ Cir. 1988), the court decided that the TDR concept did not violate the nexus–taking law of *Nollan v. California Coastal Commission*, (483 U.S. 825 (1987)) (Curtin 1999a). However, the *Suitum* court found that when used as compensation, TDRs must be worth as much as the taken property's value (Curtin 1997).

According to Curtin (1999a), TDRs should be upheld "if applied in a manner that is not arbitrary, capricious, or unrelated to the public health, safety, and welfare." Curtin (1999a) suggests that municipalities using TDRs should create a program that first details specific goals and policies as a part of the general plan, and then places implementation measures in the zoning ordinance. These should include the land use categories for sending and receiving sites (Curtin 1999a).

<u>Case Study: Tahoe Regional Planning Agency.</u> The Tahoe Regional Planning Agency (TRPA) implements a TDR program to protect the Lake Tahoe watershed. One program allows for the transfer of the right to construct impervious areas, another allows the TDR from more sensitive to less sensitive areas. TRPA places annual building quotas, which creates a demand for TDRs. When an existing dwelling is on the sending site, it must be destroyed and the area restored to its natural state. If the sending site is undeveloped, a deed restriction or title transfer to a public

agency or nonprofit organization is enacted to prevent future development. The TRPA get 25 to 35 transfers per year (Pruetz 1993).

**Development Permit**. Development Permits can be used to place conditions on a project. The Subdivision Map Act gives municipalities the right to control the design and land use type of the project, and to attach conditions of approval based on findings made in the CEQA process. If the requirements to obtain the development permit are generally legislative, the municipality must show reasonable relationship between the project impacts and the requirements (*Ehrlich v. City of Culver City,* 12 Cal. 4th 854 (1996)) (Curtin 1999a). If the fees are ad hoc or more individualized in nature, then the municipality must meet the more strict tests of the *Nollan* and *Dolan* decisions. See the discussion of Dedications and Impact Fees, below, for more information.

<u>Case Study: City of Edmonton (Canada).</u> Private property development has led to overload of the City of Edmonton's combined sewer system due to the increase in stormwater runoff. Citing authority via the City's Sewers Bylaw—adopted, among other things, to ensure proper management of, and prevent illicit discharges and undesirable flows from, the sewage system—the city requires onsite stormwater management systems to control the amount of runoff from private properties. The program applies to private new and redevelopment projects except single-family and duplex residential. Under the guidelines, the maximum release rate is generally 0.03397 inch/acre. The storage facilities are generally sized for a 5-year design storm event with maximum pond depth less than or equal to 1 foot. A maximum orifice size is 2 inches and the minimum storm service pipe is 5.85 inches. The guidelines require storage and control in specific areas of the city for lots greater than or equal to 0.4 acre, and rezoned properties that result in increased runoff; and improvement on existing sites that are greater than 0.4 acre (City of Edmonton 1999). The City of Edmonton enforces the guidelines via fines if stormwater controls are removed, changed, or destroyed (City of Edmonton 1999).

<u>Case Study: County of Santa Clara.</u> Santa Clara County has zoning regulations that require applicants for development in certain hillside areas to determine minimum lot size requirements based on a slope-density calculation performed by a registered civil engineer or licensed land surveyor. The total number of dwelling units allowed within a subdivision is calculated "…by dividing the gross land area by the average land area per dwelling unit…" (Santa Clara County, nd). The slope density formulas are adjusted based on the availability of public utilities.

The County requires hillside zoning districts to have a minimum size of 160 acres for newly subdivided lots, except in the case of (1) a one-time split into two lots and (2) cluster subdivisions. For cluster subdivisions, the County has a chart that displays the maximum density allowed for residential sites, depending on the slope. The County requires that the minimum subdivision lot size not be less than 20 acres in a hillside zoning district. The minimum amount of acreage necessary increases with the slope. The County states that cluster development should include provision for at least 90 percent of the site to be left as open space, with binding restrictions on future development (Santa Clara County, undated).

**Dedications and Impact Fees**. Standard dedications or development fees can come from municipal zoning ordinances, subdivision ordinances, or use permit regulations such as building permits and/or certificates of occupancy. In the subdivision approval process, dedications and development fees may come from specific conditions in local ordinances created via the statutory authorization in the Subdivision Map Act; environmental mitigations via CEQA and through Government Code Section 66474(e), which states that maps that may cause substantial environmental damage must be denied; or conditions created through expanded "design" and "improvement" definitions in the Map Act and as required for general plan consistency (Curtin 1999a). Municipalities can also use general plans or applicable specific plans to support such fees and dedications not directly allowed under state law (*J.W. Jones Companies v. City of San Diego*, 157 Cal. App. 3d 745 (1984)) (Curtin 1999a). Municipalities can amend their general plans to adopt goals and policies that are related to the area they want funded by developer fees. If the fees are appropriately related to the burden that would be caused by the proposed development, then they are valid (*Dolan v. City of Tigard*, 512 U.S. 374 (1994)) (Curtin 1999a).

Determining the degree to which a city can impose dedications or impact fees without causing a taking of property value causes legal controversy. The theory is that a subdivider will agree to donate a certain portion of land or money to the municipality. The dedication or fee would be used to provide the services needed by the new residents, in return for obtaining the subdivision map needed to ultimately develop the property (Curtin 1999a). The municipality must have proper nexus and findings for the conditions to be reasonable and to avoid a taking (Curtin 1999a).

The definitions of design and improvement have been expanded to include general and specific plan consistency, by evaluating the subdivision as a whole (1971 Cal. Stat. Ch. 1446, "McCarthy, The Consistency Legislation") (Curtin 1999a). Because of the tie-in with the general plan, the municipalities can condition developments by requiring dedications and fees to support more than just streets and parks. Municipalities can require fees or land dedications for improvements required by the general plan so that the map will be consistent with the general plan (Government Code Section 66474). *Nollan v. California Coastal Commission*, 483 U.S. 825 (1987) and *Dolan v. City of Tigard*, 512 U.S. 374 (1994) required a legal nexus, so the extent of a municipality's actions must be proportional to the subdivision's size, and the burden the subdivision creates on the community. Additionally, the municipality must document the findings establishing the nexus.

<u>Case Study: Ehrlich.</u> In *Ehrlich v. City of Culver City*, the California Supreme Court upheld the right of municipalities to require mitigation fees from developers for changes in land use designations. It also held that the more intensive *Nollan-Dolan* tests do not apply to development fees or other generally applied legislative acts (McCutchen et al. 1996b). In *Nollan v. California Coastal Commission,* the U.S. Supreme Court found that there must be a connection, "an essential nexus," between the legitimate government interest and the development condition of approval. The U.S. Supreme Court found in *Dolan v. City of Tigard* that the government must prove a "rough proportionality" between the condition of approval and the impact of the proposed project. The California Supreme Court found that the *Nollan* and

*Dolan* tests might apply to ad hoc fees such as individualized monetary exactions and dedications, in which conditions for individual projects are discretionary. However, for generally applied legislative acts, municipalities need only be reviewed by the test of "reasonable relationship" (McCutchen et al. 1996b). In *Ehrlich*, the court also found that a municipality could require fees for a change in land use designation.

**Local Land Trust**. Local land trusts are becoming a more popular tool to help implement watershed management strategies. Local land trusts each have a Board of Directors who are involved in land use and environmental planning. The Board of Directors is comprised of local community members who are cooperative and know local politics, and can gain the trust of all stakeholders to form a voluntary cooperation of land owners. Local land trusts are involved with land acquisition (feasibility/gift/purchase), local stewardship (monitoring and management), and land restoration (mitigation measures and independent projects) activities (Belknap 1996).

Case Study: Baywood/Los Osos Greenbelt and Conservation Plan. The Baywood/Los Osos Greenbelt and Conservation Plan was created for more than 1,000 acres to protect the Morro Bay Kangaroo Rat, rare plants, and other sensitive species. No money was available to purchase the land. A land trust was created to work with regulators and private owners to create a step implementation plan for long-term management of the open space. The first step was a conservation agreement and Safe Harbor program. The second was a permanent conservation easement and a final development plan (Belknap 1996).

**Purchase of Development Rights (also known as Conservation Easements)**. A voluntary program, purchase of development rights (PDR) programs usually entail a land trust or other agency that may be linked to the local municipality. The land trust offers to purchase the development rights to a property from the property owner. Property owners can reject or negotiate the offer. Upon agreeing, a legally binding permanent deed restriction is placed on the property restricting the type of land use activities (Daubenmire and Bline 1998).

Case Study: Town of Dunn. The Town of Dunn, Wisconsin, created an ordinance for their Rural Preservation Program and Land Trust Commission Ordinance (Town of Dunn 1997). The Town implemented the voluntary conservation easement program to protect farmland and open space, including buffer zones around sensitive areas. The Town of Dunn Land Trust Commission was created by the ordinance to create and implement the Rural Preservation Program. The Commission accepts applications year-round and reviews and ranks them every October. The ordinance authorizes the Board of Supervisors to acquire conservation easements or to pay nonprofit conservation organizations to preserve the properties.

**Conservation Credits**. These programs trade conservation credits rather than development credits. They provide a good incentive to protect the most critical areas and allow the property owners to choose whether to pay credits and develop the land, or preserve the land and receive interchangeable credits that they can easily trade elsewhere (Glickfeld 1996). While this type of program avoids parcel-specific disputes, having several property owners in the planning area is beneficial in terms of cost efficiency for transaction costs. Tradable conservation credits can be

supported in general and specific plans, and the municipality's rights under zoning regulations and the Map Act to control land use type and building design could provide the necessary regulatory power to set up such a program.
Case Study: Ormond Beach Consensus Plan. Community groups in Oxnard, California, concerned that a 4,000-home development might harm a sensitive wetland and a freshwater lagoon area at Ormond Beach, formed a coalition and produced a "Consensus Plan" composed of a blueprint for 1,404 acres, and designating conservation credits. The coalition included the California Coastal Conservancy, CDFG, California Coastal Commission, USFWS, ACOE, Ventura County Flood Control District, property owners, businesses, the City of Oxnard, Ormond Beach Observers, League for Coastal Protection, Oxnard Beautiful, and a facilitator (California Biodiversity Council 1997). The land area in the consensus plan is mostly privately owned by developers, or for agricultural and industrial uses. The plan includes one area adjacent to the beach for "conservation credits," where a developer could sell or trade credits to develop elsewhere. The City of Oxnard is reviewing the plan as an alternative to the 4,000-home development proposal, but the plan still needs a funding mechanism if accepted (California Biodiversity Council 1997).

**Mitigation Banking**. Mitigation banking is a tool used when habitat losses due to development cannot be avoided. In this case, habitats are located and replaced elsewhere, generally at a ratio higher than one to one. Mitigation banking is a highly acceptable form of conservation strategy in general, and statewide transportation agencies support mitigation banking (see case study, below). However, mitigation banking requires a lot of money to obtain, restore, and maintain a land mitigation bank, and mitigation banks have high administrative and legal complexities (Glickfeld 1996). Furthermore, when conducted in a piecemeal manner, mitigation banking can lead to habitat fragmentation and small, disconnected islands of protected areas. The use of contaminated sites to serve as restoration sites can also be problematic (Valiela 1999). Development permit requirements and conditions of approval could be used to support mitigation banks. Smaller property owners could purchase mitigation from an existing offsite bank.

Case Study: CalTrans. The California Department of Transportation (CalTrans) considers mitigation banking to be the most effective and efficient tool to mitigate environmental damage from their projects (CalTrans 1997). With the Department of Interior coordinating the effort, funding and/or contributions from the San Diego Association of Governments, CalTrans, Otay Water District, the County of San Diego, the Conservation Fund, and U.S. Fish and Wildlife Services, CalTrans initiated the purchase of roughly 1,900 acres of Rancho San Diego for $8.2 million (CalTrans 1997). The sites will be used as a mitigation bank for biological resources, including coastal sage scrub, California gnatcatcher, Least Bell's vireo, wetlands/riparian areas, and oak woodlands.

**Habitat Conservation Plans/Natural Community Conservation Planning**. HCPs, which allow for the incidental taking of listed species under the federal ESA, are available to property owners or anyone with regulatory control over the property that is covered by an HCP. Several California municipalities are creating HCPs, along with implementing the Natural Communities

Conservation Planning Act (McCutchen et al. 1996a). HCPs address a more encompassing level of protection than plans and approvals that are made on a project-by-project level. HCPs include habitat preserve areas, and then allow development in other areas, even if additional or other sensitive species may be impacted. This "no surprises" policy ensures property owners that no extra land dedication, land use restrictions, or monetary support will be necessary for lawful development activities under the properly working HCP (See 50 of Code of Federal Regulations Section 17.22(b)(5)) (Curtin 1999a). Thus, the plans allow for incidental takes, but incorporate long-term (30 to 50 years) mitigation measure implementation and can protect nonlisted species as well. A legally binding implementing agreement is signed once a plan has been developed, and specific tasks have been agreed upon. With this agreement, agencies cannot ask for additional mitigation efforts in future years (McCutchen et al. 1996a).

<u>Case Study: South Coast Sage NCCP Region Programs.</u> The Southern Coastal Sage Scrub Region of the California Resources Agency's and the CDFG's NCCP program is implementing several subregional multispecies protection plans. The NCCP uses an ecosystem approach to plan for protection of plants, animals, and habitats while allowing compatible economic development. Approved in 1996, the San Diego Multiple Species Conservation Program (MSCP) preserves 172,000 acres of the 582,000-acre planning area in southwestern San Diego County. Covering 85 plant and animal species, the MSCP subregional plan includes eleven smaller planning areas, which are developing subarea plans. In the northwestern portion of San Diego County, the County, state agencies, and several private and public partners are developing a subregional plan called the San Diego Multiple Habitat Conservation Program (MHCP). As part of the MHCP, each of the six cities in that subregion is creating subarea plans to define the planning area, design open space and reserves, assess habitat lands, and in some cases acquire conservation land. Also located in the Southern Coastal Sage Scrub NCCP Region, Western Riverside County, Orange County, and San Bernardino County are developing similar habitat and species conservation plans (California Resources Agency 1998).

## Geographic Scale

Four geographic scales can be considered—ecosystem, watershed, subwatershed, or parcel. In analyzing potential impacts from urbanization, the parcel-by-parcel basis has most often been used. This level of analysis has been found lacking in that it does not adequately take into account cumulative or growth-inducing effects. For more effective planning, preparation of an overall watershed assessment and management plan for each watershed is recommended. These plans should then be implemented on a subwatershed basis using specific and redevelopment plans. In addition to allowing a more accurate accounting of cumulative effects, planning at this scale can help streamline the permit and regulatory process for individual parcel development.

Depending on the type and location of natural resources in the area, ecosystem management may also be a useful strategy in some situations and locations. Ecosystem management can be integrated into watershed management plans, but the coordination efforts may be more intensive as ecosystem boundaries often extend beyond watershed boundaries and involve more stakeholders. For most planning situations, the recommended strategy is a combination of watershed-level overviews (which can take into account ecosystem management goals) and planning policies, which incorporate well into the general plan. Additionally, incorporating subwatershed-level planning using specific and redevelopment plans, as appropriate, to detail watershed planning goals in specific areas is recommended.

## Watershed Management Objectives

**Watershed-Wide Planning**. One objective in watershed planning is to manage urbanized and urbanizing watersheds using watershed-wide planning to avoid creating or exacerbating imperviousness and changes to drainage patterns (see Table 6-3).

To meet this objective, municipalities can include overall policies, implementation measures, and performance criteria in their general plans and specific plans. Because the Subdivision Map Act, zoning regulations, and redevelopment plans must be consistent with general and specific plans, incorporating watershed-wide principles in these oversight plans will give the municipality needed powers to implement the objective. Specific Plans can be used to outline watershed-related planning and mitigation measures for specific areas at the subwatershed level. Municipalities may also provide comment on general plans outside and adjacent to their boundaries, but that fall within the same watershed.

To avoid creating and exacerbating imperviousness and changes to drainage patterns, municipalities can define thresholds of significance for these impacts, dependent on the sensitivity of specific areas. The thresholds could be used to help define substantial or significant impacts for the CEQA process and for Government Code Section 66474(e), which denies map approval if the subdivision may cause substantial environmental damage. Master or tiered EIRs can be developed to better identify cumulative impacts of developments at a watershed or subwatershed level.

Using powers under the Subdivision Map Act, municipalities can control the street grade and other design and improvement issues to avoid detrimental changes to drainage patterns and to implement imperviousness-reduction measures. As with general plan comments, municipalities can comment on Map Act proposals outside of their territorial boundaries.

The watershed plan should also take into consideration regional housing needs. As part of general plan regulations, the Council of Governments (COG)[9] determines each community's share of the regional housing needs (Government Code Section 65584) (Curtin 1999a). Under this code section, the COG can transfer a share of a municipality's regional housing needs to another jurisdiction if they are within 10 miles of one another, in the same COG, and the same "housing market." For the transfer to occur, the jurisdiction that will be transferring housing shares must first meet 15 percent or more of its regional share, and both jurisdictions must find that the transfer will result in lower-cost housing. This ability to transfer could help or hinder municipalities in planning developments to best preserve and enhance overall watershed quality.

[9] Or the Department of Housing and Community Development in areas with no COG.

**Different Habitat Goals within the Same Watershed**. Another strategy in watershed planning is to determine where to place migration corridors in more developed reaches of the watershed, and where to maintain natural areas for water quality protection and wildlife habitat. This strategy involves providing and protecting continuous riparian buffer corridors along streams, buffers around wetlands, and large, connected areas of tidal marsh habitat (see Table 6-3).

General plan/specific plan regulations can be used to determine the placement of migration corridors and sensitive habitats. Zoning regulations could include sensitive area designations. In redevelopment areas, stricter regulations can be incorporated. Watershed management plans can include mitigation measures that could be used during the CEQA process, and required as conditions of approval under the Subdivision Map Act regulations. Thresholds of significance in these areas can be defined and mitigation measures from the watershed management plan can be incorporated into project plans.

Until January 1, 2003, landowners may sell property for offsite mitigation under Map Act regulations (Curtin 1999a). The Map Act also gives municipalities the ability to impose dedication and development fees and conditions through the "design and improvement" definitions to comply with the general and specific plans.

Specific areas of the watershed could be zoned as PUDs that allow mixed use and cluster development, and can include zoning restrictions. Zoning ordinances can also play a role in implementing TDRs and other similar tools. Municipalities could also enact ordinances for local wetland protection.

Planning for mitigation corridors, TDRs, and housing developments should involve coordination with transportation planning and the Congestion Management Program (Proposition 111, adopted in 1990).

**Policies for Remodeling and Expansion of Houses and Buildings**. A third objective of watershed planning is to include policies for the remodeling and expansion of homes and other buildings near sensitive areas (see Table 6-3). Zoning regulations are useful for implementing this objective, as they can control the type and design of buildings. Zoning regulations must be reasonably related to public welfare, consistent with the general and specific plans, consider CEQA[10], and consider the impacts on the municipality and surrounding regions. Therefore, if policies to reduce imperviousness are included in the oversight plans, then zoning regulations would need to address design issues near sensitive areas. Conditions of approval can be placed on building permits.

**Acquiring "Sensitive" Watershed Lands**. Outright acquisition of sensitive areas is another strategy to protect watershed features (see Table 6-3). Municipalities can work together with land trust and nonprofit groups to purchase outright properties. Alternatively, the municipality

[10] The majority of remodeling and expansion projects would, however, be exempt from the CEQA process.

can adopt an ordinance to preserve the sensitive areas by setting up a method through a land trust to allow for PDR. Some properties may be purchased through eminent domain if the area is critical. PDR programs could be developed via an ordinance and used to establish legally binding conservation easements to protect the lands in perpetuity. Sensitive areas could also be designated and acquired as part of a redevelopment plan.

**Restoration through Redevelopment**. Redevelopment plans can include measures that will help restore watersheds in urbanized areas (see Table 6-3). Municipalities can enact ordinances creating redevelopment agencies to begin the redevelopment process. Redevelopment plans must be consistent with the general plan, as per Health and Safety Code Section 33331; however, the California Community Redevelopment Law is superior to local building and zoning ordinances that may conflict with it (Curtin 1999a). Redevelopment projects are enticing to developers because costly infrastructure is already in place. The CEQA process can assist with incorporation of watershed planning measures in the redevelopment plan. A type of Master EIR called a Redevelopment EIR can be used to analyze the project as a whole. If policies and implementation measures to help restore watersheds are included in the general plan, then the redevelopment plan must be created to be consistent with these objectives.

**Restoration of Creeks and Floodplains**. Future development projects could be integrated with plans for creek and floodplain restoration (see Table 6-3). Creek and floodplain restoration policies, implementation measures, and performance criteria should be included in the general plan and specific plans. Through the Subdivision Map Act and using the findings from CEQA, mitigation measures can be incorporated as conditions of approval. Zoning regulations can zone for creek and floodplain restoration areas. Redevelopment plans can include offsite improvements and must be consistent with general and specific plans.

Dedications and impact fees can be used to protect sensitive areas such as riparian corridors. Dedications and impact fees can come from specific conditions in the local ordinance via the statutory authorization of the Subdivision Map Act; as mitigation measures resulting from the CEQA process; via Government Code Section 66474(e), which prevents the approval of maps that may cause substantial environmental damage; and conditions created through the expanded "design" and "improvement" definitions in the Map Act, based on the need to maintain consistency with the general plan.

**Growth Management**. If developing a growth management plan is one part of a municipality's desired watershed management strategy, the general plan is the best place to house it (see Table 6-3). If growth management measures are included in the general plan, they will likely be more effective and may be more protected from legal challenges than if the growth management plan was housed elsewhere. To be included in the general plan, the growth regulations should be shown to promote the community's general welfare (*Long Beach Equities, Inc.. v. County of Ventura*, 231 Cal. app. 3d 1016 (1991)) (Curtin 1999a). Policies and information in the general plan, including population forecasts, can be used to support growth management objectives. Another reason to incorporate growth management in general plans is that the general plan is a forum in which to balance competing interests, and requires consistency among elements.

### 6.7.2 Basinwide Planning (County General Plans)

The California Planning, Zoning, and Development Law (Government Code Section 65030 et seq.) mandates that counties and general law cities prepare a general plan. These plans must include seven basic elements, including land use, circulation, housing, conservation, open space, noise, and safety. The land use element addresses standards for population density, building density, and distribution of land uses. The circulation element addresses major transportation improvements. The housing element assesses the need for housing for all income groups, and establishes a program to meet those needs. The conservation element deals with natural resource issues. The open-space element provides a plan for long-term conservation of open space. The noise element identifies potential noise problems and measures for noise abatement. The safety element identifies seismic, other geologic, flood, and wildfire hazards, along with policies to protect the community from these hazards. In addition to the requirement that general plans be consistent with zoning ordinances, the general plan elements must be consistent among the elements.

### 6.7.3 Local Planning Policies

In addition to general plans, local planning policies include zoning ordinances and subdivision maps. Zoning ordinances (authorized by Government Code Section 65850 et seq.) are designed to translate the general plan's broad statements of policy into specific requirements for individual parcels of land. The Subdivision Map Act (Government Code Section 66410 et seq.) establishes a procedure that local governments must use when considering subdividing land into more than four separate parcels.

### 6.7.4 Implementing Agencies

The Association of Bay Area Governments (ABAG) was created by the Legislature in 1961 to protect local control, plan for the future, and promote cooperation on areawide issues (ABAG 1998). ABAG develops comprehensive planning programs in cooperative ventures with the Metropolitan Transportation Commission (MTC) and the Bay Area Air Quality Management District (BAAQMD). ABAG provides a forum to resolve local differences and encourage citizen involvement in planning and policy decisions.

LAFCOs and local municipalities have responsibility for implementing general plans that comply with CEQA. CEQA is implemented by the public agency whose project is subject to the CEQA requirements. In addition, two state agencies, the Governor's Office of Planning and Research and the California Resources Agency, are responsible for CEQA administration and oversight.

## 6.8 Regulation of Transportation

Programs associated with transportation planning are discussed below.

### 6.8.1 Laws and Regulations

The Federal Transportation Equity Act for the 21st Century (TEA-21) was adopted in 1998 and authorizes highway safety, transit, and other surface transportation programs (U.S. Department of Transportation 1998). TEA-21 is an extension of the Intermodal Surface Transportation Efficiency Act of 1991, which was the previous authorizing legislation for surface transportation. The focus of TEA-21 is to improve safety, protect and enhance communities and the environment, and advance economic growth through efficient and flexible transportation. Elements of TEA-21 dealing with environmental issues focus primarily on air pollution. Two such elements are the Congestion Mitigation and Air Quality Improvement Program, and support of ozone and particulate matter standards. Under the Congestion Mitigation and Air Quality Improvement Program, TEA-21 provides a funding source to state and local governments for transportation projects and programs to help meet the requirements of the Clean Air Act. Some eligible activities include transit improvements, travel demand management strategies, traffic flow improvements, and public fleet conversion to cleaner fuels. In addition, TEA-21 ensures the establishment of a monitoring network for fine particle evaluation.

### 6.8.2 Implementing Agencies

In the Bay Area, TEA-21 is carried out by the MTC. The MTC is the transportation planning, coordinating and financing agency for the nine-county San Francisco Bay Area (MTC 1999). Created by the California Legislature in 1970, MTC functions as both the regional transportation planning agency, and for federal purposes, as the region's metropolitan planning organization (MPO). As such, it is responsible for the Regional Transportation Plan (RTP), a comprehensive blueprint for the development of mass transit, highway, airport, seaport, railroad, bicycle, and pedestrian facilities. The Commission also screens requests from local agencies for state and federal grants for transportation projects to determine their compatibility with the plan. In addition to the RTP, MTC is coordinating a regional effort to integrate various strategies to address transportation needs, called the Bay Area Transportation Blueprint for the 21st Century. This planning effort is being conducted in cooperation with ABAG and the region’s major transportation and environmental agencies.

## 6.9 Regulation of Vector Control (Mosquito Abatement)

Programs associated with vector control are discussed below.

### 6.9.1 Laws and Regulations

California Public Health Codes include statutes addressing vector control. The statutes provide local districts wide latitude in determining the level of threat posed and the extent of abatement necessary. These local districts are governed by a Board of Directors, which delegates abatement powers to a District Manager, who through District staff, monitors mosquito populations and determines whether or not a threat to public health exists. If mosquito population levels are determined to constitute a potential threat to local health and comfort, the District Manager may issue an "abatement order," and take measures to remove any known mosquito production sources or apply pesticides to kill the mosquitoes. These abatement rights extend to both public and private property within the district's boundaries. It is generally the District Manager and his/her staff who determine whether or not a threat to public health actually exists. Thus, the degree of enforcement is often left to local discretion, and can vary widely between districts.

Laws regulating these local agencies are found in the Health and Safety Code. These statutes provide wide latitude for local discretion in abatement matters. For instance, no numerical mosquito population level exists at which abatement must take place. Rather, district personnel need only find "evidence of the presence of mosquitoes" to issue an abatement order. Most districts take a proactive role in identifying potential public nuisances, electing to educate property owners on mosquito source control rather than litigating against them, and abating sources before problems arise. Property owners are liable for the costs of any abatement procedures taking place on their property. Monitoring and abatement in areas not incorporated within a special district is usually undertaken by the California Department of Health Services, but this generally occurs only in sparsely populated regions.

### 6.9.2 Implementing Agencies

Mosquito monitoring and abatement in California is generally undertaken at the local level, with oversight from the California Department of Health Services. The agencies performing these duties are usually in the form of "special districts," which generally arise from joint powers agreements between cities. Local districts in the Santa Clara Basin are the Santa Clara County Vector Control District, the Alameda County Mosquito Abatement District, and the San Mateo County Mosquito Abatement District. In addition to mosquito abatement, Santa Clara County Vector Control also has established programs targeting other pests, including rodents, cockroaches, head lice, wasps, and wildlife (e.g., raccoons, opossum, skunks, etc.).

## 6.10 Regulation of Pesticides

Programs associated with the regulation of pesticides are described below.

### 6.10.1 Laws and Regulations

The regulations addressing pesticide use in California are the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA), the Food Quality Protection Act (FQPA), and the California Food and Agricultural Code as described below.

#### *6.10.1.1 Federal Regulation of Pesticides*

FIFRA requires that pesticide products be registered federally before distribution or sale to any person. Registration includes submission of required data by the person seeking registration, evaluation and acceptance of these data by EPA, submission of a proposed label by the registrant, review and acceptance of the final labeling by EPA, establishment of a tolerance (maximum residue level) for pesticides used on food or feed commodities, and the classification by EPA of the pesticide product for restricted use or general use as appropriate.

Once a pesticide product is registered federally, FIFRA Section 24(a) authorizes a state to regulate the sale or use of pesticides with the restriction that any sale or use prohibited federally is not permitted by the state. Section 24(b) requires uniformity of pesticide labeling and restricts a state from requiring changes to the federally accepted pesticide label. A state may register a federally registered pesticide product for additional uses to meet a special local need within the state in accord with FIFRA Section 24(c). The California Department of Pesticide Regulation (DPR) has primary enforcement responsibility for pesticide use violations in California.

FIFRA Section 11(2) authorizes states to certify applicators of federally restricted use pesticides if states submit a plan for EPA approval. DPR has submitted a plan and is authorized by EPA to certify applicators.

The FQPA of 1996 amended the FIFRA and the Federal Food, Drug, and Cosmetic Act (FFDCA). The FQPA has fundamentally changed the approach risk assessment and management of the regulation of pesticides. The requirements included a new safety standard – reasonable certainty of no harm – that must be applied to all pesticides used on foods. The 1996 law amended both major pesticide laws, FIFRA and FFDCA, to establish a more consistent, protective regulatory scheme, grounded in sound science. It mandates a single, health-based standard for all pesticides in all foods; provides special protection for infants and children; expedites approval of safer pesticides; creates incentives for the development and maintenance of effective crop protection tools for American farmers; and requires periodic reevaluation of pesticide registrations and tolerances to ensure that the scientific data supporting pesticide registrations will remain up to date in the future.

#### *6.10.1.2 California Regulation of Pesticides*

Under the Food and Agriculture Code, California has an extensive pesticide program that enables DPR to evaluate and register pesticide products before their use in the state, monitor sales within the state, and regulate and record their use.

In 1985, California enacted the Pesticide Contamination Prevention Act (PCPA) (Food and Agricultural Code Division 7, Chapter 2, Article 15). The purpose of PCPA is to prevent further pesticide pollution of groundwater from legal agricultural use of currently registered pesticides. The PCPA requires DPR to identify the active ingredients in pesticides with the potential to pollute groundwater by leaching based on their chemical and physical properties and uses. These chemicals are placed on the Groundwater Protection List and are monitored by DPR in groundwater. When a pesticide is found in groundwater or in soil under certain conditions as a result of legal agricultural use, DPR may review and modify its use. For this purpose, DPR collects environmental fate data for pesticides used in agriculture, and uses the data to identify pesticides with potential to pollute groundwater. DPR also maintains a database of wells sampled in the state for pesticides.

California law requires DPR to thoroughly evaluate and register pesticides before they are sold or used in California. During the evaluation and registration process, DPR evaluates potential water quality problems associated with uses of pesticides, including use on sites where pesticides are likely to move with runoff from irrigated agricultural fields into surface waterways. DPR gives special attention to the potential for toxicity to the aquatic biota and to factors that may interfere with attaining water quality objectives. If DPR determines that such uses will likely result in significant adverse impacts that cannot be avoided or adequately mitigated, registration is not granted unless the Director indicates otherwise, as provided in California Code of Regulations Section 6158.

### 6.10.2 Department of Pesticide Regulation/State Water Resources Control Board Management Agency Agreement

The agency with primary responsibility for these programs is the DPR. In 1997, the State Board and DPR entered into a Management Agency Agreement (MAA) to work together to protect water quality from the potential adverse effects of pesticides (Cal-EPA 1997). Pesticides have been found to be a significant contributor to water pollution through both agricultural and urban runoff. The California Pesticide Management Plan for Water Quality outlines how the agencies will work under the MAA to protect water quality from the use of pesticides. The Plan is part of an effort to make state programs addressing pesticides and water quality, and their overlapping as well as sometimes conflicting authorities, better serve the goal of addressing water quality problems and their resultant impacts on the aquatic environment and human health. The Plan contains provisions for outreach programs, compliance with water quality standards, groundwater and surface water protection programs, self-regulatory and regulatory compliance, interagency communication, and dispute and conflict resolution.

DPR and the State Board have adopted a four-stage approach to minimize the potential for pesticide movement to groundwater and surface waters. This approach is consistent with the State Board's Nonpoint Source Management Plan approach. In Stage 1, prevention of pesticide contamination of groundwater and surface water is promoted through educational outreach. Stage 2 is initiated following detection of pesticides that require response. This stage relies on self-regulating or cooperative efforts to identify and implement the most appropriate site-specific, reduced-risk practices. Stages 1 or 2 may include label changes and implementation of registrant stewardship programs that address water quality issues on a statewide or regional basis. If adequate protection cannot be achieved by Stage 2, DPR and the Commissioners implement Stage 3. In this stage, reduced-risk practices will be implemented by restricted material use permit requirements, regulations, and other regulatory authority used by DPR and the Commissioners. If Stage 4 is necessary, the State and Regional Boards will use water quality control planning programs or other appropriate regulatory measures to protect water quality. These four stages will be implemented, not necessarily in sequential order, as necessary to protect water quality. The MAA does not preclude the Regional Board from taking any listing or enforcement action related to water quality violations, nor the DPR from continuing to permit the use of a pesticide that has been found in listed waterbodies.

## 6.11 Regulation of Air Quality

Pollutants can enter watersheds through routes other than direct sources of water contamination. In particular, deposition from the air is one source of several pollutants, including dioxins, pesticides and some heavy metals. Emissions from motor vehicles enter the air first, but may enter water ultimately through rainfall or dry deposition; therefore, efforts to control air quality may have a direct impact on water quality. Programs addressing air quality are described below.

### 6.11.1 Laws and Regulations

At the federal level, air quality is regulated by the EPA under the Clean Air Act (42 USC Section 7401 et seq.). The Clean Air Act requires the adoption of national primary and secondary air quality standards, state implementation plans to meet these standards, programs to prevent the significant deterioration of air quality, and programs for areas that are not attaining standards. The Clean Air Act and local implementation plans do not directly address air impacts on water quality.

### 6.11.2 Implementing Agencies

The California Air Resources Board (CARB) is the state agency charged with implementing the Clean Air Act in California, coordinating efforts to attain and maintain air quality standards, supervising the statewide regulatory scheme for toxic air pollutants, regulating motor vehicle emissions, and conducting air pollution source research. The CARB is responsible for setting air quality and emission standards.

In 1947, the California Legislature authorized the establishment of APCDs. The Health and Safety Code currently provides for four types of APCDs: (1) countywide APCDs having geographic boundaries within a single county, (2) unified APCDs comprising several adjoining counties, (3) regional APCDs, similar in structure to unified APCDs but with representatives from cities within the region on the governing board, and (4) AQMDs. Air quality in the San Francisco Bay Area is regulated by the BAAQMD, which comprises all or part of nine counties in the area.

The BAAQMD is responsible for enforcing standards and regulating individual sources. Staff is divided into two main divisions: one for enforcement and one for engineering and permitting. Other staff divisions are responsible for rule making, planning, source testing, and air quality monitoring and forecasting.

The CARB and BAAQMD have been cooperating with the San Francisco Estuary Institute and the Bay Area Stormwater Management Agencies Association on air deposition pilot projects since 1999.

## 6.12 Regulation of Local Agency Formation

LAFCOs have a pivotal role in approving general plans and general plan amendments as described below.

### 6.12.1 Laws and Regulations

Although LAFCOs have no direct land use planning or regulatory authority, they do determine the limits of where urban expansion may occur, and the provision of urban services. Because the change of land use from rural to urban may affect the amount and types of pollutants that reach the Estuary, LAFCOs have an important land use management role in determining what kinds of pollutants are carried to the Estuary. Their responsibilities include controlling, via approval or disapproval, annexation (the act of adding territory to an existing municipality), and incorporation (the act of creating a new city) (Government Code Section 56000 et. seq.) (Governor’s Office of Planning and Research 1990; California Association of LAFCOs 1999). LAFCOs also have the responsibility to prepare an SOI for each city and special district in the county, and to conduct special studies on how to improve municipal services and reduce costs. The LAFCO delineates and adopts a line around each city or special district in the county, which is deemed to be that entity’s SOI. An annexation to a city or special district can occur if it is proposed within the entity’s SOI. LAFCOs were developed to control premature and unplanned development and to ensure that public services are provided in an efficient and cost-effective manner (California Association of LAFCOs 1999). LAFCOs must consider the effects that proposals will have on existing agricultural lands, and they discourage urban sprawl (California Association of LAFCOs 1999).

### 6.12.2 Implementing Agencies

Generally comprised of two county supervisors, two city council representatives, and one member of the public, LAFCOs have been established in each county of the state except San Francisco County. Twelve LAFCOs are in the San Francisco Estuary (SFEP 1992). The LAFCOs in the Santa Clara Basin are the Alameda, San Mateo, and Santa Clara LAFCOs. LAFCOs are influential in determining land use changes and urban growth patterns.

## 6.13 Flood Management and Control

Maintenance of local streams and other waterbodies necessary for flood control may have direct impacts on wildlife and aquatic habitats in the watershed. Some specific programs and regulations pertaining to flood management are discussed below.

### 6.13.1 Laws and Regulations

The Water District undertakes a wide variety of flood protection projects in Santa Clara County. Projects are based on several factors, including how much right-of-way is available, cost, community concerns, environmental factors, and other issues. Typical solutions to flood hazards include floodplain zoning, maintaining existing facilities, levee and floodwall construction, or structural work in channels with rock, gabions, concrete, earth-lining, or other material.

Water Code Division 5 has several provisions that address flood management and watershed protection. Some of these provisions are discussed below.

Water Code Section 8100 et. seq. contain provisions for the construction of works, improvements, levees or check dams to prevent overflow and flooding, the protection and reforestation of watersheds, the conservation of the floodwaters, and for the construction of projects outside the county if the rivers or streams affected flow in or through more than one county.

Water Code Section 12840 et. seq. contain provisions pertaining to watershed protection and flood prevention projects. Policies associated with watershed protection and flood prevention state that in order to protect the general health and welfare of the public, it is necessary to provide for the preservation and enhancement of the state's fish and wildlife resources in connection with flood control and watershed protection projects, and to realize the full potential of such projects to provide recreational opportunities to the general public. In addition, the policies state that fish and wildlife enhancement and recreational development should be among the purposes of all federal flood control and watershed protection projects.

### 6.13.2 Implementing Agencies

Agencies responsible for flood management include the Federal Emergency Management Agency (FEMA), the DWR, and local flood control districts (i.e., the Santa Clara Valley Water District). FEMA is the federal agency responsible for responding to natural disasters and emergencies, including flooding. FEMA's mission is to reduce loss of life and property and protect our nation's critical infrastructure from all types of hazards through a comprehensive, risk-based, emergency management program of mitigation, preparedness, response, and recovery. While DWR has statewide responsibility for flood control, flood management in California is primarily conducted by local flood control districts. The Water District has responsibility for flood control in Santa Clara County. San Francisquito Creek presents jurisdictional challenges because it contains portions of both Santa Clara and San Mateo Counties. To deal with this situation, the San Francisquito Creek Joint Powers Authority (JPA) has been created. The JPA is a coalition of local government agencies formed to plan and implement flood management and watershed protections plans in the San Francisquito Creek Watershed.

## 6.14 Summary

Table 6-4 lists legislation and permits associated with the regulatory topics discussed in this chapter.

Table 6-5 summarizes regulatory issues and federal, state, and regional agencies involved in addressing these issues. Table 6-6 lists contact information for agencies to use before initiating a project with environmental impacts in the Santa Clara Basin, or to gather information on local programs.

**Table 6-4**
**Summary of Laws, Regulations, and Permits**

| Topic | Regulations and Legislation | Associated Permits | Lead Agencies |
|---|---|---|---|
| Water Quality | Federal Clean Water Act<br>California Porter-Cologne Act | Waste Discharge Requirements<br>Industrial Pretreatment Permit<br>NPDES Municipal Stormwater Permit<br>NPDES Wastewater Permit | State Water Resources Control Board<br>Regional Water Quality Control Boards |
| Drinking Water Quality | Safe Drinking Water Act; California Safe Drinking Water Act; Title 22; Proposition 65 | Annual Water Quality Report<br>Consumer Confidence Report<br>Public Water Supply Permits | California Environmental Protection Agency, Department of Health Services |
| Water Rights | Appropriative rights process; riparian rights process; public trust doctrine | | California Department of Water Resources, State Water Resources Control Board, U.S. Bureau of Reclamation |
| Wetlands and Riparian zones | Clean Water Act | 404/401 permits | Regional Water Quality Control Boards, San Francisco Bay Conservation and Development Commission, U..S. Army Corps of Engineers |
| Endangered Species | Federal Endangered Species Act<br>California Fish and Game Code | Incidental take permits | U.S. Fish and Wildlife Service, California Department of Fish and Game, National Marine Fisheries Service |
| Fisheries | Magnuson Act<br>California Fish and Game Code | | U.S. Fish and Wildlife Service, California Department of Fish and Game, National Marine Fisheries Service |
| Land Use | California Environmental Quality Act;<br>local general plans, zoning ordinances;<br>California Planning, Zoning & Development Law | | California State Lands Commission, San Francisco Bay Conservation and Development Commission |
| Transportation | Federal Transportation Equity Act | | Metropolitan Transportation Commission |
| Vector Control | California Public Health Codes | | Santa Clara County Vector Control District, Alameda County Mosquito Abatement District, and San Mateo County Mosquito Abatement District |
| Pesticides | Federal Insecticide, Fungicide, and Rodenticide Act<br>California Pesticide Contamination Prevention Act<br>Food Quality Protection Act | Pesticide registration<br>Applicator certification | California Department of Pesticide Regulation |
| Air Quality | Federal Clean Air Act;<br>California Health and Safety Code | Point source permits | California Air Resources Board, Bay Area Air Quality Management District |
| Local Agency Formation | "Sphere of influence" determination | | Alameda, San Mateo, and Santa Clara Local Agency Formation Commissions |
| Flood Management and Control | Water Code Division 5 | | Federal Emergency Management Agency, California Department of Water Resources, Santa Clara Valley Water District |

## Table 6-5
## Regional, State, and Federal Agencies and Watershed Issues

| Agencies | Surface Water Quality | Ground-water Quality | Drink-ing Water | Water Rights | Air Quality | Wetland Fill | Dredg-ing | Fish and Wildlife | Agri-culture | Flood Control | Hazard-ous Materials | Land Use |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| *Regional* | | | | | | | | | | | | |
| Regional Water Quality Control Board | L | L | C | C | C | L | L | C | C | C | L | C |
| Bay Area Air Quality Management District | | | | | L | | | | | | | |
| San Francisco Bay Conservation and Development Commission | C | | | | | L | L | | | | | L |
| *State* | | | | | | | | | | | | |
| State Water Resources Control Board | L | C | C | L | | C | C | C | C | | L | |
| Department of Fish and Game | L | | | C | | C | C | L | | | | C |
| Air Resources Board | | | | | L | | | | | | | |
| State Lands Commission | | | | C | | L | L | | | | | L |
| Department of Toxic Substances Control | | L | | | | | | | | | L | C |
| Department of Health Services | C | C | L | | | | | | | | | C |
| Department of Water Resources | | | | L | | | | | | C | | |
| Department of Pesticide Regulation | | | | | | | | | L | | | |
| Integrated Waste Management Board | | C | | | | | | | | | | C |
| State Office of Historic Preservation | | | | | | C | | | | | | |
| *Federal* | | | | | | | | | | | | |
| Environmental Protection Agency | L | L | L | | L | C | C | | C | | L | |
| Army Corps of Engineers | | | | | | L | L | | | L | | |
| Bureau of Reclamation | | | | L | | | | | | C | | |
| Coast Guard | L | | | | | | | | | | | |
| Natural Resources Conservation Service | C | C | | | | | | | C | | | C |
| National Marine Fisheries Service | C | | | | | C | | L | | | | |
| Fish and Wildlife Service | C | | | | | C | | L | | | | |

L = Lead agency, with permitting, enforcement, or implementing authority
C = Commenting agency to the lead agency

**Table 6-6**
**Agency Contact Information**

| Agency | Phone Number | Web Site |
|---|---|---|
| Association of Bay Area Governments | (510) 464-7900 | www.abag.ca.gov |
| San Francisco Bay Regional Water Quality Control Board | (510) 622-2300 | www.swrcb.ca.gov/~rwqcb2/ |
| Metropolitan Transportation Commission | (510) 464-7700 | www.mtc.ca.gov |
| Palo Alto Regional Water Quality Control Plant | (650) 329-2295 | www.city.palo-alto.ca.us/environmental/ |
| San Jose/Santa Clara Water Pollution Control Plant | (408) 945-5300 | www.ci.san-jose.ca.us/esd/wpcp.htm |
| Sunnyvale Water Pollution Control Plant | (408) 730-7260 | www.ci.sunnyvale.ca.us/public-works/environ.htm |
| Santa Clara Valley Water District | (408) 265-2600 | www.scvwd.dst.ca.us |
| Bay Area Air Quality Management District | (415) 771-6000 | www.baaqmd.gov |
| San Francisco Bay Conservation and Development Commission | (415) 557-3686 | www.ceres.ca.gov/bcdc/ |
| Department of Toxic Substances Control | (510) 540-3919 | www.dtsc.ca.gov |
| Department of Fish and Game | (707) 944-5500 | www.dfg.ca.gov |
| Department of Health Services | (916) 445-0498 | www.dhs.cahwnet.gov/ps/ddwem/ |
| Integrated Waste Management Board | (916) 255-2296 | www.ciwmb.ca.gov |
| Department of Pesticide Regulation | (916) 445-4300 | www.cdpr.ca.gov |
| Department of Water Resources | (916) 653-5791 | www.dwr.water.ca.gov |
| U.S. Fish and Wildlife Service (Pacific Region) | (503) 231-6828 | www.pacific.fws.gov |
| National Marine Fisheries Service (Southwest Regional Office) | (562) 980-4000 | www.swr.ucsd.edu |
| California State Office of Historic Preservation | (916) 445-8006 | www.calhist.org |
| U.S. Environmental Protection Agency – Region IX | (415) 744-1500 | www.epa.gov/region09 |
| California State Lands Commission | (916) 574-1800 | www.slc.ca.gov/ |

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Volume One Unabridged

**Watershed Characteristics Report**

# Chapter 7
# Natural Setting

SANTA CLARA BASIN

WMI

WATERSHED MANAGEMENT INITIATIVE

**Prepared for the**
**Santa Clara Basin Watershed Management Initiative**

**by**

**Watershed Assessment Subgroup**

**August 2003**

# Watershed Characteristics Report
# Chapter 7: Natural Setting

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Santa Clara Valley Urban Runoff Pollution Prevention Program
Task SC 18.01

**August 2003**


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## ANADROMOUS FISH SUPPLEMENTARY INFORMATION

This Anadromous Fish Supplementary Information (April 2002) amends the Watershed Characteristics Report (February 2001). This Supplementary Information (1) replaces a statement on the implications of genetic testing for determining geographic origins of Chinook salmon with excerpts from two relevant scientific reports, (2) adds excerpts from documentary references and oral statements concerning the historical occurrence of Chinook salmon in Santa Clara streams, and (3) amends a table that summarizes occurrence of freshwater fish in local streams, by adding a clarifying footnote on the uncertainty of origins of chum salmon.

### Statement on Genetic Testing

The following statement, which appears in the Watershed Characteristics Report, (page 7-68 and pages 7-131 through 132), is hereby deleted due to disagreement between WMI members regarding the interpretation of current genetic testing information:

*"Although genetic testing suggests that some of these adult Chinook are of Central Valley hatchery origin, an unknown portion of the adult Chinook run may be from local wild production (Federal Register 1999; Neilsen 1995; Neilsen at al 1999)."*

Though WMI members agree that Chinook salmon are present in the Guadalupe River, they disagree whether the current population of Chinook salmon is a remnant of a historical wild run, a run populated by strays from Central Valley hatcheries, or a mixture of the two. There is also disagreement about the degree to which previously conducted genetic testing can be used together with other data to determine the origin of this population. WMI members hope that further research will help resolve these disagreements.

The deleted quote is replaced with excerpts below from: (1) "Salmon from the Sacramento-San Joaquin Basin and Guadalupe River 1992-1994", by Dr. Jennifer L. Nielsen, USDA Forest Service (1995), and (2) "Final Rule of National Marine Fisheries Service re: Endangered and Threatened Species; Threatened Status for Two Chinook Salmon Evolutionarily Significant Units (ESUs) in California," 64 Federal Register 50,393 (Sept 16, 1999). These excerpts do not interpret these documents or state a position on any findings made therein.

**Excerpts from: "Salmon from the Sacramento-San Joaquin Basin and Guadalupe River 1992-1994", by Dr. Jennifer L. Nielsen, USDA Forest Service (1995)**:

"Fin tissue was collected by the California Department of Fish and Game (CDFG) and amplified for mtDNA from 455 chinook from 8 rivers and 5 hatchery stocks of the Sacramento-San Joaquin basin in Central Valley, CA (1992-94) and from 29 spawning chinook (1994) collected from the Guadalupe River, a southern tributary of San Francisco Bay." (page 2)

"Chinook from the Guadalupe River drainage that were collected by CDFG showed distinct haplotypes, not found in any Central Valley population (wild or hatchery). These unique genotypes appear to be distributed throughout the spawning run and not temporally distributed into the early or late spawning population on the Guadalupe River. The genetic origins of these fish remain unknown, but they are definitively not hatchery strays based on the evidence available from the hatchery collections we have analyzed. It is, however, important to look further in the hatchery populations where these genotypes may be more temporally distributed before we exclude a hatchery origin for these fish." (pages 13-14)

"It is interesting that of the eight fish carrying unique mtDNA haplotypes (two haplotype #9s and six haplotype #11's) collected by CDFG in 1994, six were males and only two were females, suggesting the uneven sex ratio one expects to see in an opportunistic migration....The remaining fish collected from the Guadalupe River could not be differentiated from Chinook from the Merced and Feather River Hatcheries using the mtDNA locus." (page 14)

**Excerpts from "Final Rule of National Marine Fisheries Service re: Endangered and Threatened Species; Threatened Status for Two Chinook Salmon Evolutionarily Significant Units (ESUs) in California," 64 Federal Register 50,393 (Sept 16, 1999)**:

"Microsatellite DNA variation has also been used in recent studies to examine genetic relationships among populations of chinook salmon in California. Nielsen et al. (1994) found significant heterogeneity among fall-run hatchery stocks and also among naturally spawning fall-run populations but there was no significant geographic structure at the basin level for wild fall-run chinook salmon. However, comparisons of wild fall-run carcasses and hatchery stocks suggest that naturally spawning fall-run fish in several basins retain some degree of genetic distinctiveness not found in hatcheries. Allele-frequencies for carcass collections made on the American, Tuolumne, Merced, and Feather Rivers were significantly different from samples of hatchery populations found within the same drainage. The Merced and Mokelumne Rivers were found to be most similar to hatchery populations on their respective rivers. The heterogeneity comparisons for some wild fall-run carcass collections may have been biased by small sample sizes. Fall-run hatchery populations were differentiated from populations of other run times but samples of wild fall-run populations were not compared to populations of winter, spring, or late-fall runs. Naturally spawning late fall-run fish were differentiated in allozyme analysis from all other populations including CNFH late fall-run salmon. The naturally spawning late fall-run population was most genetically similar to either winter-run fish or the CNFH late fall-run population, depending on the genetic distance measure used. Nei's measure of genetic distance indicated that late fall-run populations were most similar to hatchery fall-run populations.

Nielsen et al. (1994) and Nielsen (1995) examined mtDNA variation in 14 samples of chinook salmon from Central Valley rivers and hatcheries and one sample from the Guadalupe River, a southern tributary of San Francisco Bay. Nielsen et al. (1999) concluded that their data support their earlier conclusions (Nielsen et al., 1994) that fall, late-fall, spring, and winter runs of Central Valley chinook salmon show consistently significant differences for the mtDNA locus, indicating infrequent straying and limited gene flow among the temporal spawning runs.

Nielsen et al. (1999) concluded that additional sampling is needed to test for significant genetic differences among natural spawning and hatchery populations of fall-run chinook salmon. A sample of chinook salmon from Guadalupe River showed significant haplotype frequency differences from samples of the four spawning runs in the Central Valley, primarily due to a haplotype (CH9) found in 2 fish in the Guadalupe River. This haplotype has not been observed in fish from the Central Valley but has been found in samples of Russian River chinook salmon. The remaining 27 samples from the Guadalupe River could not be differentiated from the chinook salmon in the Merced and Feather River hatcheries through the use of mtDNA." (pages 50,400-401)

"The status of chinook salmon spawning in tributaries to San Francisco Bay was also considered. The presence of chinook salmon adults and juveniles (including observed spawning activities) has been recorded in a number of rivers and creeks draining into San Francisco Bay (Leidy, 1984; Myers et al., 1998; San Francisco Estuary Project, 1998; Jones, 1999, unpubl. data). However, NMFS was unable to establish if any of these populations were self-sustaining. Although the historical relationship between chinook salmon spawning in San Francisco Bay tributaries and the coastal and Central Valley Evolutionarily Significant Units (ESUs) is not known, present day adults may have originated from the numerous off-site releases of Central Valley hatchery fall-run chinook salmon into the delta or San Francisco Bay. Additional information on genetic and life history traits for San Francisco Bay chinook salmon and their relationships with Central Valley and coastal chinook salmon populations is necessary to resolve this issue." (page 50,402)

## Documentary References and Oral Statements

Compiled below are documentary references and oral statements by local fishermen concerning the historical occurrence of Chinook salmon in Santa Clara streams. WMI members disagree whether this information demonstrates that Chinook salmon spawned and reared in these streams. Therefore, this Supplementary Information does not interpret the information or express an opinion on its accuracy.

### Excerpts from Documentary References

The presence of both Chinook and Coho salmon and steelhead trout in South Bay waterways is referred to in a number of historic accounts.

Ohlone life was busy. They lived in an area with numerous salmon streams and developed a lifestyle to adjust to the salmon seasonality. (Galvan) The early Spanish explorers and missionaries found indigenous people depended heavily on the seasonal rush of fish. "The Ohlone held confidence in catching and preserving enough to last to the next spawning. The favorites and most numerous were the King Salmon, the Silver Salmon and the Steelhead/Rainbow Trout." (Heizer & Elsasser). "The Ohlone found joy and satisfaction with the profusion of salmon in the area. Every tribe north of Monterey used its stream to its advantage during the seasonal salmon runs." (Heizer and Elsasser). The Ohlone trapped trout and salmon in the creeks and ponds of the hills at the end of the season. In some cases the Ohlone would dam the creeks, toss soaproot and mashed buckeye in to stun the fish. The fish would rise to the surface and the Natives could catch & eat them (Margolin). More often, the principal method of catching fish was with nets, the effectiveness of this method is reported in personal journals of visitors (Heizer). (A1)

The Indians of Santa Clara Valley had a great abundance of food. The creeks or rivers, many now no longer extant, ran year-round all teaming with trout, steelhead and salmon. Trips to Alviso Bay, Pescadero or Santa Cruz provide clams, mussels and wild duck. (A2)

The Mission has an abundance of water obtained from the River of Nuestra Senora de Guadalupe which is about a quarter league distance from the houses. In this river good trout are caught in the summer. The Thamien-Socoistaca site at the confluence of the surface arroyo and the Rio Guadalupe was a hillock of laurel trees, tall & straight at hand for building. The Mission Creek, with its ready supply of surface water for cooking and cleaning, was attractive at any point. In the full but not yet overflowing Rio Guadalupe, there were salmon for the fishermen. (A3)

Anadromous fish were an important part of aboriginal subsistence economies in northern Native California. Of the five species of Pacific salmon the two most abundant in the freshwater systems of Northern California were the Chinook and silver or Coho. Chinook are normally more prevalent in larger rivers while the Coho frequents smaller streams. In addition to these salmon species, large populations of steelhead are seasonally common in nearly all coastal streams of California. The king and silver salmon entered the rivers and streams in the latter half of the year and the king salmon also entered the larger rivers in the spring, creating an important spring-fall cycle of runs. Chinook ranged as an important resource as far south as Monterey Bay and could be found in smaller numbers as far south as the Ventura River. (A4)

King, Chinook or Quinnant salmon run in the spring and fall, Silver or Coho Salmon and Chum or Dog salmon run in the fall. Every Northern California stream of whatever kind has more or less of these fall run salmon. The southern limit for Chinook salmon is the Ventura River. The flesh of spring run fish is pink and the fall run white which makes fall run fish pretty much worthless for canning. It is not generally possible to capture any species in large numbers until they enter the rivers and streams. (A5)

"Quinnant or Chinook Salmon Range from Alaska to California, southward to the Ventura River, ascending all large streams and are especially abundant in the Columbia and Sacramento Rivers." "Dog Salmon ranges from Kamchatka to San Francisco Bay ascending all streams in the fall and spawning no great distance from the sea." Silver or Coho salmon are abundant from San Francisco Bay to Alaska ascending small streams in the fall to no great distance." (A6)

Historical migration routes for salmon and steelhead are shown leading to the South Bay. Most South Bay streams, including the Guadalupe River, Los Gatos Creek, Stevens Creek and Coyote Creek are shown as Silver salmon and steelhead streams. (A7)

1890 photo of O.A. Hale of San Jose with catch of about 24 salmon. Some salmon identified as probably Chinook by Dr. Stacy K. Li, others believed to be chum or coho salmon. (A8)

San Jose Mercury News article dated March 1988 documents two fishermen fishing for salmon in the Guadalupe River and stated they had been doing so for over a dozen years, (since the mid 1970's). The article also indicates that Linda Ulmer, CA Dept. of Fish & Game biologist stated they had evidence confirming a viable run of salmon and steelhead in the river. (A9)

In August 1994 Alviso residents reported to the San Jose Mercury News that a fish kill had occurred in the Guadalupe River, and that their carcasses were in the vicinity of Alviso. GCRCD and Silichip Chinook reported that the fish kill involved Chinook salmon and occurred in the vicinity of the Route 237 Bridge construction project. This incident was reported in the San Jose Mercury News. The news article states that Dr. Jerry Smith, of San Jose State University, documented Chinook salmon in the Guadalupe River in the mid 1980's. (A10)

On November 27, 2000, Dr. Jerry Smith, San Jose State University, distributed and e-mail stating that "Chinook salmon were reported in San Thomas Aquino Creek in the early 1980's in response to a reported sighting of a possible coho salmon in the creek." Dr. Smith stated that Chinook carcasses were investigated by Dennis Eimoto of the CA Dept of Fish and Game office in Monterey. (A11)

<u>Citations</u>:

A1. "A River Ran Through It. The Cultural Ecology of the Santa Clara Valley Riparian Zone," Erin M. Reilly, <u>Research Manuscript Series No. 3</u>, Dept. of Anthropology and Sociology, Santa Clara University, Santa Clara, CA, 1994.

A2. "Lo, the Poor Indian" of the Santa Clara Valley, Ralph Rambo, Historical Booklet, University of Santa Clara, Santa Clara, CA Orrandre Library, 1967

A3. "The Five Franciscan Churches of Mission Santa Clara 1777 to 1825," Arthur Dunning Spearman, S. J., <u>National Press</u>, University of Santa Clara, Santa Clara , CA

A4. "Ritual Management of Salmonid Fish Resources in California," Sean L. Swezey & Robert F. Heizer, <u>The Journal of California Anthropology</u>

A5. "Salmon and Trout of the Pacific Coast" Dr. David Starr Jordan, President Stanford Univer-sity, <u>Thirteenth Biennial Report of the State Board of Fish Commissioners of California for 1893</u>.

A6. "Fishes of North America," Jordan and Evermann, <u>Bulletin 47, United States National Museum</u>.

A7. "Fish and Wildlife Resources of the San Francisco Bay Area", John B. Skinner, CA <u>Dept. of Fish & Game</u>, 1962.

A8. "San Jose, California's First City," E. Beilharz and D.O. DeMers Jr.

A9. “Fish Discovery Spawns Protest,” Pat Dillon, San Jose Mercury News, March 18, 1988.

A10. "Pipes Trap Salmon, Construction Crew's Pipes Trap, Kill Salmon in River," San Jose Mercury News, September 3, 1994.

A11. E-mail letter to Distribution from Dr. Jerry Smith, San Jose State University, Nov. 27, 2000.

**Fishermen’s Oral Statements**

Numerous long-time fishermen and other residents in the South Bay area also provide accounts of observing and catching all three species of fish, chinook and coho salmon and steelhead trout, in south bay waters from the early 1900’s until the 1970’s. A number of these men also provided accountings from the late 1800's from their grandfathers. From the 1980’s until the present day, Chinook salmon and steelhead trout have be observed, captured and photographed in major South Bay waterways, in increasing numbers over the past ten years.

Mr. & Mrs. Joseph Altieri long time area residents reported seeing salmon behind their home on Los Gatos Creek during most wet years for at least the past 30 years. (B1)

Mr. Kenneth Anderson, long time resident and fisherman stated that he observed steelhead trout and silver salmon in the Guadalupe River for many years and used to catch loads of steelhead in his younger days. “ He indicated that the steelhead were so plentiful you could almost walk across the river on their backs.” Mr. Anderson provided the Natural Heritage Institute a written deposition on these facts in support of the South Bay Salmon & Steelhead Restoration Coalition’s legal actions. (B2)

Sandy Christiansen, long time resident on St. John Street, San Jose stated he has observed salmon and steelhead, from the windows of his home, in the Guadalupe River for as long as he can remember as they migrated upstream and spawned in the area. (B3)

Brian Collins, a long time resident of the area stated that he and his friends would go down to Los Gatos Creek when he was attending Del Mar High School in the 1970’s and observed and caught spawning salmon in the fall with his bare hands. (B4)

Frank Cucuzza long time resident of the area and avid fisherman stated he could remember catching steelhead in the Guadalupe River as a little boy and throughout his young adult life. He stated he had also observed spawning salmon in Los Gatos Creek from the deck of his home on the creek for many years. Mr. Cucuzza reported he caught several steelhead just above the Taylor Street Bridge several years ago in the same location he used to fish as a boy. Frank serves on one of the SCVWD’s Flood Control Zone Planning Committees. (B5)

Mr. George Garbarino, 85 year old resident and fisherman of San Jose lived in a house next to the Guadalupe River and owned and operated a Machine Shop on Los Gatos Creek. Mr. Garbarino stated he caught loads of silver salmon and steelhead trout in Los Gatos Creek, just behind his business from the 20’s to the 60’s and continued catching steelhead until several years ago when mobility problems kept him off of the creek’s steep banks. He stated he observed Chinook salmon in the Guadalupe River over this time period and they seemed to prefer the larger river. He indicated that in his younger days he would sometimes use a pitchfork to collect salmon out of the creek. Mr. Garbarino provided the Natural Heritage Institute a written deposition on these facts. (B6)

Bud Heft, long time resident reported that he observed steelhead in the Guadalupe River for as long as he could remember. (B7)

Mr. George Kasper, long term San Jose resident and avid fisherman, stated he was a member of San Jose Flycasters and fished the Guadalupe River watershed all of his life, as did his father and grandfather. He stated his grandfather and father used to catch Chinook, coho and steelhead in the river when they were young. In the 1930's his father continued to catch these species after he returned from World War II, although in lesser quantities. Mr. Kasper stated that he caught silver salmon in the upper watershed when he was younger and still fishes for and catches trout. He stated that he used to net salmon and steelhead at the base of the dam behind the Santa Clara Valley Water District offices, upstream of Blossom Hill Road, before the fish ladder was installed and released them above the dam. Mr. Kasper indicated his father used to keep detailed records of the fish he caught and indicated that he would try to locate them. (B-8)

Mr. Ken Lawrence, long-term area resident and fisherman, stated he fished the Guadalupe River for steelhead thirty to forty years ago. He is a retired local police officer and currently sits on the Board of the CA Dept. of Fish & Game. He indicated he recalls seeing his father, who just passed away, catching salmon in the Guadalupe River when he was very young. (B9)

Mr. N. Morano, long time area resident on St. John Street reported observing large salmon in the Guadalupe River system for many years, at least since the early 1970’s, although he was not able to identify if they were Chinook or Coho. (B10)

Robert von Raesfeld, long time resident, attorney and well known fly fishing instructor, stated his family came to the San Jose area in the 1800’s and his father and grandfather were also both avid fishermen. He learned to fish from his father who in turn learned from his grandfather. When he was young his family lived near the Guadalupe River at Vermont and Chestnut Streets. He said most South Bay waterways had salmon and steelhead runs. He said his father taught him how to distinguish between Coho and Chinook salmon (black versus light gums and the number of rays on the anal fin). He said that the Guadalupe River had runs of both coho and Chinook salmon and that he frequently caught 20 pound Chinook salmon in the 40’s and early 50’s from Taylor Street all the way up to the Almaden area. He used to fish the area waters intensely all the way down to Morgan Hill where he now resides and every vacation he took was a fishing vacation. He indicated his father told him many stories of catching loads of salmon in the 20’s and 30’s and that they were so plentiful that people used to either pitch fork or shovel them out of the river and load them in sacks for fruit tree fertilizer. (B11)

Mr. Clyde L. Ritchie, 80-year-old resident, indicated his family came to the area from Italy and first lived in Woodside. He used to fish the area waters extensively and all of the area streams had steelhead and salmon runs. He used to catch steelhead and silver salmon in San Francisquito Creek and the Guadalupe River System in the 30's and 40's. He said that the Guadalupe River also had runs of Chinook salmon that were very large in wet years. (B12)

Paul Stark stated that his grandfather, John DeBona, a long time resident and retired area sheriff's officer, now living in Eugene Oregon, used to tell him about the large runs of salmon in the South Bay waterways back in the 20's & 30's. He recalls the numerous photos his grandfather showed him of the fish. He said that they were so plentiful that people used to pitch fork them out of the waterways. (B13)

Mr. Mike Trojan, Alviso resident and retired commercial fisherman, and other long time local residents of Alviso interviewed by the GCRCD and Silichip Chinook indicated they had knowledge of salmon migrating through Alviso Slough in the August/September time frame almost every year for as long as they could remember. (B14)

<u>Citations:</u>

B1. Altieri, Joseph, 1280 Dr., San Jose, CA, personal conversations and meetings with L.M. Johmann, (GCRCD) 1995, 1996.

B2. Anderson, Ken, San Jose, personal meetings and conversations with L.M. Johmann (GCRCD) 1995. Interview and deposition with NHI attorney, M. Wolfe, 1996.

B3. Christiansen, St. John Street, San Jose, CA, personal conversations and meetings with L.M. Johmann, R. Castillo, 1994, 1995, 1996, 1997 & GCRCD Board of Directors, 1995.

B4. Collins, Brian, Campbell, CA, personal meeting with L.M. Johmann (GCRCD) 1996.

B5. Cucuzza, Frank, 1309 Glen Eyrie Ave. San Jose, personal conversations and meetings with L. M. Johmann & R. Castillo, (GCRCD) 1995, 1996, 1997, 1998.

B6. Garbarino, George, 34 Autumn Street, San Jose, (business address) personal conversations and meetings with L. M. Johmann and R. Castillo 1996, 1997. Interview and deposition with the GCRCD Board members and NHI attorney, M. Wolfe, 1996.

B7. Heft, Bud, Ironwood Court, San Jose, personal conversations and meetings with L.M. Johmann and R. Castillo 1995.

B8. Kasper, George, San Jose, personal conversation with L.M. Johmann (GCRCD), Nov 4, 2001.

B9. Lawrence, Ken,  San Jose, personal conversations with L.M. Johmann (GCRCD) 1996.
B10.  Morano, N, St John St., San Jose, personal meetings and conversation with L.M. Johmann (GCRCD), 1995

B11.  Von Raesfield, Robert, 900 Lafayette St. Suite 706, Santa Clara, CA, personal conversation with L.M. Johmann (GCRCD), 2000.

B12. Ritchie, Clyde, 1448 Willowmont Ave. San Jose, personal conversation with L.M. Johmann (GCRCD), 2000.

B13.  Stark, Paul,  San Jose, personal meetings and conversations with Roger Castillo and L.M. Johmann, from 1990 to 2000.

B14.  Trojan, Mike and other Alviso residents interviewed by the GCRCD, Silichip Chinook and the San Jose Mercury News, September 1994.

## **Origins of Chum Salmon**

Table 7-4b, “Current Freshwater Fishes Observed in Santa Clara Basin Watersheds” is amended to delete the “I” for “Introduced Species” in the origin column for chum salmon and replace it with a footnote 6, which states: "Native to California, but origins of individuals observed in the Guadalupe River in recent years is unknown.”

# Chapter 7
# Natural Setting

## 7.1 Santa Clara Basin Natural and Ecological History

### 7.1.1 Geography

The Santa Clara Basin (the Basin) is located in the northern part of California's Central Coast Range. The Basin is in the southern portion of the San Francisco Bay Area (the Bay Area). The Basin encompasses approximately 824 square miles of mountainous slopes, foothills, and valley bottomlands at the southern end of the South Bay (excluding the open waters of the South Bay). The Basin is bounded on the west by the Santa Cruz Mountains and on the east by the Diablo Range. All of the creeks and rivers in the Basin ultimately discharge into the South Bay. The northern limit of the Basin is defined by the Dumbarton Bridge, which crosses the South Bay between the cities of East Palo Alto and Fremont.

The Santa Cruz Mountains are a complex of steep, rugged ridges ranging in elevation up to almost 4,000 feet and separating the Basin from the Pacific coastline. The Santa Clara Valley (the lowland portion of the Basin) is nestled between the forested, east-facing slopes of the Santa Cruz Mountains and the drier grasslands, chaparral, and oak savanna on the west-facing slopes of the Diablo Range. The Diablo Range separates the Basin from the inland San Joaquin Valley (the southern portion of California's Central Valley). The portion of the Diablo Range on the east side of the Basin is often referred to as the Hamilton Range. Mount Hamilton, the highest point in the southern portion of the Diablo Range (elevation 4,213 feet), is outside and to the east of the Basin.

The cities of Palo Alto, East Palo Alto, and Menlo Park and the towns of Woodside and Portola Valley are located in the northwestern portion of the Basin. The Cities of Fremont, Newark, and Milpitas are located in the northeastern portion of the Basin. Portions of unincorporated lands in San Mateo and Alameda Counties are also included in the Basin (see Figure 7-1).

The central portion of the Basin is generally referred to as the Santa Clara Valley.[1] The Santa Clara Valley is bordered by the Santa Cruz Mountains to the west and the Los Buellis Hills and the Diablo Range to the east. Some of the larger cities in the "valley" portion of the Basin include Cupertino, Mountain View, Santa Clara, Sunnyvale, San Jose, and Campbell. The cities

[1] The term "Santa Clara Valley" appears to be used in two ways in the literature. Sometimes writers refer to Santa Clara Valley as extending from San Jose to Gilroy. When used in this context the writer is generally referring to all of the valley bottomlands in Santa Clara County. Other authors appear to differentiate between Santa Clara Valley to the north, Coyote Valley in the central part of the county, and Llagas Creek/Uvas Creek "Valley" in the Gilroy area. In this report, the term "Santa Clara Valley" is used to refer to the valley bottomlands and low-lying foothills surrounded by the mountains within the Basin.

of Saratoga, Monte Sereno, and Los Gatos are located at the southwestern end of the valley, nestled up against the base of the Santa Cruz Mountains. Almaden Valley is a narrow, northwesterly trending valley located within the larger Santa Clara Valley. At the southern end of San Jose, it is enclosed by the Santa Cruz Mountains on the southwest and south, and the Santa Teresa Hills on the northeast.

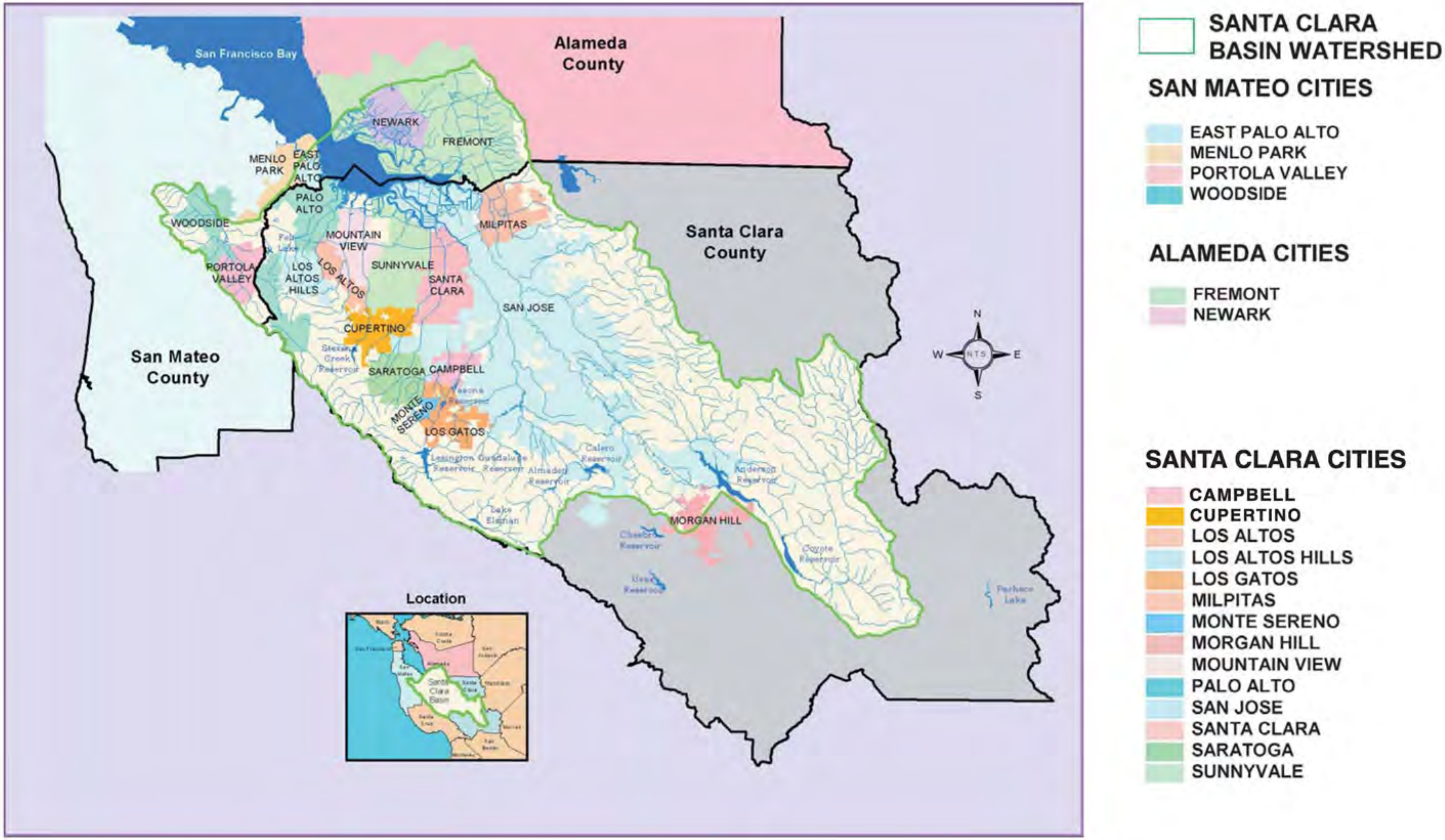
The southern end of the Basin is in Coyote Valley. Coyote Valley[2], part of the Santa Clara Valley, is at the southern end of the Santa Clara Valley. Part of the City of Morgan Hill is in the Basin. At Morgan Hill the alluvial fan of Coyote Creek forms a drainage divide as it emerges on the valley floor. Runoff on the north side of this low divide flows to the South Bay. South of Morgan Hill, runoff flows in a southerly direction to the Pajaro River and then west to Monterey Bay.

The Basin is comprised of 13 major watersheds plus the Baylands and the South Bay. Major west-side watercourses draining the east-facing slopes of the Santa Cruz Mountains include: San Francisquito Creek, Matadero Creek, Barron Creek, Adobe Creek, Permanente Creek, Stevens Creek, Calabazas Creek, San Tomas Aquino/Saratoga Creeks, and Guadalupe River. The west-facing slopes of the Diablo Range are drained by Coyote Creek and Lower Penitencia Creek. Additional lowland areas that drain to the South Bay include the Sunnyvale East and West Channels and Arroyo la Laguna in southern Alameda County.

Portions of the Basin lie in three counties: Santa Clara County, San Mateo County and Alameda County (see Figure 7-1). The vast majority of the Basin is located in Santa Clara County; however, parts of Santa Clara County are not included in the Basin. The northeastern portion of Santa Clara County that drains to Calaveras Reservoir and to Alameda Creek is not part of the Basin. The southern part of Santa Clara County that drains via Llagas Creek, Uvas Creek, and Pacheco Creek to the Pajaro River and then to Monterey Bay is also not part of the Basin. The northwestern portion of the Basin (i.e., most of the San Francisquito Creek watershed) is in southern San Mateo County. The northeastern portion of the Basin (Arroyo la Laguna) is in Alameda County.

The Basin is accessible from San Francisco and the San Francisco Peninsula (San Mateo County) via U.S. Highway 101 and Interstate 280. The Basin can be reached from the East Bay (e.g., Oakland, Hayward) via Interstate 880. Drivers coming from southern Alameda County (e.g., Livermore, Pleasanton) and Contra Costa County (e.g., Walnut Creek) enter the Basin via Interstate 680. Motorists driving to the Basin from the Monterey Bay area (e.g., Santa Cruz, Capitola) generally travel over State Highway 17 to Los Gatos. The southern end of the Basin is reached by driving north on U.S. Highway 101 from Gilroy. Scenic Skyline Boulevard (State Highway 35) follows the crest of the Santa Cruz Mountains on the western boundary of the Basin, offering excellent views of the Diablo Range, the Baylands, and Santa Clara Valley.

[2] The term “Coyote Valley” is used to refer to the valley floor between the “narrows” and the rise in the valley floor separating Coyote Valley (and the Coyote Creek drainage system) from the Llagas Creek drainage. In this document Coyote Valley is considered as a lesser valley within greater Santa Clara Valley.




Source: Santa Clara Valley Water District

Watershed Characteristics Report



**FIGURE 7-1**
**Counties and Municipalities in the Santa Clara Basin**

Mount Hamilton Road (State Highway 130) winds its way through Halls Valley (in Grant Ranch County Park) on its way to the Lick Observatory atop Mt. Hamilton.

The Basin is referred to as the Coyote Watershed by the California Rivers Assessment (CARA) and the U.S. Environmental Protection Agency (EPA). The CARA Identification Number for the Coyote Watershed is 97, and the U.S. Geological Survey (USGS) Cataloging Unit number for the Coyote Watershed is 18050003 (CARA 1997; EPA 1999). According to CARA, the Coyote Watershed (i.e., Santa Clara Basin excluding the open waters of the South Bay) is 527,548.62 acres. According to CARA, there are 937 miles of “naturally occurring waterways” in the Coyote Watershed (CARA 1997).

### 7.1.2 Geology

The Basin is situated in the northern part of the Central Coast Ranges, which extend southward from San Francisco for about 200 miles. The coast range landscape is characterized throughout its length by a series of rugged, subparallel, northwest-trending mountain ranges and intervening valleys. Located in one of the most seismically active areas in the world (Graf, undated), the Basin is nestled between the northwest-trending Santa Cruz Mountains and the San Andreas fault to the west, and the Diablo Range and the Hayward and Calaveras faults to the east. Although the geology of the area is complex, the overall picture is fairly straightforward. The Santa Clara Valley is a large trough that has been filled by sediment (gravel, sand, silt and clay) eroded from the adjacent mountain ranges. The structure of the area is controlled by faulting, the trend of which is predominantly in a northwesterly direction, as is so commonly the case in California (Lindsey 1974).

The geologic formations of the Basin are of two kinds – the hard rocks of the mountain borders, and the unconsolidated materials of the valley fill (Clark 1924). The ancient rocks exposed in the mountain ranges (which are collectively referred to as the Franciscan formation) originated as volcanic sea floor. Between 160 and 70 million years ago, these pieces of oceanic crust were subjected to intense shearing, pressure, and deformation when the tectonic plate that they were part of, the Pacific plate, was subducted (overridden) by the North American plate (Iwamura 1999). The mountains that border the Santa Clara Valley are composed of many different types of rocks. The region is particularly well known for the occurrence of serpentine, a rock created almost exclusively in oceanic subduction zones where cold, wet pieces of seafloor are subjected to intense pressures and deformation at relatively low temperatures.

While the Pacific plate was being forced beneath the North American plate, sand, silt, and clay were eroded off the growing North American continent and were transported westward to the sea. These sediments were deposited in the ocean off of the western edge of the continent, and were buried and hardened into rocks such as the sandstone, siltstone, and shale that are associated with the Franciscan formation exposed today in the mountain ranges. These rocks, which were deposited between 136 and 65 million years ago, are collectively known as Cretaceous sedimentary formation, or the Great Valley Sequence. Mountain-making processes (such as faulting) then raised up two strips of land that would later become the Santa Cruz Mountains and the Diablo Range, and dropped down the area in between them, creating a deep trough that would eventually become the Santa Clara Valley and the South San Francisco Bay. The valley floor was originally below sea level, and the older rocks deposited in it include sandstones containing many marine fossils, as well as cherts (derived from silica-rich oozes) and marine shales. As the valley sediments accumulated, the floor of the valley emerged above sea level and also received deposits of ash and bedded volcanic flows from active volcanoes in the region.

During a time period ranging from approximately 2 million to 10,000 years ago, the valley filled with gravel, sand, and silt that eroded from the mountains. These deposits comprise the Santa Clara Formation, which is found adjacent to and under the valley floor. These sediments were deposited by streams that transported the broken and weathered pieces of rock from the higher elevations to the valley floor (Iwamura 1999). Many of these sediments were deposited at the mouths of the streams that transported them, and formed deposits called alluvial fans. An alluvial fan is a cone-shaped deposit of stream sediment that forms where a narrow canyon stream suddenly disgorges into a flat valley. Between 1 million and 8,000 years ago, gravels, sands, silts, and clays were laid down in small mountain valleys. The accumulation of this “old alluvium” most likely resulted from high sediment yields in the recent geologic past when the region was wetter. Between 10,000 years ago and the present, gravel, sand, silt, and clay have been eroded from the mountains and deposited in the valleys of the Basin. This material, referred to as the “young alluvium” is an important groundwater-bearing unit of the Basin. The thickness of these deposits exceeds 1,500 feet in the Santa Clara Valley (Iwamura 1999).

During the past 30,000 years, while the southern portion of the Santa Clara Valley was being shaped largely by rivers, the northern portion of the valley was experiencing somewhat different influences. San Francisco Bay (the Bay) was formed in much the same way as the Santa Clara Valley, when a large chunk of faulted crust dropped downward with respect to its neighbors. The Bay trough was flooded repeatedly by global rises in sea level associated with the melting of glaciers. Sediment-rich glacial meltwater traveled down the Sacramento River and deposited large quantities of silt and clay in the Bay, creating blue-gray deposits of bay mud that extend well into the northern portion of the Basin (McDonald et al. 1978). Today, the Bay has retreated from its maximum extent of inundation, and significant areas of these deposits stand exposed as dry land. Many of the geologic processes that have shaped the Basin continue to alter the landscape. Gravels, sands, silts, and clays are weathered from the mountain hillslopes as a result of gradual processes, as well as episodic ones such as earthquakes, fires, and floods, and are transported down stream channels to the valley flat where they are deposited (Iwamura 1999).

Mineral deposits, mines and quarries can play important roles in the water quality of a watershed. Of particular note in the Basin is the occurrence of a significant number of inactive mercury mines, most of which are located in the vicinity of New Almaden in San Jose. Historically, nickel and copper have also been mined in the Basin. In the recent past, quarrying of alluvial gravels took place in many parts of the Basin, although few of these activities have continued to the present day (Iwamura 1999). There are three active quarries in the Basin: Stevens Creek Quarry (formerly Voss Quarry), which supplies baserock, located in the Stevens Creek watershed; and Hanson Cement Company Quarry (formerly Kaiser Permanente Cement), which supplies limestone for cement and baserock, located in the Permanente Creek watershed

(Bret Calhoun, pers. comm., 1999). The DeSilva quarry at the eastern end of the Dumbarton Bridge produces sand and gravel in the Arroyo La Laguna watershed.

### 7.1.3 Soils

Just as the Basin is the home of a wide variety of different kinds of rocks, it also plays host to many different kinds of soils. The type of soil that develops in a particular location is influenced by five major factors: climate (especially temperature and precipitation), living organisms, the parent material (such as bedrock) from which the soil forms, topography (slope and elevation), and the amount of time that the soil has had to develop (Brady 1990). Because there are so many different combinations of these factors within the Basin, many different individual soils have developed, each with its own unique properties. Figure 7-2 depicts the typical progression of soils across the northern portion of Santa Clara County, and emphasizes the relationships between topography, soil type, and vegetation (Weir and Storie 1947).

The Natural Resources Conservation Service (formerly the Soil Conservation Service) has classified 20 soil associations for Santa Clara County alone (Silva, undated), and each soil association is comprised of up to five or six different individual soils. Because of the large number of different soils that have been identified in the region, it is useful to group them and to discuss their general properties rather than to treat each soil individually. This type of analysis was most effectively articulated by Walter Weir and Earl Storie in their classic 1947 publication on the soils of Santa Clara County. Most recent soils mapping of the area was carried out in 1968 and in 1974, but a new study, scheduled to begin in 2001, will produce an updated soils map.

A useful way to group soils is based on physiographic land divisions, a parameter that takes into account both the topography (elevation) and the genesis (origin) of landforms. Based on this concept, soils form on five major types of landforms in the Basin: alluvial fans, basin land, low terrace land, high terrace land, and uplands (Weir and Storie 1947).

Alluvial fan soils form from sediment transported and deposited by rivers, and are located on the valley floor bordering streams. They tend to be deep and are easily penetrated by both roots and water due to the lack of accumulation of clay in the subsoil. Historically, these soils comprised some of the most desirable agricultural land in the area and were used to support a wide variety of crops. As seen on Figure 7-3, alluvial fan soils tend to be distributed on the margins of the valley flat, where streams flowing out of the hills have deposited sediment as a result of a loss in velocity upon reaching the flat lands (Weir and Storie 1947).

The soils in the region that occupy basins or basin-like locations are described as having a “heavy texture” and contain large amounts of clay. Because they form in very flat places, they tend not to be very well drained and sometimes contain alkali deposits that render them unfit for agricultural use because of the high concentrations of salts and ions found in them. There is a large proportion of basin land soils in the northern portion of the Basin, adjacent to the Bay. At times in the geologic past, when sea levels were higher, these areas accumulated bay muds, which have evolved into basin land soils when sea levels retreated, and these formerly underwater environments were exposed as dry land (Weir and Storie 1947).

In many places around the edges of the Santa Clara Valley, between the alluvial fan soils and the upland soils, there are soils occupying terrace positions somewhat above the general level of the valley floor.  For the most part, these low terrace land soils represent remnants of older valley-filling materials through which the present streams flow, although these areas are no longer subject to deposition or overflow.  Low terrace land soils tend to have significant percentages of clay in their subsoil, and can be difficult for both roots and water to penetrate.

Along the edges of the valley and merging into the hills are soils occupying older and higher terraces.  These areas are usually somewhat rolling, and here the soils are more fully developed and more erosive than those occupying lower terraces (Weir and Storie 1947).

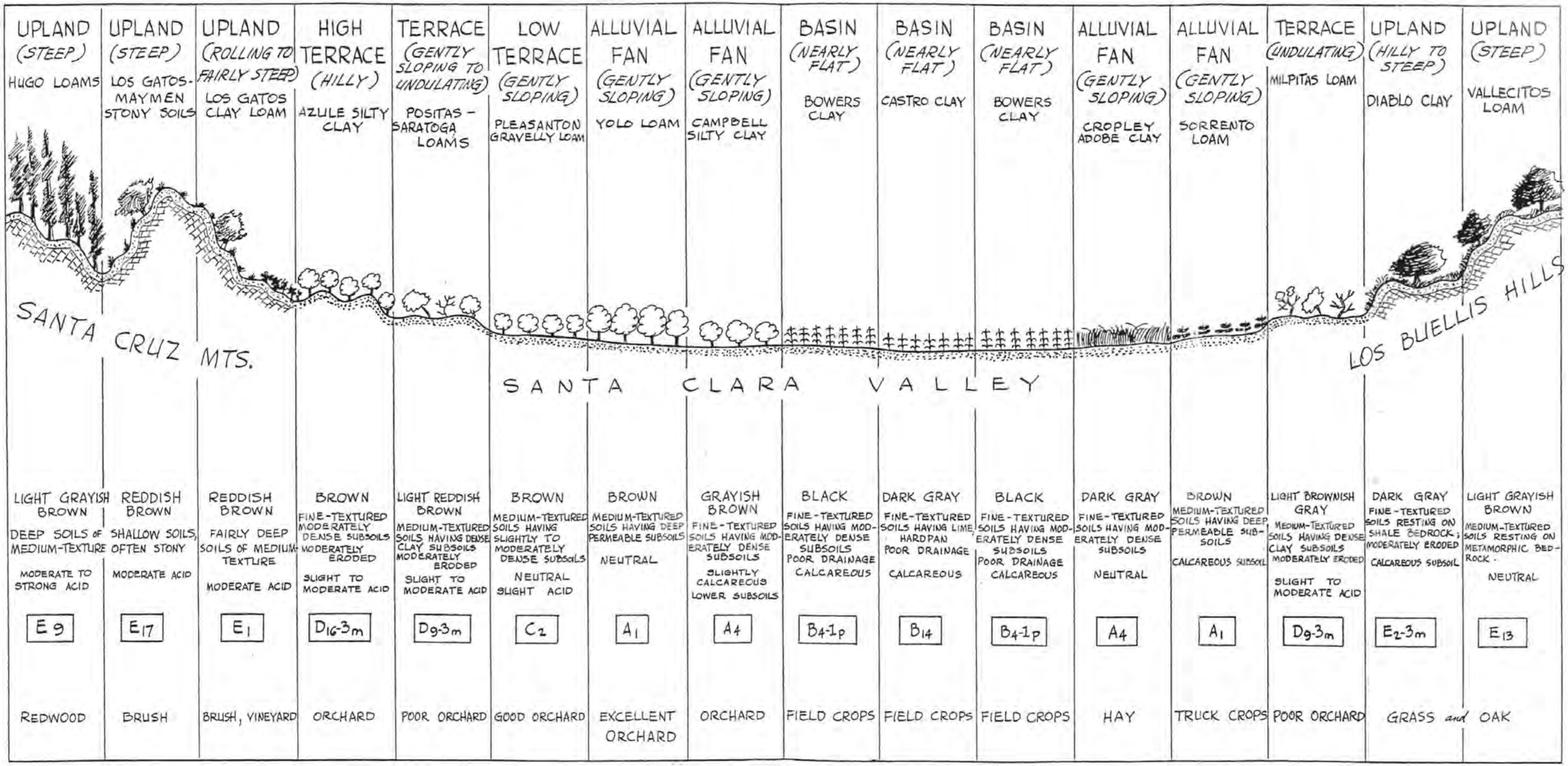
Upland, or primary, soils (soils derived in place from the weathering of underlying bedrock) occupy large portions of the Basin and are found on the slopes of both the Diablo and Santa Cruz Mountain ranges.  Although some of the flatter areas are farmed or grazed, these soils are currently of little agricultural importance and support a diverse range of natural plants and animals (Weir and Storie 1947).

Unfortunately, systems of soil classification and nomenclature are often unique to a specific county.  Although the names used to refer to particular soils often differ between counties, the characteristics of the soils are continuous across political boundaries.  Because the Basin spans three counties, it can be difficult to trace the occurrence of a particular soil or soil group across the Basin.  Additionally, soils in the portions of San Mateo and Alameda counties that lie within the Basin have not been mapped by the Natural Resources Conservation Service.  Figure 7-4 (Soil Association Map of Santa Clara County) illustrates the soil classifications across most of the Basin's land area.

### 7.1.4 Climate and Hydrology

The movement and occurrence of water in the Basin is governed by the hydrologic cycle. Although the cycle is a closed loop and has no beginning or end, it is convenient to describe the hydrologic cycle as starting with the oceans.  As illustrated on Figure 7-5, water evaporates from the surface of the oceans and water vapor moves through the atmosphere.  When atmospheric conditions are suitable, water vapor condenses and forms droplets or ice crystals that fall to the ground as precipitation.

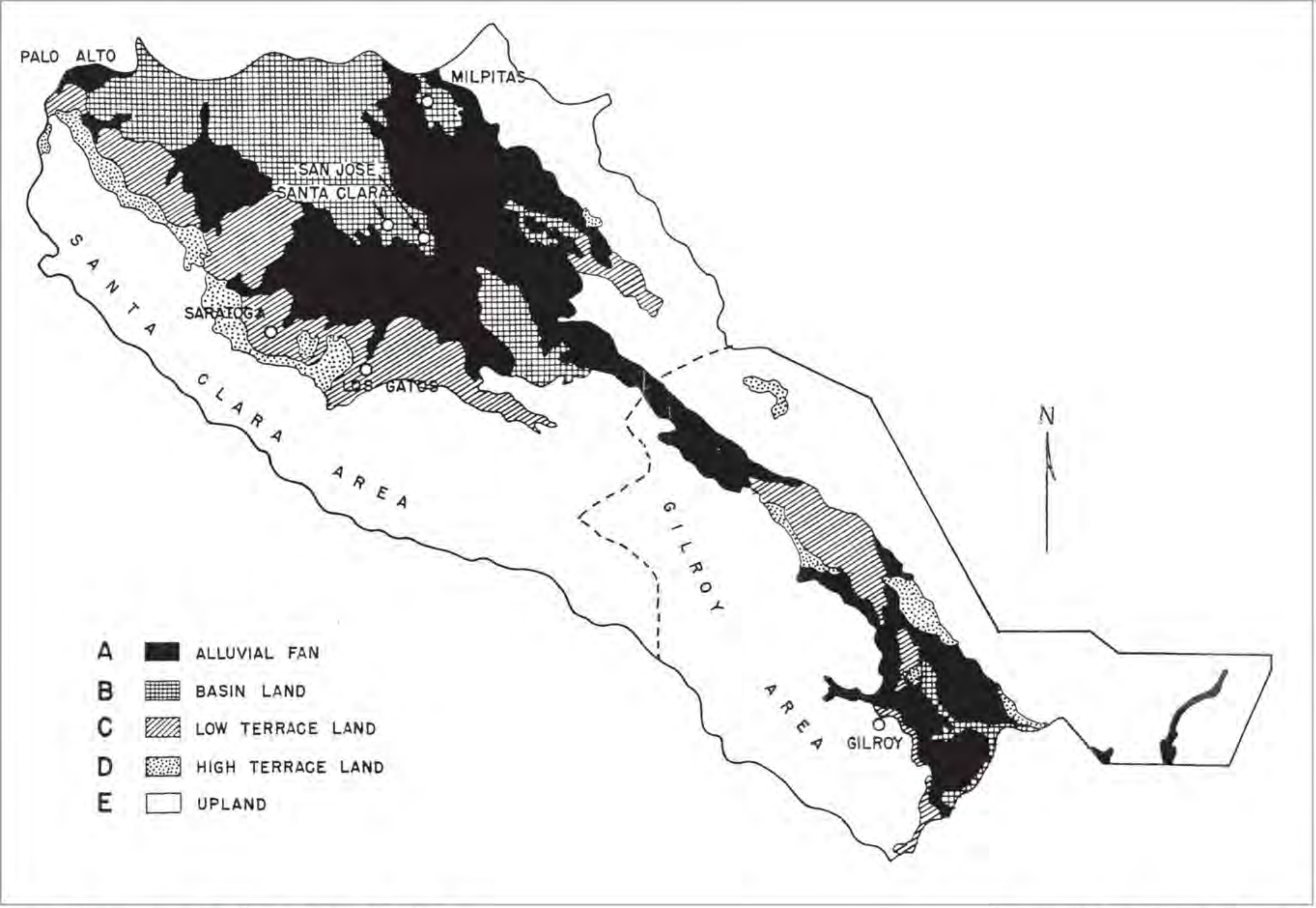
Precipitation that falls on the land surface can follow any number of paths through the hydrologic cycle.  Some of the water may reside temporarily in puddles or lakes as depressional storage.  Some proportion of the total precipitation that falls drains to stream channels via overland flow.  If the ground surface is porous, some rain infiltrates into the subsurface.  Below the land surface, water that has infiltrated can be drawn into the rootlets of plants.  As the plants use the water, some of it is transpired to the atmosphere.  Excess soil moisture is pulled downwards by gravity, and flows as groundwater through rocks and soil until it discharges as a




Source: Stories, R. Earl and Weir, Walter W., 1947



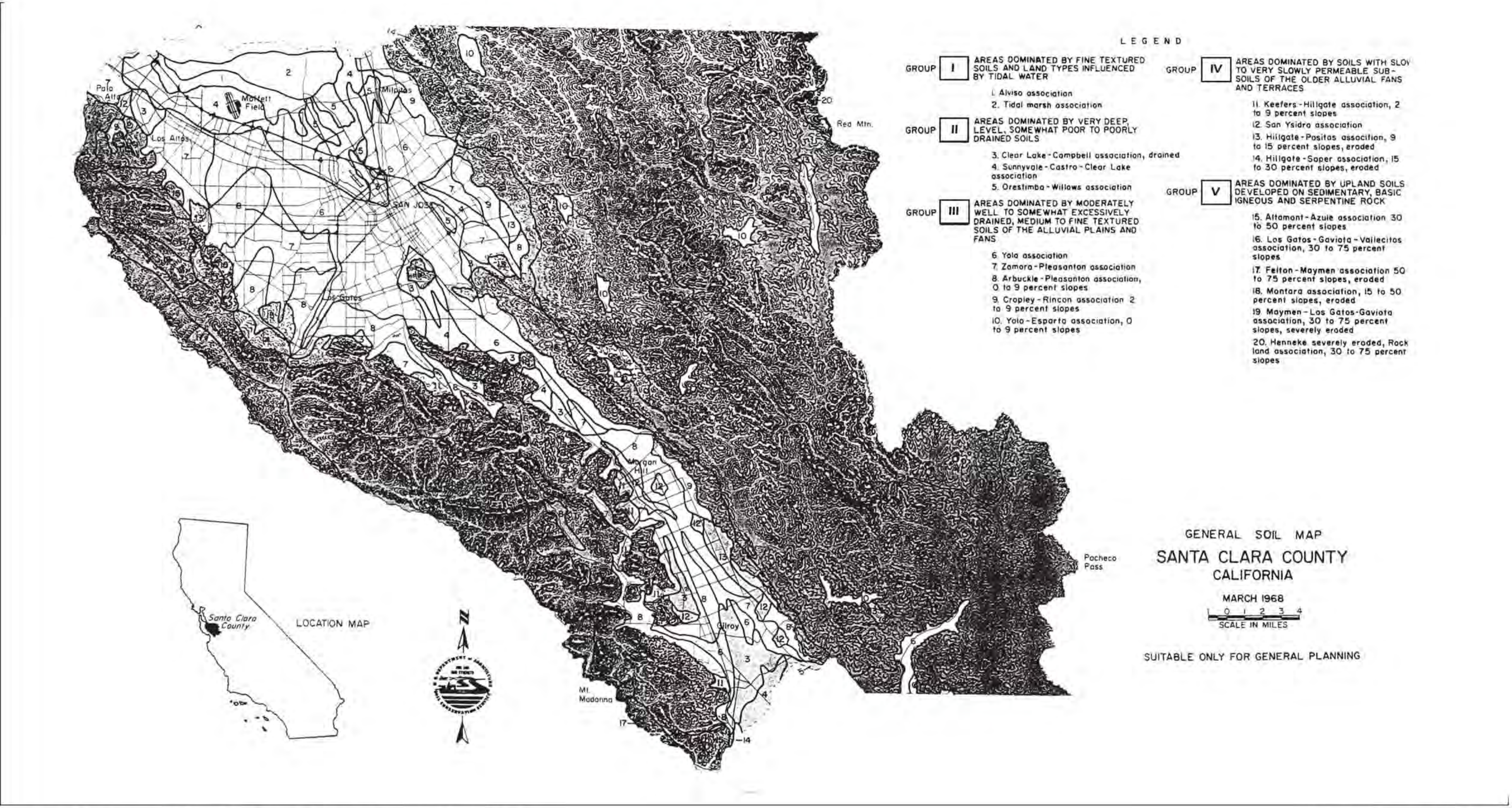
**FIGURE 7-2**
Relationship Between Topography, Vegetation, Land Use & Soils Across Northern Santa Clara County




Source: Stories, R. Earl and Weir, Walter W., 1947



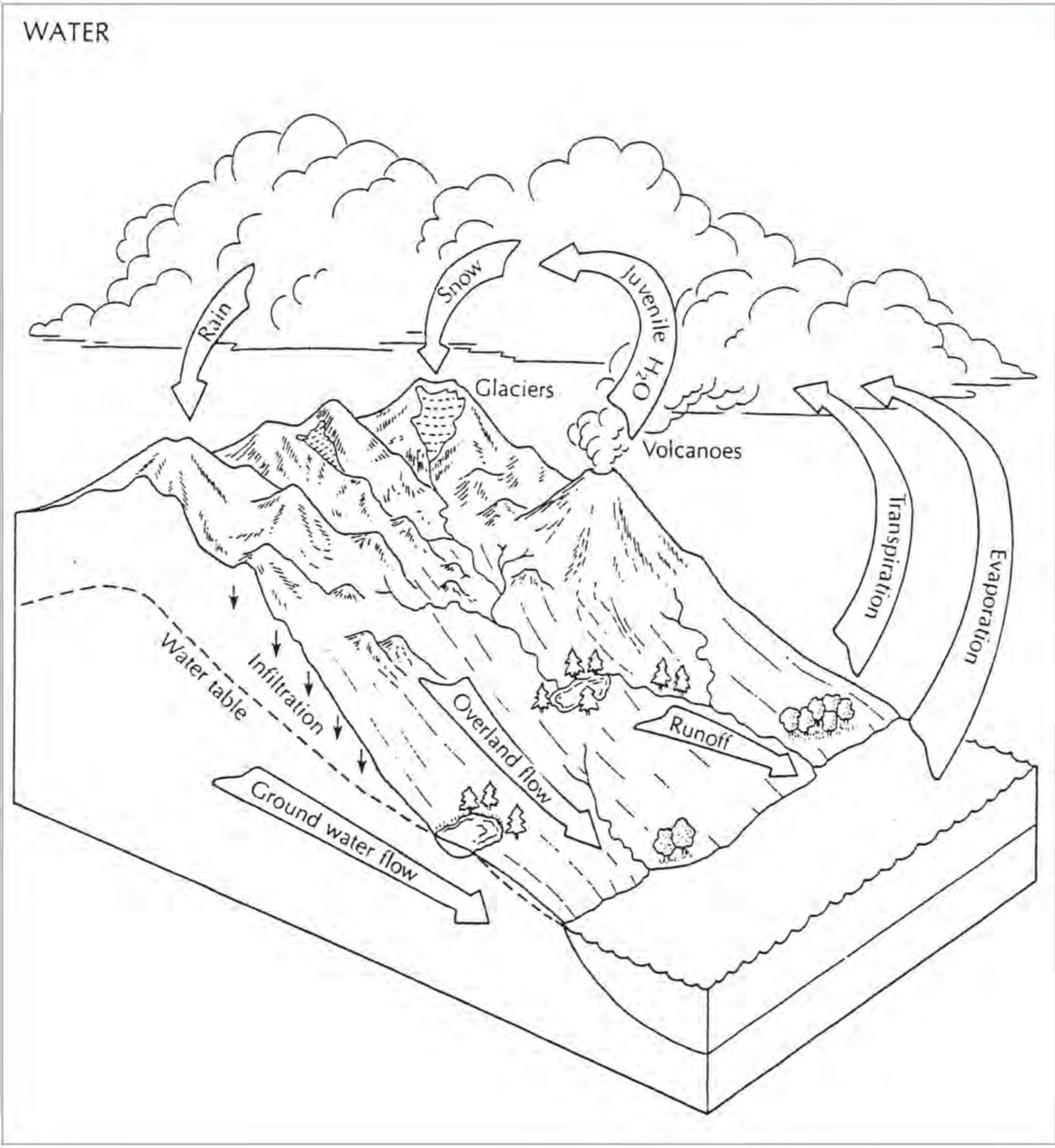
**FIGURE 7-3**
**Distribution of Soils by Physiographic Land Divisions in Santa Clara County**




Source: USDA Soil Conservation Service (now Natural Resources Conservation Service) 1968



**FIGURE 7-4**
**Soil Associations in Santa Clara County**




Source: Fetter, C.W., 1994

spring, or a seepage into a wetland, pond, lake, stream, river, or ocean. Water flowing in a stream can come from overland flow, from groundwater that discharges into the streambed, or from a combination of sources. Small streams flow together and join larger streams, until eventually rivers and streams flow into the ocean or sea. The Basin is the home of more than 900 miles of creeks and rivers. All of the major watersheds in the Basin ultimately have surface outflow to the lower South Bay.

The Basin has a Mediterranean climate, characterized by extended periods of precipitation during winter months and virtually none from spring through autumn. The wet season generally extends from approximately November through April, while rainfall during May through October tends to be minimal. Annual average rainfall amounts vary significantly due to topography. Portions of the Basin in the Santa Cruz Mountains receive 40 to 60 inches per year, while the central Santa Clara Valley receives on average 13 to 14 inches in the vicinity of downtown San Jose (see Figure 7-6). Average figures can be somewhat misleading, however, because in addition to seasonal variation, droughts in California are not uncommon. For example, the average annual rainfall amount for San Jose of approximately 13 inches per year tends to obscure the fact that rainfall over the last 100 years or so has ranged from 6 to over 30 inches in any 1 year (Santa Clara County 1994). Temperatures in the Basin tend to be fairly mild, and rarely drop far below freezing in the valley flat. Although snow is not uncommon in the mountainous portion of the Basin in winter, it does not last long. North of San Jose, the average summer temperatures are rarely higher than 90°F. South of San Jose both summer and winter extremes are somewhat greater. In summer, the humidity of the air is relatively low, while in winter it is near the saturation point a large part of the time (USDA 1968).

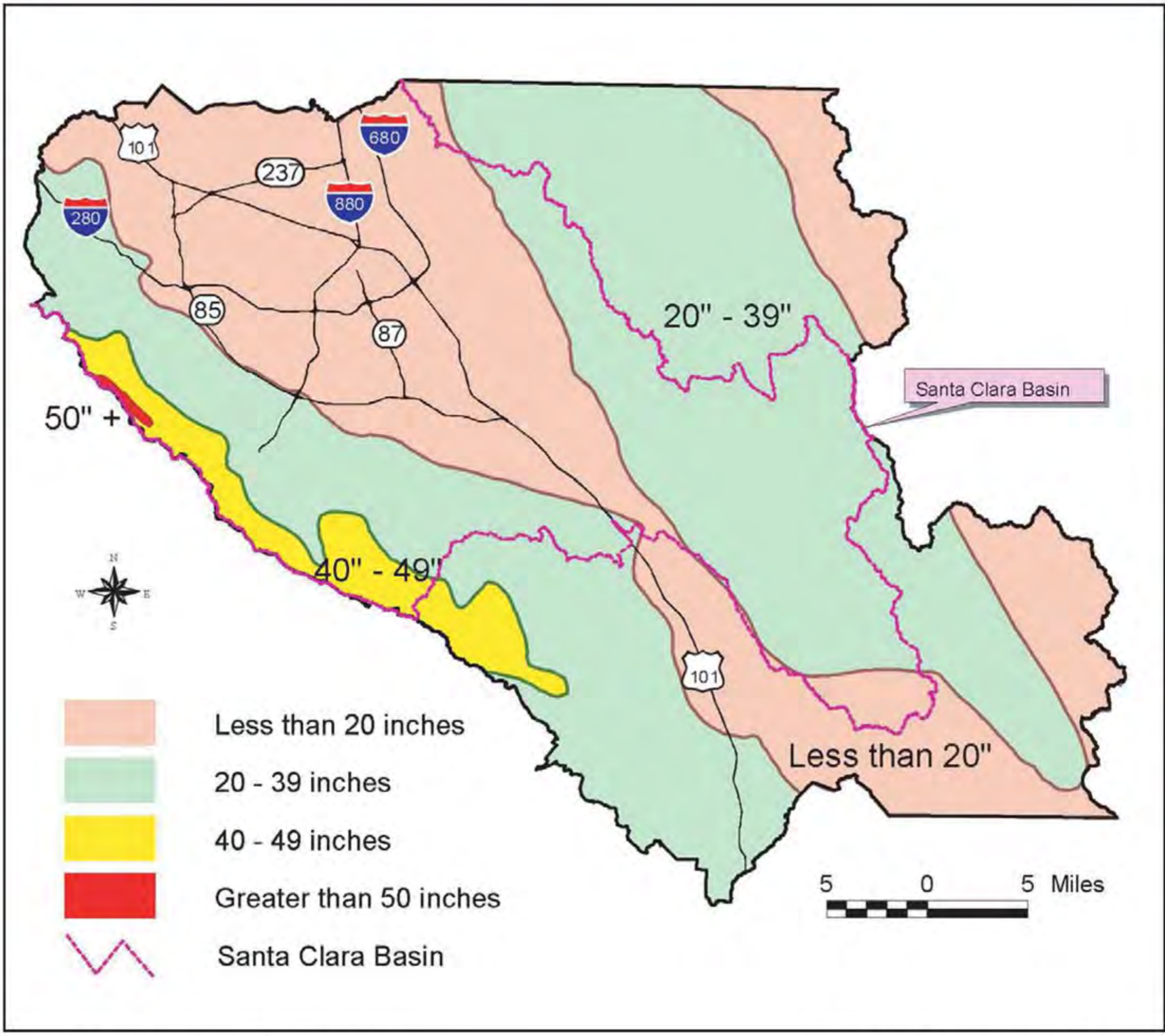
"Drought" is defined as any period of below-average precipitation. Rainfall statistics indicate that short-term droughts of 5 to 7 years have occurred many times just within the last hundred years. Tree-ring analyses indicate that 10- to 20-year periods of below-average precipitation have occurred at least three times since the mid-1500s. Although in other regions of the country drought is considered a temporary aberration in weather patterns, in much of California and in the Basin, drought should serve as a basis for planning (Santa Clara County 1994).

In the Basin, rainfall occurs chiefly during the winter, when the capacity of the atmosphere to evaporate water is at a minimum. The average annual evaporation from the surface of a pond or lake is estimated to be about 57 inches per year in the Basin, but only about 22 percent of this yearly total evaporation occurs during the rainy season, from November through April (Clark 1924). Plants draw water from the soil through their roots and discharge it into the air through their leaves. In the Basin, most of the native plants become inactive or die back during the summer months due to a lack of soil moisture, and no new growth takes place until the rains come again. Therefore, in nonurbanized areas, transpiration is highly seasonal, and is much lower in the summer than during the winter months, except adjacent to flowing streams and lakes, where water is available to riparian vegetation all year.

Runoff, which is the percentage of precipitation that is carried away by streams, is highly variable and depends upon a number of factors such as the character of the topography, the character of the soil and soil covering, and the density of urbanization and the depth to groundwater. It is estimated that between 16 and 34 percent of the precipitation that falls in various portions of the Basin becomes runoff. Like runoff, the amount of water that infiltrates into the soil and rocks is also highly variable within the Basin, and is dependent upon many of the same factors. In the Basin, groundwater generally exists at depths below the streambeds, except in the lower courses of a few of the larger streams, notably Coyote Creek north of downtown San Jose. Because it is sustained by groundwater, Coyote Creek flows year round (i.e., is perennial). Historically, most of the other creeks on the valley floor were naturally dry during the summer (Clark 1924). As patterns of water use and water importation into the Basin have evolved, many creeks have experienced increased summer flow. Some creeks flow due to artesian wells, springs, water releases and urban runoff. Many of the creeks involved are not uniformly affected, but rather display a mixture of wet and dry sections (Doug Padley, pers. comm., 1998). In an effort to recharge the groundwater basin, stored and imported water is released from reservoirs and other parts of the water distribution system during summer months into many creeks that would otherwise be dry under natural conditions. Because the upper reaches of the creek beds tend to be composed of much coarser sediment than are the lower reaches, most recharge takes place closer to the headwaters of the watersheds. Often, when water is released for recharge, only enough is made to flow through the stream channels so that all of the water has infiltrated before reaching the less permeable, lower reaches of the channel. Flows released for groundwater recharge purposes are often by design not sufficient to provide water to the lower reaches of the creeks (Barry Hecht, pers. comm., 1998). Some streams are currently perennial in their lower reaches due to urban runoff or high groundwater.

Flooding is another common process that plays a major role in the Basin. Tidal flooding along the Bay may occur due to levee failure, and its severity is increased in areas that have subsided due to overdrafting of groundwater basins. More importantly, stormwater flooding has been a long and continuing problem for much of the Basin ever since permanent settlement of the valley floor began. To the valley’s early residents, the Ohlone Indians, flooding meant the temporary inconvenience of relocating their villages, most of which were built along streams. The Spaniards who colonized the valley followed suit, building the first mission and pueblo near the Guadalupe River in the late 1700s. Their earthen dams and irrigation ditches failed to protect against the river’s frequent floods, and before the century’s end, both the pueblo and the mission were moved to higher ground. When agriculture and towns spread across the valley, winter and spring floodwaters provided much-needed irrigation for fields and orchards. As the valley’s land uses changed from agricultural to residential/industrial, and development moved into the foothills, flood damage became a larger concern (Water District, undated [b]).

Much of the valley floor is flood prone (approximately 60 out of 300 square miles) (Santa Clara County 1994). As flooding problems intensified, levees were constructed to contain floodflows along some creeks, although flood control measures have historically been sporadic and of varying effectiveness. Major floods have struck recently in 1952, 1955, 1982, 1983, 1986, 1995, and 1997, among other years. In addition, the amount of urban development in flood-prone areas over the last 20 to 30 years has dramatically increased the estimates of potential property damage from major flooding, while the increase in the amount of impervious surfaces from development has increased total stormwater runoff (Santa Clara County 1994).




Source: Santa Clara Valley Water District

As urbanization and development takes place, more and more of the ground surface is covered with asphalt, concrete, and roofs. This causes a greater percentage of rainfall to rapidly move into stream channels because it is not soaking into the ground and slowly traveling through the subsurface. The decreased infiltration and increased runoff associated with urbanization can cause the size of peak floods to increase unless measures to reduce peak runoff are included as a part of each development project (Santa Clara County Planning Department 1969). According to recent reports by the Santa Clara Valley Water District (Water District), two areas most threatened by flooding are along Guadalupe River in downtown San Jose and San Francisquito Creek in Palo Alto and East Palo Alto (Santa Clara County 1994). Additional areas subject to flooding include Coyote Creek near Williams Street, Calabazas Creek near Bollinger Road, and some areas in Milpitas (Jim Wang, pers. comm., 1998).

### 7.1.5 Plants and Plant Habitats

#### *7.1.5.1 Historical Perspective*

During the time of the Ohlone Indians (prior to Spanish settlement), the Basin had a rich variety of plant communities and wildlife habitats (Margolan 1978). Tall stands of native bunchgrasses covered the vast meadowlands and dotted the savannas. “Marshes that spread out for thousands of acres fringed the shore of San Francisco Bay,” which was much larger before landfill practices in the Bay (Margolan 1978). The rivers and streams draining into the Bay supported large estuaries and tule marshes. Along the lower salty margins of the Bay, there were vast pickleweed and cordgrass marshes (Margolan 1978).

When Portola’s party stumbled on the Santa Clara Valley in 1769, and camped near what is now called the El Palo Alto redwood on San Francisquito Creek at El Camino Real, they found a spacious, oak-studded grassy plain. Through the valley at several places ran small streams, prone to flooding in the winter and drying in the summer. The banks of the streams and arroyos were densely wooded with cottonwoods, willows, and sycamores. Portola and those who followed him encountered large marshes in places, especially near the lower portions of Coyote Creek and the Guadalupe River and on the fringes of the Bay, that rendered foot travel difficult or impossible. To the west, the mountains were heavily timbered with redwoods of considerable dimensions, and redwoods followed the streambeds of Stevens Creek and others down into the valley itself. To the east of the valley, the grassy hills were, with the exception of densely wooded arroyos, barren of trees or sparsely wooded with oaks and pines (Bolton 1927, 1930).

The arrival of European settlers dramatically changed the distribution and species composition of the plant communities in the Basin. The displacement of the once prevalent native perennial grasslands by European nonnative, annual grassland species is well known. The once heavily forested foothill areas were significantly reduced by lumbering practices in the mid- to late-1800s (Santa Clara County 1973). Douglas fir and coast redwoods were the most important lumber trees. “In the relatively short time of fifty to seventy-five years, nearly all of the timber of Santa Clara County had been removed” (Santa Clara County 1973). As settlement continued, natural stands of vegetation were converted for agricultural use such as grazing lands, crops, vineyards, and orchards. As the development of the Bay Area continued, much of the agricultural land was later replaced by urban development. Much of the valley oak woodland that was present historically in the lower foothills has been lost.

"Historically, the South Bay supported large expanses of tidal flat and tidal marsh. In many of the marshes between the tidal creeks were salt marsh ponds or pans" (Goals Project 1999). "Also much of the periphery of the baylands were wet grasslands ….." (Goals Project 1999). In the South Bay, large areas of tidal flat and tidal marsh were converted to shallow ponds of varying salinities for salt production (Goals Project 1999). "Other development along the bayshore, including sewage treatment facilities, landfills, and residential and industrial uses, also reduced the area of natural baylands habitats"(Goals Project 1999). In the South Bay Subregion (south of Coyote Point on the west side, and south of San Leandro Marina on the east side), tidal flat habitat has declined 29 percent and tidal marsh has decreased by 84 percent, compared to historical conditions (Goals Project 1999).

### *7.1.5.2 Changes Due to Human Activity*

As a result of human activities, many invasive nonnative plant species have become introduced into the Basin. Such invasive species outcompete and displace the native or indigenous plants of natural plant communities and lower the habitat value for wildlife. Problematic, invasive, nonnative plants in grassland habitats include: ripgut brome, red brome (*Bromus rubens*), yellow star thistle (*Centaurea solstitialis*), field mustard (*Brassica rapa*), bull thistle (*Cirsium vulgare*), slender-flowered thistle (*Carduus tenuiflorus*), bindweed (*Convolvulus arvensis*), and milk thistle (*Silybum marianum*).

Various invasive nonnative plant species have become established in riparian habitats such as giant reed/arundo (*Arundo donax*), German (Cape) Ivy (*Senecio mikanioides*), poison hemlock (*Conium maculatum*), white sweet clover (*Melilotus albus*), and Himalayan blackberry (*Rubus procerus*). Periwinkle (*Vinca major*), an invasive vine, has become established in the understory of many woodlands, forests, and streambanks. Some of the invasive species commonly found in riparian habitats are listed in Table 7-1.

Open and disturbed areas often encourage the establishment of invasive nonnative species. For example, the disturbed roadsides along State Highway 17 in the Santa Cruz Mountains (within mixed evergreen forest) have become invaded by French broom (*Genista monspessulana*). To a much lesser extent, Scotch broom (*Cytisus scoparius*) also occurs along State Highway 17 near Lexington Reservoir.

Several species of introduced tidal marsh plants occur in the lower South Bay. Smooth cordgrass (*Spartina alterniflora)* is a perennial grass that has invaded low tidal marsh and open mudflats in the Bay (Grossinger et al. 1998). It is a potentially serious invasive in the lower South Bay (Gale Rankin, pers. comm., 1998). Perennial pepperweed is a serious invasive of South Bay brackish marshes (Gale Rankin, pers. comm., 1998). Infestations are known to occur at Warm Springs Marsh, and in marshes adjacent to Coyote Creek, Alviso Slough, Guadalupe Slough, and Charleston Slough (Grossinger et al. 1998). Other introduced tidal marsh plants that have

| Table 7-1<br>Invasive Nonnative Plants in Riparian Corridors<br>in the Santa Clara Basin | |
|---|---|
| **Common Name** | **Scientific Name** |
| Algerian ivy | *Hedra canariensis* |
| Bermuda grass | *Cynodon dactylon* |
| Black locust | *Robinia pseudoacacia* |
| Blackwood acacia | *Acacia melanoxylon* |
| Blue-Gum eucalyptus | *Eucalyptus Globulus* |
| Bristly ox-tongue | *Picris echioides* |
| Bull thistle | *Cirsium vulgare* |
| Castor bean | *Ricinus communis* |
| Cocklebur | *Xanthium strumarium* |
| Dittander | *Lepidium latifolium* |
| English ivy | *Hedera helix* |
| Fennel | *Foeniculum vulgare* |
| Field bindweed | *Convolvulus arvensis* |
| Five-hook bassia | *Bassia hyssopifolia* |
| French broom | *Genista monspessulana* |
| Fuller's teasel | *Dipsacus fullonum* |
| Cape ivy (German ivy) | *Senecio mikanioides* |
| Giant reed | *Arundo donax* |
| Green-wattle acacia | *Acacia decurrens* |
| Himalaya blackberry | *Rubus discolor* |
| Hoary cress | *Cardaria draba* |
| London rocket | *Sisymbrium irio* |
| Mediterranean mustard | *Brassica geniculata* |
| Milk thistle | *Silybum marianum* |
| Perennial pepperweed | *Lepidium latifolium* |
| Periwinkle | *Vinca major* |
| Poison hemlock | *Conium maculatum* |
| Russian thistle | *Salsola kali* var. *tenuifolia* |
| Smilo grass | *Oryzopsis miliacea* |
| Tall fescue | *Festuca arundinacea* |
| Tree-of-heaven | *Ailanthus altissima* |
| Tree tobacco | *Nicotiana glauca* |
| Yellow star thistle | *Centaurea solstitialis* |
| White sweet clover | *Melilotus albus* |

invaded South Bay salt and brackish marshes include giant reed and glasswort (*Salsola soda*) (Grossinger et al. 1998).

### *7.1.5.3 Plant Habitat Descriptions*

The ecosystems of the Basin have been catalogued, mapped, and described by previous authors in a number of different ways. General descriptions of the ecology of the region speak of broad groupings of "habitats." Many of these habitat types are also vegetated, and are thus often referred to as vegetation types. Each vegetation type is generally broken down further into plant communities. Most of the reports describing the vegetation in the Basin refer to the occurrence of plant species within each plant community present.

Some habitat types are either unvegetated or appear to be devoid of vegetation to the casual observer. These habitats are generally overlooked in a description of vegetation types and plant communities, but are discussed in texts and reports dealing with fish and aquatic resources, wildlife, and water quality. We have elected to use the combined term "habitat/vegetation types" to cover all the habitats in the Basin.

The habitat/vegetation types described in this text represent a refinement of the habitat types used in the Santa Clara County General Plan. The Santa Clara County General Plan (Santa Clara County 1994) and the background report for the General Plan (Santa Clara County 1993) refer to four broad groupings of habitats: Baylands Habitats (including estuary, mudflat, salt marsh, salt pond, and levee); Freshwater Habitats (including flowing streams, riparian zones, freshwater marshes, and lentic zones); Grassland/Savanna Habitats (including grassland and savanna); and Chaparral/Forest Habitat (including chaparral, mixed evergreen forest, redwood forest, foothill woodland, and closed-cone pine forest). There was no map showing the distribution of these habitats in either the General Plan or the background study.[3]

The habitat/vegetation types used in this text to describe the natural history and ecology of the Basin are the following: lower South Bay, Baylands habitats, freshwater habitats with standing water (i.e., lentic habitat), freshwater habitats with flowing water (i.e., lotic habitat), freshwater wetlands, nonnative grasslands, native grasslands, scrub and chaparral, riparian and bottomland habitat, woodlands, broadleaved upland forests, coniferous forests, cliffs and rock outcrops, agricultural land, and urban habitat. Table 7-2 presents a comparison of these habitat/vegetation types with the terms commonly used to describe biotic/plant communities and wildlife habitats.

### *7.1.5.4 Unvegetated Habitat Types*

The unvegetated habitat types in the Basin include the lower South Bay (permanent open [salt] water) and the Baylands habitats subject to tidal inundation (tidal [mud] flats and tidal sloughs

[3] A map showing the distribution of Vegetative Resources in Santa Clara County was prepared as part of the general planning process in the early 1970s (Santa Clara County 1973). This color map shows the distribution of the following "General Habitats": salt ponds; salt marsh; riparian (streamside); grassland; woodland and grass; hardwood, woodland, and chaparral; pine forest; coulter pines; redwood; agricultural; and urban. This map has never been updated nor does it exactly correspond to the classification of habitat/vegetation types used in this text.

**Table 7-2**
**Habitats/Vegetation Types, Plant Community Designations, and Wildlife Habitats in the Santa Clara Basin**

| Habitat/Vegetation Type | Biotic/Plant Communities[1] | Wildlife Habitats[2] |
|---|---|---|
| Lower South San Francisco Bay | Permanent (Open) Water (Saltwater) | |
| Baylands Habitats: Estuarine Habitats and Tidal/Brackish Wetlands | Tidal (Mud) Flats | |
| | Tidal Sloughs (Brackish water) | |
| | Northern Coastal Salt (Tidal) Marsh [52110] | Saline Emergent Wetland |
| | Diked Salt Marsh | |
| | Coastal (Tidal) Brackish Marsh [52200] | |
| | Salt Ponds | No Designation |
| | Levees and Dikes | No Designation |
| | Managed Marsh | No Designation |
| Freshwater Habitats: Lentic (i.e., Standing Water) Habitats | Lakes and Reservoirs | Lacustrine |
| | Natural Ponds | |
| | Human-made Ponds | |
| | Percolation Ponds | |
| Freshwater Habitats: Lotic (i.e., Flowing Water) Habitats | Perennial Streams | Riverine |
| | Intermittent Streams | |
| | Ephemeral Streams | No Designation |
| | Mineral Hot Springs | No Designation |
| Freshwater Wetlands | Coastal Freshwater Marsh [52410] | Fresh Emergent Wetland |
| | Meadow and Seep – Freshwater Seep [45400] | Fresh Emergent Wetland and Wet Meadow |
| | Vernal Pool | Annual Grassland |
| Nonnative Grasslands | Nonnative Grassland [42200] | Annual Grassland |
| | Wildflower Field [42300] | No Designation |
| Native Grasslands | Native Grassland - Valley Needlegrass Grassland [42110] | Perennial Grassland |
| | Coastal Prairie-Scrub Mosaic, (Kuchler 1977) | |
| | Native Grassland - Serpentine Bunchgrass [42130] | No Designation |

**Table 7-2 (continued)**
**Habitats/Vegetation Types, Plant Community Designations, and Wildlife Habitats in the Santa Clara Basin**

| Habitat/Vegetation Type | Biotic/Plant Communities[1] | Wildlife Habitats[2] |
|---|---|---|
| Scrub and Chaparral | Northern Coastal Scrub [32100] | Coastal Scrub |
| | Diablan Sage Scrub [32600] | |
| | Upper Sonoran Mixed Chaparral - Northern Mixed Chaparral [37110] | Mixed Chaparral |
| | Chamise Chaparral [37200] | Chamise – Redshank Chaparral |
| | Serpentine Chaparral [37600] | Mixed Chaparral |
| | Upper Sonoran Ceanothus Chaparral – Buck Brush Chaparral [37810] | |
| | Upper Sonoran Ceanothus Chaparral – Blue Brush Chaparral [37820] | |
| | Interior Live Oak Chaparral [37A00] | |
| Riparian and Bottomland Habitats: Riparian Forests, Riparian Woodlands, and Riparian Scrubs | Central Coast Cottonwood-Sycamore Riparian Forest [61210] | Valley Foothill Riparian |
| | Central Coast Live Oak Riparian Forest [61220] | Coastal Oak Woodland |
| | Central Coast Arroyo Willow Riparian Forest [61230] | Valley Foothill Riparian |
| | White Alder Riparian Forest [61510] | |
| | Sycamore Alluvial Woodland [62100] | |
| | Central Coast Riparian Scrub [63200] | No Designation |
| | Mule Fat Scrub [63310] | |
| Woodlands | Black Oak Woodland [71120] | Montane Hardwood |
| | Valley Oak Woodland [71130] | Valley Oak Woodland |
| | Blue Oak Woodland [71140] | Blue Oak Woodland |
| | Interior Live Oak Woodland [71150] | Blue Oak Woodland and Montane Hardwood |
| | Coast Live Oak Woodland [71160] | Coastal Oak Woodland |
| | Open Digger Pine Woodland [71310] | Blue Oak – Digger Pine |
| Broadleaved Upland Forests | Mixed Evergreen Forest [81100] | Montane Hardwood Conifer |
| | California Bay Forest [81200] | |
| | Coast Live Oak Forest [81310] | Coastal Oak Woodland |
| | Interior Live Oak Forest [81330] | Blue Oak Woodland |
| | Black Oak Forest [81340] | Montane Hardwood |
| | Tan Oak Forest [81400] | Douglas – Fir |

**Table 7-2 (concluded)**
**Habitats/Vegetation Types, Plant Community Designations, and Wildlife Habitats in the Santa Clara Basin**

| Habitat/Vegetation Type | Biotic/Plant Communities[1] | Wildlife Habitats[2] |
|---|---|---|
| Coniferous Forests | Upland Redwood Forest [82320] | Redwood |
| | Douglas-Fir Forest [82400] | Douglas – Fir |
| | Knobcone Pine Forest [83210] | Closed-Cone Pine-Cypress |
| | Upland Coast Range Ponderosa Pine Forest [84131] | Ponderosa Pine |
| | Coulter Pine Forest [84140] | No Designation |
| Cliffs and Rock Outcrops | Cliffs and Rock Outcrops | No Designation |
| Agricultural Land | Field Crops | Cropland |
| | Grain and Hay Crops | |
| | Orchards | Orchard-Vineyard |
| | Vineyards | |
| | Pasture (Irrigated) | Pasture |
| | Grazing Lands (see Nonnative Grasslands) | Annual Grassland |
| Urban Habitat | Urban Forest | Urban |
| | Fallowland | |

[1] Plant Community designations used are as according to *Preliminary Descriptions of the Terrestrial Natural Communities of California* (Holland 1986) unless otherwise indicated. Brackets [ ] give the former CNDDB designation according to the “Holland Code.” Note: In 1997 the California Department of Fish and Game, Natural Heritage Division, created a new *List of California Terrestrial Natural Communities Recognized by the Natural Diversity Data Base* based on the classification put forth in *A Manual of California Vegetation* (Sawyer and Keeler-Wolf 1995). We have elected to use the 1986 rather than the 1995 designations since this new classification system is far more complex and data are not available on the distribution of plant communities in the Santa Clara Basin using this terminology.

[2] Terms used to describe wildlife habitats are as per *A Guide to Wildlife Habitats of California* (Mayer and Laudenslayer 1988). This guide describes the various wildlife habitats that constitute the California Wildlife-Habitat Relationships (WHR) System. This classification system was developed for WHR by the California Interagency Wildlife Task Group. It was developed to recognize and logically categorize major vegetative complexes at a scale sufficient to predict wildlife-habitat relationship.

[brackish water]). These habitat types are commonly referred to as estuarine habitat by fish and wildlife biologists. Salt ponds are also an unvegetated (with the exception of algae) habitat occupying a significant portion of the land area surrounding the lower South Bay. These habitat types are described in Sections 7.1.6 and 7.1.7.

The freshwater habitats with standing water (i.e., lentic habitat) including lakes and reservoirs, natural and the human-made ponds (including percolation ponds), and the flowing water (lotic) habitats (e.g., perennial and intermittent streams), are also described in Sections 7.1.6 and 7.1.7.

### *7.1.5.5 Vegetated Habitat Types and Plant Communities*

The Basin has a wide variety of vegetation types, plant communities, and plant species, which may be attributed to the varying environmental conditions present in the Basin. Differences in topography (elevation, slope, and aspect), climate, soil types, and land management activities (past and present) determine the distribution of the major vegetation types and plant communities.

As a result of varying environments, the following trends in habitat distribution are apparent. In higher and drier areas, chaparrals and grasslands tend to be dominant; whereas in shady or more moist areas, woodlands and forests occur. For example, as one looks at the west-facing slopes of the Diablo Range, oak woodlands are common in drainages and on north-facing slopes. Riparian and wetland habitats are more developed in bottomlands associated with creeks and the Bay.

Plant community designations vary between various authorities and are not necessarily directly correlated. Plant community designations used in this text are as according to *Preliminary Descriptions of the Terrestrial Natural Communities of California* (Holland 1986), unless otherwise indicated. This system for classification of plant communities was used by the California (Department of Fish and Game [CDFG]) Diversity Data Base (CNDDB) until recently. Table 7-2 lists each of the plant communities according to Holland (1986) that are known to occur within each of the major habitat/vegetation types in the Basin. (It should be noted that the "Holland" descriptions do not accurately describe or correlate with all of the plant communities in the Basin [Gale Rankin, pers. comm., 1998]).

The following is a general description of the distribution of vegetation types and plant communities in the Basin, by habitat. Mapped information showing the distribution of the plant communities in the Basin may be obtained from the following sources: CAL VEG ICE Maps; Information Center for the Environment (CARA 1997) (scale 1 inch = 10 miles); Vegetative Resources (Santa Clara County 1973) (scale .4 inches = 2 miles); and the map of Natural Vegetation of California (Kuchler 1977) (scale units 1:1,000,000).

#### Tidal Marsh Habitat

Tidal marsh habitat occurs in undiked areas of the lower South Bay and in tidal reaches of rivers and streams that are open to complete tidal action. It occurs from the top of the intertidal zone, at the maximum height of the tides, to the lowest extent of vascular vegetation. In the more saline parts of the South Bay, tidal marsh is referred to as tidal salt marsh. In the more brackish areas where there is significant freshwater influence, it is referred to as tidal brackish marsh.

Both types of tidal marsh are typically characterized by three general zones of vegetation, each of which is related to tidal elevation. Low tidal marsh occurs between the lowest margin of the marsh and mean high water (MHW). Middle tidal marsh occurs between MHW and mean higher high water (MHHW). High tidal marsh occurs between MHHW and the highest margin of the marsh (Goals Project 1999).

Salt marshes border the mudflat community, and are composed of a rich community of algae, diatoms, and invertebrates, as well as wetland[4] vegetation. Mudflats and salt marshes are generally found between mean low water (the average water level at low tide) and the extreme high tide line. Salt marshes can be distinguished from the mudflats they border by the presence of upright herbaceous vegetation, which colonizes salt marshes at an elevation approximately equal to mean sea level (msl), extending up to the extreme high tide line. The harsh environment of a salt marsh includes tidal inundations of salt or brackish water. (Brackish water is a mixture of predominantly freshwater and some saltwater). Because the water-saturated soils of salt marshes contain little oxygen and have high salt concentrations, predominantly while the surface is fully exposed to sun and wind, the plants that successfully make their home there are uniquely adapted to this challenging environment (Faber 1982).

The coastal salt marsh community is often stratified into three easily distinguishable community types that correlate with dominant vegetation cover, elevation, and tidal flow. The area from the low tide line to the mid-tidal zone is dominated by cordgrass (*Spartina foliosa*). Cordgrass can tolerate many hours of continuous submergence, as well as salt concentrations slightly higher than the open ocean. Cordgrass is the only salt marsh plant able to tolerate total submergence for more than half of the day, as well as total darkness for several days in a row if high tide occurs near mid-day during the winter (Conradson 1996). Cordgrass is considered one of the most productive land plants in the world, yielding up to eight tons of dried material per acre (Conradson 1996). This rooted aquatic perennial dies back in the fall, and decomposes into minute particles that provide the primary productivity for many organisms in the Bay. Due to land subsidence, large amounts of cordgrass habitat have disappeared in the South Bay.

The mean high tide zone is dominated by another perennial, common pickleweed *(Salicornia virginica).* Pickleweed is a fleshy plant standing approximately 18 inches high with modified succulent leaves resembling stems. Pickleweed can tolerate having its roots in the wet mud, but unlike cordgrass, cannot tolerate long periods of total submergence. Cordgrass and pickleweed zones may overlap for about 3 feet of elevation, but pickleweed has a higher tolerance level for the increase of salt concentration that comes with higher elevations (Conradson 1996). Another

[4]The term wetland does not refer to a single vegetation type or a single plant community. Any habitat where the soil is continuously saturated within 18 inches of the surface for a period of at least 1 to 3 weeks per year may considered a wetland. Because wetlands are periodically waterlogged, the plants growing there must tolerate low levels of soil oxygen. The presence of flood-tolerant species is often a good indication that a site is a wetland even if the ground appears to be dry for most of the year (Barbour et al. 1993).

common plant in the high tide pickleweed zone is a plant that starts its life rooted in the mud then becomes parasitic to pickleweed, avoiding the seasonal increase of salt concentration in the soil. This parasitic plant, the salt marsh dodder (*Cuscuta salina*) looks like orange-colored string, clumped in small patches on top of the pickleweed. The pickleweed plant community also includes Jaumea (*Jaumea carnosa*) and arrow-grass (*Triglochin spp*.).

The upper portion of the high tide zone, which is occasionally inundated, has drier alkali and soils and is dominated by various peripheral species such as salt grass (*Distichlis spicata*). This plant community may contain marsh rosemary or sea lavender (*Limonium californicum*), alkali heath (*Frankenia salina*), fat-hen (*Atriplex triangularis*), brass buttons (*Cotula coronopifolia*), marsh gum plant (*Grindelia stricta var. augustifolia*), curly dock (*Rumex crispus*), and Australian saltbush (*Atriplex semibaccata*).

The biodiversity of plant species in saltwater marshes is limited to approximately 15 native species due to the tolerance limits of these plants to high salt concentrations, as well as periods of either desiccation or water inundation due to tidal fluctuations. Although the diversity of plants is low, the three dominant plant species that have physically adapted to estuarine environments have been able to utilize the direct sunlight and abundance of nutrients (either from the land as sediments are washed down into the Bay via rivers and creeks, or from the ocean upwelling currents brought into the Bay by tidal action) to such an extent that estuaries are highly productive environments. In the Lower South Bay, smooth cordgrass is a potentially serious invasive perennial grass in low tidal marsh and open mudflats.

Brackish marshes are found in places where freshwater mixes with saltwater. A brackish marsh is one of the most restrictive types of habitat due to the extreme fluctuations in salinity found there. During the winter and spring season of heavy rains and stream runoff, brackish marshes may be flooded almost entirely by freshwater, while in the summer and fall saltier tidal waters predominate. This condition limits the variety of plants found in brackish marshes to those that can tolerate inundation by both fresh and salty water (Faber 1982). Dominant genera of brackish tidal marsh are *Scirpus* (bulrush) and *Typha spp*. (cattail) (Josselyn 1983).

The primary wetlands associated with the lower South Bay are the northern coastal salt marsh and the coastal brackish marsh (Holland 1986). To a lesser extent, diked salt marshes and estuaries also occur. Within the Basin, the coastal salt marsh is distributed along the southern fringes of the Bay such as in the Palo Alto Baylands and at the Don Edwards San Francisco Bay National Wildlife Refuge. Coastal salt marsh habitat is restricted to a zone that occurs from just below mean tide level to the level of the highest tides along the Bay rim (Santa Clara County 1993). Plants growing in the coastal salt marsh are affected by the twice daily fluctuations in the water level of the Bay and its salinity and temperature (San Mateo County Planning Department 1973). Typical plant species associated with the coastal salt marsh are salt grass, pickleweed, cordgrass, and marsh gum plant.

Coastal (tidal) brackish marsh occupies a similar position to the coastal salt marsh, except it has more freshwater input, and the salinity may vary significantly. Tidal brackish marsh often occurs in estuaries (flatlands where freshwater and saltwater mix) and intergrades with coastal salt marsh or freshwater marsh, where rivers and creeks enter the Bay. In tidal brackish marsh, cattails, California bulrush (tule) (*Scirpus californicus),* and alkali bulrush (*Scirpus maritimus)* dominate the low marsh (Goals Project 1999). A diverse assemblage of species including bulrushes, spike rush (*Eleocharis spp.*), Baltic rush (*Juncus balticus*), silverweed, and salt grass dominates the middle marsh (Goals Project 1999). Common pickleweed, saltgrass, gumplant, and alkali heath characterize the high marsh (Goals Project 1999). There has been a rapid large-scale invasion of perennial peppergrass (*Lepidium latifolium*) in the brackish marsh at the south end of the Bay over the past few years (Gale Rankin, pers. comm., 1998).

An ongoing study has been designed to detect changes in habitat types within the coastal marshes of the South Bay. The study also evaluates the possible contribution of the freshwater discharge from the San Jose-Santa Clara Regional Water Pollution Control Plant on the disruption of different habitat types. Although new marsh formation has occurred, over 127 acres of salt marsh habitat has converted to a less saline environment (mostly brackish marsh habitat) in the last 10 years. The majority of this conversion has taken place since 1996, when freshwater marsh habitats were first mapped. Much of the conversion is caused likely by large-scale influences that are affecting the entire system, including anthropogenic and environmental factors. The ongoing collection of physical data will aid in determining the relative influences of environmental and anthropogenic factors to changes in marsh types (H. T. Harvey & Associates 1999).

### Baylands Habitats – Diked Wetlands

There are many acres of diked wetlands in the South Bay. These are historical tidal marshes isolated from tidal influences due to levees or dikes, but that maintain wetland features. Some of these wetlands are connected to tidal sloughs by outlet structures. Depending on the type of outlet, tidal water may be allowed to flow into the site, although the amount of inundation is generally controlled. At other sites there may be no outlet. In these instances, surface runoff collects in the wetland areas behind dikes and levees during the winter months and evaporates in the spring.

A mosaic of pickleweed marsh, bare ground, and higher elevation salt marsh plant species occupies most of the diked wetland areas; however, there is often also a preponderance of weedy/ruderal plant species. Most of these areas have reverted to wetland habitat after being abandoned by farmers. Although the water ponded in these diked wetlands may be freshwater, the soils underlying these areas are saline due to their origin and the high levels of evaporation.

Because of land subsidence, most of these diked wetlands are too low in elevation to function as marsh if subjected to the full range of tidal action. If the levees were breached these areas would become open water habitat and not return to a wetland. Restoration of wetlands located in areas of subsidence requires restoring the subsided marsh plain back to an appropriate elevation in the intertidal zone and restoring the range of functions a tidal marsh provides. In San Francisco Bay tidal wetlands, restoration will proceed primarily by deposition of suspended sediment. It is predicted that about 10 to 15 years would be required for sediment deposition in a subsided South Bay salt pond to raise the marsh plain to an elevation where native vegetation would become established (Goals Project 1999). Muted tidal action has been restored to some of these areas through the installation of water control structures with risers.

## Baylands Habitats – Constructed Wetlands

There are a number of restored (constructed) wetlands in the South Bay. In some cases, existing dikes have been breached to allow tidal waters to enter the restoration area. In other instances, water control structures have been installed to control the extent and duration of inundation by tidal waters. In most cases, there has also been some planting of marsh plants.

## Freshwater Wetlands

In contrast to brackish water marshes, the freshwater marsh is a less demanding environment for plants and animals to grow and live in. Freshwater marshes are found throughout the coastal drainages of California wherever water slows down and accumulates, even on a temporary or seasonal basis. A freshwater marsh usually features shallow water that is often clogged with dense masses of vegetation. Although pools of water are common, as a marsh ages, vegetation accumulates, often filling in all the open water (Faber 1982). Freshwater marshes occur in lowland areas adjacent to diked tidal wetlands and along the lower reaches of the rivers and creeks upstream of tidal influence.

The following types of freshwater wetlands occur in the Basin: coastal freshwater marsh, freshwater seep, and seasonal wetlands. Freshwater marshes may form around springs, ponds, and along slow moving creeks and rivers. Typical plant species include cattail, California bulrush, common tule (*Scirpus acutus*), and various species of rush (*Juncus* spp.) and sedge (*Carex* spp.). Vernal pools may support endemic or rare and endangered plant species such as Contra Costa goldfields (*Lasthenia conjugans*) and Lobb's aquatic buttercup (*Ranunculus lobbii*). Many of the vernal pools that were present historically have been lost to urban development. For example, a previously known vernal pool in southern Alviso is now occupied by commercial buildings (Sally Casey, pers. comm., 1998).

Near the city of Fremont, a well-known vernal pool is currently being protected at the Don Edwards San Francisco Bay National Wildlife Refuge. A freshwater marsh occurs on Bailey Road west of Santa Teresa Boulevard (near Tulare Hill) (Dr. Rod Myatt, pers. comm., 1998).

## Nonnative Grasslands

Grassland habitats occur in the Santa Clara Valley floor, and foothills are interspersed with woodland areas, where the moisture is low and evaporation is high (Santa Clara County 1993). Today, the majority of the grasslands are dominated by nonnative annual plant species, including many European grasses. This plant community is designated nonnative grassland under the Holland (1986) classification system. The native grasslands present before European settlement have been reduced significantly by the invasion of weedy annual grasses and forbs, including wild oat (*Avena* spp.), soft chess (*Bromus hordeaceous*), ripgut brome (*Bromus diandrus*), sheep sorrel (*Rumex acetosella*), and filaree (*Erodium* spp.).

In some areas, nonnative grasslands intermingle with oak woodland habitats, and form a vegetation mosaic often referred to as a savanna. Savanna habitat occurs in portions of the grassy foothills along Interstate 280 in the vicinity of Los Altos Hills.

### Native Grasslands

Remnants of native perennial grasslands occur in some areas of the Basin, such as the remote hilltops at Grant Ranch County Park, where there are shallow soils or rocky outcrops that are less accessible by cattle. Native grasslands growing on serpentine soils and outcrops are a special grassland type. Known locations of serpentine bunchgrass grassland occur in Kirby Canyon, 6 miles north of Morgan Hill, and in the Stiles Ranch Easement by Santa Teresa Park (Sally Casey, pers. comm., 1998). Native forbes and annual grasses are found in the serpentine areas of the Jasper Ridge Biological Reserve and perennial native bunchgrasses are found on moister Reserve Lands. (Philippe Cohen, Director, Jasper Ridge Biological Reserve, pers. comm., 7/25/00). Apparently, the native perennial bunch grasses can tolerate shallow and/or rocky soils more than the European grasses, and therefore can compete against them (Santa Clara County 1993). Native grassland plant communities, according to Holland (1986), include valley needlegrass grassland and serpentine bunchgrass (Table 7-2).

### Scrubs and Chaparrals

Scrub habitats tend to be less dry compared to chaparrals, and consist of low-growing shrubs from 2 to 6 feet tall. In general, scrub habitats are distributed at lower elevation than chaparrals. Northern coastal scrub is the most abundant scrub type in the Basin. Common scrub species include: coyote brush (*Baccharis pilularis*), coffeeberry (*Rhamnus californicus*), poison oak (*Toxicodendron diversilobum*), and California blackberry (*Rubus ursinus*). Northern coastal scrub is often distributed as patches within grassland habitat. Coyote brush has a high reproductive rate, and has the potential to convert orchards and grasslands into scrub habitat.

Chaparral plant communities tend to be distributed in dry areas having shallow soil profiles, particularly on south- and west-facing slopes. Typical chaparral species in the Basin include: chamise (*Adenostoma fasciculatum*), buck brush (*Ceanothus cuneatus*), blue blossom/blue brush ceanothus (*Ceanothus thrysiflorus*), scrub oak (*Quercus dumosa*), black sage (*Salvia mellifera*), leather oak (*Quercus durata*), poison oak, mixed chaparral, interior live oak chaparral, and serpentine chaparral. Chaparral plant communities are “characterized by shrubs and shrubby trees from 3 to 10 feet tall with some herbaceous plants growing under them” (Santa Clara County 1993). In general, chaparrals are fire-adapted plant communities, requiring periodic fires for optimum health and stability. For example, chamise is a stump sprouter and depends on fire every 15 to 20 years (Barbour, Burk, and Pitts 1980).

### Riparian Habitats

Riparian habitats are distributed along the banks and/or floodplains of rivers and creeks. The plant composition and width of the riparian corridor vary, depending on the steepness of the channel and the hydrologic regime present (e.g., frequency of flooding). Types of riparian plant communities that occur along the rivers and creeks in the Basin include: central coast arroyo willow riparian forest, central coast cottonwood-sycamore riparian forest, white alder riparian forest, sycamore alluvial woodland, central coast live oak riparian forest, and central coast riparian scrub, which is dominated by shrub species (Table 7-2). In some areas where there is frequent flooding, gravel bars with mule fat (*Baccharis salicifolia*) scrub occur as an early seral community. Examples of relatively natural stands of white alder riparian forest occur in Upper Stevens Creek County Park and Grant Ranch County Park. Invasive, nonnative plant species reportedly found in riparian corridor within the Basin include blue gum eucalyptus, acacia, fennel (*Foeniculum vulgare*), periwinkle, English ivy, French broom, black locust, Algerian ivy (*Hedera canariensis*), Cape ivy, Himalaya blackberry, weeds, curly dock (*Rumex cripus*), thistle, backwood acacia (*Acacia melanoxylon*), tree-of-heaven, glossy privet (*Ligustrum lucidum*), fig, poison hemlock, fennel, black mustard, black walnut, almond, and giant cane (*Arundo donax*).

Riparian habitats have been significantly reduced from their historical extent. Due to the limited extent of the remaining riparian habitats and their value for wildlife resources, federal, state, and county government agencies consider them a sensitive and protected resource. Before the Santa Clara Valley was urbanized, riparian forests and woodlands often occurred as continuous bands of dense vegetation along many of the creeks. During the last two centuries, many of the streambanks were altered with artificial bank stabilization, channelization, and/or flood control clearing (Jones and Stokes 1993). Today, small disjunct stands of riparian woodlands and forests occur. Common riparian tree species include: box elder (*Acer negundo*), Fremont cottonwood (*Populus fremontii*), arroyo willow (*Salix lasiolepis*), red willow (*Salix laevigata*), white alder (*Alnus rhombifolia*), western sycamore (*Platanus racemosa*), and coast live oak (*Quercus agrifolia*).

### Woodlands

Woodland habitats primarily occur in the foothills, and are typically composed of various species of oak trees. Trees in woodlands are more widely spaced, and tend to be lower in stature compared to forest habitats; therefore, the herbaceous understory may be well-developed in undisturbed areas. Types of woodlands that occur in the Basin include coast live oak woodland, interior live oak (*Quercus wislizenii*) woodland, black oak (*Quercus kelloggii*) woodland, blue oak woodland, valley oak (*Quercus lobata*) woodland, and open gray pine (*Pinus sabiniana*) woodland (Table 7-2). The woodlands found in the Diablo Range are subject to drier conditions and are often dominated by blue oak (*Quercus douglasii*), foothill/gray pine, and interior live oak. In the Santa Cruz Mountains, the woodlands are dominated by coast live oak and tan oak (*Lithocarpus densiflorus*). Woodlands are distributed in a discontinuous band from Crystal Springs southward to Mt. Madonna (Thomas 1961).

### Broadleaved Upland Forests

Types of broadleaved forests that occur in the Basin include: mixed evergreen forest, black oak forest, tan oak forest, California bay forest, and coast live oak forest (Table 7-2). Forests are primarily distributed at higher elevations on the north- and east-facing slopes of the Santa Cruz Mountains and west-facing slopes of the Diablo Range. Hardwood forests composed mainly of coast live oak, tan oak, California black oak, madrone (*Arbutus menziesii*), and California bay (*Umbellularia californica*) occur on the east-facing slopes of the Santa Cruz Mountains.

### Coniferous Forests

Types of conifer forests that occur in the Basin include: Coulter pine (*Pinus coulteri*) forest, Douglas-fir (*Pseudotsuga menziessi*) forest, knobcone pine (*Pinus attenuata*) forest, upland ponderosa pine (*Pinus ponderosa*) forest, and upland redwood forest (Table 7-2). Coast redwood (*Sequoia sempervirens*) forest is mainly distributed in the Santa Cruz Mountains in ravines, along stream sides, and areas that are moistened by coastal fog (Thomas 1961). Stands of ponderosa pine forest, foothill/gray pine forest, and Coulter pine forest occur in the higher elevations of the Diablo Range. Timber is harvested in the Santa Cruz Mountains.

### Agricultural Lands

Agricultural lands include orchards, vineyards, field crops, grazing lands, and irrigated pastures. Orchards were once prevalent throughout the Santa Clara Valley; however, now only remnants of larger orchards remain scattered in residential areas and in the foothill regions that are less subject to development. Common fruit crops include prune, cherry, apricot, walnut, and pear. By 1930, there were 120,000 acres of orchards in production. Due to an increased demand for urban services, there was a one-third reduction in the amount of cultivated lands between 1947 and 1961. Grazing lands still occur, including lands in Grant Ranch County Park and Los Altos Hills and portions of the Stanford University leased lands west of Junipero Serra Boulevard. Since 1961, the amount of agricultural land has continued to decrease.

### Urban Habitat

The *CALVEG Mosaic of Existing Vegetation of California* (Matyas and Parker 1979) refers to artificial/human-made vegetation as the urban–agriculture complex. Urban forest primarily refers to landscaped residences, planted street trees (i.e., elm, ash, liquidambar, pine, palm), and parklands. Most of the vegetation is composed of nonnative or cultivated plant species. An invasive nonnative tree, the tree-of-heaven (*Ailanthus altissima*), has become established in yards and vacant lots in the City of San Jose area.

The City of San Jose arborist has performed past inventories of the numbers and species of street trees that have been planted along the sidewalks. Other cities, such as Palo Alto, have also conducted tree inventories. Portions of Palo Alto and San Jose (i.e., Willow Glen) have mature trees that in some areas form contiguous canopies.

### *7.1.5.6 Special Plant Species*

Special plant[5] species are plants that are legally protected under the federal and California Endangered Species Acts or other regulations, or species that are considered to be of concern by the resource agencies and/or the scientific community. Such species are often designated rare, threatened, endangered, or locally unique. The *California Native Plant Society's Inventory of Rare and Endangered Vascular Plants of California* (Skinner and Pavlik 1994) provides information on the laws and acts for endangered species protection.

The Santa Clara County General Plan (Santa Clara County 1993) lists 43 endangered and threatened plants known to occur in Santa Clara County. The list provides information on each species, including its common and scientific name, legal status, and habitat preference. A number of these rare and endangered species are associated with serpentine (also designated ultramafic) soils, including Santa Clara Valley dudleya (*Dudleya setchellii*), coyote ceanothus (*Ceanothus ferrisae*), and Metcalf Canyon jewel-flower (*Streptanthus albidus spp. albidus).*

The endangered coyote ceanothus has been recorded at Anderson Reservoir and in the Morgan Hill area. The Mt. Hamilton Range is known for rare plants such as the Mt. Hamilton thistle (*Cirsium fontinale campylon*), the Mt. Hamilton coreopsis (C*oreopsis hamiltonii*), and the Mt. Hamilton jewelflower (*Streptanthus callistus*) (Corelli and Chandik 1995).

Twenty-nine special-status plant species are known to occur in the Santa Clara Basin. Table 7-3 presents information on special-status plants in the Basin.[6]

[5] "Special Plants" is a broad term used to refer to all the plant taxa inventoried by the CNDDB, regardless of their legal or protection status. Special Plant taxa are species, subspecies, or varieties that fall into one or more of the following categories:

- Officially listed by California or the federal government as Endangered, Threatened, or Rare
- A candidate for state or federal listing as Endangered, Threatened, or Rare
- Taxa that meet the criteria for listing, even if not currently included on any list, as described in Section 15830 of the California Environmental Quality Act (CEQA) Guidelines
- A Bureau of Land Management, U.S. Fish and Wildlife Service, or U.S. Forest Service Sensitive Species
- Taxa listed in the *California Native Plant Society's Inventory of Rare and Endangered Vascular Plants of California*
- Taxa that are biologically rare, very restricted in distribution, or declining throughout their range but not currently threatened with extirpation
- Population(s) in California that may be peripheral to the major portion of a taxon's range but are threatened with extirpation in California
- Taxa closely associated with a habitat that is declining in California at an alarming rate (e.g., wetlands, riparian, old growth forests, desert aquatic systems, native grasslands, valley shrubland habitats, vernal pools, etc.)

[6] Table 7-3 is based on the Santa Clara Basin Watershed Management Initiative's (WMI's) Technical Memorandum 32: Recommended List of Special-Status Species for RARE Assessment, approved by the Core Group May 4, 2000. Information for the technical memorandum was compiled from various databases including the CNDDB, the California Native Plant Society Inventory, and the Santa Clara Valley Audubon Society Bird Species List for Santa Clara Valley and was reviewed by a number of stakeholders and biologists. The species in Table 7-3 should be considered as the current list of special-status species in the Santa Clara Basin. The reader is referred to the technical memorandum for a description of how this list was developed and the rationale of inclusion and exclusion of species in the list.

**Table 7-3**
**Special-Status Species in the Santa Clara Basin[1]**

| Ref No. | Species | Common Name | Status | | | | | Habitat Descriptions and Notes |
|---|---|---|---|---|---|---|---|---|
| | | | Federal[2] | California[3] | CDFG[4] | CNPS[5] | Other[6,7,8] | |
| | **Invertebrates** | | | | | | | |
| I-2 | *Calicina minor* | Edgewood blind harvestman | Species of concern | None | | | | Open grassland in areas of serpentine bedrock. |
| I-3 | *Danaus plexippus* | Monarch butterfly | None | None | | | | Winter roost sites extend along the coast from northern Mendocino to Baja California, Mexico. Open habitats with milkweed including meadows, weedy areas, fields, and roadsides. (Note: No formal special-status classification, but being tracked for possible classification in the future.) |
| I-4 | *Euphydryas editha bayensis* | Bay checkerspot butterfly | Threatened | None | | | | Native grasslands, commonly on outcrops of serpentine soil in the vicinity of San Francisco Bay. |
| I-5 | *Lepidurus packardi* | Vernal pool tadpole shrimp | Endangered | None | | | | Inhabits vernal pools and swales containing clear to highly turbid water in Sacramento Valley, coast ranges, and a limited number of sites in the Transverse Range and Santa Rosa Plateau. |
| | **Fish** | | | | | | | |
| F1 | *Oncorhynchus mykiss* | Steelhead-central California coast ESU | Threatened | None | | | | Rivers and tributaries of the central coast and San Francisco Bay. |
| F-3 | *Oncorhynchus tshawytscha* | Chinook salmon fall run | None; Proposed but not listed in Final Rule; Central Valley Fall-Run Chinook Salmon ESU is considered a candidate species. | None | Species of Special Concern | | | Cool, well oxygenated streams with gravelly substrates and surrounding habitat that provides sufficient instream cover and complexity. |

**Table 7-3 (continued)**
**Special-Status Species in the Santa Clara Basin[1]**

| Ref No. | Species | Common Name | Status | | | | | Habitat Descriptions and Notes |
|---|---|---|---|---|---|---|---|---|
| | | | Federal[2] | California[3] | CDFG[4] | CNPS[5] | Other[6,7,8] | |
| | **Amphibians** | | | | | | | |
| A-1 | *Ambystoma californiense* | California tiger salamander | Candidate | None | Protected/ Species of Special Concern | | | According to the CNDDB: Annual grasslands and grassy understory of valley-foothill hardwood habitats in central and northern California. Ephemeral creeks and vernal pools. According to D. Padley, SCVWD: This species is not found in creeks and rivers, it is found in ponds and vernal pools. |
| A-2 | *Rana aurora draytonii* | California red-legged frog | Threatened | None | Protected/ Species of Special Concern | | | Mostly in lowlands and foothills in/near permanent or ephemeral sources of deep water, but will disperse far during and after rain. Grassland, woodland, forest, marsh, and lakes where bullfrogs have not been introduced. |
| A-3 | *Scaphiopus hammondii* | Western spadefoot | Species of concern | None | Protected/ Species of Special Concern | | | Grassland, valley foothill hardwood woodlands, vernal pool, and slow creeks for breeding and egg-laying. |
| A-4 | *Rana boylii* | Foothill yellow-legged frog | Species of concern | None | Protected/ Species of Special Concern | | | Partly shaded shallow streams in woodland, chaparral, or forests with rocky substrate at least the size of cobbles. |
| | **Reptiles** | | | | | | | |
| R-1 | *Clemmys marmorata* | Western pond turtle | Species of concern | None | Protected/ Species of Special Concern | | | Ponds, marshes, rivers, streams and irrigation ditches with aquatic vegetation. Stream population overwinter upland in dense vegetation. Requires sparsely vegetated upland soils for nesting. Grassland and oak woodland. |

| Table 7-3 (continued)<br>Special-Status Species in the Santa Clara Basin[1] | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Ref No. | Species | Common Name | Status | | | | | Habitat Descriptions and Notes |
| | | | Federal[2] | California[3] | CDFG[4] | CNPS[5] | Other[6,7,8] | |
| R-3 | *Phrynosoma coronatum frontale* | California horned lizard | Species of concern | None | Protected/ Species of Special Concern | | | Dry, soft soil grassland, open coastal scrub, oak woodland. |
| R-4 | *Thamnophis sirtalis tetrataenia* | San Francisco garter snake | Endangered | Endangered | Fully protected | | | Vicinity of freshwater marshes, ponds, and slow-moving streams in San Mateo County and extreme northern Santa Cruz County. |
| | **Birds[9]** | | | | | | | |
| B-1 | *Accipiter striatus* | Sharp-shinned hawk | None | None | Species of Special concern | | 6a | Nests at high elevations in the Santa Clara Basin. |
| B-2 | *Accipiter cooperii* | Cooper's hawk | None | None | Species of Special Concern | | 6a | Open woodland<br>Riparian woodland<br>Urban areas |
| B-3 | *Agelaius tricolor* (nesting colony) | Tricolored blackbird | Species of concern | None | Species of Special Concern | | | Highly colonial species, most numerous in the Central Valley and vicinity. Largely endemic to California. Grassland, freshwater marsh, riparian habitats, dairies, and feedlots. Small breeding colonies at reservoirs, private and public lakes, and urban parks. |
| B-4 | *Aquila chrysaetos* (nesting and wintering) | Golden eagle | None | None | Fully Protected/ Species of Special Concern | | | Rolling foothill or coast-range terrain, where open grassland turns to scattered oaks, sycamores, or large foothill pines. Nests in upper portion of Coyote watershed. One or two pairs recorded in upper Guadalupe watershed. |

| Table 7-3 (continued)<br>Special-Status Species in the Santa Clara Basin[1] | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | Status | | | | | |
| Ref No. | Species | Common Name | Federal[2] | California[3] | CDFG[4] | CNPS[5] | Other[6,7,8] | Habitat Descriptions and Notes |
| B-5 | *Asio flammeus* | Short-eared owl | None | None | Species of Special Concern | | | Saltwater marsh, tall grass meadow, freshwater marsh, agricultural land. Last known nest in 1974, although nests north of basin on Bair Island. |
| B-6 | *Asio otus* (nesting) | Long-eared owl | None | None | Species of Special Concern | | | Found in riparian bottomlands grown to tall willows and cottonwoods; also, belts of live oak paralleling stream courses. Nests in open or semi-open short grass or sparsely vegetated areas. One nest record in the Santa Clara Basin in coniferous and broad-leaved evergreen forests. |
| B-7 | *Athene cunicularia* (burrow sites) | Burrowing owl | Species of concern | None | Species of Special Concern | | 7a | Found in open, dry annual or perennial grasslands, deserts, scrublands, and levees characterized by low-growing vegetation. Not known to nest in the area. |
| B-8 | *Buteo regalis* (wintering) | Ferruginous hawk | None | None | Species of Special Concern | | 7b | Open grasslands, plains, foothills |
| B-9 | *Charadrius alexandrinus nivosus* (nesting) | Western snowy plover | Threatened | None | Species of Special Concern | | USFWS: MNBMC | Sandy beaches on marine and estuarine shore. Also salt pond levees and the shores of large alkali lakes. |
| B-10 | *Circus cyaneus* (nesting) | Northern harrier | None | None | Species of Special Concern | | | Coastal salt marsh and freshwater marsh. Nests and forage in grasslands, from salt grass in desert sink to mountain cienegas. |
| B-11 | *Coccyzus americanus occidentalis* | Western yellow-billed cuckoo | None | Endangered | | | 6c, USFWS: MNBMC | Riparian. No breeding records since the late 1880's. Rare migrant. One has been recorded in the last decade. |

**Table 7-3 (continued)**
**Special-Status Species in the Santa Clara Basin[1]**

| Ref No. | Species | Common Name | Status: Federal[2] | Status: California[3] | Status: CDFG[4] | Status: CNPS[5] | Status: Other[6,7,8] | Habitat Descriptions and Notes |
|---|---|---|---|---|---|---|---|---|
| B-12 | *Coturnicops noveboracensis* | Yellow rail | None | None | Species of Special Concern | | | Freshwater marshes and marshy meadows. Observed in salt marshes during winter. |
| B-14 | *Dendroica petechia brewsteri* | Yellow warbler | None | None | Species of Special Concern | | 7c | Riparian. |
| B-15 | *Elanus leucurus* (nesting) | White-tailed kite | None | None | Fully Protected | | USFWS: MNBMC | Low rolling foothills/valley margins with scattered oaks and river bottomlands or marshes adjacent to deciduous woodland |
| B-16 | *Empidonax trailii* | Willow flycatcher | None | Endangered | | | 6c, 7d | Riparian. |
| B-17 | *Eremophila alpestris actia* | California horned lark | None | None | Species of Special Concern | | | Grasslands. |
| B-18 | *Falco columbarius* | Merlin | None | None | | | 6d | Seacoast, open woodland, savanna, and grassland |
| B-19 | *Falco peregrinus anatum* | American peregrine falcon | Delisted | Endangered | | | 7e | Seacoast, islands, and seacliffs. Forages in almost any open habitat |
| B-20 | *Geothlypis trichas sinuosa* | Saltmarsh common yellowthroat | Species of concern | None | Species of Special Concern | | 8a | Riparian, freshwater, brackish water, and saltwater marshes. |
| B-21 | *Gymnogyps californianus* | California condor | Endangered | Endangered | Fully Protected | | | Mountain, grasslands, and savannahs. |
| B-22 | *Haliaeetus leucocephalus* | Bald eagle | Threatened, Potential for Delisting | Endangered | Fully protected | | 6e | Seacoast, islands, sea cliffs, large lakes and rivers, and coastal lagoons |
| B-23 | *Icteria virens* | Yellow-breasted chat | None | None | Species of Special Concern | | 6b | Riparian. |
| B-24 | *Lanius ludovicianus* | Loggerhead shrike | None | None | Species of Special Concern | | | Grasslands, fields, broken woodlands, agricultural land, and other open spaces. |

**Table 7-3 (continued)**
**Special-Status Species in the Santa Clara Basin[1]**

| Ref No. | Species | Common Name | Status | | | | | Habitat Descriptions and Notes |
|---|---|---|---|---|---|---|---|---|
| | | | Federal[2] | California[3] | CDFG[4] | CNPS[5] | Other[6,7,8] | |
| B-25 | *Larus californicus* (nesting) | California gull | None | None | Species of Special Concern | | | Open sea, seacoast, sea beaches, estuaries, bays, harbors, lakes, rivers, freshwater marshes, and saltwater marshes |
| B-26 | *Laterallus jamaicensis coturniculus* | California black rail | Species of concern | Threatened | Fully protected | | 7f | Mainly inhabits salt marshes bordering larger bays. |
| B-27 | *Melospiza melodia pusillula* | Alameda song sparrow | None | None | Species of Special Concern | | 6f | Saline emergent wetland, shores, and lagoons. |
| B-28 | *Pandion haliaetus* (nesting) | Osprey | None | None | Species of Special Concern | | | Seacoast, coastal lagoons, estuaries, rivers, large lakes, and reservoirs. Nests on rivers, streams, bays, and lakes. |
| B-29 | *Pelecanus occidentalis californicus* (nesting colony) | California brown pelican | Endangered | Endangered | Fully protected | | USFWS: MNBMC | Coastal beaches. Colonial nester on coastal islands of small to moderate size. |
| B-30 | *Plegadis chichi* (nesting) | White-faced ibis | Species of concern | None | Species of Special Concern | | USFWS: MNBMC | Inhabits shallow freshwater marsh. Nesting habitat contains dense thickets of tule interspersed with areas of shallow water for foraging. |
| B-31 | *Rallus longirostris obsoletus* | California clapper rail | Endangered | Endangered | Fully protected | | | Saltwater marshes traversed by tidal sloughs in the vicinity of San Francisco Bay. |
| B-33 | *Rhynchops niger* (nesting colony) | Black skimmer | None | None | Species of Special Concern | | | Seacoast, shallow bays, and estuaries |
| B-34 | *Sterna antillarum browni* (nesting colony) | California least tern | Endangered | Endangered | Fully protected | | 7g, FWS: MNBMC | Nests along the coast from San Francisco Bay south to northern Baja California. Marine and estuarine shores and lagoons. |

| Table 7-3 (continued)<br>Special-Status Species in the Santa Clara Basin[1] | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | Status | | | | | |
| Ref No. | Species | Common Name | Federal[2] | California[3] | CDFG[4] | CNPS[5] | Other[6,7,8] | Habitat Descriptions and Notes |
| | **Mammals** | | | | | | | |
| M-1 | *Antrozous pallidus* | Pallid bat | | | Species of Special Concern | | | Open, dry, areas with rocky areas for roosting. Roosting habitat includes rock crevices, tree hollows, caves, mines, old buildings, and bridges. Foraging habitat includes oak savannah, open forest, riparian areas, creeks, and rivers. Habitat associations include oak savannah, ponderosa pine, and mixed deciduous-conifer forest. |
| M-2 | *Corynorhinus townsendii* | Townsend's big eared bat | Species of concern | | Species of Special Concern | | | Prefers mesic areas; roosts in caves or similar structures. Highly intolerant of human disturbance. Foraging habitat includes riparian areas, vegetated gullies, creeks, and rivers. Habitat associations include mixed deciduous-conifer forest and oak/hardwood woodland. |
| M-3 | *Eumops perotis californicus* | Western mastiff bat | Species of concern | | Species of Special Concern | | | Forages often in open, semiarid areas; also over wet meadows, lakes, and reservoirs. Roosts in cliffs. Habitat associations include oak savannah. |
| M-4 | *Lasiurus blossevillii* | Western red bat | | | Presently being reviewed for Species of Special Concern status | | | Roosts in riparian foliage such as cottonwood, sycamore, willow, orchards, and eucalyptus. Forages in riparian habitat and creeks and rivers and is the most dependent on riparian habitat of all bat species. |

**Table 7-3 (continued)**
**Special-Status Species in the Santa Clara Basin[1]**

| Ref No. | Species | Common Name | Status: Federal[2] | Status: California[3] | Status: CDFG[4] | Status: CNPS[5] | Status: Other[6,7,8] | Habitat Descriptions and Notes |
|---|---|---|---|---|---|---|---|---|
| M-5 | *Myotis evotis* | Long-eared bat | Species of concern | | | | | Roosts under bark, rock crevices, in old buildings and bridges. Forages in association with vegetation; riparian areas, oak woodland, creeks and rivers, lakes and ponds. Habitat association includes oak woodland, mixed deciduous conifer forests. |
| M-6 | *Myotis thysanodes* | Fringed myotis | Species of concern | | | | | Roosts in tree hollows, rock crevices, mines, caves, in old buildings and bridges. Intolerant of human disturbance. Forages in riparian forest settings, creeks and rivers, lakes and ponds. Habitat association includes mixed deciduous conifer forests, mixed hardwood-conifer forests, coastal forests, and pinyon-juniper forests. |
| M-7 | *Myotis volans* | Long-legged bat | Species of concern | | | | | Habitat association includes mixed deciduous conifer forests, brushy areas; roosts in tree hollows (large conifer snags), rock crevices and cliffs, mines, caves, and buildings. Forages in riparian forest settings, oak savannahs, creek and river drainages, and lakes and ponds. |
| M-8 | *Myotis yumanensis* | Yuma myotis | Species of concern | | | | | Roosts in tree hollows, mines, caves, and buildings. Highly colonial and relatively tolerant of humans. Forages over open still water on aquatic emergent insects. Breeding populations at lower elevations. Habitat association includes oak savannah, coastal forests, and mixed deciduous conifer forests. |

**Table 7-3 (continued)**
**Special-Status Species in the Santa Clara Basin[1]**

| Ref No. | Species | Common Name | Status | | | | | Habitat Descriptions and Notes |
|---|---|---|---|---|---|---|---|---|
| | | | Federal[2] | California[3] | CDFG[4] | CNPS[5] | Other[6,7,8] | |
| M-9 | *Reithrodontomys raviventris* | Salt marsh harvest mouse | Endangered | Endangered | Fully protected | | | Only in the saline and brackish emergent wetlands of San Francisco Bay and its tributaries. |
| M-10 | *Sorex vagrans halicoetes* | Salt marsh wandering shrew | Species of concern | None | Species of Special Concern | | | Salt marshes of the south arm of San Francisco Bay. |
| M-11 | *Dipodomys ingens* | Giant kangaroo rat | Endangered | Endangered | | | | Annual grassland and alkali scrub with sandy loam soils. |
| M-12 | *Vulpes macrotis mutica* | San Joaquin kit fox | Endangered | Threatened | | | | Annual grasslands or grassy open stages with scattered shrubby vegetation. |
| | **Plants** | | | | | | | |
| P-1 | *Acanthomintha duttonii* | San Mateo thorn-mint | Endangered | Endangered | | 1b | | Chaparral, valley and foothill grassland, coastal scrub, and vernal pools. Endemic to San Mateo serpentine clay. |
| P-2 | *Arctostaphylos andersonii* | Santa Cruz manzanita | Species of concern | None | | 1b | | Broadleaved upland forest, chaparral, and north coast coniferous forest. Known only from the Santa Cruz Mountains. |
| P-3 | *Astragalus tener* var. *tener* | Alkali milk-vetch | None | None | | 1b | | Alkali playa, valley and foothill grassland, and vernal pools. |
| P-4 | *Balsamorhiza macrolepis* var. *macrolepis* | Big-scale balsamroot | None | None | | 1b | | Valley and foothill grassland, cismontane woodland. |
| P-5 | *Castilleja affinis* ssp *neglecta* | Tiburon Indian paintbrush | Endangered | Threatened | | 1b | | Valley and foothill grassland, and serpentine soils. Known only from Marin, Napa, and Santa Clara counties. |

| Table 7-3 (continued) Special-Status Species in the Santa Clara Basin[1] | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | Status | | | | | |
| Ref No. | Species | Common Name | Federal[2] | California[3] | CDFG[4] | CNPS[5] | Other[6,7,8] | Habitat Descriptions and Notes |
| P-6 | *Ceanothus ferrisae* | Coyote ceanothus | Endangered | None | | 1b | | Chaparral, valley and foothill grassland, coastal scrub, and serpentine soils. Endemic to Santa Clara county. |
| P-7 | *Chorizanthe robusta* var. *robusta* | Robust spineflower | Endangered | None | | 1b | | Cismontane woodland, coastal dunes, and coastal scrub. |
| P-8 | *Cirsium fontinale* var. *campylon* | Mt. Hamilton thistle | Species of concern | None | | 1b | | Cismontane woodland, chaparral, valley and foothill grassland, serpentine seeps, and streams. |
| P-10 | *Clarkia concinna* ssp *automixa* | Santa Clara red ribbons | Species of concern | None | | 1b | | Cismontane woodland, and chaparral. |
| P-12 | *Coreopsis hamiltonii* | Mt. Hamilton coreopsis | Species of concern | None | | 1b | | Cismontane woodland. Only known from Santa Clara and Stanislaus counties. |
| P-13 | *Dirca occidentalis* | Western leatherwood | None | None | | 1b | | Broadleaved upland forest, chaparral, cismontane woodland, north coast coniferous forest, riparian forest, and riparian woodland. |
| P-14 | *Dudleya setchellii* | Santa Clara Valley dudleya | Endangered | None | | 1b | | Valley and foothill grassland, and cismontane woodland. Endemic to serpentine soils of Santa Clara county. |
| P-16 | *Fritillaria liliacea* | Fragrant fritillary | Species of concern | None | | 1b | | Coastal scrub, valley and foothill grassland, coastal prairie, and sandy soil in coastal habitats. |
| P-17 | *Hemizonia parryi* ssp *congdonii* | Congdon's tarplant | Species of concern | None | | 1b | | Valley and foothill grassland. |
| P-18 | *Lasthenia conjugens* | Contra Costa goldfields | Endangered | None | | 1b | | Valley and foothill grassland, and vernal pools. |
| P-19 | *Legenere limosa* | Legenere | Species of concern | None | | 1b | | Vernal pools. |

| Table 7-3 (concluded)<br>Special-Status Species in the Santa Clara Basin[1] | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | Status | | | | | |
| Ref No. | Species | Common Name | Federal[2] | California[3] | CDFG[4] | CNPS[5] | Other[6,7,8] | Habitat Descriptions and Notes |
| P-20 | *Lessingia arachnoidea* | Crystal Springs lessingia | Species of concern | None | | 1b | | Coastal sage scrub, valley and foothill grassland, cismontane woodland, serpentine soils in disturbed habitats, and ultramafic. |
| P-21 | *Lessingia micradenia* var. *glabrata* | Smooth lessingia | Species of concern | None | | 1b | | Chaparral. |
| P-22 | *Malacothamnus hallii* | Hall's bush mallow | None | None | | 1b | | Chaparral. |
| P-23 | *Monardella villosa* ssp *globosa* | Robust monardella | None | None | | 1b | | Chaparral, cismontane woodland. |
| P-24 | *Penstemon rattanii* var. k*leei* | Santa Cruz Mtns. beardtongue | None | None | | 1b | | Chaparral, lower montane coniferous forest. |
| P-25 | *Plagiobothrys glaber* | Hairless popcorn-flower | None | None | | 1a | | Meadows, coastal marshes, and alkali soils. |
| P-26 | *Potamogeton filiformis* | Slender-leaved pondweed | None | None | | 2 | | Marshes, swamps, lakes, and drainage channels. |
| P-27 | *Sanicula saxatilis* | Rock sanicle | Species of concern | Rare | | 1b | | Broadleaved upland forest, chaparral, and rocky soil. |
| P-28 | *Sidalcea malachroides* | Maple-leaved checkerbloom | None | None | | 1b | | Broadleaved upland forest, coastal prairie, coastal scrub, north coast coniferous forest, and disturbed habitats. |
| P-29 | *Streptanthus albidus* ssp *albidus* | Metcalf Canyon jewel-flower | Endangered | None | | 1b | | Valley and foothill grassland, serpentine barrens. |
| P-30 | *Streptanthus albidus* ssp *peramoenus* | Most beautiful jewel-flower | Species of concern | None | | 1b | | Chaparral, and valley and foothill grassland. |
| P-31 | *Streptanthus callistus* | Mt. Hamilton jewel-flower | Species of concern | None | | 1b | | Chaparral, cismontane woodland, and serpentine soils. |
| P-32 | *Suaeda californica* | California seablite | Endangered | None | | 1b | | Salt marsh. |

**Notes on following pages.**

**Notes:**

[1] Table 7-3 is based on WMI's Technical Memorandum No. 32: Recommended List of Special-Status Species for RARE Assessment, approved by the Core Group May 4, 2000. Information for the technical memorandum was compiled from various databases including the CNDDB, the California Native Plant Society Inventory, and the Santa Clara Valley Audubon Society Bird Species List for Santa Clara Valley and was reviewed by a number of stakeholders and biologists. The species in Table 7-3 should be considered as the current list of special-status species in the Santa Clara Basin. The reader is referred to the technical memorandum for a description of how this list was developed and the rationale of inclusion and exclusion of species in the list.

[2] Federal Status:

| | |
|---|---|
| Endangered | Listed as endangered under the federal Endangered Species Act |
| Threatened | Listed as threatened under the federal Endangered Species Act |
| Candidate | Candidate for listing under the federal Endangered Species Act |
| Species of Concern | Informal designation by USFWS; no formal listing status; may qualify for consideration under CEQA |

[3] State Status:

| | |
|---|---|
| Endangered | Listed as endangered under the California Endangered Species Act |
| Threatened | Listed as threatened under the California Endangered Species Act |
| Rare | Plant species listed as Rare under the California Native Plant Protection Act and the California Endangered Species Act |

[4] California Department of Fish and Game:

| | |
|---|---|
| Species of Special Concern | Animal species designated by CDFG for protection; qualify for consideration under CEQA |
| Protected and Fully Protected | Animal species that may not be taken or possessed without a permit from the Fish and Game Commission and/or the Department of Fish and Game |

[5] California Native Plant Society Inventory (Skinner and Pavlik 1994):

| | |
|---|---|
| 1a | Plant species believed to be extinct |
| 1b | Plant species that are rare, threatened, or endangered in California and elsewhere |
| 2 | Plant species that are rare, threatened, or endangered in California but more common elsewhere |

Other:

USFWS:MNBMC U.S. Fish and Wildlife Service: Migratory Nongame Birds of Management Concern

[6] San Francisco Bay Bird Observatory (Janet Hanson)

a. Known to nest in county
b. Extirpated from area, but may potentially reestablish in restored or enhanced riparian areas
c. Winters in county; observed foraging in riparian areas
d. California Department of Forestry- Sensitive Species; Winters in county. Observed foraging along Coyote Creek and Palo Alto baylands near the mouth of San Francisquito Creek
e. Observed at the mouth of San Francisquito Creek

**Notes (concluded):**

[7] Santa Clara Valley Breeding Bird Atlas (Bill Bousman)
a. Not known to nest in area
b. Known to winter in county
c. Uncommon to rare summer resident
d. Last nesting was recorded in the early 1960s; never common, it is now gone
e. Has nested in the area at least once in the last decade
f. Nested in the Basin a century ago (circa 1900); unlikely to reoccur due to land subsidence
g. Does not breed in the Basin

[8] San Francisco Bay Bird Observatory (Alvaro Jaramillo)
a. Breeding of this endemic subspecies appears to be away from salt marshes, but takes both open riparian habitats as well as freshwater marshes. During winter and migration other subspecies arrive in the area, making it difficult to determine exactly in which habitats the *sinuosa* subspecies is found.

[9] Bird species with no federal or state status, but which have shown significant population decline in the Basin (B. Bousman, SCVBBA)
(1) Lesser Nighthawk (last nested in 1937 or so on Coyote Creek, flood control has probably eliminated original habitat)
(2) Swainson's Thrush (once common on valley floor in riparian areas, now gone)
(3) Wilson's Warbler (once abundant on the valley floor riparian areas, now gone)

## 7.1.6 Wildlife and Wildlife Habitats

### *7.1.6.1 Historical Perspective*

Excavations of Native American middens in the Coyote Hills of Fremont, dating back from 400 BC to 400 AD, indicate that the following mammals were abundant in this area: sea otters, mule deer (black-tailed deer), canines, elk, pronghorn antelopes, harbor seals, rabbits, raccoons, skunks, squirrels, and badgers. Sea otters and mule deer comprised 62 percent of the total animals identified in midden excavations. The most numerous birds identified from these same sites include (in descending order): snow geese, Ross's geese, canvasbacks, green-winged teals, Canada geese, northern pintails, American widgeons, northern shovelers, ring-necked ducks, marbled godwits, mallards, wood ducks, surf scoters, Brandt's cormorants, and western gulls. Bones of larger birds were also found at these midden sites; tundra swan, great blue heron, and brown pelican bones were used for whistles, and California condors' bones were used in shaman kits (Harvey et al. 1990).

The native inhabitants, the Costanoans, were primarily hunters and gatherers. It is thought that the Costanoans used fire to drive small game and that this practice aided in keeping the grasslands open. The Portola expedition in 1769 reported that tule elk were abundant throughout the Santa Cruz Mountains and on the flats of the East Bay. Herds of thousands of elk, pronghorn and black-tailed deer inhabited the grasslands, marshes, shrub, and chaparral habitats around the South Bay.

The tone of pure amazement given in accounts by early settlers regarding wildlife populations in the South Bay's estuary and wetland habitats is consistent. One account noted that the population of sea otters was so abundant that otters were easily killed by boat oars when paddling through kelp beds. California sea lions and harbor seals hauled out and pupped in extensive rookeries in the South Bay (Skinner 1962 from Harvey et al. 1990). Accounts of waterfowl by settlers and game hunters in the 1800s and early 1900s describe populations so numerous that one could not see the water, and that at times the sky would be so dark with waterfowl that it would "black out" the sun when waterfowl migrated down the Pacific Flyway from Alaska to rest, feed, and nest in the Estuary and wetland habitats of the Basin (Harvey et al. 1990).

> "Andy Burnett reached California in the autumn of 1832…Andy had never seen so many waterfowl; had never imagined there could be so many, anywhere. They covered the surface of the small lakes so thickly that Andy could discern but a gleam of water here and there. On a sudden impulse he extended the long rifle and fired it into the air. A blank instant silence followed….broken a half second later by the crashes of mighty water fall as the birds took wing. It seemed as if the dark earth were lifting to expose the hidden silver of the lake. The air was full of hurtling bodies. The very sky was darkened. And another great roar, and a third, like successive peals of thunder, rolled across to the man's astonishment; and then a smooth high silence made up of the thin whistling of thousands upon thousands of wings…" (White 1947).

Bald eagles were common both along the coast and throughout the Central Valley. Records between 1860 and 1900 indicated that bald eagles nested near La Honda in San Mateo County and were commonly seen forging in all of the counties along the edges of the Bay. California condors were commonly observed on the San Francisco Peninsula and in the South Bay area, often in association with turkey vultures. In San Mateo County, it was estimated that condors occurred at a ratio of 1:20 with turkey vultures. An amateur ornithologist, J.P. Lamson, living in the East Bay redwood forest, reported seeing condors commonly between 1853 and 1855. Mr. Lamson reported seeing more than 50 individual condors within a single hour (Harvey et al. 1990).

California grizzly bears were one of the most frequently mentioned large mammals in historic accounts. Early settlers reported viewing anywhere from 9 to 40 individuals at once from the same observation point and commonly encountered them in groups of 20 (Thompson 1957 from Harvey et al. 1990). Grizzly bears, common in San Mateo County, were roped and taken to the docks at Redwood City and butchered for their meat. (Grinnel et al. 1937 from Harvey et al. 1990). They were recorded as being the most abundant in marshes, dense stands of willows and cottonwoods, and in the coast range chaparral.

#### *7.1.6.2 Changes Due to Human Activity*

Throughout the history of human habitation in the Bay Area, the regional wetlands have been impacted by anthropological activities. The earliest impacts caused by Native Americans were relatively minor compared to those caused later by European settlers. At the time of Spanish settlement in the late 1700s, the Bay's natural estuarine system covered 1,300 square miles. Tidal marshes covered over 850 square miles, including the expansive freshwater and brackish marshes of the Sacramento-San Joaquin River Delta (the Delta), Suisun Bay, and the salt marshes of the North and South Bays. Historically, this estuary system contained the largest contiguous tidal marsh system on the Pacific Coast of North America (Harvey et al. 1990).

The trend of altering native habitats for large scale agricultural use began with the arrival of the first missions in the Santa Clara Valley in 1777, and the construction of the Guadalupe River dam (located near Mission Santa Clara) for irrigation of wheat, corn, bean, and other crops. Fruit trees and grapes were also cultivated. Settlers' accounts during 1850 describe the whole plain of Alameda County to San Jose as a vast unfenced field of grain. By 1866, artesian wells could no longer meet water demands. In 1870, Los Gatos Creek was diverted in order to meet the water demands for agriculture and a booming human population. By 1870, wheat production was slightly less than three times the production of oats, barley, rye, and corn combined.

Grazing practices began with the establishment of the missions, occurring primarily in the hills and slopes of the Mt. Hamilton Range, as the valley floor was used for crops. The southernmost end of the Santa Clara Valley was also used for grazing. A large hide and tallow business with New England trading vessels was conducted by ranches in the Basin through the Port of Alviso. By 1845, livestock grazing altered natural grasslands within the entire Santa Clara Basin to such an extent that native perennial grasses were already replaced by European annuals by overgrazing and the spread of nonnative grass associated with cattle feed.

The loss of historical estuarine habitat in the Bay has been attributed to diking for agriculture and salt production, fill from sedimentation caused by intense hydraulic gold mining in the Sierra Nevada, and displacement by fill for residential, industrial and commercial development, garbage dumps, and sewage treatment plants (Eicher 1988). By 1985, the historical 1,300 square miles of contiguous undisturbed wetlands in the Bay Area had declined to patchy habitats totaling a little under 232 square miles, as illustrated on Figures 7-7 and 7-8 (Eicher 1988).

### *7.1.6.3 Wildlife Habitat Descriptions*

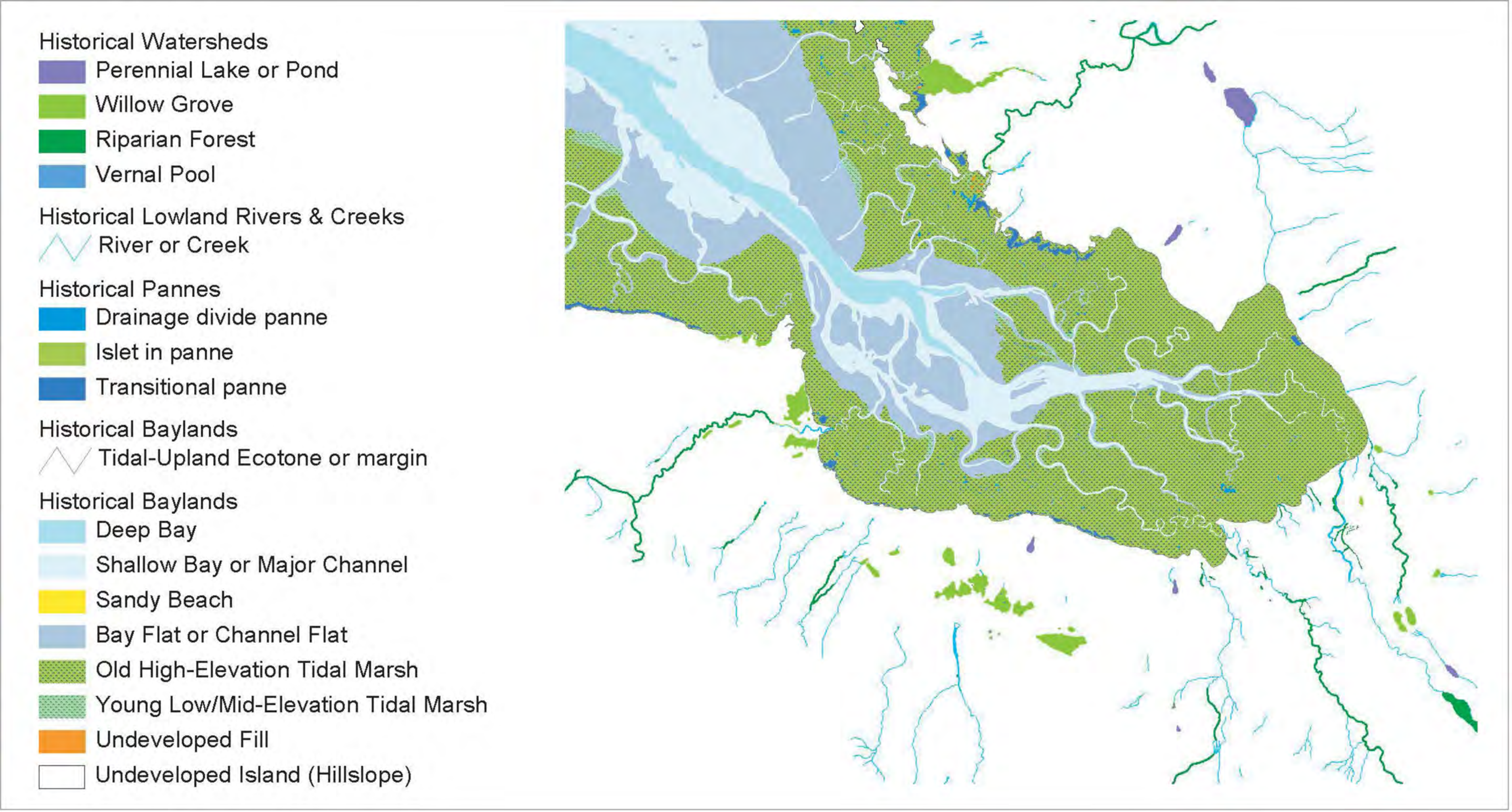
The Basin provides a wide variety of habitats for wildlife. Because of the diversity of habitat types and the relatively undeveloped character of portions of the Basin (the upper watershed lands and the Baylands), the Basin has numerous permanent and seasonal populations of wildlife species.

Following are general descriptions of the current wildlife resources in the Basin by habitat type. The terms used for habitat types in the Basin are the same terms used in the preceding vegetation section. There is also a separate terminology used by some wildlife biologists for the characterization of wildlife habitats. This classification system was developed for the California Wildlife-Habitat Relationships (WHR) System by the California Interagency Wildlife Task Group. It was developed to recognize and logically categorize major vegetative complexes at a scale sufficient to predict WHR. The various wildlife habitats that constitute the WHR System are described in *A Guide to Wildlife Habitats of California* (Mayer and Laudenslayer 1988). Table 7-2 presents the relationships between the WHR System, the habitat/vegetation type terminology used in this text, and the plant communities described by Holland (1986).

#### Lower South San Francisco Bay

The open-water habitat of the lower South Bay provides foraging habitat for harbor seals (*Phoca vitulina richardi*) and California sea lions (*Zalophus californicus*), as well as diving birds such as brown pelicans (*Pelecanus occidentalis californicus*), double-crested cormorants (*Phalacrocorax auritus*), surf scoters (*Melanitta perspicilata*), and terns. Surface water also provides resting habitat for both resident and migratory birds, including western grebes (*Aechmophorus occidentalis*), American wigeons (*Anas americana*), American coots (*Fulica americana*), loons, and seagulls.

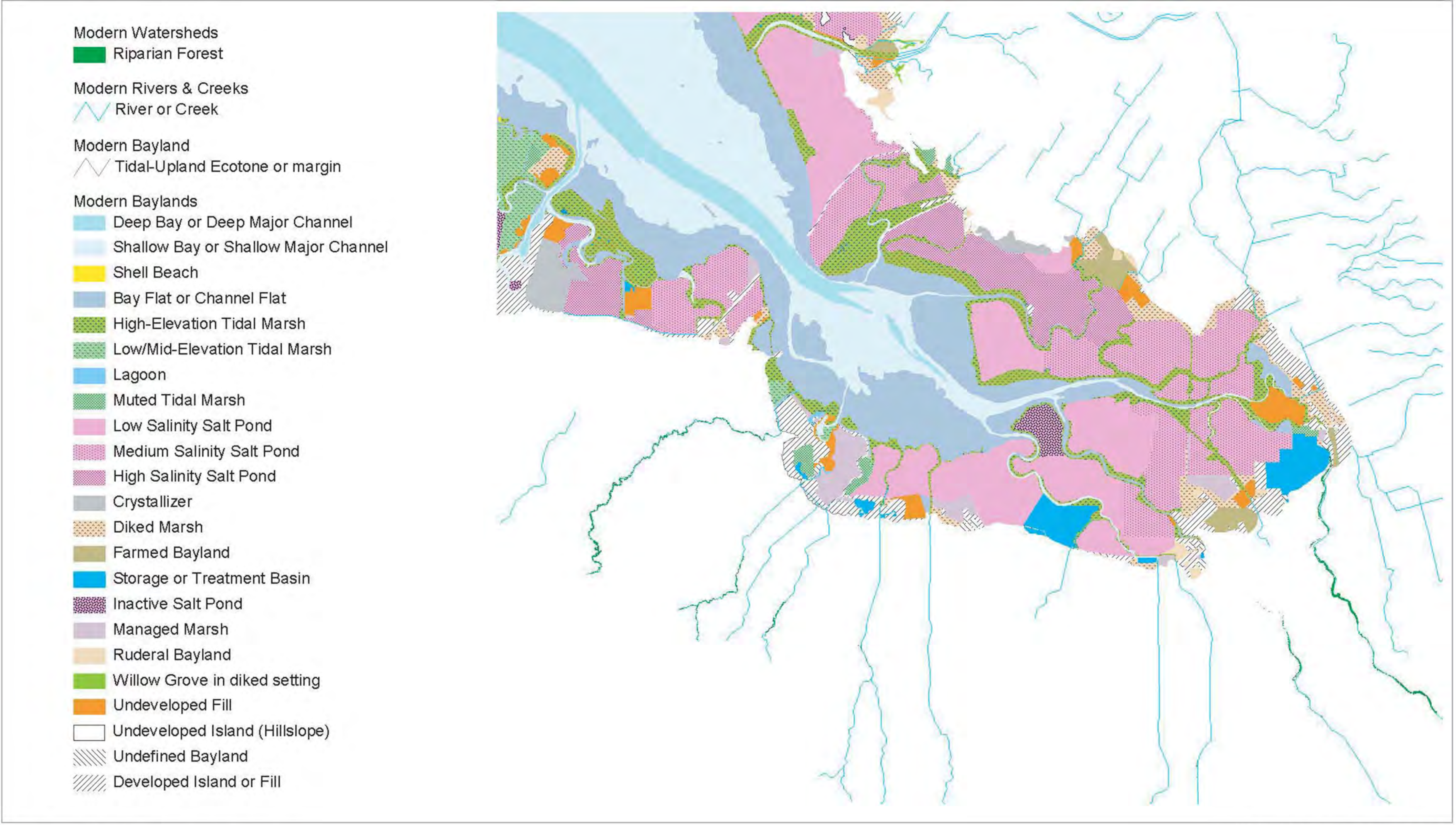
The water quality of the South Bay is very different today that it was historically with regard to freshwater inflows. "Diversions of water from local streams have altered the salinity gradients where they flow into the Bay" (Goals Project 1999). Additionally, large inputs of year-round freshwater flow into the South Bay from municipal wastewater treatment plants. These flows have changed the habitat type and function of tidal marshes (Goals Project 1999).




Source: San Francisco Estuary Institute, 1998-1999



**FIGURE 7-7**
**Past Distribution of Baylands and Adjacent Habitats (1800)**




Source: San Francisco Estuary Institute, 1998-1999



**FIGURE 7-8**
**Present Distribution of Baylands and Adjacent Habitats (1998)**

## Baylands Habitats – Tidal/Brackish Wetlands

Historically, the San Francisco Bay Delta Estuary (the Estuary) system contained the largest contiguous tidal marsh system on the Pacific coast of the Americas. Although the Estuary system is still the largest on the American west coast, available habitat for wildlife has been significantly reduced into patches – a serious problem for wildlife, especially for terrestrial vertebrates such as the endangered salt marsh harvest mouse (*Reithrodontomys raviventris*) and vagrant shrew (*Sorex vagrans*). The patchwork of tidal habitats available to wildlife in the lower South Bay poses the same problems normally associated with island ecology, with barriers to movement and recolonization, and reduction in genetic flow.

In undisturbed marshes, the transition zone between marsh and upland areas is critical to animals that use the higher areas as refuges during high tides. This transitional habitat has been severely reduced due to development. Dikes have now taken on the ecological role of providing refuge areas for many wetland species (Eicher 1988). While diked marshes act as immigration and emigration filters for many species, they may provide the only linkages for movement corridors between tidal wetlands for many wildlife species. Most importantly, continued habitat fragmentation poses serious threats to the viability of plant and animal species, as genetic flow becomes bottlenecked or reproductively isolated. In addition, fragmentation of habitats increases the edge effect as smaller parcels of land have a greater perimeter in relation to total area.

Salt marshes are rich in animal biodiversity, as terrestrial and aquatic habitats overlap. Although the biodiversity of vascular plants is low in estuarine systems, the abundant amount of available light, nutrients, and water enables this habitat type to be one of the most productive habitat types identified. The combination of vegetation and open water in estuaries provides food, rearing areas, and cover for waterfowl, shorebirds, invertebrates and marine fishes.

The Baylands are an important resting and foraging ("fueling") stop for at least 100 different species of birds that migrate along the Pacific Flyway (Conradson 1996). Seventy-one of these bird species are considered common to the Baylands (Conradson 1996), and 36 are permanent residents.

There are a number of federal and state listed endangered birds in the Bay salt marshes, such as the California clapper rail (*Rallus longirostris obsoletus*), a year-round resident associated with the mid-tide cordgrass zones. Other federal and state listed species are: California brown pelican, American peregrine falcon (*Falco peregrinus anatum*), and California least tern *(Sterna albifrons brownii*). These bird species are not limited to marsh habitats, but all utilize the Bay marshes. The shallower open-water areas may be especially critical to the survival of California least tern young, who learn to forage in these areas.

Roughly 17 terrestrial vertebrates utilize salt marshes for foraging during low tides. Representative species include: raccoon (*Procyon lotor*), vagrant shrew, striped skunk (*Mephitis mephitis*), grey fox (*Urocyon cinereoargenteus*), salt marsh harvest mouse, house mouse (*Mus musculus*), gopher snake (*Pituophis catenifer*), and western terrestrial garter snake (*Thamnophis elegans*). The salt marsh harvest mouse is both a federal and state endangered species, endemic to salt marshes of the Estuary. Salt marsh harvest mice are found in tidal marshes, as well as in diked former tidal marshes, usually in association with dense stands of pickleweed (Eicher 1988).

"Exotic animal species are also of concern, especially those that are effective predators on native species. With many of the Bay Area's natural habitats disturbed or lost, predation by mammalian predators on several endangered species has become a crucial management issue. The red fox is an introduced predator that threatens the survival of the endangered California clapper rail and severely reduces populations of other native ground nesting birds" (Goals Project 1999). "Cats are another especially effective mammalian predator on Baylands wildlife, particularly on the California least tern…." (Goals Project 1999).

## Baylands Habitats – Tidal Flats

"Tidal flat habitat includes mudflats, sandflats, and shellflats. It occurs between mean lower low water and mean tide level and supports less that 10 percent cover of vascular vegetation, other than eelgrass. About 90 percent of intertidal flat habitat occurs on the edges of the Bay, and the remainder is associated with tidal channels" (Goals Project 1999).

"During the twice-daily high tides, tidal flats provide foraging habitat for many species of Bay fishes, and during low tides they are the major feeding areas for shorebirds" (Goals Project 1999).

Mudflats comprise the largest area of tidal flat habitat. Mudflats in particular are rich in food items. These areas of fine-grained silts and clays support an extensive community of diatoms, worms, and shellfish, and more complex vegetation including green algae and red algae (Goals Project 1999).

"The South Bay is considered to be the region's most important area for shorebirds, which mainly feed across the tidal flats" (Goals Project 1999).

## Baylands Habitats – Salt Ponds, Levees, and Dikes

Salt ponds are artificial ponds created for the production and harvesting of salt. They occur within the historical areas of tidal salt marsh in the South Bay. The process of making salt in the artificial ponds involves pumping Bay water through a series of ponds, known as concentrators or evaporators, over a period of 6 or 7 years, during which time solar evaporation of the water increases its salinity from about 35 parts per thousand (ppt) to more than 180 ppt (Goals Project 1999).

Salt ponds increase in salinity from pond to pond as water evaporates. Salt ponds, especially those with relatively low- to mid-salinities, provide an important habitat for many species of resident and migratory wildlife, particularly birds. They are of primary importance to migratory shorebirds and waterfowl, and they also provide year-round foraging habitat for a number of resident species (Goals Project 1999). Within a certain range of salinity, brine shrimp grow in large numbers and can provide a year-round food source for birds such as black-necked stilts (*Himantopus mexicanus*), grebes, avocets (*Recurvirostra americana*), gulls, and ducks. Salt ponds with lower salinity ranges are utilized by migratory waterfowl as resting and wintering areas. The upland habitats around salt ponds are generally devoid of vegetation and therefore do not provide nesting habitats for waterfowl. The upland areas and islands associated with salt ponds do, however, provide nesting habitats for California gull (*Larus californicus*), western gull (*Larus occidentalis*), Caspian tern (*Sterna caspia*), Foresters tern (*Sterna forsteri*), killdeer (*Charadrius vociferus*) and snowy plovers (*Charadrius alexandrinus nivosus*).

In all, more than 40 species of birds are considered to be common in the salt pond habitat (Goals Project 1999).

"The construction of artificial salt pond habitat in the Bay enabled increased populations of many bird species. These species include eared grebe (*Podeceps nigricollis*), white pelican (*Pelecanus erythrorhynchus*), snowy plover, Caspian tern, Forester's tern, Wilson's phalarope (*Phalaropus tricolor*), California gull, American avocet, and black-necked stilt. The populations of some of these species would be greatly reduced or even extirpated from the Bay if salt ponds or shallow saline ponds were to disappear" (Goals Project 1999).

In undisturbed marshes, the transition zone between marsh and upland areas is critical to animals that use the higher areas as refuges during high tides. This transitional habitat has been severely reduced in the South Bay due to development. Dikes and levees have now taken on the ecological role of providing refuge areas for many wetland wildlife species (Eicher 1988). This "higher ground" is especially important as refuge for small mammals during periods of extreme high tide and storm events or flooding.

During the winter when shallow standing water occurs, lowland areas of diked wetlands are important resting and foraging areas for waterfowl and waterbirds. Some diked wetlands with pickleweed provide important habitat for the endangered salt marsh harvest mouse.

### Freshwater (Lentic, i.e., standing water) Habitat (Lacustrine-Pond/Reservoir)

Surface water sources provide wildlife with drinking water and are excellent breeding areas for aquatic amphibians (e.g., tree frogs (*Hyla regilla*), California newts (*Taricha torosa*), California tiger salamanders (*Ambystoma californiense*), California red-legged frogs (*Rana aurora draytonii*), and western toads (*Bufo boreas*)). Barn swallows (*Hirundo rustica*), cliff swallows (*Hirundo pyrrhonota*), tree swallows (*Tachycineta bicolor*), and bats drink from and forage on insects while on the wing over reservoirs, and adjacent to freshwater marsh areas. Raccoons forage for adult and larval amphibians, fish, and crayfish. Other representative species include ruddy ducks (*Oxyura jamaicensis*), Virginia rail (*Rallus limicola*), night herons (*Nycticorax nyticorax*), blue herons (*Ardea herodias*), green-back herons (*Butorides striatus*), blackbirds, marsh wrens, and garter snakes.

The availability of surface water in dry habitats is important for sustaining mammal populations, especially in the drier areas and in the Diablo Range. Ponds enhance all other habitats in terms of value for wildlife; mammals, birds, reptiles, and amphibians from adjacent habitats are likely to use ponds en route to surrounding areas.

There are numerous small ponds that have been constructed for livestock watering (stock ponds) throughout the foothills of the Diablo Range. Depending on the seasonality of these small ponds, they often serve as important breeding habitat for amphibians (e.g., pacific tree frogs, California red-legged frogs, California tiger salamanders, and western toads) and in turn provide foraging habitat for garter snakes, mammals, and birds.

Due to fluctuations in water levels, reservoirs lack the same type of shoreline habitat that occurs around natural lakes and ponds. Shoreline habitat provides important protective cover and foraging areas for wildlife. Percolation ponds, while often seasonally stable in water level, are highly manipulated and different in wildlife habitat value than naturally occurring ponds. While percolation ponds frequently develop emergent vegetation along the shoreline, the buffer zone between these emergent wetlands and human recreational activities and housing limit wildlife access and use of these ponds by mammals, amphibians, and reptiles. While birds maintain access to percolation ponds, human activity and domestic pets around the shoreline limit nesting by waterfowl and other birds.

### Freshwater Wetlands (Palustrine Emergent Wetlands)

Freshwater marshes, springs, and seeps provide wildlife with drinking water and are excellent breeding areas for aquatic amphibians such as tree frogs and western toads, if sufficient water is available. If standing water is present, then small mammals drink from marshes, and bats frequently hawk insects over marsh areas.

### Native and Nonnative Grasslands

Grasslands provide an important foraging resource for a wide variety of wildlife species. The grasses and forbs produce an abundance of seeds and attract numerous insects, providing food for granivorous and insectivorous wildlife. Sparrows, rabbits, and rodents are commonly found in this habitat. Consequently, grasslands are valuable aerial foraging sites for raptors such as hawks and owls, bats, swallows, American kestrels (*Falco sparverius*), and flycatchers.

In general, the wildlife values of grasslands are highest adjacent to forested or scrub habitats. This mosaic increases wildlife species richness for wildlife that utilize grasslands for feeding, as well as trees and shrubs for cover and/or nest sites. Grasses provide good escape cover, food, nesting material, and nest concealment. Typical reptile species in this habitat are the southern alligator lizard, the western fence lizard, the gopher snake, the common garter snake, and the western terrestrial garter snake. The diversity of amphibians is generally not high in grasslands, but some species such as the California tiger salamander use mammal burrows for aestivation (summer dormant condition) sites.

Passerine birds that commonly occur in grasslands in the Basin include savannah sparrows, house finches, lesser goldfinches, and lark sparrows. Grasshopper sparrows, western bluebirds, western meadowlarks, and American robins forage for invertebrates in the ground and grasses. Say's phoebe and several swallows hawk insects while flying above grasslands. Raptors that feed on small mammals in the grassland habitat include white-tailed kites, golden eagles, northern harriers, American kestrels, red-tailed hawks and common barn owls. Turkey vultures are commonly seen soaring in search of carrion. Birds that breed in grasslands include horned larks, western meadowlarks, and burrowing owls. Grasslands are also an important wintering habitat for foraging geese and egrets.

Grasslands are productive habitats for small mammals, providing abundant food plants and cover. California ground squirrels are one of the most numerous species. Other common species include the black-tailed jackrabbit, Botta's pocket gopher, the western harvest mouse, and the California vole. These small mammals provide a prey base for diurnal and nocturnal raptors – coyotes, gray foxes, badgers, long-tailed weasels, bobcats, skunks, and snakes. Bats forage for insects in this habitat. Black-tailed deer are often seen browsing or grazing in the late evening. Feral pigs typically forage on grasses and bulbs in grasslands.

The value of native grasslands to wildlife is similar to that of nonnative grasslands, but the presence of native grasses increases the habitat value for certain native wildlife species.

### Scrub and Chaparral

Coastal scrub habitat provides cover and a plentiful foraging habitat for a large diversity of songbirds, rodents, reptiles, falcons, and hawks. Browsers (e.g., deer) rely on scrub habitats for foraging and cover. The dense habitat, especially at the edges of the grasslands, provides important structural cover for many species, including: the bobcat, raccoon, skunk, mountain lion, coyote, California quail, jackrabbit, and garter snake. Blackberries, twinberries, huckleberries, and elderberries provide an important food and water source for many birds and mammals. Coyote brush also provides cover for deer, which will bed down in the grasses between the shrubs. Coyote brush scrub provides protective cover and perch sites for mammals and birds that forage in the adjacent grasslands.

Coastal scrub plant communities also provide a diversity of flowering plants that are utilized by hummingbirds and butterflies. Buckwheat (*Eriogonum sp*.), plantain, sticky monkey flower, and *Sedum sp*. are particularly noted as beneficial butterfly plants.

Coastal scrub communities can vary greatly in plant density and height. Some areas hold lesser value to wildlife due to the high shrub density and height. This is assumed to be a result of the lack of recent fire or lack of natural browsers (i.e., historic herds of elk). Coastal scrub has the highest wildlife value when there is a matrix of scrub densities or a matrix with other habitats (e.g., grasslands). A recently completed report on the fire history at Stanford's Jasper Ridge Biological Preserve noted that fires were set a least every 4 to 9 years by the Ohlone for vegetation management. Apparently no fires have occirred in the preserve for about 100 years until control burns were recently resumed (Philippe Cohen, Director, Jasper Ridge Biological Reserve, pers. comm., 2000).

Chaparral habitats are found on higher elevation ridges in the Santa Cruz Mountains and Diablo Range. Chaparral habitats are generally drier than scrub habitats. Water for herbivorous wildlife is often obtained by foraging on common chaparral plants that bear fruit, such as manzanita or coffeeberry, or by foraging on green leaves. Representative wildlife species include: the wrentit, California thrasher, Merriam chipmunk, striped racer, woodrat, black-tailed deer, bobcat, coyote, gray fox, raccoon, rabbit, bush mouse, deer mouse, California quail, song sparrow, western rattlesnake, western fence lizard, gopher snake, red-tailed hawk, and ring-necked snake.

### Riparian and Bottomland Habitat (Valley Foothill Riparian)

One of the highest levels of wildlife species diversity and abundance in California is associated with riparian habitats. At the state level, riparian plant communities are considered a sensitive habitat and have been identified by the CDFG as a habitat of special concern (Wetlands Resource Policy, CDFG Commission 1987). Riparian habitats are valuable because they support a high density and diversity of wildlife species and because they are a diminishing resource. In the State of California, at least 89 percent of riparian areas existing 140 years ago have been lost (Wetlands Resource Policy, CDFG Commission 1987).

Factors that contribute to the high wildlife habitat value of riparian habitats include the presence of surface water, the variety of niches provided by the high structural complexity of the habitat, and the abundance of plant growth. Riparian habitat is used by wildlife for food, water, escape, cover, nesting, and thermal cover. Riparian corridors along the tributaries and creeks also provide important migration and dispersal corridors for wildlife.

Amphibians are more numerous and diverse in this habitat. Streamside pools and low-flow shallows provide breeding habitat for Pacific tree frogs and California newts. Other species, such as the California slender salamander, seek the moist shelter beneath fallen logs and woodland debris for breeding and refuge. California red-legged frogs may also be observed in the riparian corridors. Common reptile species that utilize aquatic habitat within riparian corridors for foraging or escape cover include western aquatic garter snakes, western skinks, western terrestrial garter snakes, Santa Cruz garter snakes, and possibly, in the northwestern areas of the Basin, San Francisco garter snakes.

Where deciduous trees are prevalent (e.g., willows, cottonwoods, and sycamores) the abundant insects these plants attract create areas especially suitable for neotropical migrants that feed on the numerous insects to replenish their migratory fat reserves. Relatively high use by neotropical migrant birds is expected in willow riparian habitat as well as sycamore habitats. The sycamore trees provide nesting cavities favored by many bird species. Examples of neotropical migrants include: Wilson's warblers, warbling vireos, olive-sided flycatchers, and American redstart. Resident birds, such as winter wrens, Swainson's thrushes, and song sparrows, are more abundant in riparian habitats than in adjacent forests. American dippers, herons, belted kingfishers, and waterfowl utilize the open water and banks of rivers and creeks. Northern pygmy owls may be limited to streamside forests. Swifts, swallows, and flycatchers can be found hawking their insect prey over water. Red-shouldered hawks utilize riparian trees for nesting.

Raccoons, skunks, opossums, ringtail cats, long-tailed weasels, gray foxes, mountain lions, and bobcats are likely to drink from the creeks and forage on rodents, amphibians, and insects. Riparian habitats provide movement corridors and water sources for black-tailed deer and birds as well. Bats associated with riparian forests include Townsend's big-eared bats (a federal and state species of concern), California myotis, long-eared myotis, and fringed myotis.

Because Central Coast riparian scrub occurs along intermittent streams, wildlife use is expected to be more seasonal (e.g., during periods of water flow). Since the major vegetative component of this habitat is willow, these areas are also important for neotropical migrants.

Invasive exotic plant species[7] have become established in many urban riparian areas of the Basin. Many of the riparian corridors have scattered occurrences of invasive blue gum eucalyptus, giant reed, fruit trees (orchard escapees), German (Cape) ivy, periwinkle, field bindweed, poison hemlock, bull thistle, Italian thistle, and milk thistle. Because they are often a monoculture, invasive plants do not provide the same habitat value for native wildlife as native habitats.

### Woodlands (Oak Woodlands, Blue Oak, Foothill Pine)

Oak woodlands are considered critical habitats for the conservation of many bird and mammal species (Block et al. 1990). Important habitat features of oak woodlands include acorns and the presence of cavity-bearing trees. As a seasonal food, acorns are important for the survival of many species of wildlife in fall and winter. Birds that are dependent on acorns as a seasonal food include acorn woodpeckers, scrub jays, band-tailed pigeons, and California quail.

Mature oak trees bear natural cavities, which are important resources for cavity-nesting birds and small mammals. Also, mature oak forests typically contain snags (standing dead trees). Snags are valuable resources for woodpeckers, who prefer dead trees and limbs for excavation of roost and nest sites (Thomas 1979). Snags receive high levels of use by secondary cavity-nesting birds (e.g., chickadees and wrens) and mammals. Snags also support wood-boring insects that provide food for bark-gleaning insectivorous birds.

### Broadleaved Forest and Coniferous Forest

The wildlife value of broadleaved forests, mixed evergreen forest, and coniferous forests varies with the degree of canopy cover, density, and diversity of understory plant species. In general, wildlife species diversity and abundance are highest where vegetation is highly stratified, offering a greater variety of niches for wildlife species. Evergreen forest mixed with scrub communities creates a mosaic that is highly stratified and of high value to wildlife. Bird species richness and abundance is high in the mixed evergreen forest where the understory is stratified and dense.

[7] The definition of an invasive exotic plant is a nonnative plant species that did not occur naturally in California prior to European settlement and that is able to proliferate and aggressively alter or displace indigenous plant communities.

Some of the important food plants for wildlife that occur in these forest types include: California hazelnuts, madrones (only in the mixed evergreen forest), coffeeberries, blackberries, and poison oak. These plants provide seasonal wildlife foods, such as berries and nuts, which are consumed by many bird and mammal species.

Significant habitat features include the presence of cavity-bearing trees. Mature trees bear natural cavities, which are important resources for cavity-nesting birds and small mammals. Also, mature mixed evergreen forests and Douglas fir forests typically contain snags.

Great horned owls, western screech owls, and northern pygmy owls nest in mixed evergreen forests and prey on rodents that are active at night. Diurnal raptors (all of which are State species of special concern) in this habitat include golden eagles, Cooper’s hawks, and sharp-shinned hawks. These raptors feed primarily on small mammals or other birds, but golden eagles may take larger prey.

Another important feature of the mixed evergreen forest is the abundance of fallen woody debris (i.e., limbs and logs). Woody debris adds structural complexity to the forest habitat and is important as cover, nesting, roosting, and foraging substrate for wildlife. Downed wood also helps moderate arid conditions, creating micro-climates suitable for amphibians and reptiles.

The mosaic of microclimates resulting from the shade of canopy trees and the presence of downed woody debris offers suitable breeding and cover sites for many amphibians, such as arboreal salamanders, Ensatina salamanders, and California slender salamanders. Aquatic breeding species, such as the California newt typically spend their terrestrial existence in rodent burrows in grasslands, but may also take refuge under woody debris in adjacent forests.

The mixed evergreen forest supports a high diversity of reptiles due to the abundant prey and cover provided by understory vegetation and fallen woody material. Representative species, such as the common king snake, garter snake, and ringneck snake, prefer the moist, wooded drainage bottoms.

Representative mammal species that utilize both habitat types include the broad-footed mole, dusky-footed woodrat, deer mouse, black-tailed deer, Merriam’s chipmunk, western gray squirrel, bobcat, gray fox, striped skunk, Virginia opossum, and many bat species. Potential habitat occurs for several species of special concern in the mixed evergreen forest, especially in forested areas of mixed age class. Possible special animal species include the San Francisco dusky-footed woodrat, peregrine falcons, long-eared owls, sharp-shinned hawk, and Cooper’s hawk. Foraging, roosting, and nesting habitats for special bats may also occur in this habitat type.

The presence of water within some of the redwood forest enables a variety of species to potentially occur in this habitat. Species such as ringtail cats, brown creepers, nut hatches, estivating red-legged frogs, Pacific giant salamanders, California slender salamanders, California newts, Ensatina salamanders, and rough-skinned newts are expected to occur along redwood-lined creeks within the forest.

### Agricultural Land (Cropland, Orchard-Vineyard)

Orchard and vineyard fruits will attract birds (blue jays, scrub jays, starlings, western tanagers), raccoons, foxes, and coyotes. Orchards and vineyards that are not plowed provide foraging, cover, and denning sites for native (gray) and nonnative (red) foxes, burrowing owls, ground squirrels, gophers, mice, and snakes. Insects are important pollinators of blossoms to ensure fruit. Owls and other raptors such as white-tailed kites, red-shouldered hawks, red-tailed hawks, and burrowing owls will feed on rodents and insects of the orchard and vineyards. Old buildings and barns around orchards often provide habitats for bats and owls.

### Urban (Urban Forest)

A limited number of mostly nonnative species such as dogs, cats, house mice, Norway brown rats, pigeons, European starlings, and opossums thrive in urbanized habitats. Highly urban areas are often spotted with ornamental fruit-bearing trees or with a few remnant orchard escapees which provide a food source for both native and nonnative wildlife species.

The overall wildlife value of eucalyptus groves is very limited in comparison to the native plant communities that the eucalyptus has replaced. Eucalyptus trees do, however, provide night roosts, foraging perches, and nest sites for a few bird species, particularly raptors. Eucalyptus trees provide little foraging value to birds and mammals compared to native oaks or coastal scrub. Eucalyptus bark peels can create microhabitats for some small vertebrate species, such as alligator lizards and woodrats.

### *7.1.6.4 Special Wildlife Species*

A total of 67 species of mammals, birds, reptiles, insects, and amphibians within the Santa Clara Basin have been designated by federal and state governments as having sufficiently declined in numbers to deserve special protection or monitoring. Seven species of insects once endemic to the Bay are now extinct. Table 7-3 presents information on the current list of special-status species in the Santa Clara Basin (invertebrates, fish, amphibians, reptiles, birds, mammals, and plants).[8]

[8] Table 7-3 is based on WMI's Technical Memorandum No. 32: Recommended List of Special-Status Species for RARE Assessment, approved by the Core Group May 4, 2000. Information for the technical memorandum was compiled from various databases including the CNDDB, the California Native Plant Society Inventory, and the Santa Clara Valley Audubon Society Bird Species List for Santa Clara Valley and was reviewed by a number of stakeholders and biologists. The species in Table 7-3 should be considered as the current list of special-status species in the Santa Clara Basin. The reader is referred to the technical memorandum for a description of how this list was developed and the rationale of inclusion and exclusion of species in the list.

## 7.1.7 Fish and Aquatic Habitats

### *7.1.7.1 Historical Perspective*

Historically, runs of steelhead trout were prominent in a number of Basin streams – including Guadalupe River, Coyote Creek, San Francisquito Creek, Stevens Creek, and Saratoga Creek. Salmon runs were present in at least the larger drainages such as the Guadalupe River and Coyote Creek. Passage barriers, water diversions, and overall habitat degradation have diminished steelhead and salmon populations not only in Basin streams, but also throughout California and the West. Reproducing populations of steelhead are known to exist in Coyote Creek, Guadalupe River, Stevens Creek, and San Francisquito Creek. In addition, small runs of anadromous Chinook salmon occur in Guadalupe River and Coyote Creek.

Early written documents, dating as far back as the 1700s when the Spanish first settled the area, record the local presence of migrating fish in South Bay streams. Table 7-4a, *Historical Freshwater Fishes of Santa Clara Basin Watersheds* indicates the wide range of fishes that populated local streams.

In the past, the Basin headwater streams may have featured young steelhead trout, salmon, riffle sculpins, and California roach. Aquatic habitat in forested headwater streams provided cool temperatures, high dissolved oxygen, and cover including riparian vegetation, overhanging banks or roots, cobbles, boulders, and pools. Abundant riffles provided spawning areas, cover for young fish, and habitat for aquatic insects that are a primary food resource for young steelhead and other fish. Warmer tributaries that had higher summer temperatures or intermittent summer flow provided habitat for California roach (Leidy 1984).

In the main stem reaches of these streams, historical fish fauna included hitch, Sacramento sucker, California roach, prickly sculpin, Sacramento blackfish, and young steelhead. These reaches also provided habitat for anadromous fishes such as the Pacific lamprey and salmon in the larger streams. Aquatic habitat featured a mix of deeper pools, shallow riffles, and warmer summer temperatures. Some of these fish are adapted to slower stream velocities, lower dissolved oxygen, and higher temperatures. As riffle habitat decreased downstream, fish were often less dependent on aquatic insects for food; instead, they fed on smaller fish and plankton in the water column. In these small systems, the number of fish species tended to increase downstream because fish found in the upper watershed, such as California roach and steelhead, also could be found in suitable habitats in the main stem. Some of the smaller Basin streams were probably dry in the lower reaches during the summer months most years, or were composed of a series of isolated pools. Larger streams such as Coyote Creek were perennial, as indicated by historic fish accounts of Sacramento perch, Tule perch, and splittail.

In the lowest stream reaches, native fish were adapted to a range of freshwater to saltwater conditions. For example, the splittail is tolerant of brackish water. In addition, the juvenile forms of several marine fishes such as the staghorn sculpin and the Pacific herring were found in these lower reaches (Moyle 1976). Most of these fish feed on the abundant crustaceans that live in this zone (Moyle 1976).

**Table 7-4a**
**Historical Freshwater Fishes of Santa Clara Basin Watersheds[1]**

| Common Name | Scientific Name | Watershed: Coyote | Guadalupe | San Francisquito | San Tomas Aquino | Calabazas | Stevens | Permanente | Adobe | Matadero |
|---|---|---|---|---|---|---|---|---|---|---|
| Pacific lamprey | *Lampetra tridentata* | | X[2] | | | | | | | |
| Pacific brook lamprey | *Lampetra pacifica* | X (1923) | | | | | | | | |
| Chinook salmon | *Onchorhyhyrichus tshawytscha* | X | X | X[3] | | X | | | | |
| Coho salmon | *Oncorhynchus kisutch* | X (1950s) | X[3] | X[3] | | | | | | |
| Rainbow/Steelhead trout | *Oncorhynchus mykiss* | X | X | X | X | | X | | | |
| Chum Salmon[3] | *Oncorhynchus keta* | | X[3] | | | | | | | |
| Thicktail chub | *Gila crassicauda* | X (n/d) | | | | | | | | |
| Hitch | *Lavinia exilicauda* | X | X[2] | | | | | | | |
| California roach | *Lavinia symmetricus* | X | X | X | | | X | | X | |
| Sacramento blackfish | *Orthodon microlepidotus* | X | | | | | | | | |
| Sacramento splittail | *Pogonichthys macrotepidotus* | X (1905) | | | | | | | | |
| Sacramento pikeminnow | *Ptychocheilus grandis* | X | X (1922) | X (1905) | | | | | | |
| Speckled dace | *Rhinichthys osculus* | X (1978) | | | | | | | | |
| Sacramento sucker | *Catostomus occidentalis* | X | X | X | X | | X | | X | |
| Threespine stickleback | *Gasterosteus aculeatus* | X | X | X | | | X | | X | X |
| Sacramento perch | *Archopites interruptus* | X | | X | | | | | | |
| Tule perch | *Hysterocarpus traski* | X | | | | | | | | |
| Prickly sculpin | *Cottus asper* | X | X | X | | | | | X | X |
| Riffle sculpin | *Cottus gulosus* | X | X | X (1898) | | | | | | |

[1] Table includes only those watersheds for which information was available. Unless otherwise noted, the source for historical information is Leidy (1984). Dates indicate date last collected.
[2] Source: Professor Jerry Smith, Dept. Biological Sciences, San Jose State University.
[3] Source: Larry Johmann, December 7, 2000.

### Past versus Present

Although historical accounts indicate that local streams provided habitat for several species of native fishes, this may not reflect the range of species observed in more recent times. Table 7-4b, *Current Freshwater Fishes Observed in Santa Clara Basin Watersheds* displays fish species that have been collected or observed in local streams over the last 20 years.

Valley residents and fisherman reported the local presence of coho salmon until the 1970s. The Guadalupe-Coyote Resource Conservation District believes that there is a continuing presence of Chinook since the mid-1700s (GCRCD 2001). Adult fall run Chinook have been scientifically documented in the Guadalupe River and Coyote Creek since the mid-1980s. The GCRCD and the Salmon and Steelhead Restoration Group have photographs and video documenting Chinook salmon with spawning colors as early as June in the Guadalupe River in 1995, 1996, and 1997. While these efforts have helped establish a case for the modern presence of Chinook salmon, identification of the specific strains that may be present in the river during the spring and summer months has yet to occur (Larry Johmann and Nancy Bernardi, GCRCD, pers. comms., November 3, 2000). Reproduction of Chinook is occurring in the Guadalupe River and Coyote Creek.

The SCVWD biologists support the hypothesis that Santa Clara Valley chinook slamon are keyed genetically to Central Valley fall run Chinook salmon, and Guadalupe River and Coyote Creek fish are strays from the Central Valley rather than remnants of a native fish stock. The GCRCD consulting biologists support the hypothesis that most fall run Chinook salmon in the Guadalupe River and Coyote Creek are remnants of a native fish stock.

The habitat conditions and needs of steelhead and salmon species in Coyote Creek, Stevens Creek, and Guadalupe River are currently under investigation through the Fisheries and Aquatic Habitat Collaborative Effort (FAHCE), a water rights complaint resolution effort among regulatory agencies (CDFG, U.S. Fish and Wildlife Service, National Marine Fisheries Service, San Francisco Bay Regional Water Quality Control Board [Regional Board]), environmental and fisheries advocates, and the Water District. The FAHCE project is scheduled to be completed in 2001 and should provide additional information regarding steelhead and salmon in these three streams.

### *7.1.7.2 Changes Due to Human Activity*

Native fish populations began to decline in the 1940s, concurrent with a dramatic increase in human population in the Basin. Humans have altered habitat conditions for native fish through water diversions that reduce streamflows, construction of dams that create passage barriers and lake habitat, and increased erosion and sedimentation that reduces the quantity and quality of riffle habitat critical for spawning, rearing, and aquatic insect production. Channelization and flood control measures have reduced habitat complexity and riparian vegetation, contributed to streambank erosion, and increased high velocity flows. The destruction of riparian vegetation reduces pool habitat created by rootwads and woody debris, contributes to higher stream temperatures due to less shade, and lowers the abundance of terrestrial insects for food and terrestrial detritus fed upon by some aquatic insects. Native fish still common in Basin streams are those restricted to headwater streams or those tolerant of a range of environmental conditions. For example, both California roach and Sacramento suckers tolerate higher stream temperatures and lower dissolved oxygen levels than other native fish such as riffle sculpins.

## Table 7-4b
## Current Freshwater Fishes Observed[1] in Santa Clara Basin Watersheds[2]

| Common Name | Scientific Name | Origin[3] | Watershed | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Coyote | Guadalupe | San Francis-quito | San Tomas Aquino | Calabazas | Stevens | Permanente | Adobe | Matadero |
| Pacific lamprey | *Lampetra tridentata* | N | X | X | | | | | | | |
| Chinook salmon | *Onchorhyhyrichus tshawytscha* | N | X | X | | X | X | | | | |
| Rainbow/Steelhead trout | *Oncorhynchus mykiss* | N | X | X | X | X | | X | | | |
| Hitch | *Lavinia exilicauda* | N | X | X | X[4] | | | | | | |
| California roach | *Lavinia symmetricus* | N | X | X | X | X[4] | | X | | X | |
| Sacramento blackfish | *Orthodon microlepidotus* | N | X | | | | | | | | |
| Sacramento pikeminnow | *Ptychocheilus grandis* | N | X | | | | | | | | |
| Sacramento sucker | *Catostomus occidentalis* | N | X | X | X | X | | X | | X | |
| Threespine stickleback | *Gasterosteus aculeatus* | N | X | X | X | | | X | | X | X |
| Sacramento perch | *Archopites interruptus* | N | X | | | | | | | | |
| Tule perch | *Hysterocarpus traski* | N | X | | | | | | | | |
| Prickly sculpin | *Cottus asper* | N | X | X | X | | | | | X | X |
| Riffle sculpin | *Cottus gulosus* | N | X | X | X[4] | | | | | | |
| Speckled dace | *Rhinichthys osculus* | N | | | X[4] | | | | | | |
| Rainwater killifish | *Lucania parva* | I | X | X | X | X | | | X | X | X |
| Mosquitofish | *Gamusia affinis* | I | X | X | X | X | X | X | X | | X |
| Inland silverside | *Menidia audens* | I | X | X | | | | | | | |
| Bluegill sunfish | *Lepomis macrochirus* | I | X | X | X | | | | | | |
| Pumpkinseed | *Lepomis gibbosus* | I | X | X | X[4] | | | | | | |
| Green sunfish | *Lepomis cyanellus* | I | X | X | X | | | X | | | |
| White crappie | *Pomoxis annularis* | I | X | X | | | | | | | |
| Black crappie | *Pomoxis nigromaculatus* | I | X | X | X[4] | | | | | | |
| Largemouth bass | *Micropterus salmoides* | I | X | X | X | | | X[4] | | | |

## Table 7-4b (concluded)
## Current Freshwater Fishes Observed[1] in Santa Clara Basin Watersheds[2]

| Common Name | Scientific Name | Origin | Watershed | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Coyote | Guadalupe | San Francis-quito | San Tomas Aquino | Calabazas | Stevens | Permanente | Adobe | Matadero |
| Smallmouth bass | *Micropterus dolomieui* | I | X | X | | | | | | | |
| Striped Bass | *Morone saxatilis* | I | X[4] | | | | | | | | |
| Redear Sunfish | *Lepomis microlophus* | 1 | X | | X[4] | | | | | | |
| Yellow Fin Goby | *Acanthogobius flarihus* | I | X | X | | | | | | | |
| Chum Salmon | *Oncorhynchus keta* | I | | X[5] | | | | | | | |

1 Observed is defined as specimens collected and/or observed within the last 20 years.
2 This table does not indicate whether these are self-sustaining populations of these species.
3 I =Introduced N =Native
4 Keith Anderson, December 19, 2000.
5 Larry Johmann, GCRCD.

Nonnative fish species and their populations have increased dramatically over the past few decades and now outnumber native fish species in most Basin watersheds. Nonnative fish have been introduced for a variety of reasons, such as mosquito control, pet releases, fishing, game-fish prey, and by accident. While the introduction of nonnative fish can lead to the decline of native fish through direct competition, predation or behavior, in most cases, nonnative fish thrive in the altered habitat conditions found in human-impacted streams. For example, nonnative fish that originated in the eastern U.S. (e.g., sunfish) are better able to tolerate higher stream temperatures, higher turbidity, and lower dissolved oxygen levels than native fish. Additionally, nonnative fish such as largemouth bass are aggressive predators and could impact young steelhead abundance in Basin streams.

Humans have altered Bay habitats by filling wetlands, constructing salt ponds that reduce freshwater-saline water mixing areas, and reducing and redirecting freshwater flows from South Bay streams. Toxins are introduced through rural and urban runoff. While untreated sewage is no longer discharged into the Bay, treated sewage consumes oxygen and contributes additional organic materials and pollutants to Bay waters, affecting aquatic habitat. Historically, the Bay supported some of the largest fisheries on the West Coast of Dungeness crabs, starry flounder, oysters, and clams. Bay shrimp and herring roe are the only commercially viable fisheries left in the Bay (Cohen 1990).

### *7.1.7.3 Aquatic Habitat Descriptions*

The native fish fauna of the Basin and the South Bay reflect their connection to the greater Sacramento-San Joaquin watersheds that also flow out through the Bay (Moyle 1976). When ocean levels were lower, the streams tributary to the South Bay were a component of a larger freshwater system that encompassed North Bay streams and the Sacramento and San Joaquin River watersheds. Native freshwater fish common to both the Basin and Sacramento-San Joaquin River watersheds include steelhead/rainbow trout, salmon, California roaches, Sacramento suckers, prickly sculpins and hitches. Today, anadromous (migrating from the ocean to freshwater for reproduction) and marine fish share the Bay waters common to the Delta, North Bay, and South Bay. Following are descriptons of fish and aquatic life in the Basin, organized by habitat type.

#### Lower South San Francisco Bay (Open Waters) and Baylands Habitats (Tidal [Mud] Flats, Tidal Sloughs, and Salt Ponds)

San Francisco Bay is the largest estuary on the West Coast. Aquatic habitat in the Bay includes marshes, tidal mudflats, sloughs, salt ponds, and open water.

Most marine life in the Bay either depends directly on mudflats and marshes for its sustenance, or indirectly on them by feeding upon detritus or other marine life nourished there. Because most of the Bay bottom is mud, most of its bottom dwellers have muddy lifestyles. The bottom is a place for diggers and burrowers, for worms and clams and oysters and for all the things that feed on them (Cohen 1990).

Native and nonnative invertebrates include two species of mussel (ribbed/horse and bay), three species of oyster (Olympia, Atlantic, and Pacific), seven species of clam (gem, Japanese littleneck, littleneck, soft-shell, bent-nosed, Baltic, and Asian), three species of shrimp (Asian, bay, and blue mud), four species of crab (hermit, mud, Atlantic green), and Chinese mitten crab, snails, worms, brine shrimp, and brine flies (Conradson 1996). Although the diversity of invertebrate species may be low, population densities of invertebrates found in the mud or zooplankton larva and brine shrimp found in the water column are highly productive.

Conradson (1996) lists only 21 common species of invertebrates native to the Bay. The low number of native invertebrate species may be due to the relatively young geologic age of the Bay (10,000 years) in combination with geographic isolation from other salt marsh habitats (Conradson 1996). However, over more than a century, many nonnative species have been introduced intentionally and accidentally into the Bay. Approximately 100 marine invertebrate species have been introduced since 1850 (13 of which are listed as common) as passengers on cargo and other ships entering the Bay (Conradson 1996). These exotic species, which came from as far away as the Orient, South Pacific, and Australia, were often able to fill unestablished niches or outcompete and eliminate the native species because natural controls such as predators, better competitors, and disease did not accompany them.

The Asian clam is a recent introduction that may have a widespread impact on the Bay ecosystem. First observed in Suisun Bay in 1986, the Asian clam (*Potamocorbula amurensis*) most likely arrived travelling as small larvae in the ballast water of a cargo ship from China, Japan, or Korea (Cohen 1990). Since this clam consumes huge quantities of zooplankton, a primary food source for fish larvae, this nonnative may impact fish abundance in future generations (Citizens Alliance to Restore the Estuary 1996).

Since the 1992 discovery of the Chinese mitten crab in the South Bay, their population has expanded into the Sacramento-San Joaquin Delta system and watershed. The juvenile crabs migrate into freshwater areas where they develop into adults. Mitten crabs have already had adverse effects on the estuary system, and fish and water facilities (Tsukimura and Toste 2000). Locally concerns focus on the impact of mitten crab burrowing on streambanks and levees.

The Bay supports nearly 100 species of fish. Some fish spend their entire life cycle in the Bay. Others enter the Bay for a specific life stage (usually reproduction). Typical fish include herring, topsmelt, Jacksmelt, Northern anchovy, starry flounder, staghorn sculpin, shiner, goby, croaker, and perch. Anadromous steelhead, salmon, and lamprey are present in the Bay during their migration from the ocean as adults and to the ocean as young. In addition, many fish migrate seasonally into the mouths of freshwater streams for feeding and reproduction. These migrations depend on changes in salinity, temperature, and food resources.

Detritus from wetlands, phytoplankton (microscopic floating plants) and zooplankton, form the basis of food webs in the Bay. Zooplankton are minute animals that include copepods, opossum shrimp (*Neomysis mercedis)* and the larvae of fish, mollusks, barnacles, crabs, and other organisms. Zooplankton provides food for immature predatory fish such as steelhead, salmon and striped bass, bay shrimp, and filter-feeding fish such as herring and shad. Some bottom-dwelling animals feed by filtering phytoplankton, zooplankton, and other organic materials from Bay waters. These animals include oysters, clams and other bivalves, and amphipod and isopod crustaceans. Other bottom-dwelling (benthic) organisms such as snails and polycheate worms graze on plankton, patches of brown diatoms, and other algae originating on the intertidal flats. (These microscopic diatoms often lend a golden hue to the mudflat's surface). In turn, these benthic invertebrates are fed upon by crabs, carnivorous mollusks, bat rays, leopard sharks, and bottom feeding fish such as starry flounder.

The lower reaches of the Basin streams are a transition zone to the more saline waters of the South Bay. Fish in these lower reaches are generally tolerant of a range of environmental conditions. Furthermore, a number of fish migrate in and out of sloughs for feeding and reproduction as salinity and flow changes with seasons, tides, and runoff. Fish occurrence in these lower reaches has been best documented for Coyote Creek. Fish collected in lower Coyote Creek were dominated by nonnative fish – goldfish, carp, red shiner, yellowfin gobies – but included one native fish, the California roach (Habitat Restoration Group 1995). At the mouth of Coyote Creek, captured fishes were a mix of species adapted to all waters. A collection of 15 species was dominated (97 percent of catch) by five species: the Pacific staghorn sculpin, starry flounder, northern anchovy, yellowfin goby, and shiner perch. Populations of the yellowfin goby have increased dramatically and may result in future competition with native gobies and fish such as the staghorn sculpin.

Fifteen species of fish are common to the salt and brackish marshes of the Bay (Conradson 1996). However, salt marshes provide large amounts of algae and detritus to the base of the food chain, which will ultimately support more than 60 species of fish in the deeper fresh, salt, or brackish waters of the Bay to complete their life cycle (Conradson 1996).

> "Salt ponds support a distinctive and highly specialized salt-tolerant to salt-loving biota consisting of microalgae, photosynthetic bacteria, and invertebrates (e.g., brine fly and brine shrimp), but no vascular plants. The dominant species are single-celled green alga and numerous species of blue-green and other bacteria. Ponds with salinities closer to marine salinities support macroalgae such as sea lettuce and marine plankton…" (Goals Project 1999).

In the less salty ponds, fish and aquatic organisms occur that are common to other shallow waters of the South Bay. For example, topsmelt, which can tolerate salinities up to 90 ppt, inhabit salt ponds. In the saltiest ponds, brine shrimp, brine flies, and the alga *Dunaliella salina* dominate a simple ecosystem.

### Freshwater Habitats: Lotic (i.e., Flowing Water) Habitats

At present, the fish fauna in Basin streams includes 14 native species and 18 nonnative species (Table 7-4b). Abundance and distribution of native fish species have been reduced significantly through human settlement, water resource development, and other human impacts, mostly since the early 1900s. While six fish species native to Basin streams are now locally extinct, native fish persist either in certain areas of the watershed or with reduced populations throughout their former range. For example, riffle sculpin have been collected most recently only in the least disturbed, cold tributary streams of the Coyote Creek and Guadalupe River watersheds. Alternatively, a few native fishes are tolerant of environmental conditions in human-altered streams. For example, California roach and Sacramento suckers are the most abundant and widespread native fish in Basin streams. California roach are able to tolerate warmer stream temperatures and lower dissolved oxygen levels than other native fish, while Sacramento suckers are adapted to a range of environmental conditions from cold streams to warm reservoirs. Historical occurrence and subsequent changes in native fish populations are best documented for the larger watersheds: Coyote and San Francisquito Creeks and the Guadalupe River. In the smaller watersheds, an understanding of historical native fish distribution and recent changes to fish fauna is constrained by limited sampling efforts.

Reproducing populations of steelhead are known to exist in Coyote Creek, Guadalupe River, Stevens Creek, and San Francisqito Creek and their tributaries. The presence or absence of steelhead indicate the extent of human alteration in a watershed because steelhead are sensitive to human impacts such as passage barriers, water diversions, sedimentation, and increased stream temperatures. A small run of anadromous Chinook salmon occurs in the Guadalupe River.

In most Basin watersheds, headwater reaches and tributaries remain less disturbed than main stem streams and lower reaches. Quite a few tributaries flow out of protected open spaces or parks. Aquatic habitat in the forested headwater streams provides cool stream temperatures, high dissolved oxygen, and cover including riparian vegetation, overhanging banks or roots, cobbles, boulders, and pools. Abundant riffles (areas of higher gradient with gravel/cobble substrate) provide spawning areas, cover for young fish, and habitat for aquatic insects that are a primary food resource for young steelhead and other fish. Upper watershed streams are usually dominated by native fish, including California roach, Sacramento suckers, and prickly sculpins. Young steelhead and riffle sculpins also occur in headwater streams when present in the watershed. One nonnative fish, the green sunfish, prefers these upper watershed streams with few other species present. Limited information exists regarding upper watershed fish populations for several of the smaller watersheds.

Dam construction has isolated many upper watershed streams in the Basin. While native fish can persist in these streams, migratory fish such as steelhead and lampreys can no longer utilize these tributaries for spawning and rearing since most reservoirs do not have fish ladders. Reduced access to these tributaries is one of the main factors in the decline of steelhead in Coyote Creek and Guadalupe River.

Main stem streams and lower tributary reaches vary considerably among watersheds, but all are altered significantly by human impacts. Human impacts include water diversions, channelization, flood control projects, loss of riparian vegetation, and increased rates of sedimentation. These impacts reduce habitat complexity, the number and quality of pool habitats and gravel and cobble substrate, which are essential for spawning, cover, and insect production. Loss of riparian vegetation results in decreased shading, increased water temperatures, reduced cover and decreased input of nutrients and food (e.g., insects).

Nonnative fish tend to dominate fish abundance and diversity in lower reaches. In general, nonnative fish are better adapted to these human-altered stream conditions than native fish. For example, carp are tolerant of the very warm and turbid water that exists in lower Coyote Creek during much of the year. In Stevens Creek, nonnative fish are more common in the middle and lower reaches, even though native fish are predominant in the upper main stem.

#### Freshwater Habitats: Lentic (i.e., Standing Water) Habitats

In the Basin, lentic, or lake-like, freshwater habitat occurs predominantly in permanent and seasonal in-channel impoundments. Lentic aquatic habitat tends to have higher stream temperatures and lower dissolved oxygen than adjacent lotic (flowing water) habitat. Lentic habitats feature daily and seasonal patterns of temperature and dissolved oxygen levels that reflect the interaction of solar radiation, light penetration, and phytoplankton photosynthesis and respiration. In addition, water flowing into and out of reservoirs affects temperature and dissolved oxygen between upstream and downstream locations in the reservoirs. Oxygen stratification can occur in lakes and reservoirs, whereby cooler water temperatures towards the bottom have greatly reduced oxygen levels. Stratification can limit suitability for fish requiring higher oxygen levels and lower temperatures. Food resources differ in reservoirs with most fishes feeding on phytoplankton, zooplankton, aquatic insects and other invertebrates such as snails, or preying on fish and other aquatic organisms.

The lentic habitat found in reservoirs and in-channel percolation ponds tends to favor nonnative fish such as bluegills, sunfish, brown bullheads, carp, goldfish and largemouth bass. Reservoirs promote the presence of nonnative fish in the watershed by providing suitable habitat. These nonnative fish can prey on native fish and invade adjacent stream habitat, for example, largemouth bass can prey on juvenile steelhead.

Reservoirs provide habitat for some native fish (such as hitch and Sacramento blackfish) adapted to lentic conditions. Reservoirs can provide suitable rearing habitat for nonmigratory rainbow trout if cool temperatures, dissolved oxygen, and food resources are available. Reservoirs are also suitable for native fish species adapted to a range of environmental conditions, such as the California roach and Sacramento sucker. In-channel percolation ponds have the potential to provide rearing habitat for juvenile steelhead if temperatures, dissolved oxygen, and food resources are suitable, but only a few possible steelhead were captured during a 5-year study monitoring in-channel percolation ponds on Basin streams (Habitat Restoration Group 1995). Since the large, permanent reservoirs in the Basin do not provide passage for steelhead, they would not be expected to occur in these reservoirs, although native rainbow trout may persist in upstream tributaries.

### *7.1.7.4 Special Fish Species*

Steelhead trout (*Oncorhynchus mykiss)* has been federally listed as threatened in Basin streams. Steelhead and rainbow trout, common names for the species *Oncorhynchus mykiss*, have different life histories. Steelhead are anadromous: young steelhead spend from 1 to 2 years in streams before migrating to the ocean, where they mature and return to freshwater streams as adults to reproduce. Unlike salmon, steelhead can return several times to freshwater streams to spawn. Rainbow trout live full-time in freshwater streams and do not migrate to the ocean. Resident rainbow trout populations often develop in streams that had steelhead populations historically, but migration to the ocean (and back) is not possible due to changes such as the natural formation of waterfalls or the human construction of permanent dams and drop structures. However, these rainbow trout have the genetic potential to once again become a steelhead population if migration passage is restored. Both smolts (outmigrating young) and adults depend on adequate streamflows for migration. Adequate streamflows in spring (April to early June) are essential for the successful outmigration of young steelhead.

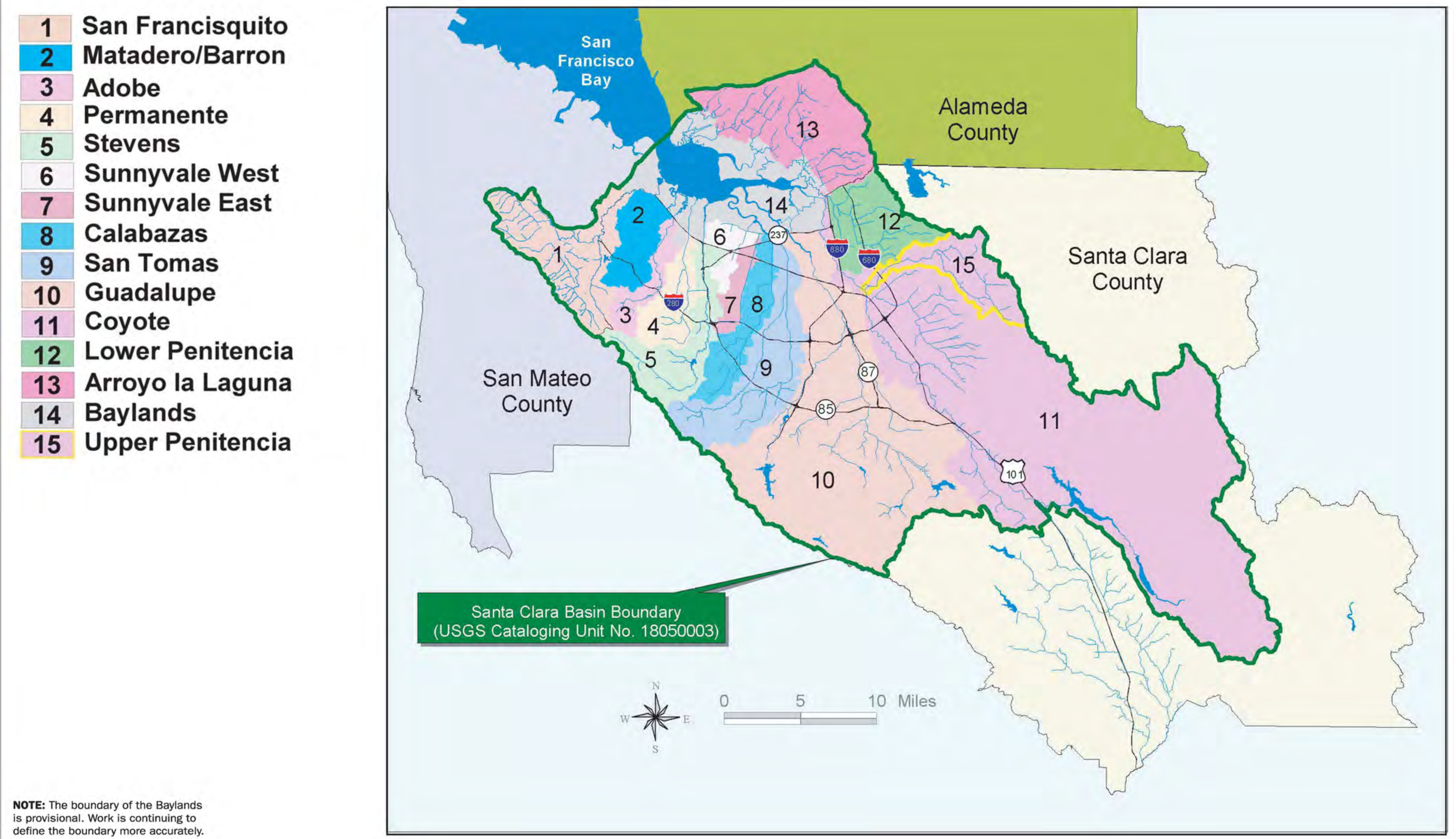
Success of anadromous fish spawning and rearing depends on several habitat factors, including cool temperatures, high dissolved oxygen levels, and substrates for spawning and rearing. Salmonids of all life stages prefer cool temperatures and well-oxygenated water. As water temperatures increase, salmonid survival is dependent upon high food productivity and high dissolved oxygen levels. Stream temperatures influence the incubation period for Chinook and steelhead eggs. Young steelhead need cover habitat such as undercut banks, pools, overhead vegetation, riffles, and boulders to escape predation and high streamflows.

Fall run Chinook salmon are a CDFG species of special concern. See Table 7-3 for information on special-status species in the Santa Clara Basin.[9]

## 7.2 Waterbodies of the Santa Clara Basin

The waterbodies of the Basin are highly varied. They include the rivers and creeks that drain the 13 separate watersheds that flow into the South Bay, the southern portion of San Francisco Bay south of the Dumbarton Bridge, and the wetlands surrounding the South Bay. There are nine major lakes/reservoirs and other smaller reservoirs located on creeks at mid-elevations in the watershed. There are also isolated wetlands throughout the Basin, including freshwater marshes and numerous small ponds. Figure 7-9 shows the location of each watershed in the Basin, along with many of the rivers, creeks, and tributaries.

[9] Table 7-3 is based on WMI's Technical Memorandum No. 32: Recommended List of Special-Status Species for RARE Assessment, approved by the Core Group May 4, 2000. Information for the technical memorandum was compiled from various databases including the CNDDB, the California Native Plant Society Inventory, and the Santa Clara Valley Audubon Society Bird Species List for Santa Clara Valley and was reviewed by a number of WMI stakeholders and biologists. The species in Table 7-3 should be considered as the current list of special-status species in the Santa Clara Basin. The reader is referred to the technical memorandum for a description of how this list was developed and the rationale of inclusion and exclusion of species in the list. Note that dissenting opinion exists among some stakeholders regarding what type of Chinook salmon are present in the Guadalupe River and Coyote Creek. Some stakeholders feel winter run Chinook occur in the Basin as well.




**Source:** *Santa Clara Valley Water District*



**FIGURE 7-9**
**Santa Clara Basin Watershed Boundaries**

## 7.2.1 Lower South San Francisco Bay [10]

The waterbodies of the lower South Bay and Baylands include the open water (saltwater) of the Estuary south of the Dumbarton Bridge and the wetlands surrounding the South Bay. The term "Baylands" is used to refer to a number of wetland ecosystems found near the Bay, and encompasses many different types of habitat, each of which have unique hydrologic properties and plant and animal associations. Baylands in the northern Santa Clara Basin include tidal mudflats, tidal sloughs, coastal (tidal) salt marshes, diked salt marshes, brackish water marshes, salt ponds, and freshwater marshes. The extensive system of dikes and levees in the Baylands not only alters the distribution of tidal, brackish, and fresh waters but also provides a unique habitat of "higher ground" within the marsh plain. A map of the Baylands is shown on Figure 7-10.

### *7.2.1.1 Open Waters, Mudflats, and Tidal Sloughs*

Although the various components of the Estuary are part of a complex hydrologic mosaic in which each piece depends on all of the other pieces, it is possible to sequentially discuss the various types of waterbodies found in the Basin, beginning with the Bay itself. Hydrologists split the Estuary into two distinct hydrologic systems: a northern reach running from the Delta through Suisun, San Pablo, and Central Bays, where the pattern of water circulation and salinity is largely determined by the flows from the Sacramento and San Joaquin Rivers; and a southern reach consisting of the South Bay, which receives much less water from its tributaries. The Basin includes the southern end of the South Bay. The Estuary as a whole is subject to the mixed semidiurnal tides typical of the West Coast, meaning that there are two unequal high tides and two unequal low tides in each (roughly) 25-hour period. In the nearly enclosed basin of the South Bay, the tides cause the water to slosh back and forth like water in a bathtub, causing the normal tidal range at the extreme southern end to approach 8.5 feet (Cohen 1990).

Tides are raised by the gravitational pull of the moon and the sun, with the tidal range changing in a regular pattern as the moon circles the earth every 28 days. The tides with the greatest range, called spring tides, occur during the full or the new moon, when the moon, sun, and earth are nearly aligned. At this time, the inequalities between the two daily high tides and the two daily low tides are also greatest. Neap tides, with the least tidal range and most similar daily highs and lows, occur during the moon's quarters. The tides also vary on an annual cycle, with extreme high and low tides occurring in May/June and November/December (Cohen 1990).

Since the South Bay only receives about one-tenth as much freshwater from its tributary streams as do the northern portions of the Bay, it does not regularly experience the strong salinity (dissolved salt) gradients or estuarine flows typical of the northern reaches of the Bay. As a result, salinities are generally higher and more uniform in the South Bay (Cohen 1990). Summer

[10] Persons interested in learning more about the ecology of San Francisco Bay may wish to access the Bay Area EcoAtlas managed by the San Francisco Estuary Institute (SFEI 1998). The Bay Area EcoAtlas is a growing assemblage of maps, images, scientific data, and information sources about the ecology of the bays, wetlands, and watersheds of the Bay Area. The EcoAtlas can be visited online at the SFEI website: www.sfei.org. Information on the EcoAtlas can be obtained by contacting the SFEI at 1325 South 46th Street, Richmond, CA 94804.

salinities can be three times higher than winter salinities due to evaporation; and sometimes parts of the South Bay are saltier than the ocean (Conradson 1996). With little freshwater flowing in, the southern portion of the South Bay is relatively stagnant, especially south of the Dumbarton Bridge.

Overall, the residence time (the average length of time it takes for a water molecule or a dissolved contaminant to leave the system) is four times longer in the southern than in the northern reach of the Bay. In wet winters, however, large floods coming down from the Delta can surge through the Central Bay and enter the southern reach, temporarily establishing vertical salinity gradients and two-layered estuarine flows (Cohen 1990). By some calculations, this reduces the residence time from around 5 months in the summer (when water exchange is controlled by less efficient mixing mechanisms such as tidal currents and wind mixing) to two months in the winter (when freshwater flow is largely responsible for mixing) (Conradson 1996). Thus, large flows through the Delta in winter and spring may help to flush pollutants out of the South Bay (Cohen 1990). Areas of the Bay with large discharges and poor water circulation, such as the lower South Bay, which in the summer receive more treated wastewater than river water, are thought to be particularly vulnerable to pollution (Cohen 1990).

Most of the Bay is extremely shallow, and this is especially true of portions of the South Bay. Although in some South Bay shallows the sediments on the Bay floor are mixed with enormous numbers of broken oyster shells, nearly everywhere else the Estuary's bottom is a slick, sticky ooze of fine silts and clays, commonly referred to as bay mud.

Tidal (mud) flats are generally understood to be the zones of apparently barren mud, muck, or sand exposed at low tide. Their upper boundary is indicated by the edge of emergent vegetation or wave-cut bank. The acreage of a typical tidal (mud) flat varies not only within the 25-hour tidal cycle, but also with the monthly or seasonal tidal cycles and floods. Within the South Bay itself, the present extent of mudflats is slightly smaller than in presettlement times. Generally, the levees and fills of the Baylands have been located along higher boundaries, above the mudflats (Tudor Engineering Company 1973).

### *7.2.1.2 Historical Perspective*

The Baylands of the Basin are an ecologically fragile area that have undergone dynamic structural and environmental changes over the past 100 years. As illustrated on Figures 7-7 and 7-8, in the Bay ecosystem as a whole, marshlands bordering the Bay now total about 75 square miles. In 1850, before diking and filling of these lands had begun, marshlands covered some 300 square miles. The prehistoric broad salt marshes dissected by the meandering brackish tidal sloughs of Coyote, Alviso, Guadalupe, and other, lesser drainages have long been trapped behind earth levees and shaped by dredgers and bulldozers. Much of the tidal wetlands and the floodplains have been modified. They were converted first to stock pasturage and hay farms, then to truck gardens and orchards, and most recently to factory and business sites, suburban housing, military installations, and aerospace industries (Tudor Engineering Company 1973).

The loss of these wetlands has come at a steep price. Wetlands are increasingly recognized as among the most productive ecosystems on Earth, but they are more than just food factories for wildlife. Wetlands serve an important role for flood control and act as filters and cleansing agents for water flowing into the Bay. By intercepting surface runoff, marshes are able to remove and retain nutrients, process chemical and organic wastes, and reduce sediment loads before the water reaches the Bay. Through their enormous absorptive capacity, wetlands are able to store floodwater that would otherwise destroy cropland or residential areas. They help control sedimentation and erosion. Given their importance to wildlife, water quality and flood protection, wetlands are an extremely valuable natural resource (Citizens Alliance to Restore the Estuary 1996).

The Bayfront cities of Palo Alto, Menlo Park, East Palo Alto, Mountain View, Sunnyvale, San Jose, and Fremont have each played their role in the environmental history of the Baylands, although the impacts to Bayfront lands at the northern edge of the Basin have been less severe than those at the extreme southern reach of the Estuary. Saltwater intrusion, land subsidence, falling water tables and destructive floods have been less severe in these northern Baylands than they have in the floodplains of Coyote Creek, Alviso Slough, and Guadalupe Slough (Tudor Engineering Company 1973).

The major, direct impact on the Baylands in the Basin during the past 75 years, and the one that has modified the Baylands environment most drastically, was brought about by the development of the salt industry (Tudor Engineering Company 1973). The tidal marshes of the South Bay had saline soils, lacked readily available irrigation water, and experienced high evaporation rates during the summer – all of which made agriculture less feasible than in the northern portions of the Estuary. Extensive, natural crystallizing ponds suggested another use: salt production (Josselyn 1983). Salt ponds of the South Bay were diked beginning in 1854 (Bay Institute of San Francisco 1987). By the late 1800s, extensive lands were diked by small companies to produce salt in evaporation ponds. By the 1930s, over 99 square miles had been diked in the South Bay for salt production, a use that continues to this day, although diking and filling in the South Bay have slowed greatly during the past 30 years, since the passage of the Clean Water Act.

The discharge of freshwater from wastewater treatment plants into the South Bay presents another ongoing problem. Over the last 20 years, approximately 270 acres of tidal salt marsh dominated by pickleweed and cordgrass in the South Bay have been converted to brackish marsh dominated by alkali bulrush in areas of freshwater discharge from wastewater treatment.

A number of marsh-dependent plants and animals have become rare or endangered, largely as a result of habitat loss and fragmentation of the Estuary. A total of 90 taxa of mammals, birds, reptiles, insects, and amphibians within the Bay was designated by federal and state governments as having sufficiently declined in numbers to deserve special protection or monitoring.

The "Baylands Ecosystem Habitat Goals" report (Goals Project 1999) distinguishes three separate segments within that portion of the South Bay Subregion that is south of Dumbarton Bridge: Segment O – Mountain View Area; Segment P – Coyote Creek Area; and Segment Q –

Mowry Slough Area. Descriptions of the historical distribution of Baylands habitats in each of these areas are contained in this report.

### 7.2.2 Santa Clara Basin Watersheds

A watershed is defined as "a hydrologic unit that drains to tidal waters of the Bay, including tributaries and land areas above reservoirs" (WMI Work Group C). This discussion of the hydrologic features in the Basin describes each of the stream systems that flow to the South Bay.

The Basin encompasses 13 distinct watersheds that drain to the southern portion of the South Bay. Seven of these watersheds (San Francisquito Creek, Matadero/Barron Creeks, Adobe Creek, Permanente Creek, Stevens Creek, Calabazas Creek, and San Tomas Aquino/Saratoga Creek watersheds) drain the northeast and east-facing slopes of the Santa Cruz Mountains, originating on the east side of Skyline Boulevard (State Highway 35). Each of these creeks flows across the western portion of the Santa Clara Valley to the Baylands bordering the west and southwest sides of the South Bay. Two small drainage basins (Sunnyvale West and Sunnyvale East Channel watersheds) drain lowland areas on the southwest side of the South Bay. Guadalupe River watershed drains the north-facing slopes of the Santa Cruz Mountains at the southern end of the Santa Clara Valley. Guadalupe River flows north through the Santa Clara Valley to the south end of the Bay.

The west-facing slopes of the Diablo Range in the southern and southeastern portions of the Basin are drained primarily by Coyote Creek. Coyote Creek watershed is the largest watershed in the Basin. Guadalupe River watershed is the second largest. Coyote Creek flows the full length of the Santa Clara Valley from south to north at the base of the Diablo Range before entering the eastern side of the South Bay. The foothills of the Diablo Range in the northeastern portion of the Basin are drained by Lower Penitencia Creek watershed. Finally, the lowland areas in the northeasternmost portion of the Basin are drained by the Arroyo la Laguna watershed that flows to the Baylands at the northeastern side of the South Bay via several slough systems.

Table 7-5 (Rivers and Creeks in the Basin) presents the relationship between each of the watercourses within each watershed. Table 7-6 provides information on the drainage area and channel length of many of the rivers and creeks in the Basin.

Each of the watersheds in the Basin is discussed in detail below. The purpose of these watershed descriptions is to provide the reader with a general understanding of the location and character of each watershed, along with a feeling for the resource values associated with each stream system and the perturbations that have affected the health of these stream and riparian ecosystems.

Each watershed is discussed in sequence starting with the San Francisquito Creek watershed on the west side of the Basin, and moving through the Basin in a counter-clockwise direction (as viewed from the Dumbarton Bridge), ending with the Arroyo la Laguna watershed on the east side of the Basin.

**Table 7-5**
**Rivers and Creeks in the Santa Clara Basin**

| Watercourses Entering the South Bay | Major Rivers and Creeks | Major Tributaries and Reservoirs | Tributaries to Tributaries and Reservoirs | Additional Tributaries | Additional Tributaries |
|---|---|---|---|---|---|
| **San Francisquito Creek Watershed** | | | | | |
| San Francisquito Creek discharges into the South Bay south of the Dumbarton Bridge and north of the Palo Alto Flood Basin. | San Francisquito Creek | Los Trancos Creek (An unnamed diversion occurs to Felt Lake with a return.) | Buckeye (East Fork) | | |
| | | Bear Creek | Bear Gulch | | |
| | | | West Union Creek | McGarvey Gulch | |
| | | | | Squealer Gulch | |
| | | | | Tripp Gulch | |
| | | | | Appletree Gulch | |
| | | | Dry Creek | | |
| | | Searsville Lake | Alambique Creek | | |
| | | | Sausal Creek | Bozzo Gulch | |
| | | | | Neils Gulch | |
| | | | | Bull Run Creek | |
| | | | | Dennis Martin Creek | |
| | | | Corte Madera Creek | Coal Creek | |
| | | | | Rengstorff Gulch | |
| | | | | Damiani Creek | |
| | | | | Jones Gulch | |
| | | | | Hamms Gulch | |
| | | | Westridge Creek | | |
| **Matadero and Barron Creek Watershed** | | | | | |
| Matadero and Barron Creeks discharge into the Palo Alto Flood Basin. | Matadero Creek | Stanford Channel | | | |
| | | Deer Creek | | | |
| | | Arastradero Creek | | | |
| | Barron Creek | | | | |
| **Adobe Creek Watershed** | | | | | |
| Adobe Creek discharges into the Palo Alto Flood Basin. | Adobe Creek | Robleda Drain | | | |
| | | Purissima Creek | | | |
| | | Moody Creek | | | |
| | | North Fork | | | |
| | | West Fork | | | |
| | | Middle Fork | | | |
| **Permanente Creek Watershed** | | | | | |
| Permanente Creek discharges to the South Bay via Mountain View Slough. | Permanente Creek | Hale Creek | Loyola Creek | | |
| | | | Magdalena Creek | | |
| | | West Branch Permanente | Ohlone Creek | Big Green Moose Creek | |

**Table 7-5 (continued)**
**Rivers and Creeks in the Santa Clara Basin**

| Watercourses Entering the South Bay | Major Rivers and Creeks | Major Tributaries and Reservoirs | Tributaries to Tributaries and Reservoirs | Additional Tributaries | Additional Tributaries |
|---|---|---|---|---|---|
| **Stevens Creek Watershed** | | | | | |
| Stevens Creek discharges into the South Bay east of Permanente Creek and west of Guadalupe Slough. | Stevens Creek | Permanente Diversion | | | |
| | | Heney Creek | | | |
| | | Stevens Creek Reservoir | Swiss Creek | Montebello Creek | |
| | | | | North Swiss Creek | |
| | | | Stevens Creek | Gold Mine Creek | |
| | | | | Indian Cabin Creek | |
| | | | | Bay Creek | |
| | | | | Indian Creek | |
| **Sunnyvale West Channel Watershed** | | | | | |
| Sunnyvale West Channel discharges into Moffett Channel and thence into Guadalupe Slough. | Sunnyvale West Channel | | | | |
| **Sunnyvale East Channel Watershed** | | | | | |
| Sunnyvale East Channel discharges into Guadalupe Slough. | Sunnyvale East Channel | | | | |
| **Calabazas Creek Watershed** | | | | | |
| Calabazas Creek discharges to the South Bay via Guadalupe Slough. | Calabazas Creek | Prospect Creek | | | |
| | | Rodeo Creek | | | |
| | | Regnart Creek | | | |
| | | Junipero Serra Channel | | | |
| | | El Camino Storm Drain | | | |
| **San Tomas Aquino/Saratoga Creek Watershed** | | | | | |
| San Tomas Aquino Creek discharges to the South Bay via Guadalupe Slough. | San Tomas Aquino Creek | Smith Creek | Page Ditch | | |
| | | Wildcat Creek | Vasona Creek | Vasona Creek | |
| | | | | Sobey Creek | |
| | | Saratoga Creek | Congress Springs Canyon | | |
| | | | Bonjetti Creek | San Andreas Creek | Sanborn Creek |
| | | | | Todd Creek | |
| | | | | McElroy Creek | |
| | | | Booker Creek | | |

**Table 7-5 (continued)**
**Rivers and Creeks in the Santa Clara Basin**

| Watercourses Entering the South Bay | Major Rivers and Creeks | Major Tributaries and Reservoirs | Tributaries to Tributaries and Reservoirs | Additional Tributaries | Additional Tributaries |
|---|---|---|---|---|---|
| **Guadalupe River Watershed** | | | | | |
| Guadalupe River discharges to the South Bay via Alviso Slough. | Guadalupe River | Los Gatos Creek | Dry Creek | | |
| | | | Daves Creek | | |
| | | | Vasona Reservoir | Los Gatos Creek | Almendra Creek |
| | | | | | Trout Creek |
| | | | Lexington Reservoir | Limekiln Creek | |
| | | | | Lyndon Canyon Creek | Lake Ranch Reservoir |
| | | | | Soda Springs Creek | |
| | | | | Aldercroft Creek | |
| | | | | Black Creek | |
| | | | | Briggs Creek | Dyer Creek |
| | | | | Hendrys Creek | |
| | | | | Los Gatos Creek | Moody Gulch |
| | | | | | Hooker Gulch Creek |
| | | | | | Lake Elsman<br>Austrian Gulch<br>Williams Reservoir<br>Los Gatos Creek |
| | | Canoas Creek | | | |
| | | Ross Creek | Short Creek | | |
| | | | Lone Hill Creek | | |
| | | | East Ross Creek | | |
| | | Guadalupe Creek | Shannon Creek | | |
| | | | Pheasant Creek | | |
| | | | Reynolds Creek *(Exact Location Unclear)* | | |
| | | | Hicks Creek *(Exact Location Unclear)* | | |
| | | | Guadalupe Reservoir | Los Capitancillos Creek | |
| | | | | Upper Guadalupe Creek | Rincon Creek |
| | | Lake Almaden | Alamitos Creek | Golf Creek | McAbee Creek |
| | | | | Greystone Creek | |
| | | | | Randol Creek | West Branch Randol Ck. |
| | | | | Arroyo Calero Creek | Santa Teresa Creek |
| | | | | | Calero Reservoir<br>Cherry Canyon Creek<br>Pine Tree Canyon Creek |
| | | | | Chilanian Gulch | |
| | | | | Deep Gulch | |
| | | | | Almaden Reservoir | Larabee Gulch |
| | | | | | Jacques Gulch |
| | | | | | Alamitos Creek |
| | | | | | Barrett Canyon Creek |
| | | | | | Herbert Creek |

| Table 7-5 (continued)<br>Rivers and Creeks in the Santa Clara Basin | | | | | |
|---|---|---|---|---|---|
| **Watercourses Entering the South Bay** | **Major Rivers and Creeks** | **Major Tributaries and Reservoirs** | **Tributaries to Tributaries and Reservoirs** | **Additional Tributaries** | **Additional Tributaries** |
| **Coyote Creek Watershed** | | | | | |
| Coyote Creek discharges to South Bay via Lower Coyote Creek. | Coyote Creek | Upper Penitencia Creek | Arroyo Aquague Creek | Papa Saca Creek | |
| | | | Dutard Creek | | |
| | | | Cherry Flat Reservoir | Upper Penitencia Creek | |
| | | Lower Silver Creek | Miguelita Creek | | |
| | | | North Babb Creek | | |
| | | | South Babb Creek | | |
| | | | Flint Creek | Ruby Creek | |
| | | | Norwood Creek | | |
| | | | Thompson Creek | Quimby Creek | |
| | | | | Fowler Creek | |
| | | | | Evergreen Creek | |
| | | | | Yerba Buena Creek | |
| | | | | Cribari Creek | |
| | | | | Misery Creek | |
| | | | | Hawk Creek | |
| | | | | Dry Creek | |
| | | Upper Silver Creek | | | |
| | | Coyote Canal | | | |
| | | Fisher Creek | Willow Springs Creek | | |
| | | Anderson Reservoir | San Felipe Creek | Shingle Valley Creek | |
| | | | | Las Animas Creek | |
| | | | | Carlin Canyon Creek | Brushy Creek |
| | | | | Cow Creek | |
| | | | Packwood Creek | Hoover Creek | Star Canyon Creek |
| | | | Coyote Creek | Otis Canyon Creek | South Fork |
| | | | | | North Fork |
| | | | | Coyote Reservoir | Larios Canyon Creek |
| | | | | | Coyote Creek |
| | | | | | Bear Creek |
| | | | | | Canada de los Osos |
| | | | | | Hunting Hollow Creek |
| | | | | | Big Canyon Creek |
| | | | | | Soda Springs Canyon |
| | | | | | Middle Fk Coyote Creek |
| | | | | | Little Coyote Creek |
| | | | | | Sulpher Creek |
| | | | | | East Fk Coyote Creek |
| | | | | | Kelly Cabin Canyon |
| | | | | | Water Gulch |
| | | | | | Grizzly Creek |

**Table 7-5 (concluded)**
**Rivers and Creeks in the Santa Clara Basin**

| Watercourses Entering the South Bay | Major Rivers and Creeks | Major Tributaries and Reservoirs | Tributaries to Tributaries and Reservoirs | Additional Tributaries | Additional Tributaries |
|---|---|---|---|---|---|
| **Lower Penitencia Creek Watershed** | | | | | |
| Lower Penitencia Creek Discharges to the South Bay via the tidal portion of Lower Coyote Creek. Lower Penitencia Creek flows to lower Coyote Creek on the west side of Interstate 880 at Dixon Landing Road. | Lower Penitencia Creek | Berryessa Creek | Calera Creek | | |
| | | | Tularcitos Creek | South Branch | |
| | | | Arroyo de los Coches | | |
| | | | Piedmont Creek | North Branch | |
| | | | Sierra Creek | | |
| | | | Crosley Creek | | |
| | | | Sweigert Creek | | |
| | | | Los Buellis Creek | | |
| | | East Penitencia Channel | | | |
| **Arroyo la Laguna** | | | | | |
| Line A discharges into the tidally influenced section of Lower Coyote Creek, north of the old Fremont Airport. | Lower Coyote Creek | Line A | Scott Creek (Line A) | | |
| | | | Unnamed Line B | Unnamed Line B-1 | |
| | | | | Line C | Toroges Creek (Line C) |
| | | | | | Agua Fria Creek (Line D) |
| | | | | | Agua Caliente Creek (Line F) |
| Mud Slough discharges into lower Coyote Creek within the Baylands. | Mud Slough | Laguna Creek (Line E) | Unnamed (Line G) | | |
| | | | Unnamed (Line H) | | |
| | | | Canada del Aliso (Line J) | | |
| | | | Unnamed (Line I) | | |
| | | | Sabercat Creek (Line K) | Unnamed (Line K-1) | |
| | | | Mission Creek (Line L) | Lake Elizabeth | |
| | | | | Stivers Lagoon | |
| | | | Morrison Creek (Line M) | | |
| Mowry Slough discharges into the lower South Bay south of Newark Slough and north of Coyote Creek. | Mowry Slough | | | | |
| Plummer Creek and Newark Slough discharge into the lower South Bay just southeast of Dumbarton Point. | Plummer Creek | | | | |
| | Newark Slough | | | | |

| Table 7-6<br>Drainage Area and Channel Length of Rivers<br>and Creeks in the Santa Clara Basin[1] | | |
|---|---|---|
| **River or Creek** | **Drainage Area (Square Miles)** | **Channel Length (Miles)** |
| **San Francisquito Creek Watershed** | | |
| Alambique Creek | n/a | n/a |
| Appletree Gulch | n/a | n/a |
| Bear Creek | *n/a* | *n/a* |
| Bear Gulch | n/a | n/a |
| Bozzo Gulch | n/a | n/a |
| Buckeye Creek | n/a | n/a |
| Bull Run Creek | n/a | n/a |
| Coal Creek | n/a | n/a |
| Corte Madera Creek | n/a | n/a |
| Damiani Creek | n/a | n/a |
| Dennis Martin Creek | n/a | n/a |
| Dry Creek | n/a | n/a |
| Hamms Gulch | n/a | n/a |
| Jones Gulch | n/a | n/a |
| Los Trancos Creek | 7.25 | 6.58 |
| McGarvey Gulch | n/a | n/a |
| Neils Gulch | n/a | n/a |
| Rengstorff Gulch | n/a | n/a |
| San Francisquito Creek | 42.04 | 8.77 |
| Sausal Creek | n/a | n/a |
| Squealer Gulch | n/a | n/a |
| Tripp Gulch | n/a | n/a |
| West Union Creek | n/a | n/a |
| Westridge Creek | n/a | n/a |
| **Matadero/Barron Creeks Watershed** | | |
| Arastradero Creek | 1.13 | 0.95 |
| Barron Creek | 3.09 | 4.92 |
| Deer Creek | 1.60 | 2.46 |
| Matadero Creek | 13.57 | 7.97 |
| Stanford Channel | 1.08 | 1.60 |
| **Adobe Creek Watershed** | | |
| Adobe Creek | 10.84 | 14.01 |
| Middle Fork | n/a | n/a |
| Moody Creek | n/a | n/a |
| North Fork | n/a | n/a |
| Purissima Creek | 1.25 | 0.37 |
| Robleda Drain | n/a | n/a |
| West Fork | n/a | n/a |

**Table 7-6 (continued)**
**Drainage Area and Channel Length of Rivers and Creeks in the Santa Clara Basin[1]**

| River or Creek | Drainage Area (Square Miles) | Channel Length (Miles) |
|---|---|---|
| **Permanente Creek Watershed** | | |
| Big Green Moose Creek | n/a | n/a |
| Hale Creek | 4.80 | 3.16 |
| Loyola Creek | n/a | 0.74 |
| Magdalena Creek | 1.28 | 0.63 |
| Ohlone Creek | n/a | 1.04 |
| Permanente Creek | 8.11 | 12.97 |
| West Branch Permanente | n/a | 2.84 |
| **Stevens Creek Watershed** | | |
| Bay Creek | n/a | n/a |
| Gold Mine Creek | n/a | n/a |
| Heney Creek | 0.64 | 0.72 |
| Indian Cabin Creek | n/a | n/a |
| Indian Creek | n/a | n/a |
| Montebello Creek | n/a | 1.54 |
| North Swiss Creek | n/a | n/a |
| Permanente Diversion | 8.96 | 1.35 |
| Stevens Creek | 38.04 | 20.22 |
| Swiss Creek | n/a | 1.67 |
| **Sunnyvale West Channel Watershed** | | |
| Sunnyvale West Channel | 4.10 | 3.20 |
| **Sunnyvale East Channel Watershed** | | |
| Sunnyvale East Channel | 6.35 | 6.40 |
| **Calabazas Creek Watershed** | | |
| Calabazas Creek | 20.67 | 13.30 |
| El Camino Storm Drain | 3.23 | 2.31 |
| Junipero Serra Channel | 1.25 | 2.51 |
| Prospect Creek | 1.44 | 1.38 |
| Regnart Creek | 3.41 | 2.94 |
| Rodeo Creek | 1.43 | 1.90 |
| **San Tomas Aquino-Saratoga Creek Watershed** | | |
| Bonjetti Creek | n/a | 0.14 |
| Booker Creek | 0.50 | 0.66 |
| Congress Springs Canyon | n/a | n/a |
| Guadalupe Slough | - - | 6.32 |
| McElroy Creek | n/a | n/a |
| Page Ditch | 0.38 | 0.86 |
| San Andreas Creek | n/a | n/a |
| San Tomas Aquino Creek | 39.06 | 16.55 |
| Sanborn Creek | 1.02 | 0.34 |
| Saratoga Creek | 16.56 | 15.44 |

| **Table 7-6 (continued) Drainage Area and Channel Length of Rivers and Creeks in the Santa Clara Basin[1]** | | |
|---|---|---|
| **River or Creek** | **Drainage Area (Square Miles)** | **Channel Length (Miles)** |
| Smith Creek | 2.65 | 3.41 |
| Sobey Creek | 0.63 | 0.01 |
| Todd Creek | n/a | n/a |
| Vasona Creek | 1.43 | 0.51 |
| Wildcat Creek | 4.12 | 3.84 |
| **Guadalupe River Watershed** | | |
| Alamitos Creek | 37.96 | 8.93 |
| Aldercroft Creek | n/a | 1.39 |
| Almendra Creek | 1.08 | 1.88 |
| Arroyo Calero Creek | 12.40 | 6.08 |
| Austrian Gulch | n/a | 1.41 |
| Barrett Canyon Creek | n/a | 2.55 |
| Black Creek | n/a | n/a |
| Briggs Creek | n/a | 1.12 |
| Canoas Creek | 18.62 | 7.39 |
| Cherry Canyon Creek | n/a | n/a |
| Chilanian Gulch | n/a | n/a |
| Daves Creek | 0.61 | 1.62 |
| Deep Gulch | n/a | n/a |
| Dry Creek | n/a | n/a |
| Dyer Creek | n/a | n/a |
| East Ross Creek | 0.80 | 0.90 |
| Golf Creek | 3.08 | 2.27 |
| Greystone Creek | 1.38 | 1.56 |
| Guadalupe Creek | 15.24 | 28.03 |
| Guadalupe River | 170.64 | 19.78 |
| Hendrys Creek | n/a | 0.76 |
| Herbert Creek | n/a | 2.27 |
| Hicks Creek | n/a | 1.8 |
| Hooker Gulch Creek | n/a | 1.98 |
| Jacques Gulch | n/a | 0.93 |
| Larrabee Gulch | n/a | 0.96 |
| Limekiln Creek | n/a | 1.8 |
| Lone Hill Creek | 1.29 | 0.91 |
| Los Capitancillos Creek | n/a | 0.58 |
| Los Gatos Creek | 54.83 | 24.05 |
| Lyndon Canyon Creek | 1.90 | 3.13 |
| McAbee Creek | 0.50 | 0.47 |
| Moody Gulch | n/a | 4.36 |
| Pheasant Creek | 1.40 | 1.00 |
| Pine Tree Canyon Creek | n/a | n/a |

**Table 7-6 (continued)**
**Drainage Area and Channel Length of Rivers and Creeks in the Santa Clara Basin[1]**

| River or Creek | Drainage Area (Square Miles) | Channel Length (Miles) |
|---|---|---|
| Randol Creek | 2.28 | 1.93 |
| Reynolds Creek | n/a | n/a |
| Rincon Creek | 2.57 | 1.93 |
| Ross Creek | 9.96 | 6.16 |
| Santa Teresa Creek | 1.99 | 1.89 |
| Shannon Creek | 1.20 | 1.14 |
| Short Creek | 0.50 | 0.52 |
| Soda Springs Creek | n/a | 0.66 |
| Trout Creek | n/a | 0.28 |
| Upper Guadalupe Creek | n/a | n/a |
| West Branch Randol Creek | n/a | 3.63 |
| **Coyote Creek Watershed** | | |
| Arroyo Aquague Creek | 9.00 | 15.15 |
| Bear Creek | n/a | n/a |
| Big Canyon Creek | n/a | n/a |
| Brushy Creek | n/a | n/a |
| Canada de los Osos | n/a | n/a |
| Carlin Canyon Creek | n/a | n/a |
| Cow Creek | n/a | n/a |
| Coyote Canal | n/a | n/a |
| Coyote Creek | 321.62 | 42.14 |
| Cribari Creek | 1.53 | 0.34 |
| Dry Creek | n/a | n/a |
| Dutard Creek | n/a | n/a |
| East Fork Coyote Creek | n/a | n/a |
| Evergreen Creek | 1.98 | 2.86 |
| Fisher Creek | 15.78 | 7.99 |
| Flint Creek | 1.98 | 1.52 |
| Fowler Creek | 2.78 | 2.85 |
| Grizzly Creek | n/a | n/a |
| Hawk Creek | 0.60 | 0.40 |
| Hoover Creek | n/a | n/a |
| Hunting Hollow Creek | n/a | n/a |
| Kelly Cabin Canyon | n/a | n/a |
| Larios Canyon Creek | n/a | n/a |
| Las Animas Creek | 12.10 | 4.66 |
| Little Coyote Creek | n/a | n/a |
| Lower Silver Creek | 43.50 | 7.15 |
| Middle Fork Coyote Creek | n/a | n/a |
| Miguelita Creek | 4.49 | 4.05 |
| Misery Creek | 0.90 | 1.46 |

| Table 7-6 (continued) Drainage Area and Channel Length of Rivers and Creeks in the Santa Clara Basin[1] | | |
|---|---|---|
| **River or Creek** | **Drainage Area (Square Miles)** | **Channel Length (Miles)** |
| North Babb Creek | 2.57 | 1.29 |
| North Fork - Otis Canyon Creek | n/a | n/a |
| Norwood Creek | 2.18 | 3.13 |
| Otis Creek | n/a | n/a |
| Packwood Creek | 10.10 | 10.89 |
| Papa Saca Creek | n/a | n/a |
| Quimby Creek | 2.17 | 2.05 |
| Ruby Creek | 1.55 | 1.61 |
| San Felipe Creek | 8.00 | 29.17 |
| Shingle Valley Creek | 3.40 | 6.06 |
| Soda Springs Canyon | n/a | n/a |
| South Babb Creek | 4.00 | 3.61 |
| South Fork - Otis Canyon Creek | n/a | n/a |
| Star Canyon Creek | n/a | n/a |
| Sulpher Creek | n/a | n/a |
| Thompson Creek | 17.99 | 8.81 |
| Upper Penitencia Creek | 23.91 | 11.04 |
| Upper Silver Creek | 5.96 | 7.24 |
| Water Gulch | n/a | n/a |
| Willow Springs Creek | n/a | n/a |
| Yerba Buena Creek | 2.58 | 1.52 |
| **Lower Penitencia Creek Watershed** | | |
| Arroyo de los Coches | 4.02 | 3.41 |
| Berryessa Creek | 22.05 | 9.66 |
| Calera Creek | 2.93 | 3.13 |
| Crosley Creek | 0.93 | 1.28 |
| East Penitencia Creek | 1.70 | 0.68 |
| Los Buellis Creek | n/a | 0.73 |
| Lower Penitencia Creek | 27.20 | 4.13 |
| Piedmont Creek | n/a | n/a |
| Piedmont Creek – North Branch | 1.93 | 1.46 |
| Sierra Creek | 0.77 | 2.10 |
| Sweigert Creek | 0.94 | 0.36 |
| Tularcitos Creek | n/a | n/a |
| Tularcitos Creek – South Branch | 1.96 | 0.86 |
| **Arroyo la Laguna Watershed** | | |
| Agua Caliente (Line F) | n/a | n/a |
| Aqua Fria Creek (Line D) | n/a | n/a |

| Table 7-6 (concluded)<br>Drainage Area and Channel Length of Rivers and Creeks in the Santa Clara Basin[1] | | |
|---|---|---|
| **River or Creek** | **Drainage Area (Square Miles)** | **Channel Length (Miles)** |
| Canada del Aliso (Line J) | n/a | n/a |
| Laguna Creek (Line E) | n/a | n/a |
| Lower Coyote Creek | n/a | n/a |
| Mission Creek (Line L) | n/a | n/a |
| Morrison Creek (Line M) | n/a | n/a |
| Mowry Slough | n/a | n/a |
| Mud Slough | n/a | n/a |
| Newark Slough | n/a | n/a |
| Plummer Creek | n/a | n/a |
| Scott Creek (Line A) | 1.01 | 3.75 |
| Sabercat Creek (Line K) | n/a | n/a |
| Toroges Creek (Line C) | n/a | n/a |
| Unnamed Channel (Line B) | n/a | n/a |
| Unnamed Channel (Line B-1) | n/a | n/a |
| Unnamed Tributary to Laguna Creek (Line G) | n/a | n/a |
| Unnamed Tributary to Laguna Creek (Line H) | n/a | n/a |
| Unnamed Tributary to Laguna Creek (Line I) | n/a | n/a |
| Unnamed Tributary to Sabercat Creek (Line K-1) | n/a | n/a |

[1] Not all of the creeks in the Santa Clara Basin are included in this table; channel lengths only include those areas within Santa Clara Valley Water District jurisdiction.

n/a = Data not readily available.

- - = Not applicable.

Source: Santa Clara Valley Water District

### *7.2.2.1 San Francisquito Creek Watershed*

The San Francisquito Creek watershed is located in the northwesternmost portion of Santa Clara County and the most southeastern portion of San Mateo County. The creek's drainage basin is approximately 45 square miles. The uppermost portion of the watershed along Skyline Boulevard (State Highway 35) in the Santa Cruz Mountains is approximately 2,200 feet in elevation. A map of the watershed is shown on Figure 7-11.

San Francisquito Creek begins at the outlet of Searsville Dam located on Stanford University lands in San Mateo County. The creek is approximately 12.5 miles long – extending from the base of Searsville Dam to the Bay. Tributaries in the upper watershed that feed into Searsville Lake include Alambique Creek, Martin Creek, Sausal Creek, and Corte Madera Creek. Tributaries that enter San Francisquito Creek downstream of Searsville Dam include Bear Creek and Los Trancos Creek.

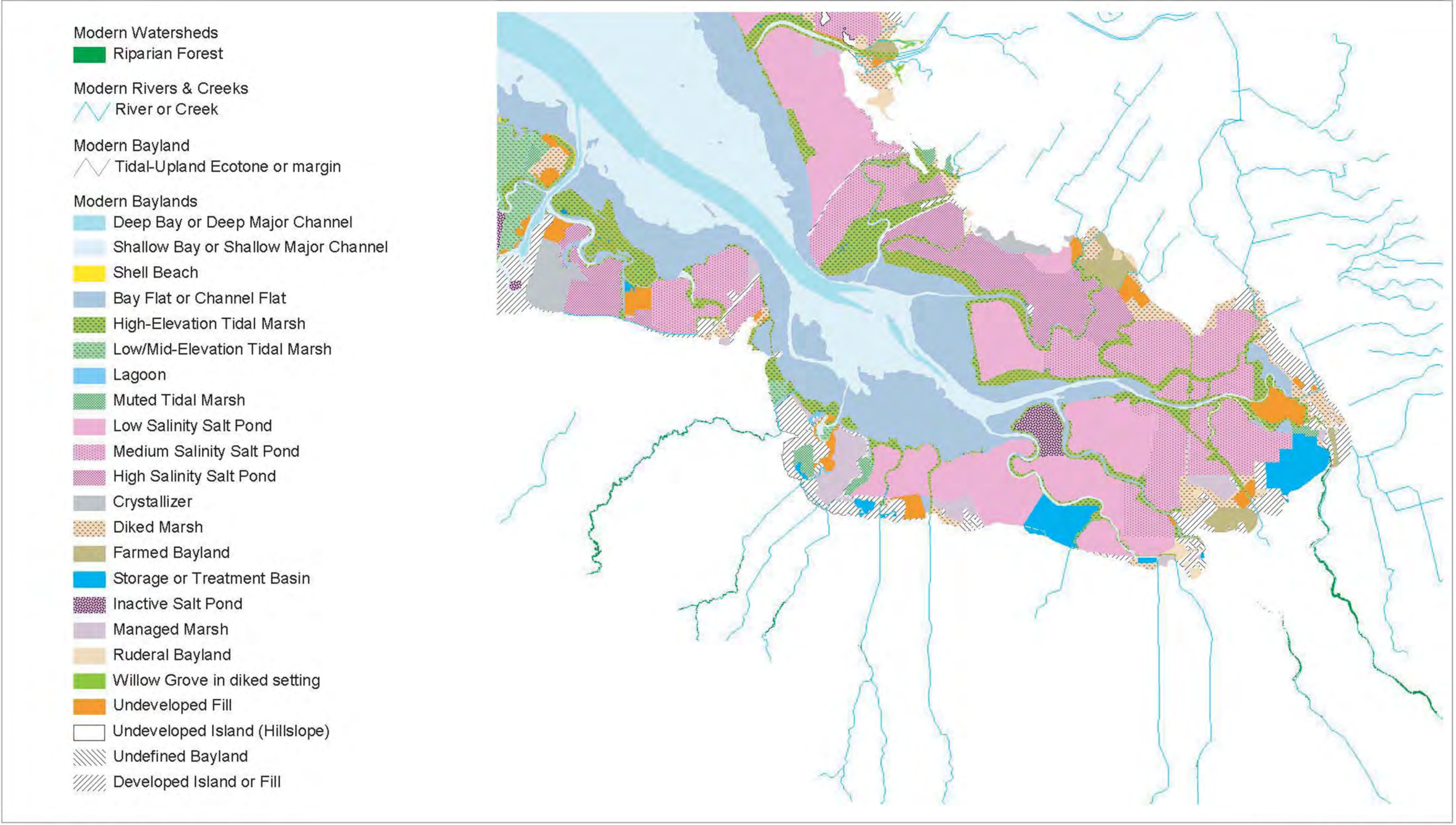
Downstream of the confluence with Los Trancos Creek, San Francisquito Creek forms the boundary between San Mateo County and Santa Clara County. Bordering the creek on the north are the cities of Menlo Park and East Palo Alto, and on the south is the city of Palo Alto. San Francisquito Creek runs through Stanford University lands. The towns of Woodside and Portola Valley are in the upper portion of the watershed.

As late as 1912, San Francisquito Creek flowed year-round as far east as El Camino Real (State Highway 82) (Wels et al., undated). It still flows past El Camino in wet years (Doug Padley, pers. comm., 1998).

San Francisquito Creek lies within the Water District's Lower Peninsula (Northwest) Flood Control Zone and San Mateo County's San Francisquito Creek Flood Control Zone. Recent flood events have occurred in 1955, 1958, 1982, 1995, and 1998. In an attempt to control flooding and bank erosion in portions of the lower channel, areas between University Avenue Bridge and U.S. Highway 101 have been lined with sacked concrete and protected with berms or low floodwalls. The reach between U.S. Highway 101 and the Bay has been widened and leveed.

Prior to 1998, the largest flood on record for San Francisquito Creek occurred in December of 1955. The magnitude of this flood, which has a 4 percent chance of occurring in any given year, was sufficient to inundate 1,200 acres of commercial and residential property and about 70 acres of agricultural property. Before the 1955 flood, the creek overtopped its banks six times between 1910 and 1955. Because development in the area was sparse before the 1950s, only light damage resulted from these earlier floods. A flood event that occurred in April 1958 caused a levee failure downstream of the Bayshore Freeway (U.S. Highway 101) and resulted in the subsequent flooding of the Palo Alto Airport, city landfill, and golf course to depths of up to 4 feet.

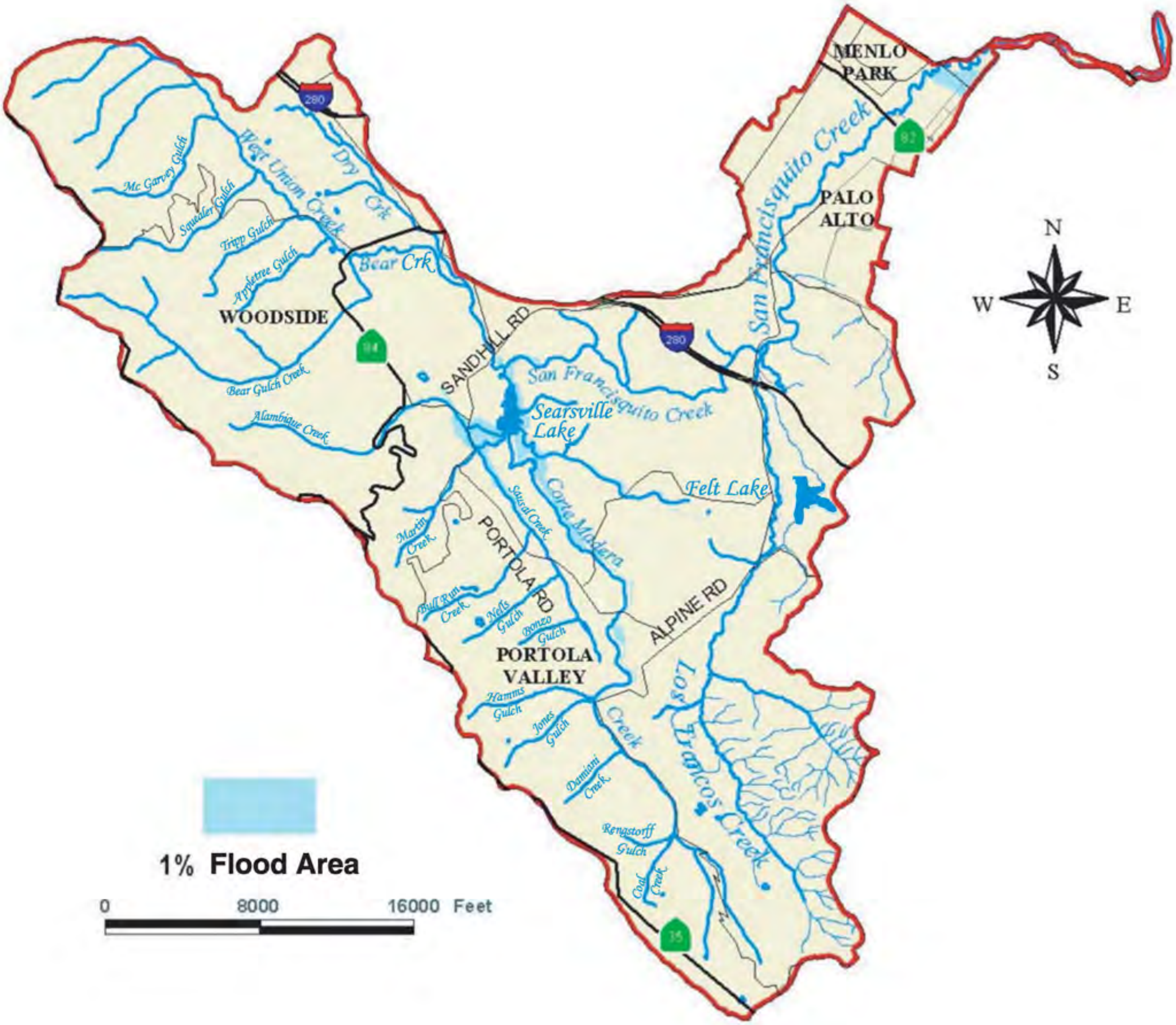
After the floods of 1955 and 1958, interim flood protection measures were implemented on the creek in the reaches upstream and downstream of the Bayshore Freeway. The creek flooded




*Source: San Francisco Estuary Institute, 1998-1999*



**FIGURE 7-10**
**Baylands Map**




Source: Santa Clara Valley Water District

again in 1998, when streamflows exceeded the highest on record and resulted in substantial flooding, causing over $28 million in property damage in Santa Clara County alone.

The severity of flooding has been increased due to sedimentation. Sedimentation occurs in the reach of the creek downstream of U.S. Highway 101 due to tidal action, as well as due to deposition of sediment from upstream sources. Sediment that is transported from the headwaters of the creek is deposited when water slows down as the gradient of the stream changes in the flatter parts of the watershed. Once deposited, sediment occupies space in the channel that is no longer available to transport floodwaters. In 1996, sediment occupied at least one-third of the flow area in the channel beneath the U.S. Highway 101 crossing. Sediment can also interfere with local drainage outfalls by blocking pipes and culverts. Recent studies in the headwaters of San Francisquito Creek indicate that erosion rates are currently quite high. Since the forested headwaters have not been extensively burned for more than 100 years, the high rate of erosion cannot be attributed to fire (Kittleson and Hecht 1996).

A Coordinated Resources Management and Planning (CRMP) process has been under way since 1993 in the San Francisquito Creek watershed. In January 1997, the San Francisquito CRMP (now called the San Francisquito Creek Watershed Council, or “Watershed Council”) produced a *Draft Watershed Management Plan*. The Flood and Erosion Control Task Force of the San Francisquito Creek Watershed Council produced a *Reconnaissance Investigation Report of San Francisquito Creek* addressing alternative solutions for flooding and erosion problems. Over 30 organizations are signatories to the process of preserving the resources of the San Francisquito Creek watershed. Most recently, the San Francisquito Joint Powers Authority (“JPA”) has been formed as a coalition of local government agencies to plan and implement flood management and watershed protection plans in the San Francisquito Creek Watershed.

The upper portion of the watershed is vegetated with scattered oak and madrone woodlands that are intermingled with grassland habitat, in some areas forming a savanna. A grove of upland redwood forest occurs along San Francisquito Creek just below Searsville Lake. Native tree species that occur in the riparian corridor include valley oak, coast live oak, willows and California buckeyes. Common native riparian shrubs include coffeeberry (*Rhamnus californicus*), ocean spray (*Holodiscus discolor*), and creeping snowberry (*Symphoricarpos mollis*).

A section of both banks of San Francisquito Creek lies within the Jasper Ridge Biological Preserve, and here one finds isolated second-generation stands of coast redwood. Other common woody species along the creek banks include the yellow-flowering box elder, big-leaved maple, willows of several species, white alder, California bay and California hazelnut (Wels et al., undated).

Invasive, nonnative plant species are a significant component of the riparian corridor along San Francisquito Creek, and include blue gum eucalyptus, acacia, fennel (*Foeniculum vulgare*), periwinkle, English ivy, French broom, black locust, Algerian ivy (*Hedera canariensis*) and Cape ivy (Cities of Menlo Park and Palo Alto 1998; Lee Ellis, pers. comm., 1998). The San Francisquito Watershed Council has produced a *Streamside Planting Guide for San Mateo and Santa Clara County Streams* as a means of educating landowners adjacent to the creek about beneficial plants they can use in their landscaping that are compatible with the riparian habitat.

California red-legged frogs, a federal threatened species, are present along San Francisquito Creek (Keith Anderson, pers. comm., 1998).

The upland portion of the watershed consists of low-density residential development. The relatively flat valley floor has been extensively developed.

San Francisquito Creek watershed supports a healthy and stable steelhead population. Much of the watershed lies in a steep, mountainous area of the Santa Cruz Mountains and includes open space, Stanford University's Jasper Ridge Biological Preserve, and rural residential housing. This mix of land uses has preserved areas of high quality steelhead habitat in the upper tributaries of Los Trancos and Bear Creeks. Good steelhead habitat also exists in main stem reaches just downstream of Searsville Dam to the Lagunita Diversion (Alan Launer, pers. comm., 1998). Downstream of the Stanford golf course, steelhead habitat is fair to poor.

The Lake Lagunita Diversion Dam (owned by Stanford University) was a significant passage barrier until 1978, when the fish ladder was replaced with a Denil-style fishway. Also, a fish ladder was placed on the Felt Lake Diversion Dam on Los Trancos Creek in 1995 (Keith Anderson, pers. comm., 1998). Since then, the fishway has been further modified to improve passage (Margaret Roper, pers. comm., 1998). Searsville Dam, built in the late 1800s and located within Stanford's Jasper Ridge Biological Preserve, is a terminal barrier on San Francisquito Creek for all upstream migrating fish. While the primary passage barriers on the main stem San Francisquito have been laddered, other passage obstructions and barriers may exist on the main stem and in the tributaries (Alan Launer, pers. comm., 1998). The San Francisquito Creek Joint Powers Authority and the San Francisquito Watershed Council are working to remove identified barriers in the watershed.

In the San Francisquito watershed, extremely high natural sediment rates coupled with erosion associated with human settlement are constraints for steelhead spawning and rearing. Future development on Stanford property and addressing flood control problems in the lower main stem will need to preserve existing passage for both downmigrating young and upmigrating adult steelhead.

Fish collected in San Francisquito watershed include six other native species and seven nonnative species. Other native fish captured are the California roach, Sacramento sucker, hitch, speckled dace, threespine stickleback, and prickly sculpin. Three additional species of native fish were present historically: Sacramento perch, last collected in 1960; squawfish, last collected in 1905; and while prickly sculpin have not been collected recently, they may still be present in the upper tributaries.

#### *7.2.2.2 Matadero/Barron Creeks Watershed*

The upper Matadero Creek and Barron Creek watersheds are located on the lower-elevation northeast-facing slopes of the Santa Cruz Mountains. The Matadero Creek watershed drains an area south of the San Francisquito Creek watershed. Barron Creek is parallel to, and south of Matadero Creek. The Barron Creek watershed lies to the north of the Adobe Creek watershed.

The Matadero Creek and Barron Creek watersheds are often discussed as a single hydrologic unit since high flows from the upper Barron Creek watershed are transferred to Matadero Creek via a diversion constructed by the Water District. A map of the watershed is shown on Figure 7-12.

### Matadero Creek

Matadero Creek originates near the town of Los Altos Hills and flows in a northeasterly direction through the residential, commercial, and industrial areas of the City of Palo Alto and unincorporated areas of Santa Clara County. Downstream of the Bayshore Freeway (U.S. Highway 101), Matadero Creek discharges into the Palo Alto Flood Basin, which outfalls into the Bay. Matadero Creek has a total watershed area of about 14 square miles, of which approximately 11 square miles are mountainous land, and 3 square miles are gently sloping valley floor (Water District 1988).

Prior to the turn of the century, Matadero Creek was a well-defined channel that meandered down a gently sloping alluvial fan on the eastern side of the Santa Cruz Mountains. The stream channel lost definition as the land surface flattened out. Historic streamflows spread out as shallow overland flow in a broad floodplain that stretched east toward the Baylands.[11] Streamflows eventually discharged into the South Bay through Mayfield Slough. By the turn of the century, diking off of wetlands and the construction of salt ponds eliminated much of the original broad floodplain and forced the use of outfall channels to carry freshwater streamflow to the South Bay (Water District 1988).

In the late 1930s, the City of Palo Alto purchased land from Leslie Salt Company for what is today known as the Palo Alto Flood Basin: a 600-acre tidal basin immediately northeast of the Bayshore Freeway (U.S. Highway 101). In the early 1940s, the City made various modifications to the flood basin, and Matadero Creek was extended as an earth ditch out to the Bay. Following the flood of 1955, the Matadero Creek stream channel was lined with concrete to increase its capacity and prevent erosion. Downstream of Alma Street, Matadero Creek is entirely a human-made channel, and never existed as a natural watercourse (Water District 1988).

Flooding occurred along Matadero and Barron Creeks in 1941, 1952, 1955, 1958, 1973, and 1983. The Water District constructed improvements on Matadero Creek in 1958, consisting of an earth channel with sacked concrete side slopes from Bayshore Freeway to Greer Road and varying sizes of concrete-lined channel between Greer Road and El Camino Real (Water District 1988). In 1959, the Water District constructed the Stanford Channel. The channel has a drainage area of about 1 square mile and flows into Matadero Creek under El Camino Real. In 1971, the Water District raised the existing levees and constructed a retaining wall on the outside of the levees from Bayshore Freeway to just upstream of Greer Road. Sacked concrete streambank protection was installed through Bol Park by Santa Clara County in 1972.

[11] Originally, Matadero Creek did not flow all the way to the Bay, but discharged into the wetlands on the floodplain east of Alma Avenue (Bob Moss, pers. comm., 1998).

The Water District prepared a *Matadero and Barron Creeks Planning Study* in 1988 (Water District 1988). Subsequently, one of the alternatives for flood control channel improvements between the Palo Alto Flood Basin and Foothill Expressway was selected and constructed.

The upper reaches of Matadero Creek traverse through oak woodlands and grassland savanna. The portion of the riparian corridor adjacent to the Veterans' Administration Hospital (downstream of Hillview Avenue) is composed of yellow willow – coast live oak riparian forest (Habitat Restoration Group 1994c). Native tree species that occur in the riparian corridor include valley oak, coast live oak, willows, and California buckeye. The riparian corridors along the urbanized sections of both Matadero and Barron Creeks are small and fragmented due to portions of the creek banks protected with bank stabilization and flood control structures. Due to the proximity to many residences, garden escapees, including the invasive nonnatives Himalaya blackberry, Algerian ivy and English ivy, are common. California red-legged frogs are present in the headwaters.

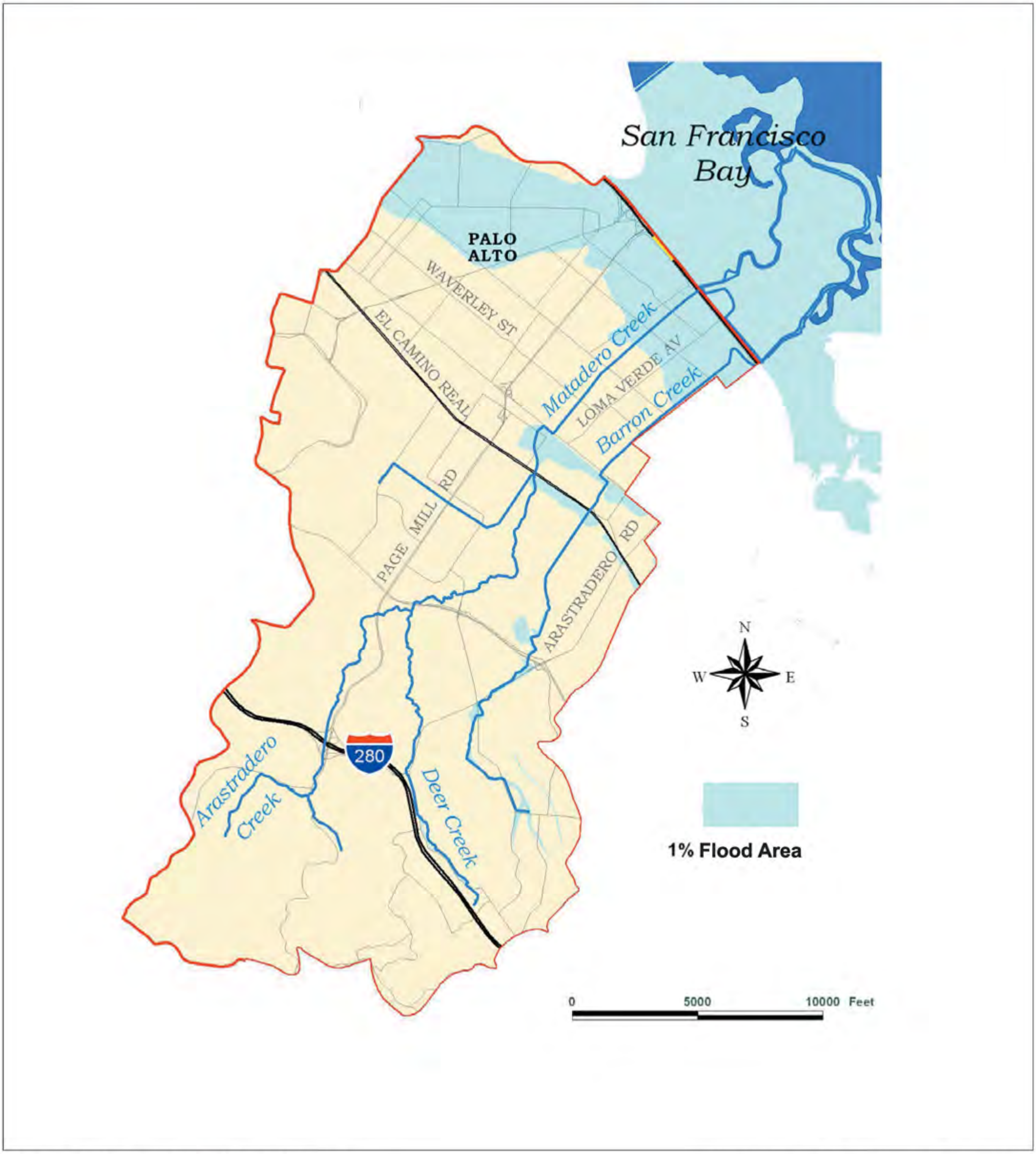
Limited historical and recent fishery information is available for Matadero and Barron Creeks. Most likely, these streams were intermittent in the lower reaches during summer, but probably supported native species such as California roach, prickly sculpin, and Sacramento sucker in the upper reaches. Four fish species have been collected in Matadero Creek: native threespine stickleback and prickly sculpin, and nonnative rainwater killifish and mosquitofish. Local residents have seen steelhead in Matadero Creek (Alan Launer, pers. comm., 1998). Additional native and nonnative fish would possibly be collected with more thorough sampling in all reaches. Channelization, flood control, and barriers such as culverts have drastically reduced fish habitat.

## Barron Creek

Barron Creek originates in the residential areas of Los Altos Hills west of Interstate 280. Barron Creek flows in a northeasterly direction through the City of Palo Alto and joins with Adobe Creek just upstream of the Bayshore Freeway (Water District 1988). Adobe Creek then flows beneath the Bayshore Freeway into the Palo Alto Flood Basin.

Originally (i.e., prior to the 1920s) Barron Creek did not flow all the way to the Bay. It turned northeast to join Matadero Creek near the present intersection of Matadero Avenue and Tippawingo Drive (Bob Moss, pers. comm., 1998). In the late 1920s or early 1930s, a channel was dug all the way to the Bay; thus, the downstream portion of Barron Creek is an artificial alignment from Amaranta Avenue to the Bayshore Freeway.

Barron Creek is primarily an urban watershed with a drainage area of about 3 square miles. Many modifications were made to the creek channel in the late 1950s (Water District 1988). Barron Creek flooded seven times between 1956 and 1983 (Bob Moss, pers. comm., 1998).




Source: Santa Clara Valley Water District

Watershed Characteristics Report

### *7.2.2.3 Adobe Creek Watershed*

The Adobe Creek watershed is located in northwestern Santa Clara County. Adobe Creek originates on the northeasterly facing slopes of the Santa Cruz Mountains near Montebello Ridge, which is greater than 2,600 feet in elevation. Adobe Creek drains an area of approximately 10 square miles, of which roughly 7½ miles are mountainous, and 2½ square miles are on the valley floor. The main stem of Adobe Creek is joined by three forks: the middle, west, and north forks. Other major tributaries in the upper watershed are Moody Creek and Purissima Creek. A map of the watershed is shown on Figure 7-13.

Much of the upper Adobe Creek watershed is open-space land owned by the Mid-Peninsula Regional Open Space District and the Trust for Hidden Villa. The remainder of the mountainous portion of the watershed is occupied by low-density residential development. No reservoirs have been built on Adobe Creek. The valley floor portion of Adobe Creek flows through residential areas of Los Altos Hills, Los Altos, Palo Alto, and Mountain View. Robleda Drain flows into Adobe Creek west of Foothill Expressway. Adobe Creek is joined by Barron Creek just to the west of the Bayshore Freeway. Adobe Creek does not discharge directly into the South Bay. Adobe Creek (along with Barron and Matadero Creeks) flows into the Palo Alto Flood Basin.

The majority of the flow in Adobe Creek is produced by rainfall that occurs in the higher elevations within the watershed. The steep nature of the upper watershed results in short duration and high intensity runoff for most major storms. "Adobe Creek has a long history of flooding. Prior to the turn of the century, the creek was a well-defined channel that meandered down a gently sloping alluvial fan flattening out and losing definition as it approached San Francisco Bay." Historic floods resulting in flood damage have occurred in 1952, 1955, 1983, 1986, and 1995.

There have been many places where changes have been made in the creek channel alignment. In all cases, the creek was moved from a meandering alignment across a historic floodplain to a straightened channel at the edge of a development. In 1959, the Water District constructed a trapezoidal concrete channel along the reach of Adobe Creek between Alma Street and El Camino Real. In 1975, an 8-foot pipe bypass intended to prevent flooding of properties along Adobe Creek was constructed starting near the intersection of Moody and El Monte Roads (on the Foothill College Campus) going upstream approximately 2,200 feet, ending just upstream of Tepa Way.

In 1988, the City of Los Altos, the Town of Los Altos Hills, and the Hidden Villa Trust received an Urban Stream Restoration Program Grant from the California Department of Water Resources for the development of a comprehensive stream restoration plan for Adobe Creek from El Camino Real to the headwaters. The Adobe Creek Restoration Plan contains specific measures for the restoration and enhancement of riparian habitat (and other biological values) and the control of streambank erosion along upper Adobe Creek.

In 1996, the Water District prepared the Adobe Creek Watershed Planning Study addressing alternatives for resolving existing and potential flooding, erosion, and sedimentation problems on

Adobe Creek upstream of El Camino Real to the Hidden Villa Trust Property on Moody Road, a distance of approximately 7½ miles.

The upper, less developed portion of the watershed is located in the Los Altos Hills, and is primarily chaparral and broadleaved upland forest dominated by madrone and oak species. To a lesser extent there are also grassland areas. According to the *Adobe Creek Restoration Plan* (Habitat Restoration Group 1989), the riparian vegetation along Adobe Creek (from Montebello Ridge to the El Camino Real) forms an almost continuous riparian corridor of trees and shrubs along both banks. Along the upper creek bank, coast live oak, California buckeye, blue elderberry, California bay, and valley oak occur. The mid-bank vegetation is typically composed of box elder, California dogwood (*Cornus californica*), big leaf maple, and California black walnut (*Juglans hindsii*) (Habitat Restoration Group 1989). Nonnative plant species are abundant along the banks and include the following invasive nonnative species: blue gum eucalyptus, fennel (*Foeniculum vulgare*), periwinkle, English ivy, French broom, and Algerian ivy (Habitat Restoration Group 1989). From El Camino Real to the Bay (City of Palo Alto), there is no riparian vegetation due to the channelization of Adobe Creek.

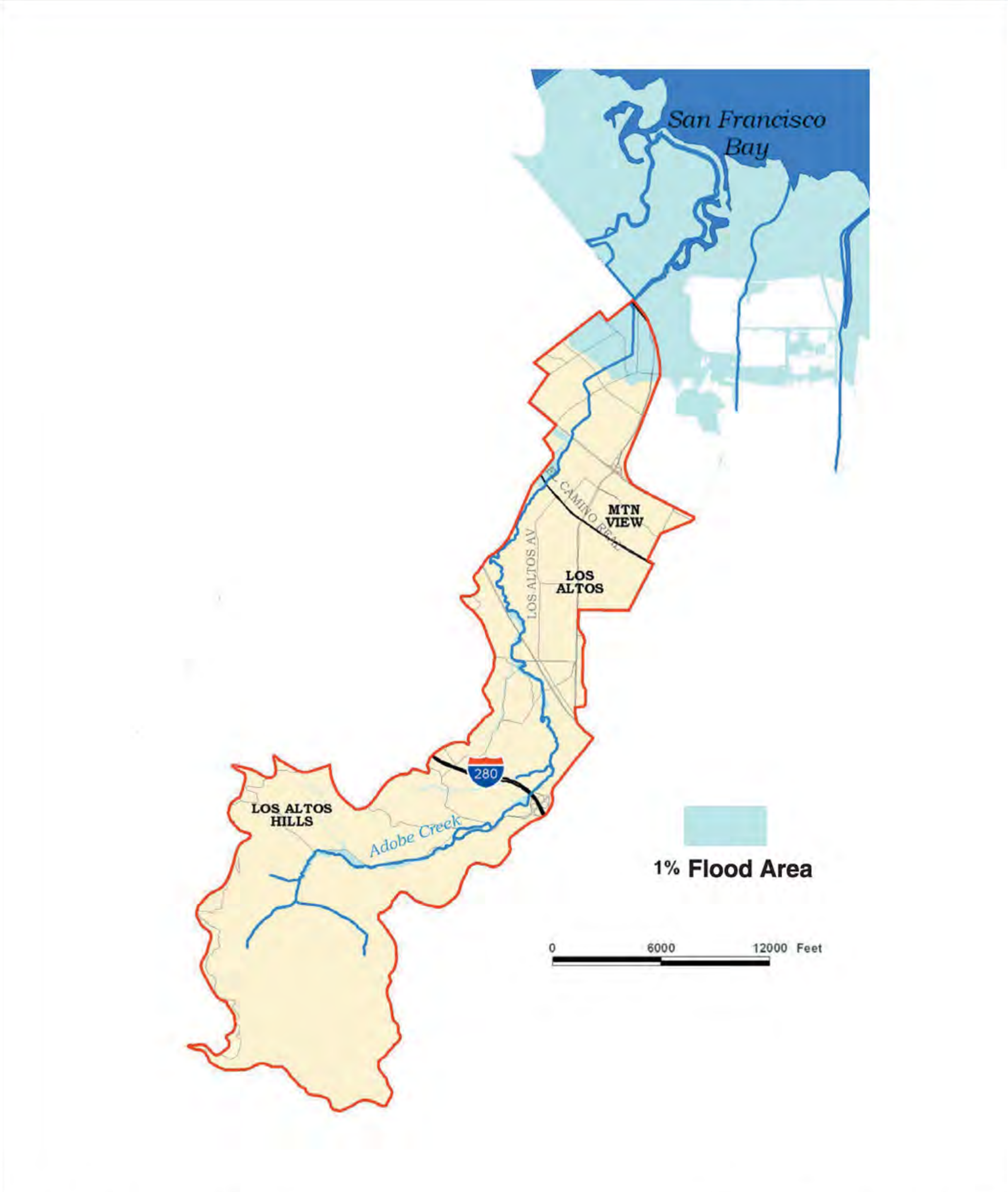
Fire plays an important role in long-term sediment production in the headwaters of Adobe Creek. Following an intense fire, surface soil material creeps or ravels from hill slopes into small drainages, often when the soils are dry. Rainfall that occurs in the first years following a fire entrains large amounts of debris that are transported downstream. Streamside landsliding also contributes sediment directly to the channel of Adobe Creek. Fires and debris flows are both highly episodic.

A catastrophic fire has not occurred in the Adobe Creek watershed in the last 150 to 200 years, based on the age of Douglas-fir trees in the upper watershed. The complete absence of fire in recent years, combined with relatively high rainfall, suggests that Adobe Creek has the capacity to carry far more sediment than its current supply. Because streams self-adjust sediment loads by depositing or eroding sediment, the result of this recent (and probably temporary) imbalance has been an increase in the erosion of the bed and banks of the creek.

Limited historical and recent fishery information is available for Adobe Creek. Most likely, Adobe Creek was intermittent in the lower reaches during summer, but probably supported native species such as California roach, prickly sculpin, and Sacramento sucker in the upper perennial reaches. In Adobe Creek, collected fish include four native species (California roach, Sacramento sucker, threespine stickleback, and prickly sculpin) and two nonnative species (rainwater killifish and carp). Additional native and nonnative fish would possibly be collected with more thorough sampling in all reaches. Channelization, flood control, and physical barriers such as culverts have drastically reduced fish habitat.

#### *7.2.2.4 Permanente Creek Watershed*

The Permanente Creek watershed is located to the south of the Adobe Creek watershed and north of the Stevens Creek watershed. Permanente Creek drains an area of approximately 17 miles on the northeast-facing slopes of the Santa Cruz Mountains. The headwaters of Permanente Creek




Source: Santa Clara Valley Water District

lie just to the east of Black Mountain (elevation 2,800 feet) on Montebello Ridge. A map of the watershed is shown on Figure 7-14.

Permanente Creek is approximately 13 miles in length. Permanente Creek flows through the cities of Los Altos and Mountain View and discharges into the South Bay via the Mountain View Slough. Flows of up to 1,500 cubic feet per second (cfs) are diverted to Stevens Creek via the Permanente Creek Diversion, a diversion constructed in 1959.

The upper, less developed portion of the watershed is located in the southern Los Altos Hills, and is dominated by chaparral and upland broadleaved forest dominated by madrone, tan oak, coast live oak, big leaf maple, and black oak. To a lesser extent, there are also grassland areas.

Much of Permanente Creek's streambank within the City of Mountain View has been treated with artificial materials for bank stabilization and flood control. Limited historical and recent fishery information is available for Permanente Creek. Most likely, Permanente Creek was intermittent in the lower reaches during summer, but probably supported native species such as California roach, prickly sculpin, and Sacramento sucker in the upper reaches. In Permanente Creek, only two species have been collected: nonnative rainwater killifish and mosquitofish.

The Hanson Permanente Cement Company, Inc. (formally Kaiser) owns and operates a cement plant and rock quarry adjacent to Permanente Creek in the city of Cupertino. In September 1998, the Regional Board issued Hanson a Notice of Violation for discharges of sediment-laden stormwater into Permanente Creek. Hanson has implemented interim measures as required by the Notice, and submitted two reports to the Regional Board that document the progress made to date. Some of these measures include stabilizing all disturbed slopes at the facility that are not being mined actively and are contributing to sediment discharges, intercepting all sediment laden stormwater in excess of 50 mg/L total suspeneded solids before the stormwater enters the creek, and cleaning out all sediment from existing permitted sedimentation basins to achieve adequate retention volume (Regional Board 1999).

#### *7.2.2.5 Stevens Creek Watershed*

Stevens Creek originates on the northeast-facing slopes of the Santa Cruz Mountains. Upper Stevens Creek lies just to the east of Skyline Boulevard north of Saratoga Gap. The Stevens Creek watershed is bound on the northwest by the Permanente Creek watershed and on the southeast by the Calabazas Creek watershed. The Stevens Creek watershed drains an area of approximately 38 square miles. This includes almost 9 miles of the Permanente Creek watershed, whose peak flows were diverted to Stevens Creek in 1959 (Water District 1980). A map of the watershed is shown on Figure 7-15.

The headwaters of the Stevens Creek watershed are bisected by the northwesterly trending San Andreas fault, through which Stevens Canyon has formed. The southwest side of the San Andreas fault, up to the county line, is underlain by sediments. On the northeast side of the fault, most of the watershed is underlain by the Franciscan Group and its serpentine members. The types of minerals dissolved in the waters of Stevens Creek are consistent with the geology of the watershed. The presence of serpentine results in magnesium-rich groundwater, which feeds the creek during drier periods. Rainfall brings surface waters into the creek, and these waters tend to be high in calcium and tend to greatly dilute the influence of groundwater during wet periods (Iwamura 1999).

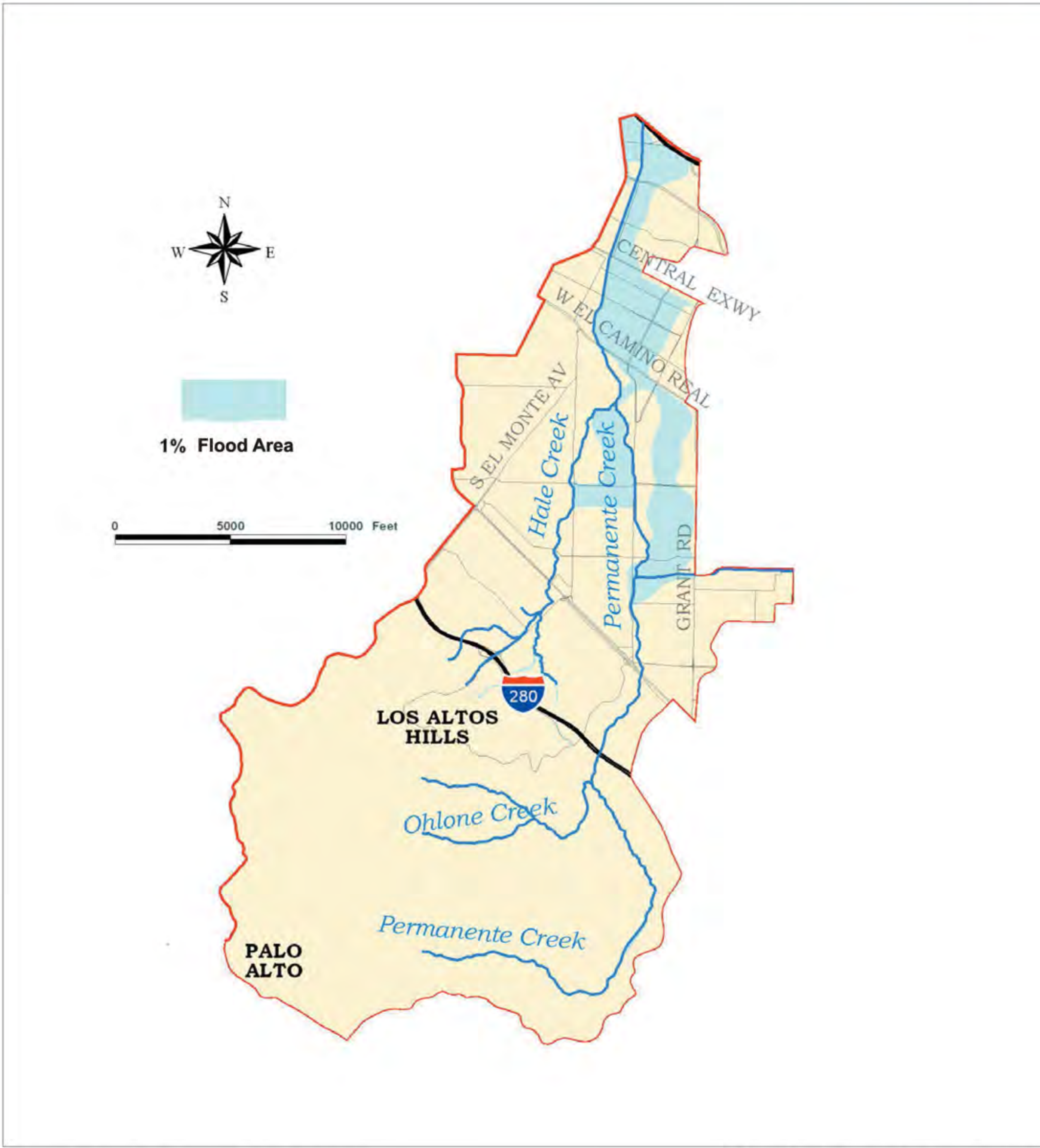
From its headwaters at Russian Ridge in the Santa Cruz Mountains (elevation 2,500 feet), Stevens Creek flows southeasterly along the San Andreas Fault Zone for 5½ miles before swinging to the northeast and then north to Stevens Creek Reservoir. From Stevens Creek Dam, the creek flows northward to the South Bay, a distance of approximately 13 miles (Water District 1980).

Much of the upper watershed of Stevens Creek is in Upper Stevens Creek Park owned by Santa Clara County. Upper Stevens Creek flows southeast along the San Andreas Rift Zone and then turns to the northeast before flowing into Stevens Creek Reservoir. From the Stevens Creek Reservoir, the creek continues northward onto the valley floor. Stevens Creek flows in a defined channel through the Cities of Cupertino, Los Altos, Sunnyvale and Mountain View. Stevens Creek flows into the South Bay near Long Point, north of Moffett Field Naval Air Station. Salt ponds are located on both sides of Stevens Creek where it meets the Bay.

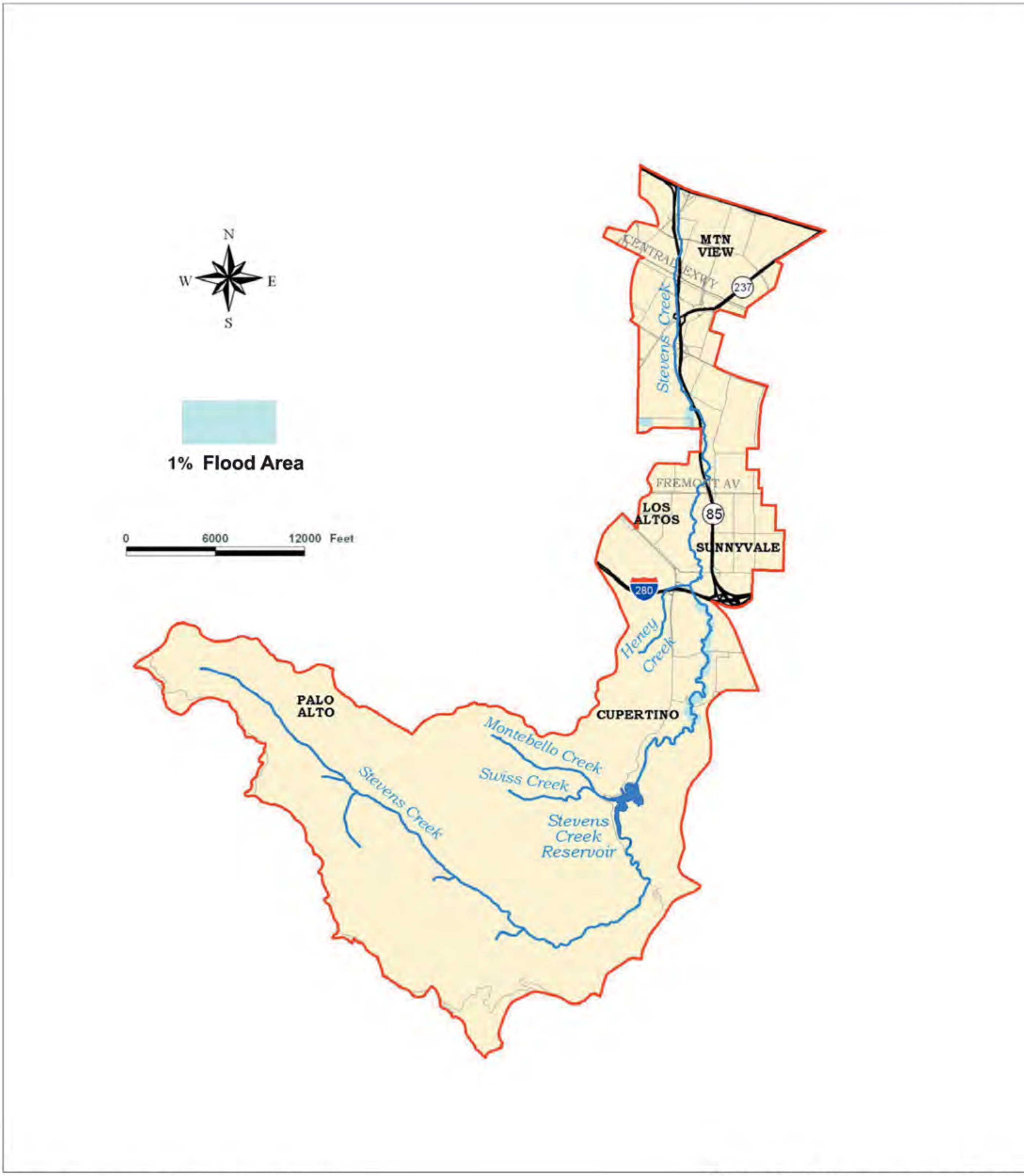
Two tributary channels flow into Stevens Creek downstream of Stevens Creek Dam. Heney Creek, with a total watershed area of 0.64 square mile is an improved facility constructed in 1965. It outfalls into Stevens Creek just downstream of Interstate 280. Permanente Creek Diversion diverts a maximum flow of 1,550 cfs from Permanente Creek into Stevens Creek. The Permanente Creek Diversion outfalls into Stevens Creek between Bryan Avenue and Levin Avenue in Mountain View, and constitutes the major tributary to Stevens Creek on the valley floor (Water District 1980). The Water District uses the streambed between Stevens Creek Reservoir and El Camino Real for recharging the groundwater basin (Water District 1980).

The predominant plant community in the highest elevations is broadleaved upland forest with patches of chaparral and nonnative grassland. Common tree species include tan oak, black oak, big leaf maple, California bay, Douglas fir, California buckeye and madrone. In the mountainous areas along Stevens Creek, common riparian tree species are white alder, big leaf maple and California bay. Downstream from Stevens Creek Reservoir, the stream gradient becomes less steep, and the riparian corridor is wider compared to the upper canyons. Typical riparian tree species include box elder, arroyo willow, red willow, cottonwood, western sycamore, valley oak, and coast live oak. As Stevens Creek crosses the City of Mountain View, much of its streambank is channelized and covered/treated with artificial materials for bank stabilization and flood control.

Stevens Creek supports a native fish fauna in the upper reaches and includes resident rainbow trout, California roach, and Sacramento sucker. The Creek is also thought to support a reproducing population of steelhead. Fish ladders at U.S. Highway 101 and Central Expressway were barriers under low-flow conditions; however, these problems were corrected in 1998. The drop structure at L'Avenida is a passage barrier during low-flow; the drop structure will be modified in 2000. Native




Source: Santa Clara Valley Water District




Source: Santa Clara Valley Water District

hitch, squawfish, and threespine stickleback have been collected in Stevens Creek. Nonnative fish are more common in the middle and lower reaches of Stevens Creek, and include channel catfish, goldfish, carp, mosquitofish, and green sunfish.

### 7.2.2.6 Sunnyvale West and Sunnyvale East Channels Watersheds

The Sunnyvale West and Sunnyvale East Channels are two artificial channels that were constructed by the Water District to provide drainage for a large area in Sunnyvale between Calabazas Creek and Stevens Creek (California History Center, De Anza College 1981). The Sunnyvale West Channel watershed is located to the east of Stevens Creek. The Sunnyvale East Channel watershed is located to the west of Calabazas Creek. Maps of the watersheds are shown on Figures 7-16 and 7-17.

Sunnyvale East Channel empties into Guadalupe Slough (California History Center, De Anza College 1981). Sunnyvale West Channel drains into Moffett Channel (California History Center, De Anza College 1981) and thence into Guadalupe Slough.

### 7.2.2.7 Calabazas Creek Watershed

Calabazas Creek drains approximately 20 square miles in the northwestern portion of the Basin (Water District 1989). Situated on the northeast-facing slopes of the Santa Cruz Mountains, the Calabazas Creek watershed is located south of the Stevens Creek Watershed and north of the Saratoga Creek watershed. A map of the watershed is shown on Figure 7-18.

Calabazas Creek is 13.3 miles in length and flows in a northeasterly direction. Beginning at an elevation of approximately 2,000 feet above sea level, Calabazas Creek is steep in the mountainous areas, then flattens to a gentle slope as it crosses the valley floor. Major tributary streams to Calabazas Creek include Prospect Creek, Rodeo Creek, and Regnart Creek. Drainage facilities entering Calabazas Creek include Junipero Serra Channel and the El Camino Storm Drain. Calabazas Creek flows into Guadalupe Slough. The valley floor portions of the watershed are extensively urbanized (Water District 1989).

Mean annual precipitation ranges from about 37 inches in the upper watershed to 16 inches on the lower valley floor. The steep nature of the upper portion of the watershed results in short-duration, high-intensity runoff for most major storms (Water District 1989).

Calabazas Creek has a history of chronic flooding. One of the largest floods reported on the creek occurred on December 22, 1955. In Sunnyvale alone, over 160 homes were inundated to a depth of up to 3 feet during this event. More recently, flooding has occurred in 1978, 1980, 1983, 1986, 1995, and 1998. The majority of this recent flooding is attributed to inadequate culverts, which are easily blocked by debris or overwhelmed by floodflow (Water District 1989).

Both sedimentation and erosion have been problematic in various reaches of Calabazas Creek. The most significant sediment problems occur between State Highway 237 and U.S. Highway 101. The sediments come from both the Bay and the upstream watershed. Suspended silts from the Bay are carried up the channel by tidal currents where they mix with freshwater streamflows. In this mixing zone, a chemical process occurs that causes the suspended silts to coagulate and to settle along the banks of the creek where water velocities are low. The receding tide draws water back into the Bay, eroding and transporting only a portion of its original sediment load. Over time, benches are formed along the channel sides. Vegetation that becomes established on these benches secures them and protects them from erosion. High volumes of fluvial (stream transported) sediments are also deposited in sections of Calabazas Creek. The Calabazas Creek watershed has a moderately high sediment yield that can be attributed to both cultural activities in the upper watershed and to active channel erosion (Water District 1989).

The northernmost portion of Calabazas Creek from El Camino Real to Guadalupe Slough was relocated by farmers along straight property lines prior to the turn of the century, and has been relocated or modified three times since 1900. Following the 1955 flood, the Water District realigned Calabazas Creek (in 1958) to its original outfall in Guadalupe Slough along the "farmers' alignment."

The section of Calabazas Creek between El Camino Real and Lawrence Expressway was concrete-lined in the late 1960s and early 1970s. In 1979, a trapezoidal, concrete-lined channel was constructed between U.S. Highway 101 and El Camino Real. Also in 1979, commercial developers realigned the creek between Stevens Creek Boulevard and Vallco Parkway in a double-cell reinforced concrete box culvert, and between Interstate 280 and Vallco Parkway in a trapezoidal earth channel. In 1980, Calabazas Creek from Guadalupe Slough to U.S. Highway 101 was enlarged by constructing an earth channel with levees (Water District 1989).

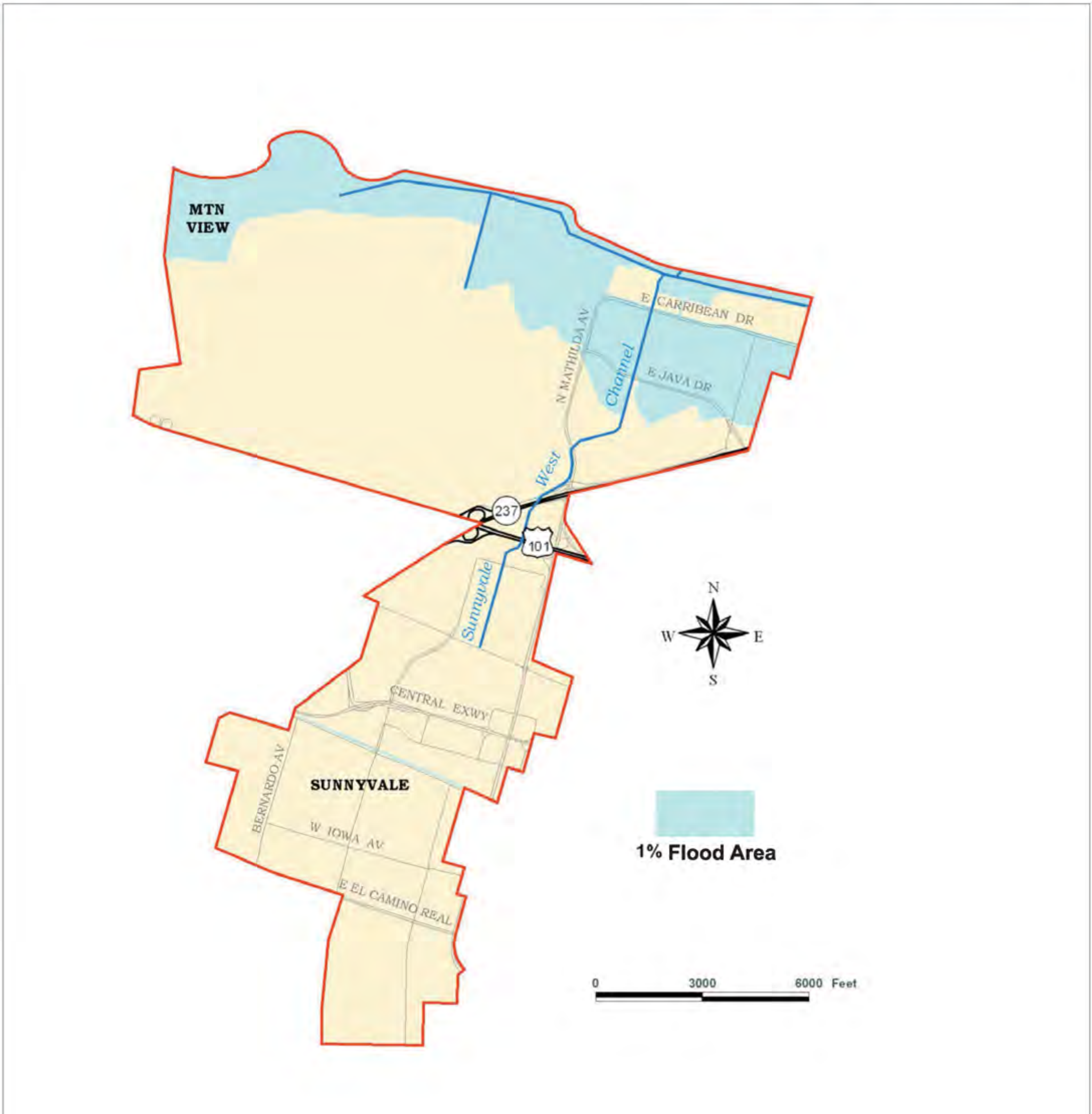
In 1989, the Water District prepared the *Calabazas Creek Planning Study and Draft Environmental Report* (Water District 1989). Subsequently, one of the alternatives for flood control channel improvements between the Guadalupe Slough and Miller Avenue was selected and constructed.

Portions of Calabazas Creek are used to recharge imported water. Since 1967, when the Stevens Creek Pipeline was completed, the Water District has had the capability to release water into Calabazas Creek for artificial recharge.

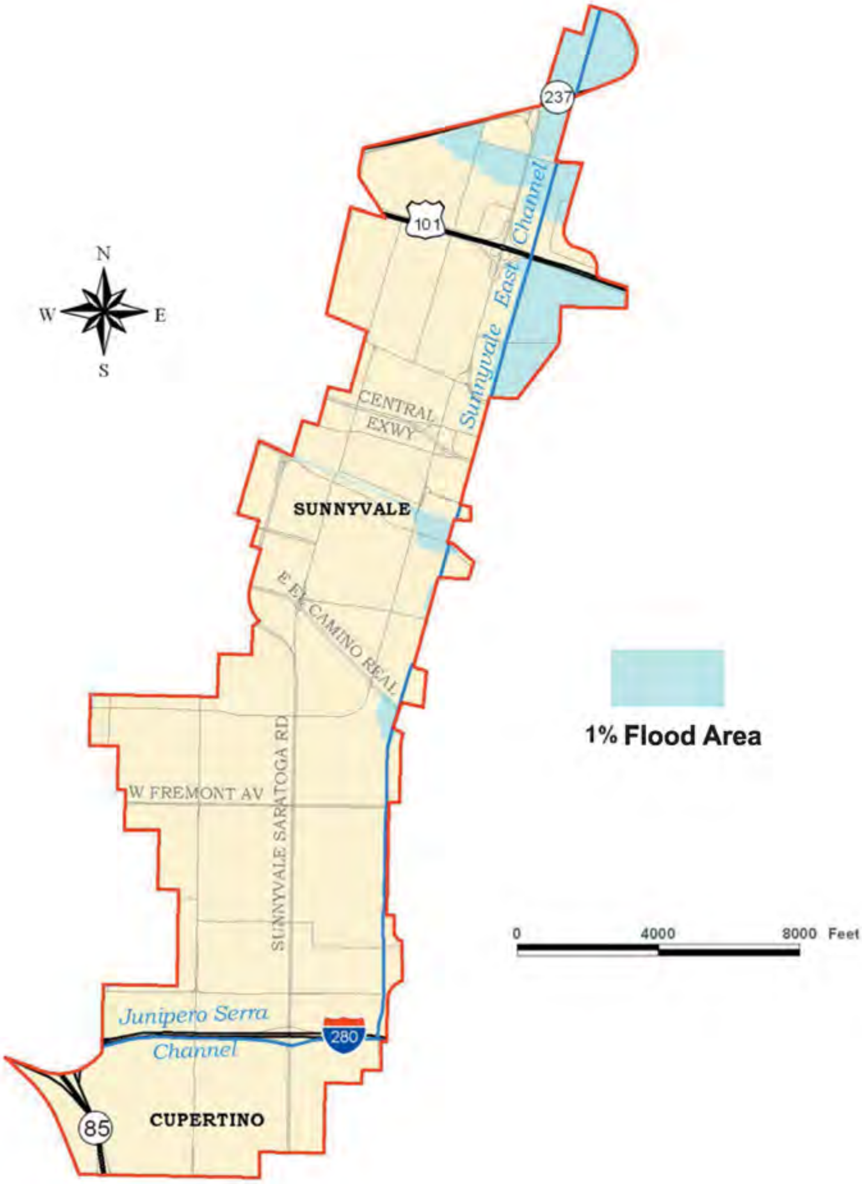
Calabazas Creek has a degraded riparian corridor dominated by nonnative species integrated with remnants of natives. The uppermost portion of Calabazas Creek watershed is composed of chaparral and broadleaved upland forest; however, the majority of Calabazas Creek travels through urban areas. Lower reaches of the riparian corridor from the Guadalupe Slough to U. S. Highway 101 are composed of riparian scrub.

Native tree species in the lower reaches include sandbar willow, Fremont cottonwood, arroyo willow, and yellow willow. Farther upstream, between Lawrence Expressway and Miller Avenue, typical riparian tree species include coast live oak, willow, valley oak, and blue elderberry. Native shrub species include poison oak, coyote brush, native California rose, and buckeye. Nonnative plants include introduced weeds, garden cultivars/ornamentals, and invasive

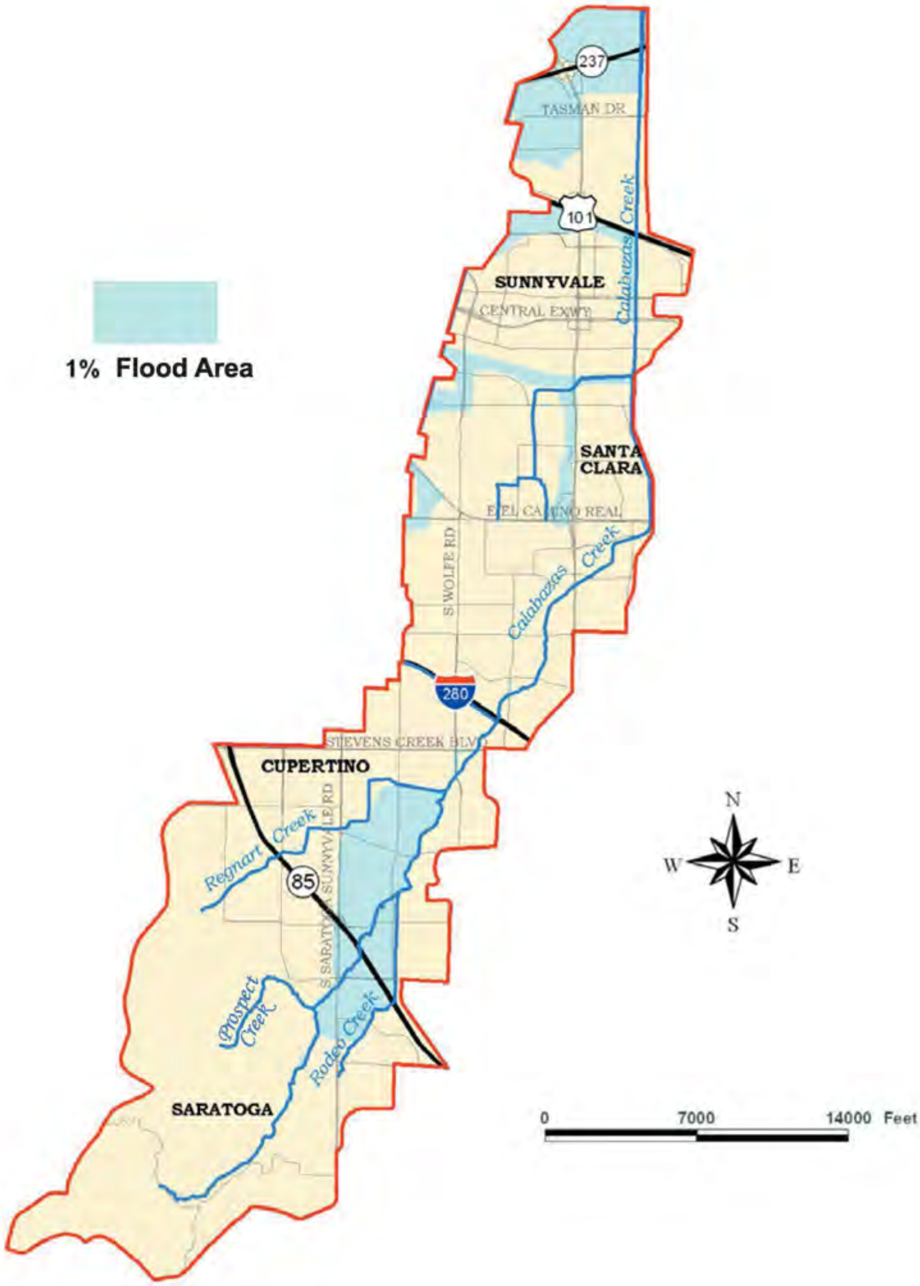
## FIGURE 7-16
## Sunnyvale West Watershed Map




Source: Santa Clara Valley Water District




Source: Santa Clara Valley Water District




Source: Santa Clara Valley Water District

species such as curly dock (*Rumex crispus*), thistles, eucalyptus, and blackwood acacia (*Acacia melanoxylon*). A number of fruit and nut trees have been introduced into the riparian corridor. Black walnut and almond trees are common (Water District 1989).

Calabazas Creek has limited fishery resources due to a lack of natural summer flow. Mosquitofish are the only recorded fish collected in Calabazas Creek.

### 7.2.2.8 San Tomas Aquino/Saratoga Creek Watershed

The San Tomas Aquino/Saratoga Creek watershed drains an area of 45 square miles. Saratoga Creek joins San Tomas Aquino Creek in the City of Santa Clara just south of Monroe Street, which is north of El Camino Real and south of Central Expressway in Santa Clara. A map of the watershed is shown on Figure 7-19.

#### San Tomas Aquino Creek

San Tomas Aquino Creek begins in the foothills of the Santa Cruz Mountains and flows north through the cities of Campbell and Santa Clara. San Tomas Aquino Creek flows into the upper (southern) end of Guadalupe Slough. A levee-raising project was completed on San Tomas Aquino Creek from the Bayshore Highway to Guadalupe Slough in the early 1980s (Water District 1983b). Major portions of the creek have been channelized for flood control, particularly in the lower reaches. As a result, segments of the creek are lacking riparian vegetation.

In addition to incoming flows from Saratoga Creek, San Tomas Aquino Creek also receives water from Vasona Creek and its tributaries that drain portions of Saratoga and Campbell.
In San Tomas Aquino Creek, hitch is the only native fish that has been captured during limited sampling efforts. Nonnative fish collected have been rainwater killifish, golden shiner, goldfish, and carp.

An impassable barrier at the confluence of San Tomas Aquino and Saratoga Creeks prevents anadromous fish passage to both creeks.

#### Saratoga Creek

The Saratoga Creek watershed drains an area of approximately 17 square miles on the northeast-facing slope of the Santa Cruz Mountains. The Saratoga Creek watershed begins at an elevation of approximately 3,100 feet above sea level along Skyline Boulevard at the crest of the Santa Cruz Mountains. The upper portion of the watershed is a bowl-shaped area that is about 4½ miles across at the widest point. The lower portion of the watershed between the City of Saratoga and its confluence with San Tomas Aquino Creek varies between ¼ and 1 mile wide (Water District 1983b).

Saratoga Creek is a little over 15 miles in length. The creek is steep in the mountainous areas and flattens to a minimal slope as it crosses the valley floor. The elevation at the point where Saratoga Creek joins San Tomas Aquino Creek is about 40 feet above msl.

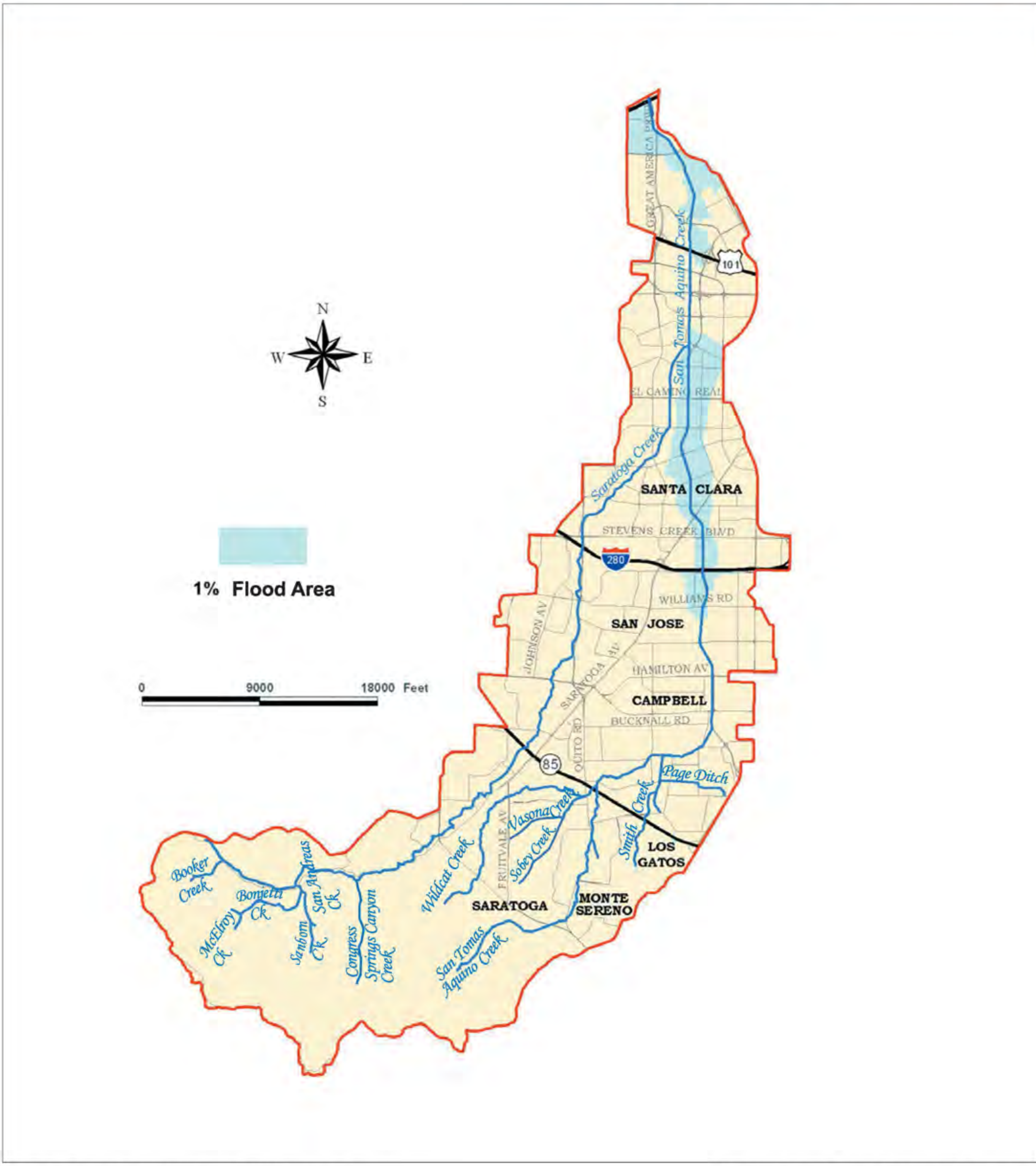
The earliest floods of record on Saratoga Creek date to the year 1861. Other floods have occurred in the years 1892, 1910, 1940, 1943, 1955, and 1958. The largest flood recorded on Saratoga Creek occurred on December 22, 1955. On that day, the peak flow recorded at the USGS Gaging Station No. 1695 (located in the City of Saratoga) was 2,730 cfs (Water District 1983b).

Construction of flood control channel improvements was completed on the lowermost reach of Saratoga Creek between Cabrillo Avenue and the confluence with San Tomas Aquino Creek in 1980. Between 1984 and 1986, the 3-mile section of the Saratoga Creek channel between Pruneridge Avenue and Cabrillo Avenue was modified to increase channel capacity. The channel was excavated and a gabion lining was installed. Native vegetation has been planted within and above the gabions.

Some of the native riparian vegetation found along the lower portion of Saratoga Creek during preparation of the Saratoga Creek Planning Study included coast live oak, willow, cottonwood, blue elderberry, California sycamore and California buckeye. Some of the more common shrubs and vines in the riparian corridor include poison oak, coyote brush, mule fat, California coffeeberry, and blackberry (Water District 1983b).

The upper portions of the Saratoga Creek watershed are vegetated with broadleaved upland forest, especially mixed evergreen forest, including redwood and Douglas fir, and chaparral. The riparian corridor in the mountainous portion of the watershed is narrow as it courses through steep canyons. Common riparian tree species along the upper reaches of Saratoga Creek include white alder, big leaf maple, and California bay. Scattered Douglas fir and coast redwoods also occur along some of the drainage courses. Native riparian plant species occurring along the lower portions of Saratoga Creek (from Monroe Street to Lawrence Expressway) include arroyo willow, box elder, Fremont cottonwood, western sycamore, red willow, yellow willow, blue elderberry, coffeeberry, coyote brush, and mule fat (Water District 1983b). Nonnative weedy species are common. Invasive nonnative species in the riparian corridor include prickly wild lettuce (*Lactuca serriola*), Italian thistle, bristly ox-tongue, French broom, curly dock, arundo/giant reed, pampas grass, cocklebur (*Xanthium strumarium*) and periwinkle (Water District 1983b). Fruit and nut trees have become established in the riparian corridor including fig, prune, almond, black walnut, olive (*Olea europaea*) and quince (*Cydonia oblonga*) (Water District 1983b).

Three native fish species (resident rainbow trout, hitch and Sacramento sucker) and two nonnative species (rainwater killifish and mosquitofish) have been collected in Saratoga Creek. Saratoga Creek is a historic steelhead stream, and the rainbow trout are of steelhead origin (Keith Anderson, pers. comm., 1998).


N
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1% Flood Area
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GREAT AMERICA PKWY
101
San Tomas Aquino Creek
EL CAMINO REAL
Saratoga Creek
SANTA CLARA
STEVENS CREEK BLVD
280
WILLIAMS RD
SAN JOSE
JOHNSON AV
SARATOGA AV
HAMILTON AV
CAMPBELL
BUCKNALL RD
85
QUITO RD
Page Ditch
Smith Creek
Vasona Creek
Sobey Creek
FRUITVALE AV
LOS GATOS
Wildcat Creek
SARATOGA
MONTE SERENO
San Tomas Aquino Creek
Booker Creek
Bonjetti Ck
McElroy Ck
San Andreas Ck
Sanborn Ck
Congress Springs Canyon Creek

### *7.2.2.9 Guadalupe River Watershed*

The headwaters of the Guadalupe River are located in the eastern Santa Cruz Mountains near the summit of Loma Prieta, elevation 3,790 feet. A map of the watershed is shown on Figure 7-20.

#### Guadalupe River

The Guadalupe River begins at the confluence of Alamitos Creek and Guadalupe Creek, which is just downstream of Coleman Road in San Jose. From this point, the Guadalupe River flows north approximately 14 miles through heavily urbanized portions of the City of San Jose, eventually discharging to the South Bay via the Alviso Slough near the community of Alviso. South of State Highway 237, the Guadalupe River watershed has a total drainage area of approximately 170 square miles.

Three tributary creeks join the Guadalupe River as it flows north towards the San Francisco Bay: Ross, Canoas and Los Gatos creeks. Ross Creek drains an area of about 10 square miles before it joins the Guadalupe River just downstream of Branham Lane. Canoas Creek drains an area of about 19 square miles before joining the Guadalupe River just upstream of Curtner Avenue. Los Gatos Creek, with a drainage area of about 55 square miles, joins the Guadalupe River in downtown San Jose.

The Guadalupe River played an important role in the settlement of San Jose. As a result, it has been subject to considerable modification. The first major modification of the stream channel occurred in 1866 when a canal was dug to alleviate flooding and to improve conditions for rapidly expanding orchards. More recently, in the early 1960s, Canoas Creek and Ross Creek were realigned. As part of the 1975 Almaden Expressway construction project, about 3,000 feet of the Guadalupe channel were widened and moved eastward. The original stream channel was filled to allow the construction of the northbound expressway (Jones & Stokes 1997).

The written history of flooding in the Basin begins with the founding of the Mission Santa Clara and the Pueblo San Jose de Guadalupe in 1777. Floods during the first few years forced both to move to higher ground. Historic accounts of flooding were recorded in 1779, 1862, 1867, 1869 and 1911. The storm of December 1955 (known as the “Christmas Storm”) caused widespread flooding throughout the Basin. The Guadalupe River inundated some 5,200 acres. Although extensive flooding occurred as a result of this storm, it would have been more severe if the upstream storage reservoirs had not been nearly empty prior to the storm event. Major flooding also occurred on the Guadalupe River on April 2, 1958, when floodwaters covered portions of downtown San Jose to a depth of up to 4 feet. Flooding also occurred downstream, inundating 2,700 acres of agricultural land, as well as the town of Alviso, for 17 days. The discharge of the Guadalupe River in 1958 was nearly twice the discharge recorded for the December 1955 storm, even though it rained a lot more in 1955; this was because the upstream storage reservoirs were full when the 1958 storm occurred. In recent years, the Guadalupe River has flooded San Jose communities during the winters of 1980, 1982, 1983, and 1995.

The Guadalupe watershed has been identified as a significant mercury source to the Bay, owing to prior mining of mercury ore within the watershed. Most of the mining activities occurred within what was once known as the New Almaden Mining District and is now the present location of the Almaden Quicksilver County Park. Mercury mining within the Park began in 1845 and occurred up to 1975, when the area was purchased by Santa Clara County for use as a recreational park. The park occupies approximately 3,750 acres in the foothills of the Santa Cruz Mountains, on Los Capitancillos Ridge. Seventy-five percent of the total park area drains into the Guadalupe River via intermittent creeks and perennial streams. The remaining area drains into the Guadalupe and Almaden reservoirs.

Inactive mercury mines in the New Almaden area include Guadalupe, Senator, San Mateo, San Antonio, Enriquita, San Francisco, Providencia, American, and New Almaden. The principal mercury ore in the area is cinnabar (mercury sulfide), which is situated within a host silica-carbonate rock. The cinnabar is processed by crushing the ore and reducing the ore to elemental mercury in retorts or furnaces. The burned rocks, referred to as calcines, typically were dumped in piles near the processing areas or used as road base material. Generally, the calcines are sandy or silty gravel materials. The calcine piles still remain at the site and vary in area, steepness, mercury concentration, and particle size distribution. Erosion and runoff from calcine piles, waste rockpiles (unprocessed rock), and road material cause mercury-laden sediment to be transported into nearby surface waterbodies.

There are six major reservoirs in the Guadalupe River watershed: Calero Reservoir on Calero Creek, Guadalupe Reservoir on Guadalupe Creek, Almaden Reservoir on Alamitos Creek, and Vasona Reservoir, Lexington Reservoir, and Lake Elsman on Los Gatos Creek. All of these reservoirs were constructed for water conservation and storage purposes, but can provide flood control benefits depending on the size of the upstream drainage areas and the available water storage capacities.

During the drier months, the Water District augments the natural recharge of groundwater along the Guadalupe River and its tributaries through an artificial recharge program. Offstream recharge occurs in percolation ponds that are fed by water diverted from tributary creeks or by imported water pipelines. Prior to 1995, the District used temporary dams to enhance instream recharge. In 1995 the Water District's permits for the operation of these recharge facilities expired. The Water District has an active project to reevaluate its recharge operations and determine which facilities are critical to the County's water supply.

Riparian areas along the Guadalupe River on the valley floor include the following native species: arroyo willow, Fremont cottonwood, box elder (*Acer negundo*), western sycamore, red willow and sandbar willow (*Salix exigua*). Garden/orchard escapees and invasive nonnative species are prevalent in the urban riparian corridors. According to a tree survey conducted along reaches of the Guadalupe River between Blossom Hill Road and Interstate 280, the relative abundance of black locust (an invasive nonnative tree) was 20 percent, while the relative abundance of the native species, Fremont cottonwood was 15 percent. The following invasive nonnative plant species are known to occur along the lower Guadalupe River riparian corridor


Source: Santa Clara Valley Water District

(from Interstate 880 to Hedding Street): arundo/giant reed (*Arundo donax*), fennel, black locust, tree-of-heaven, Himalayan blackberry, prickly wild lettuce, white sweet clover, and bristly ox-tongue (*Picris echioides*) (Habitat Restoration Group 1998).

The valley floor reaches of the Guadalupe River provide important habitat for birds. Bird species using the riparian forest habitat along the Guadalupe River include: mourning doves, downy woodpeckers, Nuttall's woodpeckers, red-shouldered hawks, Pacific-slope flycatchers, chestnut-backed chickadees, and northern orioles. The diversity of nesting birds is reduced along the more urbanized sections of the Guadalupe River where the riparian corridor is narrow and native understory vegetation is absent or localized, or where natural habitats adjacent to the river are largely absent. Mammals known or expected to exist in the riparian habitat include the Virginia opossum, raccoon, Trowbridge shrew, broad-footed mole, fox squirrel, Botta's pocket gopher, and feral house cat.

Aquatic habitat in the Guadalupe River and its tributaries, including Los Gatos Creek, has been altered significantly by reservoirs, passage barriers, flood control projects, and other channel modifications. While many of the native fish that occurred historically in Guadalupe River still occur in the watershed, nonnative fish dominate the system (see Tables 7-4a and 7-4b). Sixteen nonnative species have been collected in Guadalupe River and include golden shiner, threadfin shad, catfish, goldfish, carp, sunfish, largemouth bass, and black crappie. Nine native fish regularly occur in the Guadalupe River watershed: Pacific lamprey, Chinook salmon, hitch, California roach, Sacramento sucker, steelhead, threespine stickleback, riffle sculpin, and prickly sculpin. Sacramento pikeminnow was last collected in 1922 (Leidy 1984).

The Guadalupe River supports a reproducing steelhead population. The steelhead population had declined significantly by 1962 following the construction of reservoirs on all main tributaries (Los Gatos, Guadalupe, Alamitos, and Arroyo Calero creeks) and the construction of a drop structure upstream of Blossom Hill Road. From the time dams were installed in the river up until 1999, steelhead were confined to the main stem of the Guadalupe River and lower Los Gatos Creek, where limited spawning and rearing habitat occur. In these stream reaches, habitat is restricted by high-velocity winter flows that can destroy eggs and young, and by high summer stream temperatures and minimal cover habitat that provide marginal rearing conditions. Downstream tributaries such as Canoas and Ross creeks have less suitable habitat and streamflow for steelhead.

A small run of Chinook salmon occurs in the Guadalupe River. Early written documents record the local presence of migrating salmon in the "Rio Guadalupe" dating as far back as the 1700s when the Spanish first settled the area. Valley residents and fisherman reported the local presence of coho salmon until the 1970s. The GCRCD (2001) believes that there is a continuing presence of Chinook since the mid-1700s. The SCVWD biologists support the hypothesis that Santa Clara Valley chinook slamon are keyed genetically to Central Valley fall run Chinook salmon, and Guadalupe River and Coyote Creek fish are strays from the Central Valley rather than remnants of a native fish stock. The GCRCD consulting biologists support the hypothesis that most fall run Chinook salmon in the Guadalupe River and Coyote Creek are remnants of a native fish stock.

Adult fall run Chinook have been scientifically documented in the Guadalupe River watershed since the mid-1980s. Reproduction of Chinook is occurring in this watershed.

Over the past few years, passage conditions have been improved at several locations. A stream gage (23B at Foxworthy Road) has been modified and a crossing (at Branham Lane) has been removed. Although the Hillsdale Road weir has been modified, it remains a passage barrier under low flow conditions (David Salsbery, Jerry Smith, pers. comms., 1998). In addition, the Water District recently modified the Alamitos drop structure and installed a fish ladder in 1999. Removal of this terminal barrier on Guadalupe River and installation of a fish ladder at Masson Diversion Dam on lower Guadalupe Creek in 2000 has provided potential access to over 16 miles of steelhead spawning and rearing habitat in Guadalupe and Alamitos creeks. In order to realize this potential fully, it will be necessary to address smaller barriers and passage obstructions that occur on Guadalupe and Alamitos creeks.

## Los Gatos Creek

The Los Gatos Creek watershed is located on the north-facing slopes of the Santa Cruz Mountains and varies in elevation from 3,483 feet at the peak of Mt. Thayer to about 90 feet at the Creek's confluence with the Guadalupe River. The drainage area of the Los Gatos Creek watershed is approximately 55 square miles. The watershed above Vasona Dam encompasses about 44 square miles.

Lexington Reservoir is located on Los Gatos Creek about 11 miles upstream of its confluence with the Guadalupe River. Lake Elsman is located upstream of Lexington Reservoir.

Just upstream of Lexington Reservoir, the San Andreas fault cuts northwest across the watershed of Los Gatos Creek. The upper reaches of the watershed, on the southwestern side of the San Andreas fault to the Santa Clara County line, are underlain by sedimentary formations. Lexington Reservoir and areas to the east and northwest are underlain by the Franciscan Group and related serpentine beds. In some areas along stream channels beneath the reservoir, there are ribbons of old alluvium, stream deposits that have since been dissected by erosion and now have the appearance of terraces above today's creek (Iwamura 1999).

The water chemistry of the drainage is dominated by calcium, in the form of calcium bicarbonate. The amount of magnesium present is relatively low because only a small portion of the watershed is underlain by the Franciscan Formation and its magnesium-rich serpentine beds (Iwamura 1999).

The vegetation in the upper watershed is composed of broadleaved upland forest (especially mixed evergreen forest) and chaparral. The broadleaved forest intergrades with oak woodlands at lower elevations. In the upper watershed, the creek's course is through steep terrain and the width of the riparian corridor is narrow. Common riparian tree species include white alder, California buckeye, big-leaf maple (*Acer macrophyllum*), coast live oak, and California bay.

In the lower watershed, Los Gatos Creek passes through urban areas (Cities of Los Gatos, Campbell, and San Jose), and much of the riparian corridor has been fragmented by bank stabilization for flood control purposes. Upstream of Lark Avenue, the Los Gatos Creek riparian corridor is relatively lush and diverse; whereas downstream of Lark Avenue, the riparian vegetation is reduced to low-growing willow clumps and isolated western sycamore trees with blackberry vines (EIP 1976), with the exception of the Willow Glen area where the creek is again shaded. Drop structures are barriers to steelhead migration on this historic steelhead stream (Keith Anderson, pers. comm., 1998).

## Alamitos Creek, Arroyo Calero, and Santa Teresa Creek

Alamitos Creek and its major tributary—Arroyo Calero (often referred to as Calero Creek)—are located in the Almaden Valley, a northwest-trending valley located within the larger Santa Clara Valley. Alamitos Creek originates in the Santa Cruz Mountains at an elevation of around 3,800 feet. From its source, Alamitos Creek first flows northwesterly to Almaden Reservoir. The Alamitos Creek watershed (including the Calero Creek watershed) is approximately 38 square miles.

From Almaden Reservoir, Alamitos Creek flows in a northeast direction to its confluence with Calero Creek. Along this stretch, the stream gradient is moderately steep. At the Calero Creek confluence, Alamitos Creek turns slightly more westward and continues along a moderately steep gradient to the point of confluence with Guadalupe Creek, where the resultant stream becomes known as the Guadalupe River.

There have been several major floods in the Alamitos and Calero Creek watersheds, some of which have caused significant damage. These floods occurred in 1931, 1937, 1940, 1941, 1943, 1945, 1952, 1955, 1958, 1962, 1967, and 1968. The flood that resulted in the heaviest damages occurred just before Christmas in 1955. This flood, which resulted from heavy rains over a number of days, would have resulted in even greater damages except for the fact that the upstream reservoirs were not full and were therefore able to store a great deal of the runoff. The continuous and heavy rainfall persisted over a period of several days before the flood also loosened and scoured out large trees, which floated downstream along with other accumulated debris. These trees and debris became lodged under bridges and in culverts, obstructing the channel and resulting in severe local flooding (Water District, undated [b]).

Alamitos Creek was widened and levees were constructed from Bertram Road bridge downstream to its confluence with Guadalupe Creek (a distance of approximately 33,000 feet) in the late 1970s.

Randol Creek, Greystone Creek, and Golf Creek enter Alamitos Creek downstream of Calero Creek. The lower reaches of each of these streams were modified by flood protection projects constructed in the mid-1970s.

Of the 12½ square miles comprising the Calero Creek Watershed, 7 are located in the hills above Calero Reservoir. From Calero Reservoir, Calero Creek flows northwest to its confluence with Alamitos Creek.

Santa Teresa Creek begins in the Santa Teresa Hills and flows northwest, parallel to and about 1,000 feet north of Calero Creek. Santa Teresa Creek outfalls into Calero Creek just below Harry Road. A section of Santa Teresa Creek was also widened in the late 1970s.

#### Guadalupe Creek

Nearly the entire Guadalupe Creek watershed above Guadalupe Reservoir is underlain by the Franciscan Formation and its related serpentine beds. Only a small portion of the southwestern edge of the headwaters of the watershed is underlain by sedimentary formations. It is interesting to note that limited chemical sampling of water in the drainage indicates a predominance of calcium rather than magnesium ions, a surprising result, considering the large percentage of the watershed composed of magnesium-rich serpentine rocks (Iwamura 1999).

The Masson Dam diversion is currently being installed with a fish ladder and screens on the diversion.

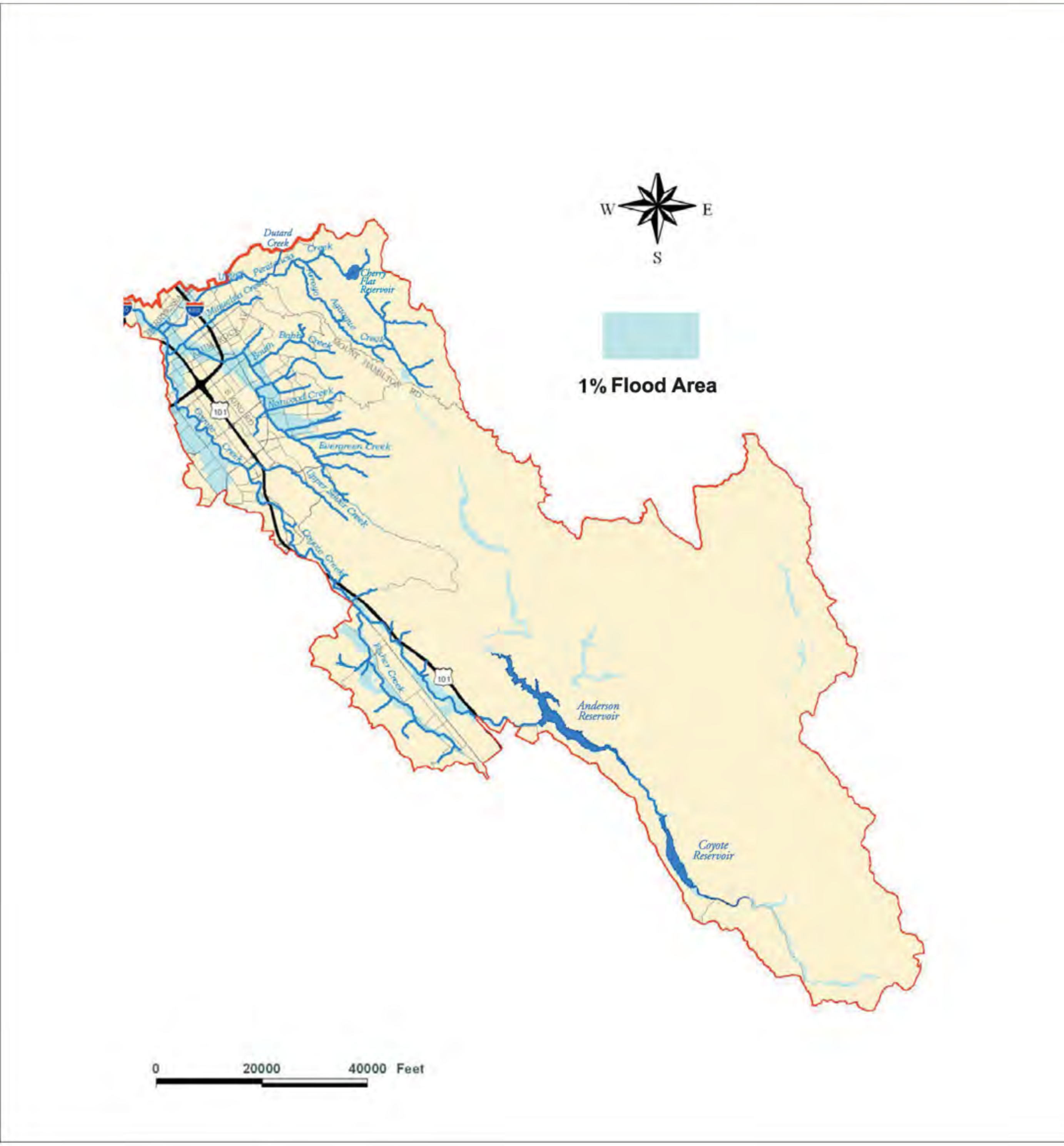
### *7.2.2.10 Coyote Creek Watershed*

Coyote Creek originates in the mountains of the Diablo Range northeast of Morgan Hill. Coyote Creek drains an area of approximately 320 square miles. The Coyote Creek watershed is the largest watershed in the Basin. Coyote Creek drains most of the west-facing slope of the Diablo Range. Coyote Creek flows in a northwesterly direction for approximately 42 miles before entering the South Bay. A map of the watershed is shown on Figure 7-21.

There are two major reservoirs in the upper watershed: Anderson and Coyote. The upper reservoir, Coyote Reservoir, was constructed in 1936. Anderson Reservoir was constructed in 1950.

Water released from Coyote Reservoir flows into Anderson Reservoir. There are nine major tributaries to Coyote Creek within the drainage area to these two reservoirs. Canada de los Osos, Hunting Hollow, Dexter Canyon, and Larios Canyon Creeks are within the Coyote Reservoir drainage area. Otis Canyon, Packwood, San Felipe, Las Animas, and Shingle Valley Creeks are tributaries to Anderson Reservoir. Runoff above the Coyote Dam accounts for about 75 percent of the total runoff for the entire Anderson/Coyote watershed (Iwamura 1999).

The northeastern half of the headwaters of Coyote Creek is underlain by the ancient volcanic seafloor of the Franciscan Formation, with its characteristic serpentine beds. The remainder of the watershed is composed of sand, gravel, silt, and clay deposits of varying ages, some of which contain beds of volcanic ash. In the upper reaches of the watershed, the occurrence of serpentine beds has consequences for water quality in the drainage. During low-flow periods, when




Source: Santa Clara Valley Water District

groundwater accounts for a relatively high percentage of streamflow, there is an elevated amount of magnesium present in the waters of Coyote Creek that has been dissolved from serpentine rocks.  During storms, when the amount of surface runoff is high, calcium is more prevalent than magnesium in the creek waters, reflecting the decreased importance of groundwater during high-flow events (Iwamura 1999).

Three notable mineral springs occur within the drainage.  These springs are all along or in proximity to the Madrone Springs fault.  All of these springs are tributaries to upper Coyote Creek, well upstream of Coyote Reservoir.  These springs include Gilroy Hot Springs, Madrone Springs, and Coe Springs (Iwamura 1999).

> "Two minor mining prospects are noted in the watershed.  The first manganese prospect known as the Pine Ridge Mine, located atop of Pine Ridge near the entrance of Henry Coe State Park, off Steeley Road.  This little worked prospect is located within the Franciscan Group.  It is within the Hoover Valley Creek drainage, which drains into Anderson Reservoir via Packwood Creek.  The second is a copper prospect known as the Masson Ranch located within the Huntington Hollow tributary of Coyote Creek, just upstream from the confluence of Canada De los Osos.  This prospect is also located in the Franciscan Group. Both of these are minor and should have no effect upon the watershed.  There are neither ongoing commercial rock quarrying nor gravel quarrying operations at this time within the watershed" (Iwamura 1999).

After leaving the mountains, Coyote Creek flows northwest along the floor of the Santa Clara Valley to the South Bay, a distance of about 30 miles.  Major tributaries entering Coyote Creek downstream of Anderson Dam include Fisher Creek, Upper Silver Creek, Lower Silver Creek, and Upper Penitencia Creek.  The boundary between the mountains of the Diablo Range and the alluvial plain that forms the valley floor is quite sharply defined.  Tributary creeks flowing out of the mountains must cross this alluvial plain to reach Coyote Creek.

Coyote Creek flows through unincorporated, predominately agricultural (but rapidly urbanizing) land between the cities of Morgan Hill and San Jose.  Coyote Creek then flows through the urbanized areas of San Jose close to the Bay.  Coyote Creek is bordered on the east by the City of Milpitas and on the west by the City of San Jose.

The lower reaches of Coyote Creek have been partially modified for flood protection. Setback levees and high-flow bypass channels have been constructed in the section of lower Coyote Creek between Montague Expressway and Dixon Landing Road.  Many acres of young riparian forest habitat have been planted along this section of lower Coyote Creek by the Water District as mitigation plantings for habitat loss resulting from construction of the flood control project. The overall result of the flood control project is that there is a wider, more diverse riparian corridor along this section of Coyote Creek than existed when the adjoining lands were farmed up to the edge of the streambanks.

As Coyote Creek nears the South Bay a transition occurs from a freshwater environment to an estuarine environment where the channel and adjacent Baylands contain many acres of brackish marsh, salt marsh, and mudflats. The Water District had been installing a seasonal dam (Standish Dam) on lower Coyote Creek just upstream of Dixon Landing Road annually until 1998. The dam was intended to prevent saltier water from moving upstream during the summer months, where it could impact potential steelhead habitat. Substantial debate has taken place regarding the value of installing this seasonal dam. A negotiated agreement between Water District and the CDFG resulted in the removal of the dam and an impact study to verify that there is no need to continue installation.

Lower Coyote Creek flows past the City of San Jose's sludge-drying lagoons located immediately to the west of the channel upstream of Dixon Landing Road and around the north side of the Newby Island Land Disposal Site located just downstream of Dixon Landing Road.

Salt evaporation ponds bordered by levees are located on both sides of lower Coyote Creek at its confluence with the South Bay. There are also several important salt and brackish water marshes along the lowermost section of Coyote Creek.

Coyote Creek receives freshwater discharged from the San Jose-Santa Clara Water Pollution Control Plant just upstream from its confluence with the South Bay. Some of this freshwater is "pushed" back upstream by incoming tides with the result that, during low flow periods, tidal water in the lower Coyote Creek is less saline than would otherwise be the case. Over the years, this has resulted in changes in the composition of the wetland vegetation in some former salt marsh areas (i.e., conversion of salt marsh habitat to brackish water marsh habitat).

Flooding occurred along portions of Coyote Creek in 1911, 1917, 1931, 1958, 1969, 1982, 1983, and 1997.

The plant communities in the upper Coyote Creek Watershed in the Diablo Range are typically composed of grassland, scrub, or chaparral habitat on the tops of the hills and oak woodlands in the steep valleys and canyons.

The following types of riparian plant communities have been documented along mid-Coyote Creek extending from East Santa Clara Street downstream to the Montague Expressway: central coast cottonwood/willow riparian forest, riparian scrub and eucalyptus/cottonwood/willow riparian forest. Native riparian plant species recorded along mid-Coyote Creek include: box elder, white alder, Fremont cottonwood, coast live oak, California bay, valley oak, willow species, western sycamore, blue elderberry, and coyote brush. Invasive nonnative plant species include eucalyptus, black locust, tree-of-heaven, acacia, glossy privet (*Ligustrum lucidum*), and fig (Habitat Restoration Group 1995).

In the lower reaches of Coyote Creek a significant corridor of riparian vegetation flanks both sides of the channel. The original vegetation is believed to have been situated on a high, naturally occurring terrace. Alteration of Coyote Creek began taking place prior to 1900, resulting in the high-terrace riparian vegetation being replaced by orchards and farmlands. A middle terrace has managed to survive, with cottonwoods dominating the riparian corridor. Only a relatively small number of oak and sycamore remain along lower Coyote Creek. In spite of alterations to the riparian habitat that have taken place for nearly a century, lower Coyote Creek is considered the highest quality riparian corridor remaining in the South Bay region (ACOE 1986).

Among the Basin watersheds, Coyote Creek has the most diverse native fish fauna, both historically and in the present (see Tables 7-4a and 7-4b). Native fish species found in the Coyote Creek drainage are steelhead/rainbow trout, Chinook salmon, Pacific lamprey, California roach, hitch, Sacramento blackfish, Sacramento sucker, threespine stickleback, prickly sculpin, riffle sculpin, Sacramento pikeminnow, Tule perch, and Sacramento perch. Steelhead are rare in Coyote Creek watershed. While less common than in Guadalupe River, Chinook salmon have been observed in Coyote Creek since the mid-1900s and reproduction has been documented. Some coho salmon occurred in Coyote Creek as late as the 1950s (Smith 1998). Four species of native fish, Pacific Brook lamprey, coho salmon, splittail, and speckled dace, were present historically in the Coyote Creek watershed, but are now locally extinct (Leidy 1984; Smith 1998). Thicktail chub is considered extinct throughout its range (Moyle 1976). Twenty-two nonnative fish species have been collected in the Coyote drainage, including golden shiner, fathead minnow, threadfin shad, goldfish, carp, mosquitofish, sunfish (bluegill, green, pumpkinseed, redear), largemouth bass, smallmouth bass, striped bass, catfish, black crappie, and inland silversides.

Native freshwater clams have been recently found in Coyote Creek, above Anderson Reservoir (Palassou Ridge). They were identified as the rare California floater (*Anodonta californiesis*). (Larry Serpa, pers. comm., 2000)

Numerous migration barriers for steelhead and salmon exist on Coyote Creek and its tributaries. These barriers include permanent dams, seasonal dams, drop structures, and dry stream reaches. Anderson Dam is the impassable terminal barrier on the main stem of Coyote Creek. Downstream of Anderson Dam, Coyote Steel (Percolation) Dam (Metcalf Dam) is laddered. Downstream, fish ladders on three year-round gravel dams for the Ford Road percolation ponds[13] can pose migration barriers during low-flow periods and when ladders are clogged during storm events. Further downstream along the main stem are drop structures that can be migration barriers under certain flow conditions. Also, low-flow vehicle crossings at stream miles 12.8 and 15.5 are partial barriers to steelhead migration (Keith Anderson, pers. comm., 1998).

Streamflows are regulated extensively in Coyote Creek. Downstream of Anderson Reservoir, water is diverted into a 6-mile canal that parallels the stream channel. This water is discharged for groundwater recharge in Metcalf Pond and the Ford Road ponds; consequently, the reach between the canal intake and Metcalf Pond runs dry in all but the wettest years. Downstream of the percolation ponds, the stream channel often runs dry, or only intermittently during most summers. Lower reaches are fed by groundwater and urban runoff, but water quantity and

[13] The Ford Road "gravel dams" are not currently being installed by the Water District (Doug Padley, pers. comm., 1998).

quality are low. As a result of these flow alterations, summer rearing habitat for young steelhead is limited, and spring and early summer streamflows are often inadequate for outmigrating smolts (Smith 1998).

Much of the main stem Coyote Creek provides marginal aquatic habitat for native fish, other aquatic organisms, and aquatic invertebrates. Results of a habitat survey found that nine reaches of mid-Coyote Creek were dominated by poor instream habitat conditions with slow-moving pool habitat, minimal instream cover, and fine substrates (Habitat Restoration Group 1989). Isolated patches exist that provide fair rearing and spawning habitat for salmonids, but overall, instream habitat conditions were poor. Habitat conditions were also marginal for other native fish, but were more conducive to nonnative fishes in the system. Riffle habitat, important to salmonid spawning and rearing, was located in limited areas. Riffle habitats did occur, but had very low abundance and diversity of aquatic invertebrates and often had fine sediments that reduced oxygen levels available in the substrate.

Native fish collected in mid-Coyote Creek – California roach, Sacramento sucker, hitch, and Sacramento blackfish – can tolerate warmer water temperatures and do not depend exclusively on aquatic insects as their primary food source. Nonnative fish collected in main stem Coyote Creek include fathead minnow, red shiner, mosquitofish, bluegill, and goldfish.

### Upper Penitencia Creek

Upper Penitencia Creek joins Coyote Creek about 10 miles from the Bay. The total area of the Upper Penitencia Creek watershed is about 24 square miles. The upper watershed, upstream of Dorel Drive, occupies about 21 square miles and includes Upper Penitencia Creek and its principal tributary, Arroyo Aguague. The topography is rugged; the slopes are steep and the canyons are deep and narrow, with little or no flat land along their bottoms. The elevation of the upper watershed ranges from nearly 3,000 feet to 280 feet at Dorel Drive near the base of the mountains. A small reservoir, Cherry Flat Reservoir, is located in the Upper Penitencia Creek watershed.

After leaving the Los Buellis Hills, Upper Penitencia Creek flows westward across the alluvial plain for a distance of about 3½ miles before joining Coyote Creek.[14] The elevation at the junction of Upper Penitencia and Coyote Creeks is 80 feet.

Much of the riparian habitat along the Upper Penitencia Creek has been preserved (interrupted in only a few places), and represents one of the few remaining contiguous riparian corridors that connects the Diablo Range to Coyote Creek. Native riparian species observed upstream of the confluence with Coyote Creek and downstream of Dorel Drive include: western sycamore, box elder, Fremont cottonwood, blue elderberry, coast live oak, and willow species.

[14] Upper Penitencia Creek was diverted along Berryessa Road into Coyote Creek by farmers in 1875, separating Upper Penitencia Creek from Lower Penitencia Creek (Water District 1982).

Currently, the best habitat for steelhead is in the Upper Penitencia Creek (Jerry Smith, pers. comm., 1998). Flowing out of Alum Rock Park, the upper stream reaches are less disturbed and provide cool stream temperatures, riffle habitats, and riparian vegetation necessary for successful steelhead spawning and rearing. Resident rainbow trout occur in these reaches. Passage has been improved recently at the Noble Avenue diversion, a frequent passage barrier in past years.

#### Lower Silver Creek

Lower Silver Creek originates in the low foothills southeast of San Jose in the general vicinity of Metcalf Road. Starting at about 1,200 feet in elevation, Lower Silver Creek drains a watershed of 43.5 square miles. The creek flows in a north-northwesterly direction until it meets Coyote Creek near the Bayshore Freeway.

### *7.2.2.11 Lower Penitencia Creek Watershed*

The Lower Penitencia Creek watershed lies in the unincorporated area of Santa Clara County and in the cities of Milpitas and San Jose. The total watershed area is about 30 square miles, with about 16 square miles lying on the valley floor and the remainder in the hills of the Diablo Range (Water District 1982). The only two major creeks in the watershed are Lower Penitencia Creek and Berryessa Creek. A map of the watershed is shown on Figure 7-22.

#### Lower Penitencia Creek

Lower Penitencia Creek is located in the northeasterly sector of Santa Clara County and is bounded by Berryessa Creek to its east and Coyote Creek to its west. It flows northerly from Montague Expressway to its confluence with Coyote Creek near the intersection of Interstate 880 and Dixon Landing Road (Water District 1982).

Major tributaries to Lower Penitencia Creek are Berryessa Creek and the East Penitencia Channel. Berryessa Creek is the major drainage channel for the mountainous portion of the Lower Penitencia Creek Watershed (Water District 1982).

As farming became more intensive in the valley, Penitencia Creek became an important source of irrigation water. One farmer plowed a channel to divert the water to his fields south of the creek. This split Penitencia Creek into two streams: Upper Penitencia, which now flows from the hills above Alum Rock Park to Coyote Creek near the San Jose flea market, and Lower Penitencia Creek which flows from the neighborhoods north of Berryessa Creek through Milpitas to Coyote Creek near Dixon Landing Road (Water District, undated [b]).

In 1955, the Water District designed and constructed the portion of Lower Penitencia Creek from the confluence with Coyote Creek to Spence Avenue (Water District 1982). The earth channel between Spence Avenue and Sylvia Avenue was constructed by the Water District in 1962. In 1965, the Water District constructed the channel from Sylvia Avenue to Old Oakland Highway (Water District 1982).

> "Prior to 1965, Lower Penitencia Creek extended about 3,000 feet south of Montague Expressway. In March of 1965, the [Water District] Board of Directors approved a new flood control facility known as East Penitencia Channel. It was to be constructed in lieu of that portion of Lower Penitencia Creek south of Montague Expressway. The East Penitencia Channel and the portion of Lower Penitencia Creek from Capitol Avenue to Montague Expressway were built by the County as part of the Montague Expressway project in 1973" (Water District 1982).

In 1982, the Water District conducted a study of Lower Penitencia Creek between Coyote Creek and Montague Expressway in order to resolve flooding, erosion, sedimentation and channel maintenance problems (Water District 1982). The proposed project consisted of various channel modifications to the creek to increase its capacity. In the reaches downstream of the confluence with Berryessa Creek, the District proposed that the existing channel be widened and levees be constructed to provide adequate capacity and freeboard. The District also proposed that portions of the channel be concrete-lined. Upstream of Berryessa Creek, flood control measures were proposed to extend to the entrance of Elmwood Rehabilitation Center. These measures consisted of a combination of earth levees, floodwalls, culvert enlargement, and concrete lining (Water District 1982). It is assumed that this project was constructed as designed.

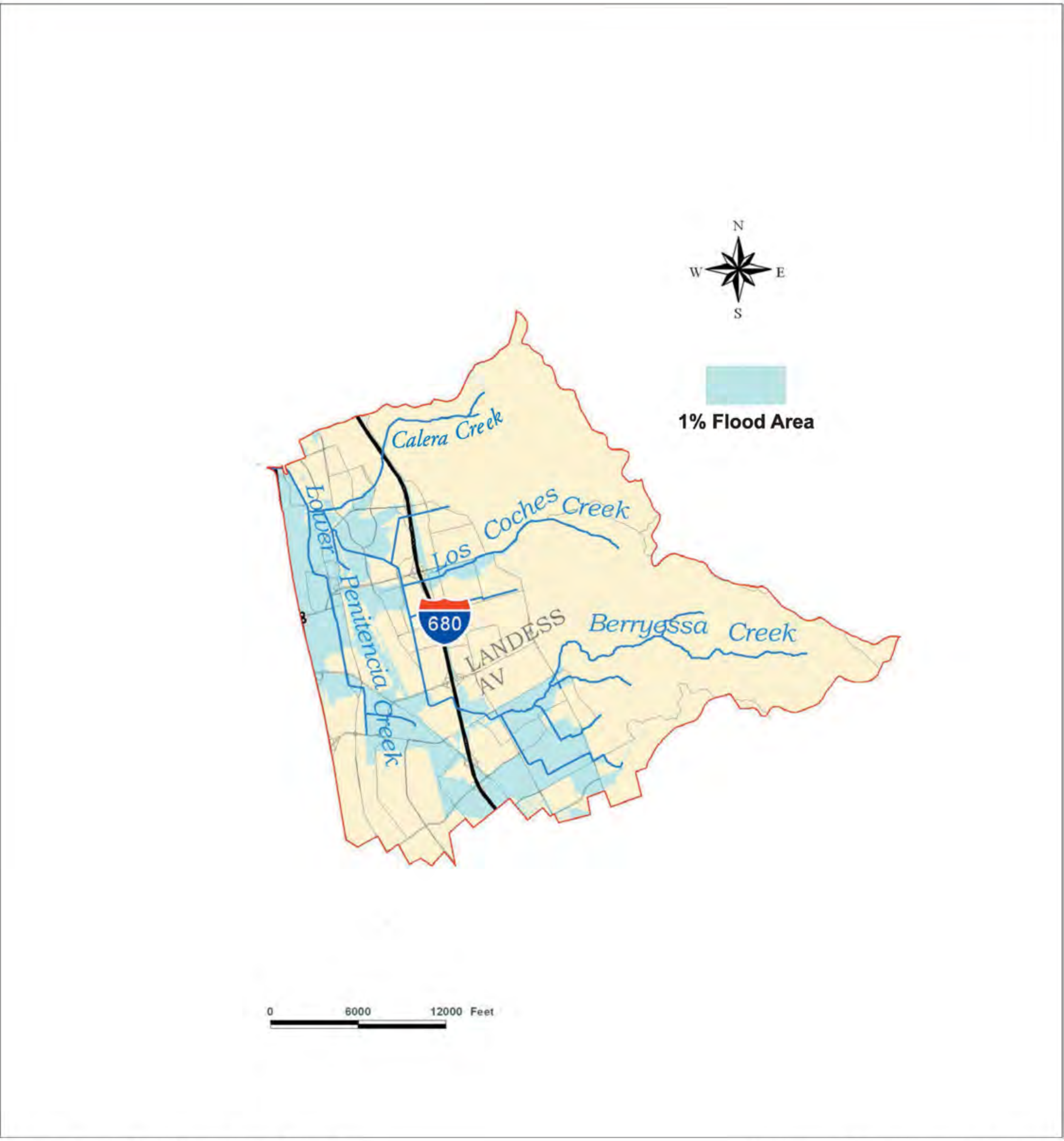
## Berryessa Creek

The Berryessa Creek drainage basin covers about 22 square miles in the northeastern portion of the Basin. Berryessa Creek flows westerly from its headwaters in the Diablo Range, at approximately 2,000 feet above msl. Below the foothills, it continues in a westerly direction through the cities of San Jose and Milpitas, and turns north before flowing into Lower Penitencia Creek (ACOE 1986).

Berryessa Creek is an intermittent stream with water flow occurring primarily during the wet winter and spring months. The stream is usually dry during the summer months (ACOE 1986).

The upper portion of the watershed is located in the foothills of the Diablo Range and generally consists of grassland habitat with patches of upland broadleaved forest dominated by oak, madrone, and California bay trees (Water District, undated [a]), which tend to be distributed in ravines and drainages. Patches of chaparral habitat occur to the west of Calaveras Reservoir. Most of the upper reaches of Berryessa Creek occur within oak woodland habitat, whereas the lower reaches are surrounded by grasslands, agricultural lands, or urban habitat. Native riparian trees that occur along Berryessa and Calaveras Creeks include California bay, big leaf maple, and coast live oak. Invasive nonnative plant species known to occur in the riparian corridors of Calaveras and Calera Creeks in Ed Levin County Park include poison hemlock, fennel, milk thistle, star thistle, and black mustard (Brady and Associates 1995).

Insert Figure 7-22 (Front)




Source: Santa Clara Valley Water District

### *7.2.2.12 Arroyo la Laguna Watershed*

The Arroyo la Laguna watershed is a composite of several small watersheds in southern Alameda County. These “subwatersheds” drain the west-facing slopes of the Diablo Range in the area south of the Alameda Creek watershed and north of the Alameda County/Santa Clara County line. The lower portions of these watercourses have been modified for flood control and drainage purposes. They are located in the Alameda County Public Works Agency Zone 6. Some of these watercourses have names and some do not. Many no longer follow their original alignments. Once these streams flow onto the Bay plain they are most often referred to by the line numbers used for reference by the Agency. A map of this watershed is shown on Figure 7-23.

All of the watercourses in the Arroyo la Laguna watershed discharge into the lower South Bay north of Dixon Landing Road and south of the Dumbarton Bridge. The major creeks and sloughs in the Baylands portion of the watershed that receive these waters include lower Coyote Creek (downstream of Dixon Landing Road), Mud Slough, Mowry Slough, Plummer Creek, and Newark Slough.

The southernmost of the watercourses in the Arroyo la Laguna watershed is Scott Creek (also referred to as Line A). The Scott Creek subwatershed lies due north of the Calera Creek (tributary to Lower Penitencia Creek) subwatershed. North of the Scott Creek subwatershed are Lines B and B-1. Line B is a small creek to the north of Scott Creek and south of Toroges Creek. The Toroges Creek subwatershed (also referred to as Line C) lies directly to the south of the Agua Fria watershed. Agua Fria Creek (Line D) is due south of Agua Caliente Creek, which lies within the Laguna Creek Basin. Lines D, C, and B empty into an approximately 2-mile-long outfall channel that flows in a southerly direction paralleling the west side of Interstate 880. North of the old Fremont Airport, this channel turns to the west to empty into Lower Coyote Creek. Scott Creek (Line A) flows into this outfall channel before it empties into Lower Coyote Creek (Gary Shawley, pers. comm., 1998).

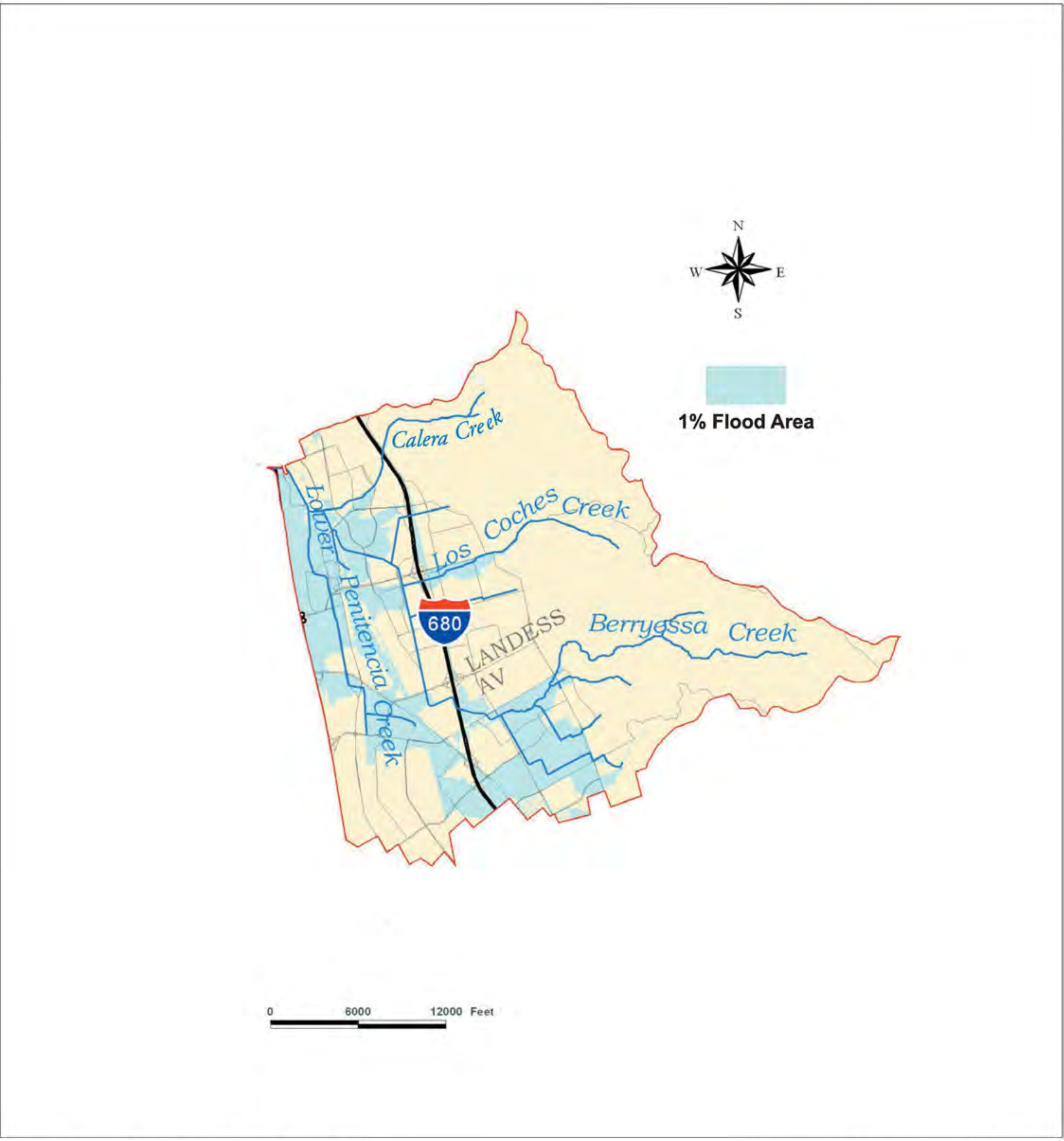
Laguna Creek Basin is the term used to describe an area within the City of Fremont that is drained by Laguna Creek and the network of channels within the “Basin.” The Laguna Creek Basin discharges to Mud Slough, which then discharges into Lower Coyote Creek. The creeks and/or “lines” within the Laguna Creek Basin are described below. The Laguna Creek Basin is described in detail in the Laguna Creek Basin Reconnaissance Study and Water Quality Enhancement Plan prepared for the City of Fremont by Jones & Stokes Associates, Inc. (Jones & Stokes 1999).

Portions of the City of Newark that lie south of Dumbarton Road and Thornton Avenue also drain to the Baylands. Drainage from this area west of the Laguna Creek Basin enters the lower South Bay via Mowry Slough, Plummer Creek, and Newark Slough.

## Laguna Creek Basin

The Laguna Creek Basin covers approximately one-third of Fremont's land area. Mission, Morrison, Cañada del Aliso, and Agua Caliente Creeks, as well as City stormdrains throughout the Irvington District, all drain into Laguna Creek. Not all the creeks in the Laguna Creek watershed are officially named. Most of Laguna Creek and its tributaries are maintained flood control channels managed by the Alameda County Flood Control and Water Conservation District (Jones & Stokes 1999). Each watercourse has been assigned a letter designation by the District.

> "According to the District, the Laguna Creek channel begins west of Paseo Padre Parkway. Historically, this seasonal creek drained overbank flows from Stivers Lagoon, a geographic low spot where Central Park and Lake Elizabeth are currently. A historic remnant of Laguna Creek begins west of Paseo Padre Parkway and meanders through the older Irvington District neighborhoods, crosses the commercial district near Five Corners, and more or less follows Fremont Boulevard until it reaches Auto Mall Parkway. This historic Laguna Creek currently collects all drainages in the watershed south of Mission Creek and does not carry flow from Central Park except during very large storms" (Jones & Stokes 1999).
>
> "Mission and Morrison Creeks drain the steep hills that form the eastern limit of development in the City. From the confluence with Morrison Creek, Mission Creek flows southward adjacent to Lake Elizabeth. At Paseo Padre Parkway, Mission Creek is split into Lines E and G. Line E follows the historic Laguna Creek channel. Most of the flow from Mission and Morrison Creeks draining through Central Park is carried by a flood control channel designated as Flood Zone 6 Line G. Line G begins at Paseo Padre Parkway and generally follows Grimmer Boulevard. It meanders for a short distance through the Rix Park neighborhood south of Blacow Road" (Jones & Stokes 1999).
>
> "Lines E and G flow generally southward through the City until they are combined near Interstate 880. Line E picks up significant runoff from other creeks that drain the Hills Planning Area of the City. Line G picks up only local runoff. The two channels, Laguna Creek and Line G, meet again near Interstate 880 and flow into the San Francisco Bay via Mud Slough" (Jones & Stokes 1999).
>
> "Significant erosion and sedimentation problems have been identified at several locations within the Laguna Creek watershed: Morrison Canyon; Mission Creek downstream of Palm Avenue; new developments north of Mission Boulevard; Lake Elizabeth; and Laguna Creek adjacent to Fremont Boulevard. Near the origins of Cañada Del Aliso in the Diablo Range, a substantial landslide has




Source: Santa Clara Valley Water District

occurred that threatens homes in the area and contributes significant quantities of sediment to the creek and its receiving waters, Laguna Creek" (Jones & Stokes 1999).

### 7.2.3 Lakes and Reservoirs

There are numerous lakes, reservoirs, and ponds in the Basin. Most of the lakes are really reservoirs in that they were created by dams constructed for water conservation purposes. Stevens Creek, Almaden, Calero, Guadalupe, Vasona, and Coyote reservoirs were constructed in the mid-1930s to store water for the recharge of the groundwater basin during the summer months.

There are two small reservoirs in the San Francisquito watershed, one major reservoir in the Stevens Creek watershed, seven reservoirs in the Guadalupe River watershed, and three reservoirs in the Coyote Creek watershed. There are no reservoirs of any consequence in the Matadero/Barron Creeks, Adobe Creek, Permanente Creek, Sunnyvale East/West, Calabazas Creek, San Tomas Aquino/Saratoga Creek, Lower Penitencia, or Arroyo la Laguna watersheds. Data on the lakes and reservoirs in the Basin are presented in Table 7-7.

The lakes and reservoirs in the Basin have other important attributes aside from their water conservation function. They are used extensively for recreation, provide some flood protection, and have significant wildlife habitat value. All of the reservoirs owned by the Water District are leased to the Santa Clara County Department of Parks and Recreation. Depending on the reservoir, permitted activities include powerboating, sailing, fishing, swimming, and picnicking.

Permanent reservoirs not only block upstream migration of fish but also replace lotic (flowing water) habitat with lentic (lake) habitat for fish and aquatic organisms. These altered environments support the presence of nonnative fish that are adapted to these lentic environments with calm water, moderate to low oxygen levels, and warmer temperatures. For example, inland silversides and threadfin shad are found almost exclusively in reservoirs. Other nonnative fish such as carp, catfish, and centrarchids (sunfish family) that thrive in reservoirs populate adjacent stream channels.

Reservoirs provide habitat for some native fish adapted to lentic conditions such as hitch and Sacramento blackfish. Reservoirs are also suitable for native fish species adapted to a range of environmental conditions such as California roach and Sacramento sucker. Since the large, permanent reservoirs in the Basin do not provide passage for steelhead, they would not be expected to occur in these reservoirs. Reservoirs can provide suitable rearing habitat for rainbow trout if appropriate temperatures, dissolved oxygen, habitat cover, substrate, and adequate food resources are available.

The CDFG maintains a "put-and-take" trout fishery in several urban lakes in addition to Coyote Reservoir, Lexington Reservoir, Stevens Creek Reservoir, and in Coyote Creek downstream of Anderson Dam (Margaret Roper, pers. comm., 1998).

The largest single source of nickel to the Bay appears to be the natural erosion of nickel-containing soils. (Natural erosion refers to erosion caused by factors unrealted to human activity.) Nickel is derived from recently disturbed serpentine geologic formations. Pyrrhotite is an iron sulfide mineral that contains small amounts of nickel and is reported to occur in the County (Woodward Clyde Consultants and EOA 1997).

Basin reservoirs have been identified as a major source of nickel to the Bay. Erosion causes metal-laden sediment to be transported into nearby streams then to Basin reservoirs and eventually to the Bay. Thus, natural erosion, and not reservoirs themselves, should be considered a source of the nickel to the Bay (Woodward Clyde Consultants and EOA 1997).

#### *7.2.3.1 Almaden Reservoir*

Almaden Reservoir is located on Alamitos Road south of the City of San Jose in west central Santa Clara County. The southeastern end of Almaden Quicksilver County Park is opposite Almaden Reservoir on the north side of Alamitos Road. Almaden Reservoir was completed in 1935. It has an average surface area of 59 acres and a capacity of 1,586 acre-feet. The reservoir extends roughly west-to-east in Almaden Canyon at the foot of the east-facing slopes of Sierra Azul, a principal northwest/southeast-trending ridge of the Santa Cruz Mountains (Water District 1995).

The Almaden Reservoir is located in a 12-square-mile drainage area of hilly terrain covered with range grass, low bushes, and trees. Almaden Reservoir collects runoff from the surrounding watershed that includes Herbert and Barrett Creeks flowing into the southwest end of the reservoir near the small community of Twin Creeks. Barrett Canyon Creek and Herbert Creek flow all year. Jacques Gulch Creek flows most of the year and Larabee Gulch Creek contributes during high peak flows, then drops off quickly (Iwamura 1999). The reservoir releases water to Alamitos Creek for groundwater recharge. During the rainy season, storms or long wet periods, often produce more runoff than the reservoir can contain. Excess runoff is directed to Calero Reservoir via the Almaden-Calero Canal. The Water District operates this reservoir for water conservation purposes only; however, there some incidental flood control benefits (Water District 1995).

Reservoir waters range from a calcium bicarbonate type to the more frequent calcium-magnesium bicarbonate type. This is consistent with the geology of the watershed (Iwamura 1999).

Beneficial uses established by the Regional Board include groundwater recharge, municipal and domestic water supply, wildlife habitat, warm and cold freshwater habitat, fish spawning, water contact recreation (fishing from shore), and noncontact water recreation. Bacteriological contamination from nearby residential septic systems has been a water quality concern for the reservoir. Petroleum product use associated with boating has historically been considered a potential water quality concern (Water District 1995).

**Table 7-7**
**Lakes and Reservoirs in the Santa Clara Basin by Watershed**

| Lake/Reservoir | Stream Location | Year Constructed[1] | Drainage Area (Sq Mi) | Surface Area (Acres) | Storage Capacity (Ac-ft) | Spillway Crest Elevation (Feet) | Reservoir Length (Miles) | Ownership[2] |
|---|---|---|---|---|---|---|---|---|
| **San Francisquito Creek Watershed** | | | | | | | | |
| Searsville Lake | Corte Madera Creek | 1892 | | 23 | 307 | 340 | 0.45 | SU |
| Felt Lake | Diversion from Los Trancos Creek | DU | | | | 360 | 0.4 | SU |
| Lake Lagunita | Water pumped from San Francisquito | 1880s | | | | | | SU |
| **Stevens Creek Watershed** | | | | | | | | |
| Stevens Creek Reservoir | Stevens Creek | 1935 | 17.3 | 92 | 3,465 | 535 | 1.1 | SCVWD |
| **Guadalupe River Watershed** | | | | | | | | |
| Almaden Lake | Alamitos Creek | DU | | | | | | |
| Almaden Reservoir | Alamitos Creek | 1935 | 12.0 | 59 | 1,780 | 607 | 1.1 | SCVWD |
| Calero Reservoir | Arroyo Calero Creek | 1935 | 6.9 | 347 | 10,050 | 484 | 2.2 | SCVWD |
| Guadalupe Reservoir | Guadalupe Creek | 1935 | 5.9 | 79 | 3,723 | 617 | 1.1 | SCVWD |
| Lake Couzzens | | DU | | | 153 | 1,387 | | SJWC |
| Lake Elsman (Austrian Dam) | Los Gatos Creek | 1951 | | | 6,153 | 1,110 | | SJWC |
| Lake Kittredge | | DU | | | 244 | 1,412 | | SJWC |
| Lake Ranch Reservoir (McKenzie) | Beardsley Creek | DU | | | 215 | 1,816 | | SJWC |
| Lexington Reservoir (James J. Lenihan Dam) | Los Gatos Creek | 1952 | 37.5 | 475 | 19,834 | 650 | 2.5 | SCVWD |
| Vasona Lake/Reservoir | Los Gatos Creek | 1935 | 43.9 | 57 | 400 | 295 | 0.8 | SCVWD |
| Williams Reservoir | Los Gatos Creek | DU | | | 157 | | | SJWC |
| **Coyote Creek Watershed** | | | | | | | | |
| Anderson Reservoir | Coyote Creek | 1950 | 192.7 | 1,245 | 89,073 | 625 | 7.8 | SCVWD |
| Bass Lake | San Felipe Creek | DU | 80.0 | 2.0 | | | <.1 | SCCPRD |
| Coyote Reservoir | Coyote Creek | 1936 | 121.0 | 648 | 22,925 | 777 | 4.8 | SCVWD |
| Cherry Flat Reservoir | Upper Penitencia Creek | 1932 | | | 100 | 1,680 | | SJCAED |
| Eagle Lake | San Felipe Creek | DU | 20.0 | 1.5 | | | <.1 | SCCPRD |
| Grant Lake | San Felipe Creek | DU | | 40 | | | | SCCPRD |
| Hellyer Pond | Off-Channel Coyote | DU | | | | | | |
| Lake Cunninghan | | DU | | | | | | |
| McCreery Lake | Arroyo Aguague | DU | | 1.5 | | | <.1 | SCCPRD |
| Pig Lake | San Felipe Creek | DU | 20.0 | .75 | | | <.1 | SCCPRD |
| Standish Dam | Lower Coyote Creek | 1994 | | | 74 | | | SCVWD |

## Table 7-7 (concluded)
## Lakes and Reservoirs in the Santa Clara Basin by Watershed

| Lake/Reservoir | Stream Location | Year Constructed[1] | Drainage Area (Sq Mi) | Surface Area (Acres) | Storage Capacity (Ac-ft) | Spillway Crest Elevation (Feet) | Reservoir Length (Miles) | Ownership[2] |
|---|---|---|---|---|---|---|---|---|
| **Lower Penitencia Creek Watershed** | | | | | | | | |
| Sandy Wool Lake | Tularcitos Creek | DU | | | | | | |
| Spring Valley Golf Club Lake | | DU | | | | | | |
| Spring Valley Lake | Arroyo Coches | DU | | | | | | |
| **Arroyo la Laguna Watershed** | | | | | | | | |
| Lake Elizabeth | Mission Creek | 1968/1986 | | 82 | 931 | 56 | | ACFCWCD |
| Mission Reservoir | Mission Creek | DU | | | | | | |
| Stivers Lagoon | Mission Creek | Natural | | 40 | | | | |
| Tule Pond (Tyson's Lagoon) | | Natural | | | | | | |

Sources: Santa Clara Valley Water District 1997
Brad Howald, pers. comm., 1998
City of Fremont 1999
Brady & Associates, Inc. 1995
Wels, Susan et al. Undated. Jasper Ridge, A Stanford Sanctuary.

[1] DU = date unknown
[2] Key: ACFCWCD = Alameda County Flood Control and Water Conservation District (Alameda County Public Works Agency)
SCCPRD = Santa Clara County Parks and Recreation District
SCVWD = Santa Clara Valley Water District
SJCAED = City of San Jose, Conventions, Arts, & Entertainment Department
SJWC = San Jose Water Company
SJWW = San Jose Water Works
SU = Stanford University

The now inactive New Almaden Mine atop Mine Hill is located northwest of Almaden Reservoir and a portion of the mine area is located within the reservoir watershed (Iwamura 1999). Studies have found that fish caught at Almaden Reservoir have had levels of methyl mercury that exceed U.S. Food and Drug Administration thresholds (Water District 1995). It is suspected that the problem of accumulated mercury in the flesh of fishes has a significant part of its origin from mine wastes washed into streams and into the reservoir from the mercury mining activities at the New Almaden Mine, largely via Jacques Gulch (Iwamura 1999).

#### *7.2.3.2 Anderson Reservoir*

Anderson Reservoir is located within Anderson Lake County Park in the southern portion of Santa Clara County approximately 2 miles northeast of the City of Morgan Hill. Anderson Reservoir was completed in 1950. It has an average surface area of 1,245 acres and a capacity of 89,073 acre-feet (Water District 1995).

Anderson Reservoir impounds water from several creeks: Coyote Creek flows into the reservoir at the southern end; Otis Creek joins Coyote Creek near the southern end of the lake; Packwood Creek drains into the reservoir roughly midway; and San Felipe, Las Animas, and Shingle Valley Creeks flow into the northern end. The reservoir is approximately 7 miles long, and ½ mile at maximum width. The northwest/southeast-trending valley flooded by Anderson Reservoir was the juncture at which the northern creeks joined Coyote Creek before a descent from the western foothills of the Diablo (Mt. Hamilton) Range foothills to the Santa Clara Valley. The drainage area upstream from Anderson Reservoir is approximately 193 square miles (Water District 1995).

The principal purpose of Anderson Reservoir is to impound the flows of several creeks and the stormwater runoff from the surrounding watershed for controlled release during the drier months of the year to aid in aquifer recharge. Coyote Reservoir and Anderson Reservoir are a reservoir series impounding the same principal water source, Coyote Creek. Coyote Reservoir releases water downstream via Coyote Creek to Anderson Reservoir. Anderson Reservoir then releases water to the Santa Clara Valley portion of Coyote Creek, where it recharges the Santa Clara Groundwater Subbasin through a series of percolation ponds that have been constructed along the north-flowing path of Coyote Creek (Water District 1995).

The general mineral quality of the waters from the Coyote Creek watershed above Anderson Dam is dominated by calcium, magnesium, and bicarbonate. Contribution of calcium and bicarbonate comes from all the geologic formations, while a large contribution of magnesium comes from the Franciscan Group, particularly from the serpentine member (Iwamura 1999).

> "Housing developments are located along the southwest side of Anderson Reservoir. Most are sewered to a publicly owned treatment plant but some are not. In the past and to the present, certain accidental incidents of sewage spills into the reservoirs had been noted. Septic tank systems are also associated with the limited recreational developments on the west side of Coyote Reservoir." (Iwamura 1999).

An industrial development occurs in two small tributaries to the northern arm of Anderson Reservoir. The development is the Coyote Unit, Chemical Systems Division of United Technologies Corporation and is located in Shingle Valley and in the adjacent valley referred to as Mixer Valley. The operations consist of the manufacturing and testing of solid fuel rocket propellant. Volatile organic solvents have locally contaminated soils and groundwater. With remedial action activities implemented by United Technologies Corporation, the contamination is confined to the property itself (Iwamura 1999).

Recreational motorized boating occurs at Anderson Reservoir. Methyl tert-butyl ether (MTBE) and oil film are present in the reservoir waters at trace levels. The Water District is monitoring MTBE levels within the reservoir, and as a means of controlling its level, the District and County Parks and Recreation Department started to regulate motorized boating activities on the reservoir (Iwamura 1999).

#### *7.2.3.3 Calero Reservoir*

Calero Reservoir is located in the central area of southern Santa Clara County just south of the Santa Teresa Hills section of San Jose and east of the community of New Almaden and Almaden Reservoir. Calero Reservoir was completed in 1935. It has a surface area of 347 acres and a capacity of 10,050 acre-feet (Water District 1995).

Calero Reservoir dam impounds Calero Creek on the west end, flooding a section of the broad Calero Creek Valley of the eastern foothills of the Santa Cruz Mountains. A smaller saddle dam was constructed along McKean Road north of the main dam. The U-shaped Calero Reservoir is approximately 5½ miles long and 2 miles wide at the western end, its widest point. Calero Reservoir collects runoff from a 7-square-mile drainage area and also receives surplus surface water from Almaden Reservoir via the Almaden-Calero Canal. Excess runoff from Almaden is transferred to Calero Reservoir, which has a storage capacity five times greater than that of Almaden. The area surrounding the reservoir is predominantly grasslands and oak savannah (Water District 1995).

The inflows into Calero Reservoir include Arroyo Calero and Cherry Creek, which flow most of the year at low volume. Cow Creek also contributes part of the year (Iwamura 1999).

The primary purpose for Calero Reservoir is controlled release of surface runoff for downstream groundwater recharge. Recharge waters are released either directly to Calero Creek or to the Almaden Valley Pipeline that delivers raw water to the Vasona Pumping Station, approximately 1 mile north of Vasona Reservoir. Water District operates Vasona Reservoir for water conservation purposes; however, there may be some incidental flood control benefits.

Reservoir water represents a mix of indigenous waters from within the watershed and additional waters diverted into the reservoir from Almaden Reservoir via the Almaden-Calero Canal. It should be noted that the Almaden-Calero Canal water transfer is a source of mercury transfer to Calero Reservoir (Keith Anderson, pers. comm., 1998). At times, imported waters from the San Felipe Project could be discharged into the reservoir; therefore, the reservoir water quality could vary with the scheme of reservoir operation. The mix of waters in the reservoir should produce a calcium bicarbonate to a calcium-magnesuim type water, a lot like the mineral quality of Almaden Reservoir water (Iwamura 1999).

Beneficial uses established by the Regional Board include groundwater recharge, municipal and domestic water supply, wildlife habitat, warm freshwater habitat, fish spawning, water contact recreation, and noncontact water recreation. Water quality in the reservoir is influenced by many sources, including cattle grazing, stables, and water originating in the Almaden watershed. Historical water quality issues of concern have been elevated levels of bacteriological contamination (coliforms), iron and manganese, mercury, and algae. Petroleum product use associated with boating has historically been considered a potential water quality concern. No mercury mining historically took place in the Calero Reservoir watershed, but naturally occurring mercury deposits are present in the watershed. Sampling of the tissue of fish caught in Calero Reservoir has determined that mercury levels exceed those set by the U.S. Food and Drug Administration (Water District 1995).

The Arroyo Calero watershed above Calero Reservoir is devoid of mercury mining or any other type of mining activity (Iwamura 1999).

#### *7.2.3.4 Cherry Flat Reservoir*

Cherry Flat Reservoir is located in the Upper Penitencia Creek watershed upstream from Alum Rock Park. Cherry Flat Reservoir was constructed in 1932 as a means of solving the constant problem of reoccurring floods and drought in Alum Rock Park. Cherry Flat Reservoir has a storage capacity of 100 acre-feet. The San Jose Conventions, Arts, and Entertainment Department owns and operates the reservoir.

#### *7.2.3.5 Coyote Reservoir*

Coyote Reservoir is within Coyote Lake County Park situated in the southern portion of Santa Clara County approximately 4½ miles east of the City of Gilroy. Coyote Reservoir was completed in 1936. It has an average surface area of 648 acres and a capacity of 22,925 acre-feet. The reservoir is approximately 3.2 miles in length and 1,800 feet at its widest point (Water District 1995).

Coyote Reservoir has a 121-square-mile drainage area. The Reservoir collects runoff from the ridges to the east and west of the Coyote Creek drainage basin in addition to the flow of Coyote Creek. Coyote Reservoir releases water into Coyote Creek that flows north approximately 2 miles to Anderson Reservoir (Water District 1995).

Coyote Reservoir is located in a northwest-trending narrow valley in the Mt. Hamilton foothills west of Timber Ridge. The prominent geologic feature of the western front range foothills is the northwest-trending seismically active Calaveras fault that underlies the creek channel of Coyote Creek north of the reservoir, as well as underlying nearly the entire length of the reservoir (Water District 1995).

The Regional Board has established the following beneficial uses: municipal and domestic water supply, agricultural supply, wildlife habitat, warm and cold freshwater habitat, fish spawning, water contact recreation, and noncontact water recreation. Parameters of concern include bacteriological and pathogenic contaminants that could originate from cattle grazing and park facility leach fields.

### *7.2.3.6 Guadalupe Reservoir*

Guadalupe Reservoir is located on the southern boundary of Almaden Quicksilver County Park on Hicks Road in unincorporated central Santa Clara County south of the City of San Jose. The Guadalupe Reservoir dam is located on Guadalupe Creek approximately 2 miles south of the Almaden Valley area of San Jose. Guadalupe Reservoir was completed in 1935. It has an average surface area of 79 acres and a capacity of 3228 acre-feet (Water District 1995).

Guadalupe Reservoir impounds the channel of Guadalupe Creek in a narrow, northwest-trending valley. The valley is in the northern foothills of the Sierra Azul, a massive ridge complex in the northern Santa Cruz Mountains. At the south end of the Reservoir, Los Capitancillos Creek from the west and Rincon Creek from the east join Guadalupe Creek. The ridge north of the Reservoir, rising to 849 feet, is part of Almaden Quicksilver County Park and was the site of the Enriquita Mine and Providencia Mine, former cinnabar (mercuric sulfide) mines. Numerous unnamed intermittent streams drain from this ridge into the reservoir. The drainage area upstream from Guadalupe Reservoir is approximately 6 square miles (Water District 1995).

> "The primary inflows into the reservoir are Guadalupe Creek which runs all year at a low volume, Rincon Creek which confluences with Guadalupe Creek and can run all year, and Los Capitancillos Creek. Los Capitancillos Creek contributes water mainly during flooding events and is considered 'flashy.' Rincon Creek, although it can flow all year, is also considered to be 'flashy'" (Iwamura 1999).

The principal purpose of Guadalupe Reservoir is to provide staged releases of impounded water to the Alamitos Percolation Pond system downstream on Guadalupe Creek. Water District operates this reservoir for water conservation purposes; however, there may be some incidental flood control benefits (Water District 1995).

Beneficial uses established for Guadalupe Reservoir include groundwater recharge, municipal and domestic water supply, wildlife habitat, warm and cold freshwater habitat, fish spawning, water contact recreation (fishing from shore/boat), and noncontact water recreation (Water District 1995).

The limited number of complete mineral analyses available indicates the waters to be a consistent calcium-magnesium bicarbonate type. It is surprising that the magnesium equivalent percentage is not higher, since the watershed drainage is almost entirely underlain by the Franciscan Group and its related serpentine member (Iwamura 1999).

Adjacent to the north and east side of the reservoir are old mine workings of the San Antonio Mine and the Enriqueta Mine. Just upstream of the reservoir occurs the old workings of the Providencia Mine, and further upstream on the Los Capitancillos tributary are the American Mine and the New Almaden Mine atop Mine Hill. Downstream of the reservoir is the San Mateo Mine on the north side of Guadalupe Creek at the toe of the dam, and the Senator Mine a little further downstream. None of these old mercury mines is active (Iwamura 1999).

### 7.2.3.7 Lake Elizabeth and Stivers Lagoon

> “Stivers Lagoon is one of a number of freshwater marshes along the east side of the Hayward fault. The marsh was formed as a sag pond (i.e., an accumulation of groundwater that fills a depression formed by the fault). This movement created a shallow depression of approximately 200 acres. The marsh is primarily fed by Mission Creek” (Jones & Stokes 1999).
>
> Stivers Lagoon “historically included both areas of deep open water and freshwater marsh. Hydrologically, the lagoon functioned similarly to a lake, with the creeks discharging into a broad open area with a well-defined outlet channel downstream known as Laguna Creek. As a result, the water depth and inundated areas would have varied both seasonally and annually. Levees were constructed around the marsh in the mid-1900s to limit the extent of flooding and to reduce soil saturation. In the mid-1930s, a channel was excavated through the marsh for flood control and indirectly dried the marsh soils, particularly in the summer months. Continued excavation and dredging of this channel up to the present time has allowed the encroachment of upland plant species into the former lagoon. Stivers Lagoon now comprises approximately 40 acres and is fed by both Mission and Morrison Creeks.” (Jones & Stokes 1999).

Lake Elizabeth was created in 1968 by excavating a portion of Stivers Lagoon. The lake was expanded to its current 82-acre area in 1986. Lake Elizabeth is owned and operated by the Alameda County Flood Control and Water District (ACFCWD) as an integral part of the Mission Creek flood control system. A realigned channel was created for Mission Creek.

> “High flows in Mission Creek backup at the Paseo Padre culverts and flow over a weir into Lake Elizabeth. When flows recede, Lake Elizabeth drains back into Mission Creek via the same weir. During the summer months, the City installs flash boards in the weir to regulate the lake level for recreation. Under its lease agreement with the [ACFCWD], the City must maintain 931 acre-feet of storage within the lake at an elevation of 55.6 feet above mean sea level”.
>
> “Lake Elizabeth, Stivers Lagoon, and Mission Creek adjacent to the lake are sediment sinks. Materials transported from Morrison Canyon and Mission Creek settle out in these areas because of the abrupt change in slope, which reduces creek velocity and the creek’s ability to carry sediment” (Jones & Stokes 1999).

> "In 1968, a sediment basin with a 25,000 cubic yard capacity was also created to trap sediments before they entered Lake Elizabeth in large flood events. Analysis of aerial photos showed that by 1983 the sediment basin was filled and wetland vegetation had become established" (Jones & Stokes 1999).
>
> "The [ACFCWD] has dredged the Mission Creek channel to remove excessive sediment and restore channel capacity. This action has caused adjacent marsh lands of Stivers Lagoon to become disconnected from the creek during low summer flows".
>
> "Lake Elizabeth has slowly filled with sediment to the extent that water levels are critically low in summer months and do not adequately support water sports such as sailing".

#### *7.2.3.8 Lake Elsman*

Lake Elsman is located upstream of Lexington Reservoir in the Los Gatos Creek watershed. Lake Elsman has a storage capacity of 6,200 acre-feet. Water released from Lake Elsman flows to Lexington Reservoir.

#### *7.2.3.9 Lake Williams*

Lake Williams is a small impoundment on Los Gatos Creek immediately upstream of Lexington Reservoir.

#### *7.2.3.10 Lexington Reservoir*

Lexington Reservoir is located adjacent to State Highway 17 in unincorporated western Santa Clara County approximately 1 mile south of the Town of Los Gatos. Lexington Reservoir was completed in 1952. It has an average surface area of 475 acres and a capacity of 19,044 acre-feet (Water District 1995).

The James J. Lenihan Dam impounds Los Gatos Creek and numerous other drainages within the surrounding watershed. Los Gatos Creek enters the south end of the reservoir, while Lime Kiln Creek and Soda Springs Creek drain into the reservoir from the east, Aldercroft Creek, Black Creek and Briggs Creek from the west, and Moody Gulch and Hendrys Creek from the south. Hendrys Creek, Los Gatos Creek (with Lake Elsman), and Aldercroft Creek contribute water most of the year. Briggs Creek, Black Creek, and Beardsley Creek contribute water only part of the year during the wet season (Iwamura 1999). The drainage area upstream of Lexington Reservoir is 369 square miles. The principal geologic feature of the Lexington Reservoir vicinity is the San Andreas Fault zone that trends northwest/southeast through the extreme southern end of the reservoir (Water District 1995).

Lexington Reservoir discharges to the north to the Los Gatos Creek channel at the base of Sierra Azul. Lexington Reservoir is roughly 2½ miles long and 3,000 feet wide at the northern end near the dam. The reservoir also includes several deep sloughs where reservoir waters have backed into the creek channels of Soda Springs Canyon Creek, Aldercroft Creek, and Briggs Creek (Water District 1995).

The primary purpose of the Lexington Reservoir is to store water for scheduled releases to replenish groundwater at recharge facilities further downstream on Los Gatos Creek (Water District 1995).

The mineral quality of the reservoir waters ranges from calcium bicarbonate to calcium-magnesium bicarbonate type. This is consistent with the geologic character of the watershed (Iwamura 1999).

Several insignificant mercury prospects occur within the Los Gatos Creek watershed. Perhaps the only significant metals prospect is the Hooker Creek copper prospect located at Aldercroft Heights. The limited mining activity continued intermittently from 1917 to 1929. A small production of gold and silver was reported from 1936 to 1938, and since then the prospects have been inactive. They pose no adverse effect upon the overall water quality of the reservoir waters (Iwamura 1999).

> "Quarrying activities have been in the form of limestone at two sites up the Lime Kiln Canyon tributary of Lexington Reservoir. These are the Douglas Ranch and the Lyndon quarries. Small stone quarrying operations occurred at various locations within the watershed but perhaps most notably at the Alma Fire Station area. These quarries are inactive and generally pose little effect on the overall quality of reservoir areas" (Iwamura 1999).

A once active, very small oil field is located 2½ miles upstream (south) of Lenihan (Lexington) Dam in the Moody Gulch area. The oil field was discovered in 1879 and had its greatest production before 1912. It had produced intermittently to the 1950s, but by then it was producing only a couple of barrels per day. Today, most of the wells are buried beneath State Highway 17 fill at Moody Gulch (Iwamura 1999).

Of the reservoir watersheds in the county, Los Gatos Creek above Lexington is the most highly developed. Aldercroft Heights, Chemeketa Park, Holy City, Redwood Estates, and a development above Lexington Reservoir on the Monte Vina arm are clusters of development within the watershed above Lexington Reservoir. In addition, there are individual houses and estates outside the relatively densely populated areas, and also schools and recreational camps. These developments have the potential to cause nutrient loading due to septic tanks. Short-term sediment yield from construction and longer-term yields from roads could also pose reservoir water quality problems. According to the analyses of reservoir waters, nutrient load does not appear to be a problem thus far for the reservoir (Iwamura 1999).

### *7.2.3.11 Searsville Lake*

Searsville Lake is located in the San Francisquito Creek watershed. San Francisquito Creek begins at the outlet of Searsville Dam. The reservoir is approximately 12.5 miles upstream from the Bay. Searsville Lake has a surface area of approximately 35 acres. Tributaries in the upper watershed that feed into Searsville Lake include Alambique Creek, Martin Creek, Sausal Creek, and Corte Madera Creek.

In 1879, the United States District Court condemned the mill town of Searsville for a new reservoir that would extend San Francisco's domestic water collection system. Most houses were moved away, and by the time the first classes were taught at Stanford University in 1891, Searsville Lake was filling with water for the first time (Wels et al., undated).

First dammed in 1892, the lake once covered 90 acres in a "Y" shape, with arms reaching through swamp and marshlands. Today, the swamp is drying out, and the lake itself covers less than 23 acres. More than 45 feet of silt have gathered on the bottom, reducing the lake's depth to only 22 feet at the center (Wels et al., undated).

### *7.2.3.12 Stevens Creek Reservoir*

Stevens Creek Reservoir is located in Stevens Creek Park on Stevens Canyon Road just south of the city limits of Cupertino in western Santa Clara County. Stevens Creek Reservoir was completed in 1935. It has an average surface area of 197 acres and a capacity of 3,465 acre-feet (Water District 1995). The dam is located downstream of the confluence of Stevens Creek and Swiss Creek (Iwamura 1999).

Stevens Creek has cut a narrow canyon along the base of Montebello Ridge on the north and Table Mountain to the south. Montebello Ridge, a northwest-trending ridge, is adjacent to and east of the San Andreas Fault zone that crosses within 500 feet of the southern end of Stevens Creek County Park. The reservoir impounds the creek at the point where the canyon begins to widen as it descends from the northeastern foothills of the Santa Cruz Mountains. Stevens Creek Reservoir is located in a 17-square-mile drainage basin (Water District 1995).

> "There are three primary inflows into the reservoir: Stevens Creek, Swiss Creek, and Firehouse Creek. Stevens Creek and Swiss Creek typically run all year. Firehouse Creek does not run all year and contributes mostly in the rainy season. Stevens Creek is supplemented by four main tributaries: Indian Creek, Bay Creek, Indian Cabin Creek, and Gold Mine Creek. There are numerous springs located on the southwest side of Montebello Ridge which feed the tributaries." (Iwamura 1999).

Mineral analyses indicate the waters to be calcium bicarbonate and magnesium-calcium bicarbonate types. These mineral types are consistent with the geology of the watershed; the calcium bicarbonate types are suspected to predominate at times of high runoffs; magnesium-calcium bicarbonate are suspected to predominate at times of lower flows (Iwamura 1999).

The primary purpose of Stevens Creek Reservoir is to impound the water of Stevens Creek for percolation to recharge the Santa Clara Groundwater Subbasin. The Water District operates this reservoir for water conservation purposes; however, there may be some incidental flood control benefits (Water District 1995).

Beneficial uses established by the Regional Board include groundwater recharge, municipal and domestic water supply, wildlife habitat, warm and cold freshwater habitat, fish spawning and migration, and noncontact water recreation (Water District 1995).

"There are no known active or inactive mining activities in the watershed. In the past, gravel quarrying operations occurred in the area of Stevens Creek Dam and upstream on one of the northern tributaries close to the dam. These operations involved the quarry of gravels from the conglomerate of the Santa Clara formation" (Iwamura 1999).

Limited recreational activities occur in the reservoir area and in the watershed, including a recreation camp. The limited amount of sampling of reservoir water has not indicated any potential nutrient problem (Iwamura 1999).

#### *7.2.3.13 Vasona Lake/Reservoir*

Vasona Reservoir is located within Vasona Lake County Park in the Town of Los Gatos near the intersection of State Highway 17 and State Highway 85. Vasona Dam is located on Los Gatos Creek approximately 2 miles downstream (northeast) of Lenihan Dam. The watershed drainage area downstream of Lexington Reservoir is approximately 6.46 square miles. Vasona Reservoir was completed in 1935. It has an average surface area of 58 acres and a capacity of 400 acre-feet (Water District 1995).

"The Los Gatos Creek watershed between Vasona Dam and Lexington Reservoir is a relatively small watershed with a little more than one-half its area in the mountains and foothills of the Santa Cruz Mountains, and the remainder on the valley floor of Santa Clara Valley" (Iwamura 1999). The upper part of the watershed is located on the eastern slopes of El Sereno and the northern slopes of St. Joseph's Hill. The lower part of the watershed consists of the mainly flat Los Gatos area north of the upper part of the watershed. The lower part of the watershed is well developed and urbanized. The upper part is less urbanized in the steeper portions (Iwamura 1999). The town of Los Gatos and City of Monte Sereno lie within the lower portion of the watershed.

Vasona Reservoir is located in the alluvial floodplain formed by Los Gatos Creek prior to its channelization. The Water District uses the reservoir to store and release recharge waters to percolation ponds further downstream on Los Gatos Creek (Water District 1995).

> "Inflow into Vasona is mainly from Lexington Reservoir and smaller amounts from urban runoff through stormdrains and surface runoff. There is also contribution from Trout Creek, which runs all year and empties into Los Gatos Creek. Almendra Creek contributes only during storm flash flooding" (Iwamura 1999).

Beneficial uses established by the Regional Board for Vasona Reservoir include industrial process supply, navigation, ocean commercial and sport fishing, warm freshwater habitat, fish migration, water contact recreation, and areas of special biological significance (Water District 1995).

Park visitors actively use the reservoir and surrounding parklands. One water quality concern related to recreation is the concentration of waterfowl in and around the reservoir. Waste matter from waterfowl has the potential to result in reduced dissolved oxygen levels, and an increase of suspended materials, biostimulatory substances, and unpleasant odors (Water District 1995).

Since the capacity of Vasona Reservoir is small, water released from Lexington Reservoir is just momentarily detained in Vasona Reservoir before passing through. However, as the flows from Lexington passes through urban areas, landscaped urban recreational parks, and Vasona Reservoir, itself a refuge for ducks, geese, and other birds, subtle differences in quality are noted from Lexington Reservoir discharge to Vasona Reservoir. In most instances, the nitrate, total phosphorus, total organic carbon, dissolved organic carbon, and heavy metals content are slightly higher at Vasona as compared to Lexington waters, although the concentrations of these constituents are still considered to be extremely low (Iwamura 1999).

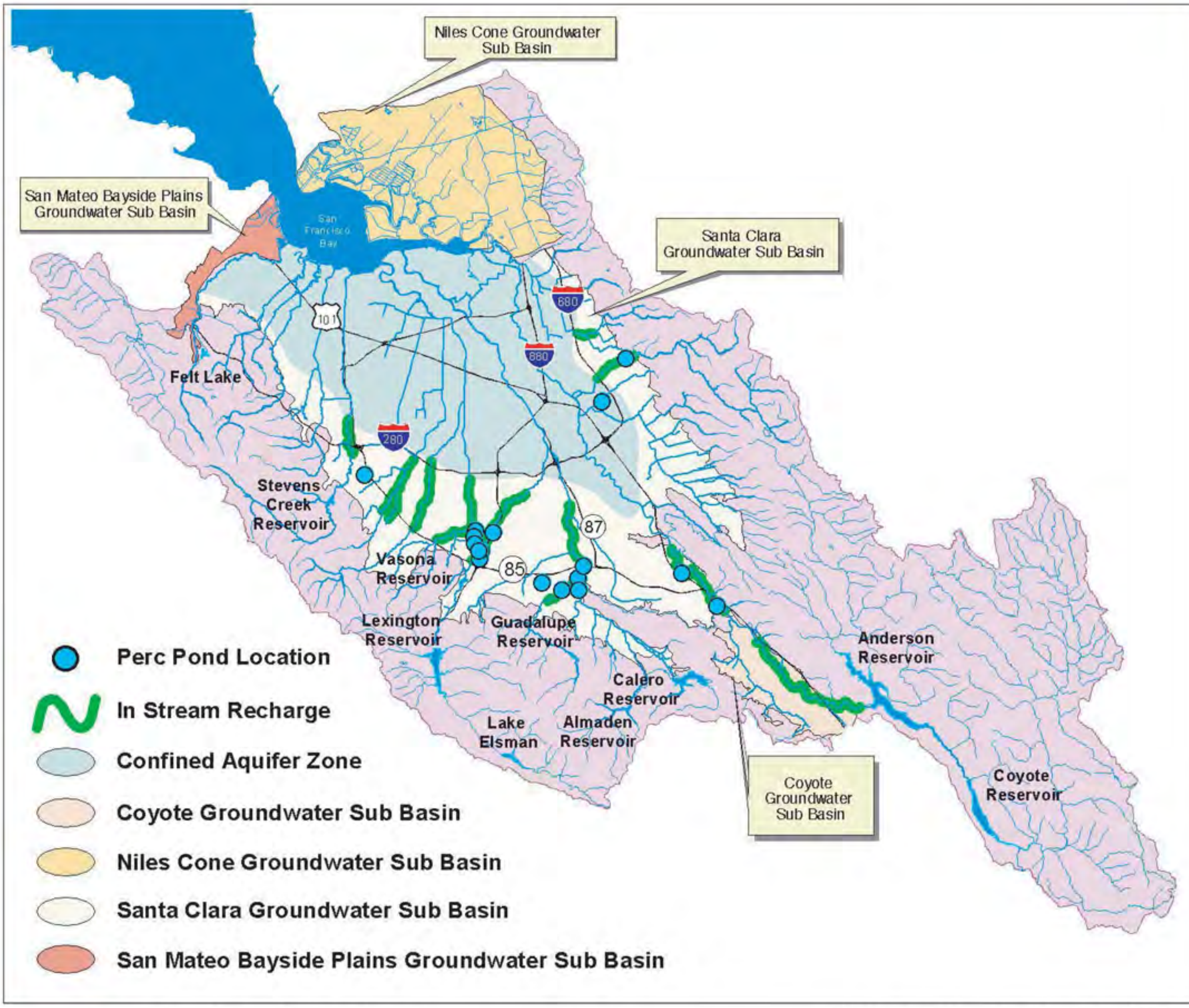
### 7.2.4 Groundwater Basins

The groundwater resources of the Basin are considerable. Although very little water is found in the hard bedrock formations that underlie the mountainous and foothill areas, groundwater is abundant in the valley. The geologic materials that have filled the Santa Clara Valley over millions of years are comprised of gravels, sands, and silty sands. These types of deposits are very permeable (transmit water easily) and constitute good aquifers[15] (water-bearing units), which have the capability to yield large flows to wells (Wilson and Iwamura 1989). In most areas of the Basin, groundwater quality is good to excellent and is suitable for most beneficial uses (Wilson and Iwamura 1989). Groundwater wells contribute about half the potable water supply in Santa Clara County.

The Basin groundwater system is composed of a large valley filled with sediment that has been divided into four interconnected subbasins, as shown on Figure 7-24. The largest of these subbasins, and the most important with respect to local water supply, is the Santa Clara groundwater subbasin. The southern groundwater basin is the Coyote Basin, located south of the Coyote Narrows, while the Niles Cone and San Mateo Bayside Plains groundwater subbasins are located adjacent to the east and west shores of the Bay, respectively. Like the other groundwater subbasins, the Santa Clara subbasin is composed of silt, sand, clay, and gravels that have been washed down from the Diablo Range and Santa Cruz Mountains and deposited by rivers and streams in the low foothills and in the valley between the two mountain ranges (Iwamura 1995).

[15] Aquifers are typically composed of varying layers of sand and loose, porous soils containing small voids in which water can reside and flow (Water District 1998).

# FIGURE 7-24
## Groundwater Basins in the Santa Clara Basin




*Source: Santa Clara Valley Water District*

At the edge of the subbasins, in the low foothills, the geologic materials that compose the aquifers are exposed at the ground surface. These zones are collectively known as the “forebay” of the aquifer. In these exposed areas, rainfall, streamflow, and other surface water is able to infiltrate and to seep into the aquifer (Iwamura 1995). The infiltration of new water into the aquifer is a process called “recharge,” and is critical to continued use of the aquifer. The Water District is active in promoting recharge to the aquifer, and uses local and imported water to recharge the subbasin with 393 acres of percolation ponds located throughout Santa Clara County. Seasonal dams on creeks and rivers are also used to encourage instream recharge (Water District 1998).

From the recharge areas at the margins of the subbasins, groundwater flows downgradient towards the valley flat. Outside of the recharge areas, the Santa Clara subbasin becomes divided vertically into two major water-bearing zones. These two zones are located above and below a very thick layer of clay, or aquiclude, which prevents groundwater movement and exchange between the two zones. Throughout most of the subbasin, the clay layer is encountered at a depth of approximately 150 feet (Iwamura 1995). Water-bearing units beneath this clay layer are called confined aquifers, and have slightly different hydraulic properties than the unconfined aquifers above them. The unconfined aquifers in the subbasin are little used now, but still represent an important resource that could be used in the future or under emergency conditions[16].

Like the Santa Clara subbasin, the Coyote Valley subbasin is filled with alluvial (river deposited) sediments and is interconnected with the Santa Clara subbasin to the north through the Coyote Narrows. The bulk of the water-bearing alluvial deposits emanated from Coyote Creek as it entered the valley floor from the east side of the Diablo Range. Groundwater occurs in the alluvial fill and is essentially unconfined as it moves in a general northwesterly direction down the valley. Depths to groundwater in the subbasin range from about 40 feet to less than 10 feet. As the subbasin becomes restricted at the Coyote Narrows, groundwater rises so as to discharge into Coyote Creek just upstream of the Coyote Narrows (Wilson and Iwamura 1989).

The Santa Clara Valley subbasin is a managed groundwater system. The Water District recharges the subbasin with water to counterbalance water pumped from the aquifer. In addition to helping maintain groundwater supplies, recharge ameliorates problems related to land subsidence. Subsidence is a broad sagging of the land surface over many miles as a result of decreased water pressure in the underlying aquifers, and is a phenomenon that has occurred extensively in the Santa Clara subbasin during the 20th century (Water District 1998). The broad sag of the land surface had centers of subsidence centered near downtown San Jose and in the Mountain View-Sunnyvale area, and extending into Alviso and Palo Alto (Figure 7-25) (Iwamura 1995).

The recharge program uses storm runoff caught in the local reservoirs and Sacramento-San Joaquin River waters imported through the Central Valley Project.

[16] Small portions of the upper aquifers have become contaminated from industrial and fueling operations. These are under investigation and most of the plumes are being remediated (Tom Iwamura, pers. comm., 1998).

The Alameda County Water District operates a similar recharge program throughout the Fremont area, using a combination of waters from local reservoirs and from the Delta to recharge the Niles Cone groundwater subbasin. Although most of the Alameda Creek alluvial deposits are just beyond the northern boundary of the Basin, some of the Alameda Creek recharge does enter portions of the northeastern corner of the Basin, and also flows at depths of several hundred feet beneath the Bay, sustaining the groundwater pumped along the bayfront in Palo Alto, Menlo Park, East Palo Alto and Mountain View.

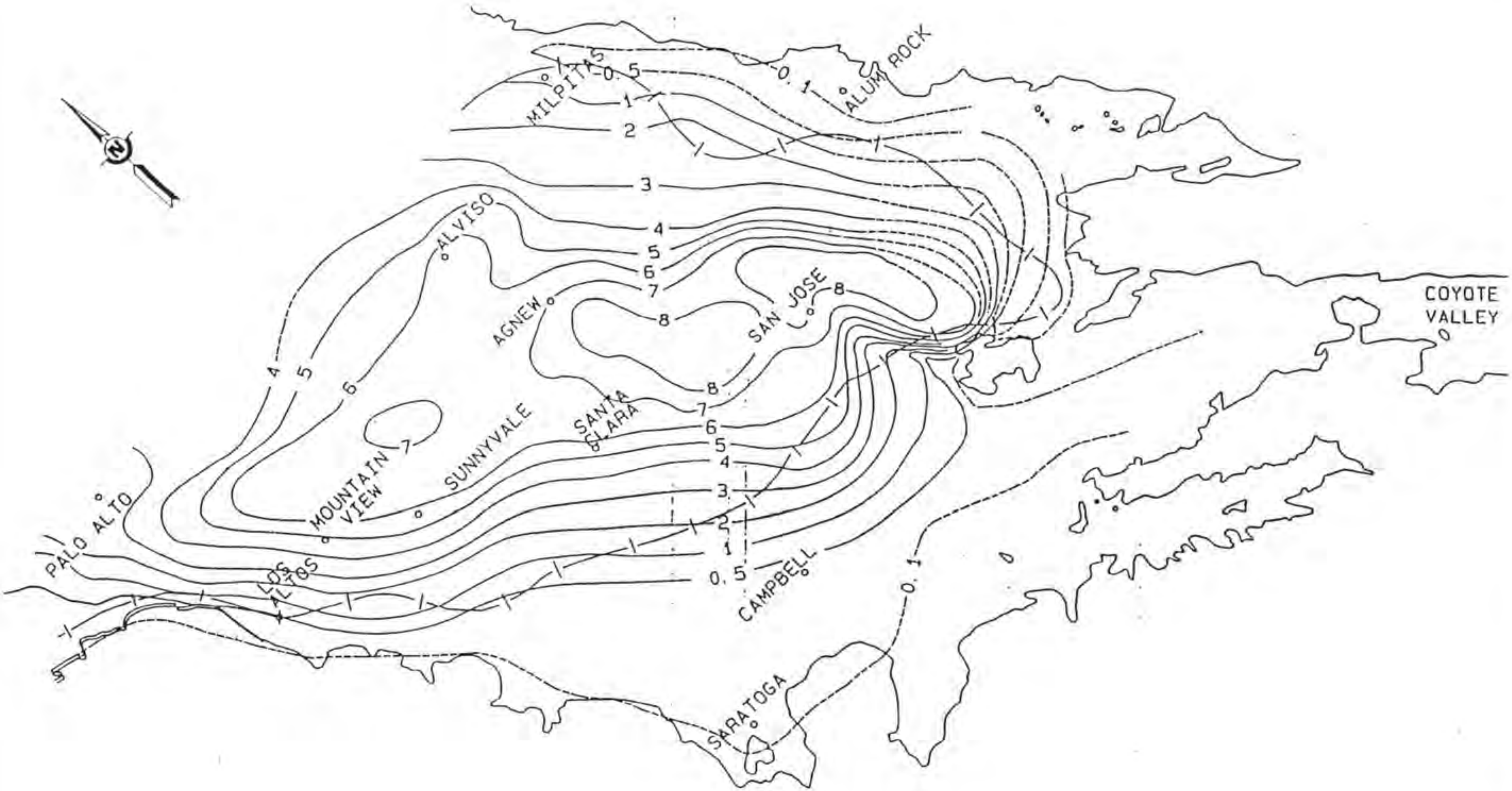
Smaller groundwater basins are found along streams in the foothills of the Santa Cruz Mountains from Morgan Hill northward to Atherton. Groundwater that percolates through fractured bedrock and through fault zones plays locally important roles in sustaining summer streamflow, which is needed by streamside vegetation, fish, and other wildlife. Groundwater pumped from local wells is used by Stanford for irrigation and as a backup potable water supply for Palo Alto.

#### *7.2.4.1 Land Subsidence*

The decrease in water pressure that led to land subsidence in the Santa Clara subbasin was due largely to overpumping of the aquifer. Prior to the turn of the century, very little water was pumped from wells in the lowlying interior portion of the subbasin, and what little was pumped was for domestic use. With the development of the deep well turbine pump and the availability of cheap electrical power, pumping from wells for agricultural irrigation became popular. In 1912, only about 30 percent of the valley land was irrigated, but by 1920, 67 percent was irrigated. Nearly all of this water was pumped from wells. The period from 1920 to 1936 was abnormally dry, and as a result, more and more wells were drilled to meet increasing demands for water (Roll 1964). The effects of groundwater overdraft were dramatic.

In the Basin, one serious consequence of subsidence was that lands near the Bay sank below sea level. Land subsidence started around 1920 and continued until 1969, enabling saltwater to intrude upstream through the mouths of rivers, dramatically affecting the riparian (stream channel) habitat of those rivers (Water District 1998). Land subsidence also altered the gradients of streams, affected streamflow capacity, and cost taxpayers millions of dollars in levees (Tom Iwamura, pers. comm., 1998). The most serious cases of saltwater intrusion occurred in the Guadalupe River area from Alviso to Montague Bridge, and in the Palo Alto bayfront area (Wilson and Iwamura 1989). Other effects have resulted from this gradual change in the elevation of the ground surface: one of these is damage to wells within the area in which subsidence occurred (Roll 1964); and another has to do with the amount of land below sea level in the region. As the land subsided, levees fronting on the Bay and the main streams were raised, often 6 to 10 feet, in order to prevent flooding. This has reduced the extent of tidal marshes, which provide important wildlife habitat, and has diminished daily tidal exchanges, making the South Bay more stagnant.

Several attempts have been made to arrest the problem of land subsidence, and relative success has been achieved in recent decades. Figure 7-26 shows the relationship between groundwater elevations and land subsidence in Santa Clara County. The subsidence issue led to the creation



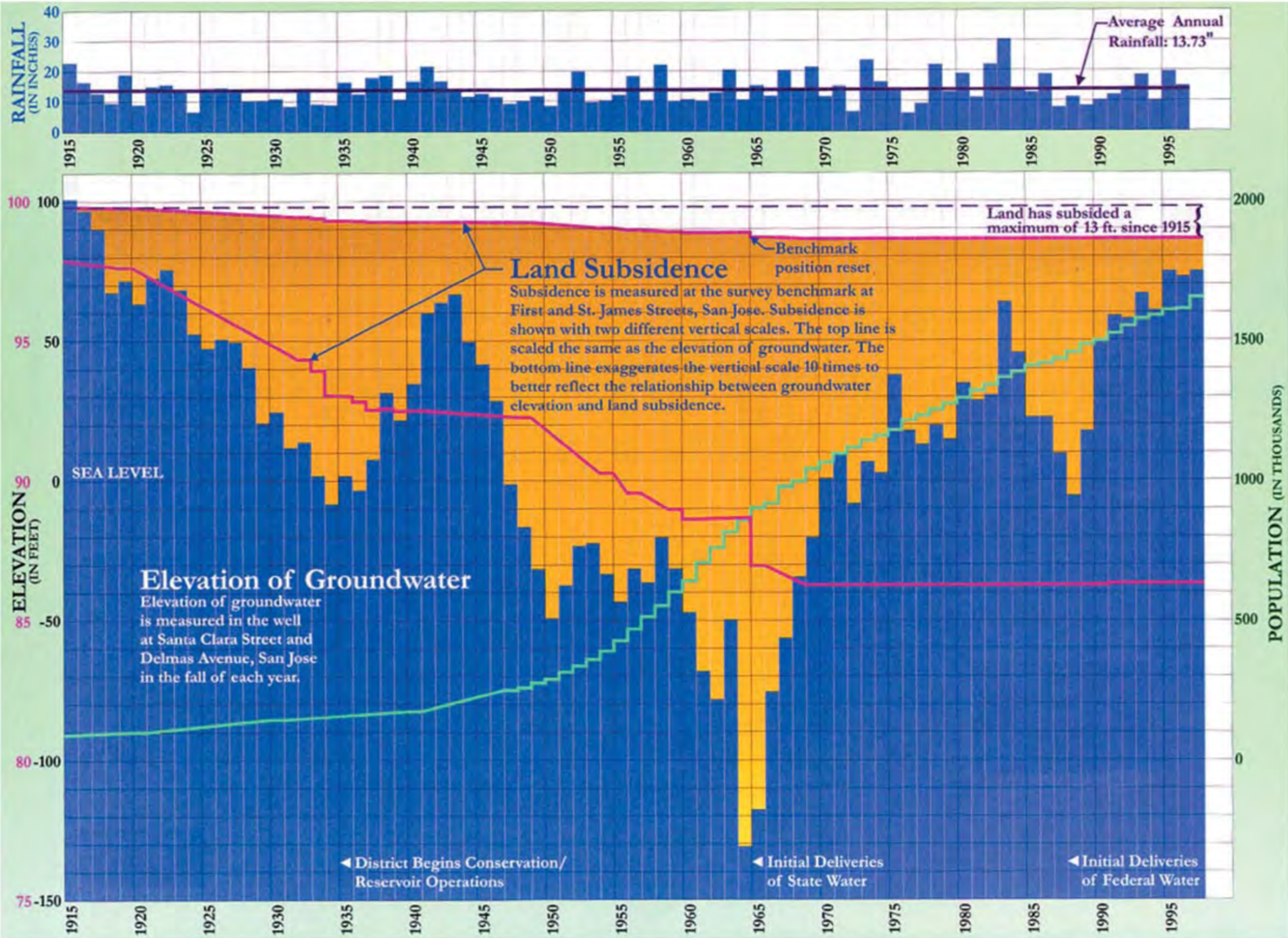

Source: Iwamura, Thomas I., 1995

Watershed Characteristics Report

WMI

**FIGURE 7-25**
**Lines of Equal Subsidence**

Santa Clara Basin




Source: Santa Clara Valley Water District

Watershed Characteristics Report

**FIGURE 7-26**
**Relationship Between Groundwater Elevations & Land Subsidence in Santa Clara County**

WMI Santa Clara Basin

of the Santa Clara Valley Water Conservation District in 1928, the forerunner of the current Water District. Dams built in the 1930s for water conservation and for flood control provided an alternative source of water to the overpumped aquifers. Following the construction of water conservation reservoirs in the mountains, groundwater levels and pressures began to rise in 1935. This rise continued until 1944. During the period of water level recovery, land subsidence slowed from 1937 to 1948. The years between 1937 and 1944 were a very wet period. After 1944, water levels again started to decline as increased pumping resulted in overdraft, and subsidence resumed in 1948. With the importation of surface waters from the State and Federal Water Projects and the Hetch Hetchy system in 1965, pumping draft from the Basin was reduced, and overdraft of the Basin was eliminated. Subsidence ceased in 1969 as pressures in the lower aquifer zone started to recover, a trend that has continued in recent years for wells located in the interior portion of the subbasin. In contrast, wells located at the margins of the subbasin have not yet recovered to preoverdraft levels (Iwamura 1995). The possibility exists, however, that further subsidence could resume with an extended drought period (Wilson and Iwamura 1989).

### 7.2.5 Groundwater Recharge Facilities

There are two types of groundwater recharge facilities in the Basin: onstream recharge facilities and offstream recharge facilities. Onstream recharge takes place when rainwater or water released from reservoirs flows into the sandy-gravelly bed of a stream and then seeps downward into an aquifer (Water District 1978). During summer months, the Water District releases water from its reservoirs, allowing it to flow downstream through stream reaches that have permeable streambeds. In some instances, the Water District also releases imported water for percolation from "turnouts" from the extensive water distribution system in the Santa Clara Valley. Onstream percolation is enhanced through the construction of "spreader dams" (temporary gravel dams) in certain stream reaches in order to slow the water and increase percolation.

Offstream recharge occurs in groundwater recharge ponds (commonly referred to as percolation ponds). These are located at carefully chosen sites where gravels and sands have been naturally deposited at or near ground level and where water can soak down most easily into the aquifer(s) (Water District 1978). See Table 7-8 for information on the groundwater recharge facilities (Percolation Ponds) in the Basin. The Water District operates offstream percolation ponds along Stevens Creek; along Los Gatos Creek downstream of Lexington and Vasona Reservoirs; along Alamitos Creek, Guadalupe Creek, and the Guadalupe River downstream of Almaden, Calero, and Guadalupe Reservoirs; along Coyote Creek downstream of Anderson Reservoir; and along Lower Penitencia Creek.

Instream and offstream percolation ponds are not a new phenomenon. Local farmers formed the Valley Water Conservation Association in the early 1920s and began constructing in-channel "spreading dams." These low-check dams constructed from a variety of local materials were installed in order to retard the flow of water during the winter months, thereby increasing percolation of water into the underground aquifers for storage. The Santa Clara Valley Water Conservation District began purchasing land, installing removable dams, and operating

| Table 7-8<br>Groundwater Recharge Facilities<br>(Percolation Ponds) in the Santa Clara Basin | | | | | |
|---|---|---|---|---|---|
| **Percolation Pond** | **Location** | **Number of Ponds** | **Total Surface Area** | **Source of Water** | **Date Constructed** |
| Alamitos | South San Jose | 2 | 11 acres | Guadalupe & Alamitos Creeks & Almaden Valley Pipeline | 1932/ Reconstructed 1963 |
| Budd | Campbell | 3 | 9 acres | Los Gatos Creek & Central Pipeline via Upper Page Ditch | 1967 |
| Camden | Campbell | 3 | 62 acres | Los Gatos Creek & Central Pipeline via Upper Page Ditch | 1962 |
| Coyote | South San Jose | 1 | 30 acres | Coyote Creek, Anderson Reservoir & San Felipe Project | 1934 |
| Ford Road | South San Jose | 4 | 34 acres | Coyote Creek, Anderson Reservoir & San Felipe Project | 1964 |
| Guadalupe | South San Jose | 4 | 31 acres | Guadalupe River & Alamitos Creek & Almaden Valley Pipeline | 1967 |
| Kooser | South San Jose | 4 | 2 acres | Almaden Valley Pipeline | 1962 |
| Los Capitancillos | San Jose | 10 | 63 acres | Guadalupe Creek & Almaden Valley Pipeline | 1962/ Reconstructed 1964 |
| McClellan | Cupertino | 2 | 2.5 acres | Stevens Creek Pipeline | 1976 |
| McGlincey | Campbell | 6 | 7 acres | Los Gatos Creek & Central Pipeline via Kirk Ditch | 1959 |
| Oka Lane | Campbell | 3 | 17 acres | Los Gatos Creek & Central Pipeline via Kirk Ditch | 1958 |
| Overfelt | East San Jose | 4 | 6 acres | Lower Penitencia Creek | 1976 |
| Page | Campbell | 8 | 14 acres | Los Gatos Creek & Central Pipeline via Page Ditch | 1935/ Reconstructed 1964 |
| Penitencia | East San Jose | 3 | 20 acres | Lower Penitencia Creek & South Bay Aqueduct | 1958/ Reconstructed 1964 |
| Sunnyoaks | Campbell | 4 | 3 acres | Los Gatos Creek & Central Pipeline | 1967 |

Source: Santa Clara Valley Water District 1997 percolation ponds along Los Gatos Creek, Guadalupe/Alamitos Creeks, and Coyote Creek in the early 1930s (California History Center 1981). Lake Lagunita was constructed for percolation to downstream wells by former Governor Leland Stanford in the 1870s (San Francisquito Creek-Our Natural Resource, 1994).

#### *7.2.5.1 Coyote Percolation Pond*

Coyote Percolation Pond, completed in 1934, is located in southern San Jose at the northeast corner of the intersection of Metcalf Road. It has an average surface area of 30 acres and a capacity of 150 acre-feet (Water District 1995).

Coyote Percolation Pond is one of a series of percolation ponds impounding the northwest/southeast trending Coyote Creek that flows along the center of the Santa Clara Valley. The series of ponds is used for groundwater recharge of the Santa Clara groundwater subbasin (Water District 1995).

#### *7.2.5.2 Los Gatos Percolation Ponds*

The Los Gatos Percolation Ponds, also referred to as the Camden Percolation Ponds, are within Los Gatos Creek County Park just west of State Highway 17 and south of Camden Avenue in the City of Campbell. Water from Los Gatos Creek is diverted to three principal ponds with a combined surface area of 59 acres and a capacity of 1,780 acre-feet. The Los Gatos Percolation Ponds were completed in 1935 (Water District 1995).

The primary use of the ponds is for recharge of the Santa Clara groundwater subbasin. The ponds divert water from Los Gatos Creek and receive water from the Water District Central Pipeline that carries untreated water from the South Bay Aqueduct (Water District 1995).

The Los Gatos Percolation Ponds are in the alluvial deposits created by Los Gatos Creek before it was channelized. Los Gatos Creek flows northeast from the percolation ponds and joins the Guadalupe River in central San Jose (Water District 1995).

#### *7.2.5.3 Instream Percolation Ponds*

In the past, the Water District utilized seasonal in-channel impoundments and Guadelupe Creek to enhance groundwater recharge on the Guadalupe River and its tributaries Los Gatos Creek and Guadalupe Creek, as well as on Coyote, Stevens, and Saratoga Creeks. These in-channel percolation ponds were created by installing gravel spreader dams across the stream. The spreader dams remained in place from approximately April to September. Year-round dams were maintained in Coyote Creek. In-channel flash board dams are still used on Los Gatos Creek above Camden Avenue for percolation and water diversion purposes causing negative riparian impacts and fish migration blockings.

A 5-year study found that temperatures in percolation ponds were often marginal for steelhead and would require high food supply to provide rearing habitat (Habitat Restoration Group 1995).

While in-channel percolation ponds have the potential to provide rearing habitat for juvenile steelhead if temperatures, dissolved oxygen, and food resources are suitable, only a few possible steelhead were captured over a 5-year study (Habitat Restoration Group 1995). In addition, the lake-like (lentic) habitat found in percolation ponds tends to favor nonnative fishes such as bluegill, sunfish, goldfish, and largemouth bass. Largemouth bass can prey on juvenile steelhead. In addition, these nonnative fish can invade adjacent stream habitat. In-channel percolation ponds often reduce streamflow downstream. Maintenance of percolation ponds often requires draining the pond completely, stranding thousands of fish. Finally, gravel dam sites become shallow passage barriers if the low-flow channel is not maintained following removal.

## 7.3 Designated Beneficial Uses for the Santa Clara Basin

### 7.3.1 Beneficial Uses of Waterbodies

The Regional Board, in consultation with state and local authorities and based upon best available information, designates existing and potential beneficial uses for significant surface and ground waterbodies in the region. The following discussion describes the beneficial uses of surface waters, groundwaters and marshes designated by the Regional Board in its 1995 *Water Quality Control Plan for the San Francisco Basin* (Basin Plan).

The definitions of beneficial uses provided below are taken from the Basin Plan. The words in italics are the definitions taken directly from the Basin Plan. This is followed by a summary of some of the water quality requirements. The reader is directed to Chapter 2 of the Basin Plan for a detailed description. The beneficial uses are presented in alphabetical order using their abbreviations.

(***AGR) Agricultural Supply.*** *Uses of water for farming, horticulture, or ranching, including, but not limited to, irrigation, stock watering, or support of vegetation for range grazing.*

Water quality objectives and standards are set to prevent (1) soluble salt accumulations, (2) chemical changes in the soil, (3) toxicity to crops, and (4) potential disease transmission to humans through reclaimed water use. Irrigation water classification systems, arable soil classification systems, and public health criteria related to reuse of wastewater have been developed with consideration given to these issues.

***(ASBS) Areas of Special Biological Significance.*** *Areas designated by the State Water Resources Control Board.*

Alteration of natural water quality in these areas is undesirable, and therefore potential impacts (such as wastes to be discharged) generally must occur at a sufficient distance from these areas to maintain natural water quality conditions. Areas of special biological significance include marine life refuges or ecological reserves, and other areas designated by the State Board where the preservation and enhancement of natural resources requires special protection.

***(COLD) Cold Freshwater Habitat.*** *Uses of water that support coldwater ecosystems, including, but not limited to, preservation or enhancement of aquatic habitats, vegetation, fish, or wildlife, including invertebrates.*

Water quality objectives/standards are set to protect cold freshwater habitats to support anadromous fisheries (e.g., salmon, steelhead) and trout and other coldwater fisheries. Such objectives set limits on key habitat requirements such as temperature, toxicity, and dissolved oxygen. Life within these waters is relatively intolerant to environmental stresses.

***(COMM) Ocean, Commercial, and Sport Fishing.*** *Uses of water for commercial and recreational collection of fish, shellfish, and other organisms in oceans, bays, and estuaries, including, but not limited to, uses involving organisms intended for human consumption or bait purposes.*

The protection of ocean fishing is largely dependent upon protection of habitats where fish reproduce and forage.

***(EST) Estuarine Habitat.*** *Uses of water that support estuarine ecosystems, including, but not limited to, preservation or enhancement of estuarine habitats, vegetation, fish, shellfish, or wildlife (e.g., estuarine mammals, waterfowl, shorebirds), and the propagation, sustenance, and migration of estuarine organisms.*

The protection of estuarine habitat is contingent upon (1) the maintenance of adequate Delta outflow to provide mixing and salinity control; and (2) provisions to protect wildlife habitat associated with marshlands and the Bay periphery (i.e., prevention of fill activities). Estuarine habitat is associated with moderate seasonal fluctuations in dissolved oxygen, pH, and temperature.

***(FRSH) Freshwater Replenishment.*** *Uses of water for natural or artificial maintenance of surface water quantity or quality.*

The Basin Plan does not provide any description of water quality requirements for FRSH.

***(GWR) Groundwater Recharge.*** *Uses of water for natural or artificial recharge of groundwater for purposes of future extraction, maintenance of water quality, or halting saltwater intrusion into freshwater aquifers.*

The requirements for groundwater recharge operations generally reflect the future use to be made of the water stored underground. Hence, the water quality objectives are set to protect those future uses. Future beneficial uses for groundwater in the Basin include municipal and domestic supply, agricultural supply, industrial process supply, and industrial service supply.

***(IND) Industrial Service Supply.*** *Uses of water for industrial activities that do not depend primarily on water quality, including, but not limited to, mining, cooling water supply, hydraulic conveyance, gravel washing, fire protection, and oil well pressurization.*

Most industrial service supplies have few water quality limitations except for gross constraints, such as freedom from unusual debris, and salt or total dissolved solids.

***(MAR) Marine Habitat.*** *Uses of water that support marine ecosystems, including, but not limited to, preservation or enhancement of marine habitats, vegetation such as kelp, fish, shellfish, wildlife (e.g., marine mammals, shorebirds).*

In many cases, the protection of marine habitat will be accomplished by measures that protect wildlife habitat generally, but more stringent objectives may be necessary for waterfowl marshes and other habitats, such as those for shellfish and marine fishes. This beneficial use does not apply to waters within the Estuary. Instead, the EST beneficial use applies to the South Bay.

***(MIGR) Fish Migration.*** *Uses of water that support habitats necessary for migration, acclimatization between freshwater and saltwater, and protection of aquatic organisms that are temporary inhabitants of waters within the region.*

The water quality objectives established for coldwater fisheries protect anadromous fish as well; however, for migratory species, particular attention must be paid to maintaining zones of passage. Barriers to migration or free movement of migratory fish impacts reproduction. Natural tidal movement in estuaries and adequate river flows are necessary to sustain migratory fish and their offspring. A water quality barrier, whether thermal, physical, or chemical, that prevents migration is an indicator of nonprotection of this use.

***(MUN) Municipal and Domestic Supply.*** *Uses of water for community, military, or individual water supply systems, including, but not limited to, drinking water supply.*

The principal issues involving municipal water supply quality are (1) protection of public health; (2) aesthetic acceptability of the water; and (3) the economic impacts associated with treatment- or quality-related damages. Published water quality objectives give limits for known health-related constituents and most properties affecting public acceptance. These objectives for drinking water include the EPA Drinking Water Standards and the California State Department of Health Services criteria.

Water quality objectives relate to prevention of direct disease transmission, toxic effects, and increased susceptibility to disease. In addition, aesthetic factors are important and include parameters associated with excessive hardness, unpleasant odor or taste, turbidity, and color. Though not listed in the Basin Plan, corrosive potential and disinfection byproduct precursors should be included in the water quality objectives.

***(NAV) Navigation.*** *Uses of water for shipping, travel, or other transportation by private, military, or commercial vessels.*

The Basin Plan does not provide any description of water quality required for NAV.

***(PRO) Industrial Process Supply.*** *Uses of water for industrial activities that depend primarily on water quality.*

Water quality requirements differ widely among the many industrial processes in use today. Because of this, no specific criteria have been applied to the quality of raw water supplies.

***(RARE) Preservation of Rare and Endangered Species.*** *Uses of waters that support habitats necessary for the survival and successful maintenance of plant or animal species established under state and/or federal law as rare, threatened, or endangered.*

The water quality objectives for protection of rare and endangered species are often the same as those for protection of fish and wildlife habitats. However, where rare or endangered species exist, special control requirements may be necessary to assure attainment of this use and may vary slightly with the environmental needs of each particular species.

***(REC1) Water Contact Recreation.*** *Uses of water for recreational activities involving body contact with water where ingestion of water is reasonably possible. These uses include, but are not limited to, swimming, wading, waterskiing, skin and scuba diving, surfing, whitewater activities, fishing, and uses of natural hot springs.*

Water contact implies a risk of waterborne disease transmission and involves human health; accordingly, objectives required to protect this use include limits on bacterial concentrations, tastes and odors, and floating material.

***(REC2) Noncontact Water Recreation.*** *Uses of water for recreational activities involving proximity to water but not normally involving contact with water where water ingestion is reasonably possible. These uses include, but are not limited to, picnicking, sunbathing, hiking, beachcombing, camping, boating, tide pool and marine life study, hunting, sightseeing, or aesthetic enjoyment in conjunction with the above activities.*

Water quality considerations relevant to noncontact water recreation, such as hiking, camping, or boating, and those activities related to tide pool or other nature studies require protection of habitats and aesthetic features from odors or floating materials.

***(SHELL) Shellfish Harvesting.*** *Uses of water that support habitats suitable for the collection of crustaceans and filter feeding shellfish (e.g., clams, oysters, and mussels) for human consumption, commercial, or sport purposes.*

Shellfish harvesting areas require protection and management to preserve the resource and protect public health. The potential for disease transmission and direct poisoning of humans is of considerable concern in shellfish regulation; therefore, bacteriological objectives for the open ocean, bays, and estuarine waters where shellfish cultivation and harvesting occur are established to protect public health.

***(SPWN) Fish Spawning.*** *Uses of water that support high quality aquatic habitats suitable for reproduction and early development of fish.*

Dissolved oxygen levels in spawning areas should ideally approach saturation levels. Free movement of water is essential to maintain well-oxygenated conditions around eggs deposited in sediments. Water temperature, size distribution and organic content of sediments, water depth, and current velocity are also important determinants of spawning area adequacy.

***(WARM) Warm Freshwater Habitat.*** *Uses of water that support warmwater ecosystems including, but not limited to, preservation or enhancement of aquatic habitats, vegetation, fish, or wildlife, including invertebrates.*

The warm freshwater habitats supporting bass, bluegill, perch, and other panfish are generally lakes and reservoirs, although some minor streams will serve this purpose where streamflow is sufficient to sustain the fishery. The habitat is also important to a variety of nonfish species, such as frogs, crayfish, and insects, which provide food for fish and small mammals. This habitat is less sensitive to environmental changes, but more diverse than the cold freshwater habitat, and the ranges of objectives for temperature, dissolved oxygen, pH, and turbidity are usually greater.

***(WILD) Wildlife Habitat.*** *Uses of waters that support wildlife habitats, including, but not limited to, the preservation and enhancement of vegetation and prey species used by wildlife, such as waterfowl.*

The two most important types of wildlife habitat are riparian and wetland habitats. These habitats can be impacted by development, erosion, and sedimentation, and by poor water quality. The water quality requirements of wildlife pertain to the water directly ingested, the aquatic habitat itself, and the effect of water quality on the production of food materials. Waterfowl habitat is particularly sensitive to changes in water quality. Dissolved oxygen, pH, alkalinity, salinity, turbidity, settleable matter, oil, toxicants, and specific disease organisms are water quality parameters particularly important to waterfowl habitat.

**Present and Potential Beneficial Uses in the Region**. The Regional Board has designated beneficial uses for surface and groundwaters, and has begun to address beneficial uses associated with wetland areas. According to the Basin Plan, inland surface waters support or could support municipal and domestic supply (MUN); agricultural supply (AGR); industrial process supply (PRO); groundwater recharge (GWR); water contact recreation (REC1); noncontact water recreation (REC2); wildlife habitat (WILD); cold freshwater habitat (COLD); warm freshwater habitat (WARM); fish migration (MIGR); and fish spawning (SPWN). In addition to the above uses, the Estuary supports estuarine habitat (EST); industrial service supply (IND); and navigation (NAV).

Groundwater in the region supports or could support municipal and domestic water supply (MUN); industrial water supply (IND); industrial process water supply (PRO); agricultural water supply (AGR); and freshwater replenishment to surface waters (FRSH).

The Regional Board is in the process of developing a Regional Wetlands Management Plan that will "identify and specify the beneficial uses and/or functions and values of existing wetlands and establish wetland habitat goals for the region" (Regional Board 1995). Potential beneficial uses of wetlands include wildlife habitat (WILD); preservation of rare and endangered species (RARE); shellfish harvesting (SHELL); water contact recreation (REC 1); noncontact water recreation (REC 2); ocean, commercial, and sport fishing (COMM); marine habitat (MAR); fish migration (MIGR); fish spawning (SPWN); and estuarine habitat (EST). Wetlands improve water quality.

### 7.3.2 Designated Beneficial Uses for the Santa Clara Basin

#### *7.3.2.1 1995 Basin Plan Designations*

The latest Basin Plan (Regional Board 1995) designates specific beneficial uses to surface waterbodies in the Basin. These are listed in Table 7-9. The beneficial uses of a waterbody generally apply to all its tributaries (This is known as the "Tributary Rule"). In some cases, a beneficial use may not be applicable to the entire body of water.

Within the Santa Clara Basin, the Regional Board has designated the following as existing beneficial uses of groundwater: municipal and domestic water supply (MUN); industrial process water supply (PROC); industrial service water supply (IND); and agricultural water supply (AGR).

The South Bay, currently the only wetland area designated by the Regional Board within Santa Clara Basin, has the following beneficial uses associated with it: estuarine habitat (EST); fish migration (MIGR); ocean, commercial, and sport fishing (COMM); preservation of rare and endangered species (RARE); water contact recreation (REC1); noncontact water recreation (REC2); fish spawning (SPWN); and wildlife habitat (WILD).

#### *7.3.2.2 Comments on Basin Plan Designations*

WMI Stakeholders have identified errors and omissions in the 1995 Basin Plan's designations. There is also disagreement over some of the designations. One objective of the WMI process is to work with the Regional Board to improve the Basin Plan throughout the stakeholder process. Stakeholders' increased understanding of the Basin's resources leads to suggested changes to the Regional Board's designations. For example, the Water District's recent fieldwork could be used to improve Table 7-9 in the area of existing Basin fisheries. Designations for beneficial uses for some of the listed waterbodies in the table are also controvesial, based on stakeholders' first-hand knowledge of specific waterbodies.

This section presents some of the problems that have been identified with the Basin Plan's Table 2-5 (Table 7-9). These problems have been categorized as errors, omissions, or redesignation considerations. There may be other corrections, but this list identifies some general problems associated with Table 7-9. The Regional Board should evaluate the need to update the Basin Plan table and establish a process to work with the WMI on this effort.

## Table 7-9
## Beneficial Uses of Waterbodies in the Santa Clara Basin[1]

BENEFICIAL USE (see Section 7.3 text for description)

| WATERBODY | AGR | COLD | COMM | EST | FRSH | GWR | IND | MAR | MIGR | MUN | NAV | PROC | RARE | REC-1 | REC-2 | SHELL | SPWN | WARM | WILD |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| San Francisco Bay South | | | E | E | | | E | | E | | E | | E | E | E | E | P | | E |
| Matadero Creek | | E | | | | | | | E | | | | | E | E | | E | E | E |
| Permanente Creek | | E | | | | | | | | | | | | E | E | | E | | E |
| Saratoga Creek | E | E | | | E | E | | | | | | | | E | E | | | E | E |
| Calabazas Creek | E | E | | | | E | | | | | E | | | E | E | | | E | E |
| San Francisquito Creek | | E | | | | | | | E | | | | | P | P | | E | E | E |
| Los Trancos Creek | | | | | | | | | | | | | | | | | | | |
| West Union Creek | | | | | | | | | | | | | | | | | | | |
| Felt Lake | E | | | | | | | | | | | | | E | E | | E | E | E |
| Stevens Creek | | E | | | E | | | | E | | | | | E | E | | P | E | E |
| Stevens Creek Reservoir | | E | | | | E | | | E | E | | | | | E | | E | E | E |
| Searsville Lake | E | E | | | | | | | | | | | | E | E | | E | E | E |
| Coyote Creek | | E | | | | | | | E | | | | E | P | E | | E | E | E |
| Elizabeth Lake | | E | | | | | | | | | | | | | E | | E | E | E |
| Fremont Lagoon | | | | | | | | | | | | | | | | | | | |
| Sandy Wool Lake | | | E | | | | | | E | | | | | E | | | | E | |
| Cottonwood Lake | | E | | | | | | | | | | | | E | E | | E | E | E |
| Guadalupe Reservoir | | E | | | | E | | | | E | | | | E | E | | E | E | E |
| Coyote Lake | E | E | | | | | | | | E | | | | E | E | | E | E | E |
| Upper Penitencia Creek | | | | | | | | | | | | | | | | | | | |
| Cherry Flat Reservoir | E | | | | | | | | | E | | | | L | E | | E | E | E |
| Penitencia Creek | | | | | | | | | | | | | | | | | | | |
| Silver Creek | | | | | | | | | | | | | | | | | | | |
| Soda Springs Canyon Creek | | | | | | | | | | | | | | | | | | | |
| Otis Canyon Creek | | | | | | | | | | | | | | | | | | | |
| San Felipe Creek | | P | | | | | | | | | | | | P | P | | P | E | E |
| Halls Valley Reservoir | | | | | | | | | | | | | | E | E | | | E | E |
| Arroyo Aquague Creek | | | | | | | | | | | | | | | | | | | |
| Berryessa Creek | | | | | | | | | | | | | | | | | | | |
| Guadalupe River | | | | | | | | | P | | | | | P | E | | P | E | E |
| Campbell Percolation Pond | | | | | | | | | | | | | | | | | | | |
| Lexington Reservoir | | E | | | | | | | | E | | | | E | E | | E | E | E |
| Los Gatos Creek | | E | | | E | E | | | P | E | | | | | P | | P | E | E |
| Vasona Lake | | E | | | | E | | | | | | | | E | E | | E | E | E |
| Los Gatos Creek | | | | | | | | | | | | | | | | | | | |
| Alamitos Creek | | | | | | | | | | | | | | | | | | | |
| Guadalupe Creek | | | | | | | | | | | | | | | | | | | |
| Herbert Creek | | | | | | | | | | | | | | | | | | | |
| Calero Reservoir | | | | | | E | | | | E | | | | E | E | | E | E | E |
| Almaden Reservoir | | E | | | | E | | | | E | | | | E | E | | E | E | E |
| Lake Elsman | | E | | | | | | | | E | | | | | | | | | E |
| Anderson Lake | | E | | | | E | | | | E | | | | L | E | | E | E | E |
| Barrett Canyon Creek | | | | | | | | | | | | | | | | | | | |

Source: San Francisco Bay Regional Water Quality Control Board. 1995. San Francisco Regional Water Quality Control Plan, Table 2-5.
Legend: E = Existing Beneficial Use; P = Potential Beneficial Use; L = Limited Beneficial Use
[1] WMI stakeholders have identified errors and omissions both in the use designations and the waterbodies as listed in this table.

### Errors in Basin Plan Table 2-5

- The Guadalupe Reservoir is incorrectly listed under Coyote Creek and should be listed under Guadalupe River.
- Coyote *Reservoir* appears to be identified as Coyote *Lake.*
- Anderson Lake is incorrectly listed under the Guadalupe River and Anderson *Lake* should be changed to Anderson *Reservoir*.
- Anderson *Reservoir* should be listed under Coyote Creek.
- Vasona Reservoir seems to be identified as Vasona Lake.
- Stivers Lagoon appears to be identified as Fremont Lagoon and should be in the Arroyo La Laguna watershed.
- Lake Elizabeth (not Elizabeth Lake) is in the Arroyo La Laguna watershed, not Coyote.
- Penitencia Creek should be *Lower* Penitencia Creek.
- Herbert Creek is listed twice under Guadalupe River.
- Los Gatos Creek is listed twice; once with a number of beneficial uses, and the other with no beneficial uses.
- The Campbell Percolation Pond (listed under the Guadalupe River) is a percolation pond and should not be listed as a waterbody.
- Searsville Lake is in the San Francisquito Creek watershed.

### Omissions in Basin Plan Table 2-5

- There are a number of creeks, lakes, lagoons, and reservoirs listed under the Coyote Creek which cannot be located on most available maps (e.g., Fremont Lagoon, Sandy Wool Lake, Halls Valley Reservoir), while other better-known creeks that do appear on most maps are not listed (e.g., Thompson Creek, Fisher Creek, and Yerba Buena Creek).
- Anderson Reservoir, the area's largest, is not listed, although it may be incorrectly listed as Anderson Lake (see Errors above).
- There are numerous significant waterbodies not listed under the Guadalupe River. They include Alviso Slough, Lake Almaden, Canoas, Ross, Calero, and Rincon Creeks, as well as a number of other minor creeks.
- Adobe Creek is not listed in the table.
- San Tomas is not listed, with Saratoga Creek as a tributary.
- Barron Creek is not listed.

#### *7.3.2.3 Redesignation Considerations*

The following comments were made by some WMI stakeholders based on their understanding of the local waterbodies. The Regional Board should review the merits of these comments when redesignating the Basin beneficial uses.

- For clarity, waterways in the Basin that have diverse characteristics should have listings for each of the major sections, or alternatively, they should only be listed once and all beneficial uses should be included. Los Gatos Creek is an example of this type of stream. There are numerous distinct sections of Los Gatos Creek (e.g., natural, channelized, concrete channel). Each section has unique characteristics, and different beneficial uses.

- Guadalupe River is used by coldwater salmonids for migration and spawning and is used by southwestern pond turtle, but the table does not reflect this.

- The Guadalupe River is navigable under California law and is used for small watercraft navigation, and water contact recreation (swimming in Almaden Reservoir). The table does not reflect this.

- Guadalupe Creek, above the Masson Dam, is a coldwater stream and has a self-sustaining population of resident rainbow trout. It also has potential habitat for the southwestern pond turtle, the California red legged frog, and migrating salmonids. The table does not reflect this.

- Coyote Creek should be considered navigable.

- Alamitos and Calero Creeks have a population of self-sustaining fish and have the potential habitat for migrating salmonids, the red legged frog, and the southwestern pond turtle. The table does not reflect this.

- Fishery information from the Water District indicates that there are numerous waterbodies for which beneficial use designations (specifically, coldwater fisheries, migration, rare, and spawning) should be adjusted in the table. This information is included in an endnote to this chapter.[i]

- The Regional Board staff have requested that the San Francisquito Watershed CRMP assist in groundtruthing the beneficial uses as a pilot project; however, resources for the efforts have to be identified. SCVURPPP has suggested the Coyote watershed as a demonstration site.

## 7.4 Conveyance Functions of Water Corridors in the Santa Clara Basin

The community relies on the local stream and creek corridors to convey water within the Basin and to the Bay. This conveyance function is not a beneficial use identified and defined by the Regional Board. Watershed management planning needs to acknowledge the conveyance functions when addressing the designated beneficial uses.

The conveyance function can be separated into three categories: (1) conveyance of stormwater, (2) conveyance of dry-weather flows, and (3) conveyance of water stored in reservoirs to groundwater recharge facilities.

- **Dry-Weather Flow Conveyance**. During dry weather, Basin streams and creeks convey natural base flows and nonstormwater discharges received from storm sewers to the Bay. Certain nonstormwater discharges are allowed to flow to stormdrains by municipal and industrial stormwater permits. Examples of these discharges include pumped uncontaminated groundwater, planned and unplanned discharges from potable water sources, water line and hydrant flushing, landscape irrigation, air conditioning condensate, and individual residential car washing. These discharges, called conditionally exempted discharges, must take steps to minimize adverse effects from their discharge on water quality.

- **Stormwater Conveyance**. During storm events, Basin streams and creeks convey runoff from land areas and urban stormwater discharges from storm drains to the Bay. Thus, local streams are an integral part of the Basin's flood control and private property flood protection system. It is important to acknowledge the flood management function of the streams, and adjacent floodplains.

- **Groundwater Recharge Supply Conveyance**. The Water District stores local runoff water and imported water in reservoirs. This water is released to recharge the groundwater basin through percolation ponds and instream recharge. The Water District relies on Basin creeks, streams and pipelines to convey recharge water from the reservoirs or pipelines to the percolation ponds.

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[i] Below are specific suggestions from the Santa Clara Valley Water District for redesignation based on the District's most recent experiences with these watersheds. The designation codes from Table 7-9 are used (e.g., E = existing beneficial use).

*Coldwater Fisheries:*

- **Los Trancos Creek** = E per steelhead/rainbow trout populations

- **Upper Penitencia Creek** = E per steelhead/rainbow trout populations and some limited evidence of Chinook salmon.

- **San Felipe Creek** = E per rainbow trout populations

- **Vasona Lake** = L per significant warming during the summer months. Only intermittent trout plants would be successful except during the winter months.

- **Los Gatos Creek** = E below Camden drop structure per evidence of steelhead and Chinook spawning observations. Summer temperatures/flows may not be optimal for summer steelhead rearing.

- **Alamitos Creek** = E per resident populations of rainbow trout below Almaden Reservoir. Current laddering project at the Blossom Hill drop structure may provide access to anadromous salmonids.

- **Guadalupe Creek** = E per resident populations of rainbow trout below Guadalupe Reservoir. Current laddering projects at the Blossom Hill drop structure and Masson Diversion may provide access to anadromous salmonids.

- **Herbert Creek** = E per resident populations of rainbow trout above reservoir. No good recent data on reservoir use by this population.

- **Add Tributary to Guadalupe Creek: Pheasant Creek** = P per resident populations of rainbow trout in Guadalupe Creek. Access at confluence is through a culvert and 1- to 2-foot drop. Recent accounts of occurrence are unconfirmed.

- **Add Tributary to Guadalupe Creek: Reynolds Creek** = E per resident populations of rainbow trout in Creek, recently observed.

- **Add Tributary to Guadalupe River: Arroyo Calero Creek** = E per resident populations of rainbow trout below Calero Reservoir. Current laddering project at the Blossom Hill drop structure may provide access to anadromous salmonids.

*Migration:*

- **Upper Penitencia Creek** = E Anadromous steelhead run in this creek. There may be some use by Chinook salmon.

- **Guadalupe River** = E Anadromous steelhead and Chinook salmon run in this river. The fish ladder at Blossom Hill, currently under construction, will permit access to the tributaries of the upper watershed.

- **Alamitos Creek** = P The fish ladder at Blossom Hill, currently under construction, will permit access to this tributary of the upper watershed of Guadalupe River for anadromous steelhead and Chinook salmon.

- **Guadalupe Creek** = P The fish ladders at Blossom Hill and Masson diversion, currently under construction, will permit access to this tributary of the upper watershed of Guadalupe River for anadromous steelhead and Chinook salmon.

*Rare (NOTE: Regional Board designations have not been updated to reflect recent listings by CDFG/USFWS/NMFS):*

- **San Francisquito Creek** = E per presence of steelhead.

- **Stevens Creek** = E per presence of steelhead.

- **Upper Penitencia Creek =** E per presence of steelhead.

- **San Felipe Creek** = P per potential presence of California red-legged frog.

- **Guadalupe River** = E per presence of steelhead.

- **Los Gatos Creek** = E per presence of steelhead.

- **Alamitos Creek** = P per potential presence of steelhead resulting from fish ladder project at Blossom Hill.

- **Guadalupe Creek** = P per potential presence of steelhead resulting from fish ladder projects at Blossom Hill and Masson Diversion.

- **Add Tributary to Guadalupe Creek:** Pheasant Creek = P per anticipated populations of steelhead trout in Guadalupe Creek resulting from fish ladder projects at Blossom Hill and Masson Diversion. Access at confluence is through a culvert and 1- to 2-foot drop.

- **Add Tributary to Guadalupe Creek:** Reynolds Creek = P per anticipated populations of steelhead trout in Guadalupe Creek resulting from fish ladder projects at Blossom Hill and Masson Diversion.

*Fish Spawning:*

- **Saratoga Creek** = E per various year classes of resident trout.  Successful spawning/reproduction.

- **Los Trancos Creek** = E per various year classes of steelhead and resident trout.  Successful spawning/reproduction.

- **Stevens Creek** = E per various year classes of resident and anadromous trout.  Successful spawning/reproduction.

- **Penitencia Creek** = E per various year classes of resident and anadromous trout.  Successful spawning/reproduction.

- **San Felipe Creek** = E per various year classes of resident trout.  Successful spawning/reproduction.

- **Alamitos Creek** = E per various year classes of resident trout.  Successful spawning/reproduction. Anticipated successful use of tributary by steelhead and Chinook due to fish laddering at Blossom Hill on Guadalupe River.

- **Guadalupe Creek =** E per various year classes of resident trout.  Successful spawning/reproduction. Anticipated successful use of tributary by steelhead and Chinook due to fish laddering at Blossom Hill on Guadalupe River.

- **Arroyo Calero Creek =** E per various year classes of resident trout.  Successful spawning/reproduction.  Anticipated successful use of tributary by steelhead and Chinook due to fish laddering at Blossom Hill on Guadalupe River.

- **Add tributary to Guadalupe Creek**: Pheasant Creek = P per various year classes of resident trout in Guadalupe Creek.  Successful spawning/reproduction. Unconfirmed for Pheasant Creek. Anticipated successful use of tributary by steelhead due to fish laddering at Blossom Hill on Guadalupe River.

- **Add tributary to Guadalupe Creek: Reynolds Creek** = P per various year classes of resident trout in Guadalupe Creek.  Successful spawning/reproduction. Unconfirmed for Reynolds Creek. Anticipated successful use of tributary by steelhead due to fish laddering at Blossom Hill on Guadalupe River.

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Volume One Unabridged

**Watershed Characteristics Report**

# Chapter 8
# Water Management in the Santa Clara Basin

SANTA CLARA BASIN
WMI
WATERSHED
MANAGEMENT INITIATIVE

**Prepared for the**
**Santa Clara Basin Watershed Management Initiative**

**by**

**Watershed Assessment Consultant**

**February 2001**

# Watershed Characteristics Report
# Chapter 8: Water Management in the Santa Clara Basin

## List of Authors

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Funded by:
Santa Clara Valley Water District
and
City of San Jose


**February 2001**

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# Chapter 8
# 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<br>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 |

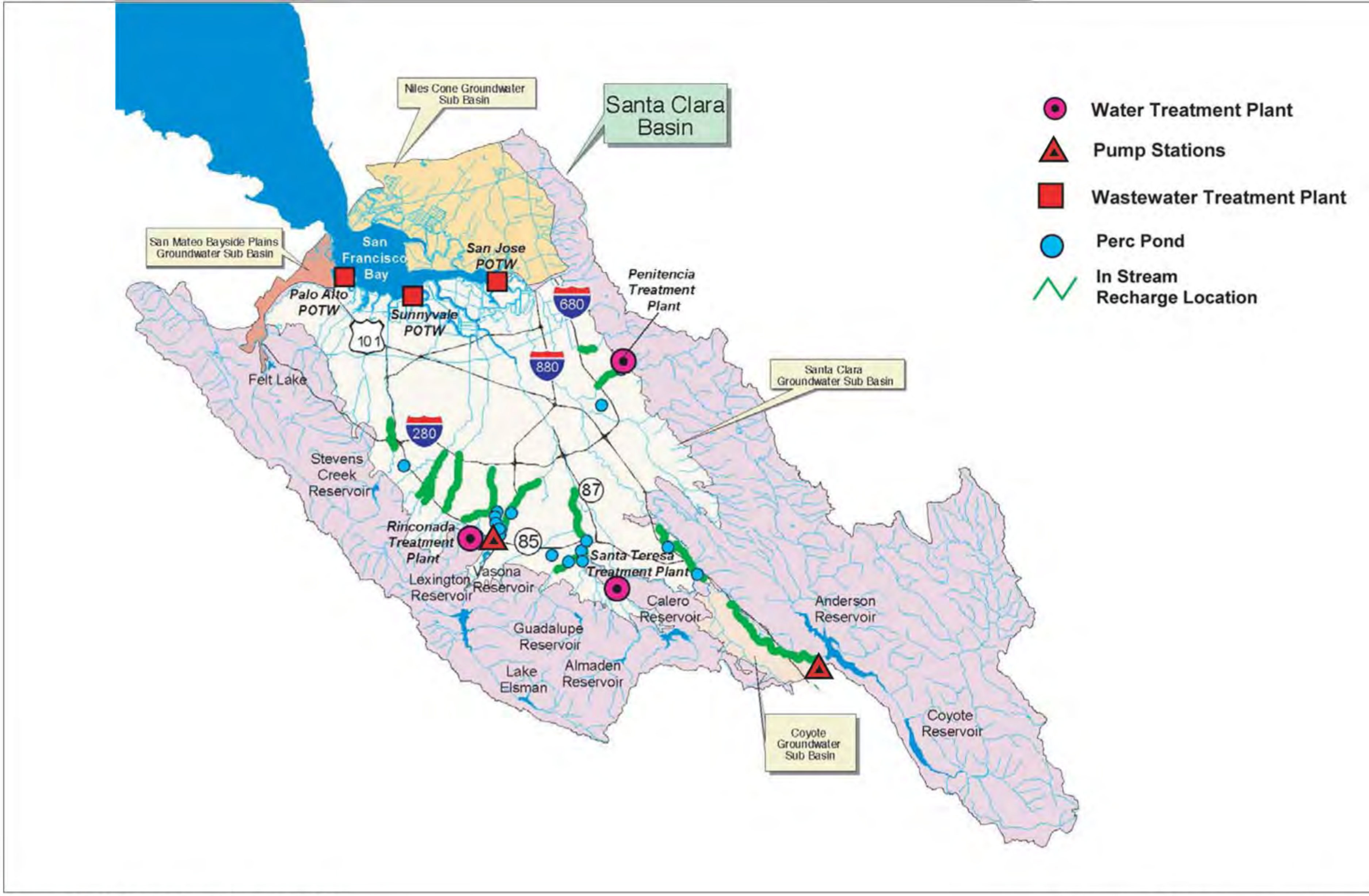
Under natural conditions, some of the water flowing in streams in the Basin percolates into the ground and fills or recharges the upper and lower aquifers. The Water District artificially increases the rate of groundwater recharge by releasing water from reservoirs and pipelines to streams during the 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




**Source: Santa Clara Valley Water District**

*Watershed Characteristics Report*

**FIGURE 8-1**
**Reservoirs, Groundwater Recharge Facilities, Groundwater Basins, and Water and Wastewater Treatment Plants in the Santa Clara Basin**

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 Local | Source of Water Imported | Affected Creeks | Watershed |
|---|---|---|---|---|---|
| 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.

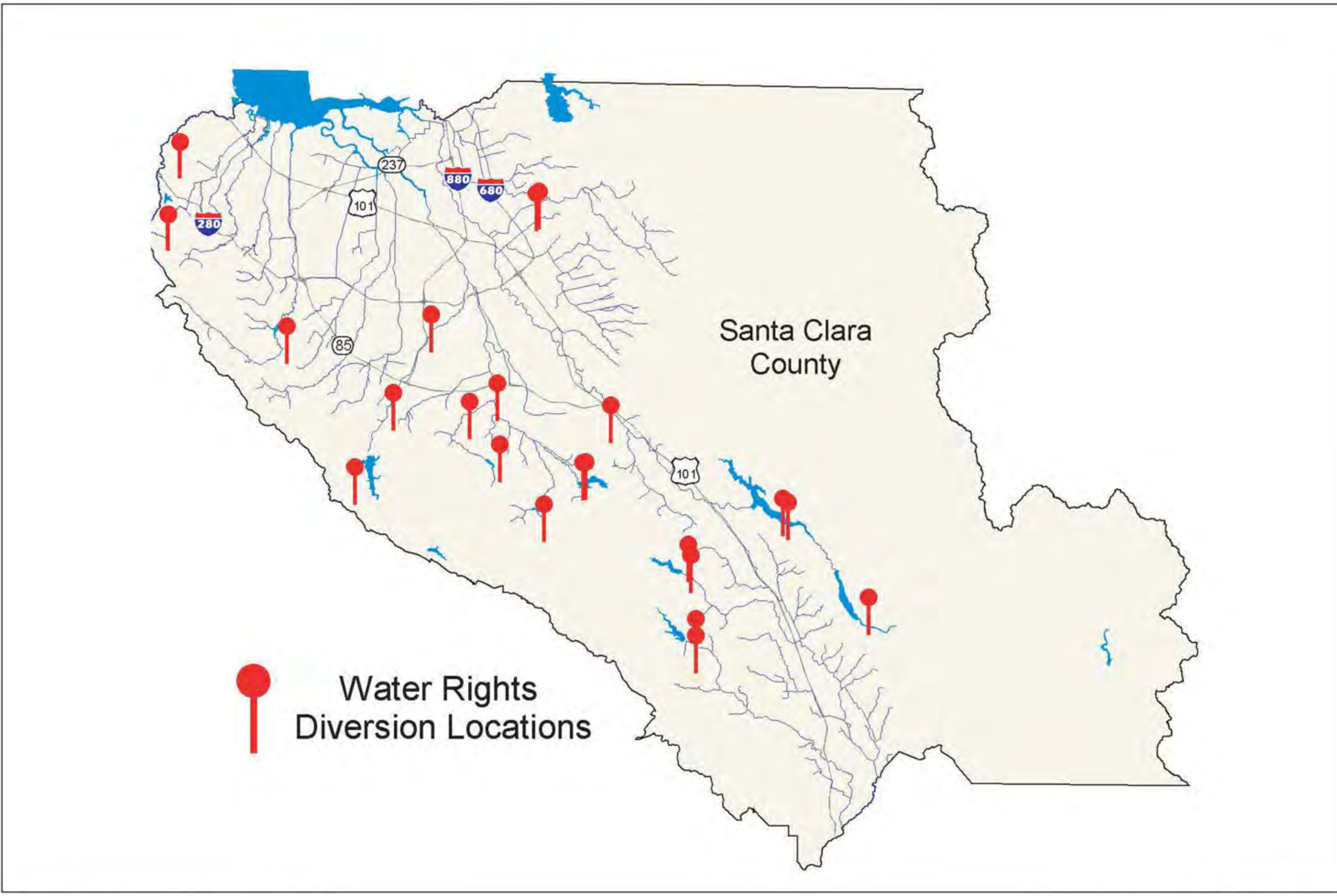
#### *8.3.2.2 Water Recycling*

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




Source: Santa Clara Valley Water District



**FIGURE 8-2**
**Water Diversion Structures in Santa Clara County**

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).

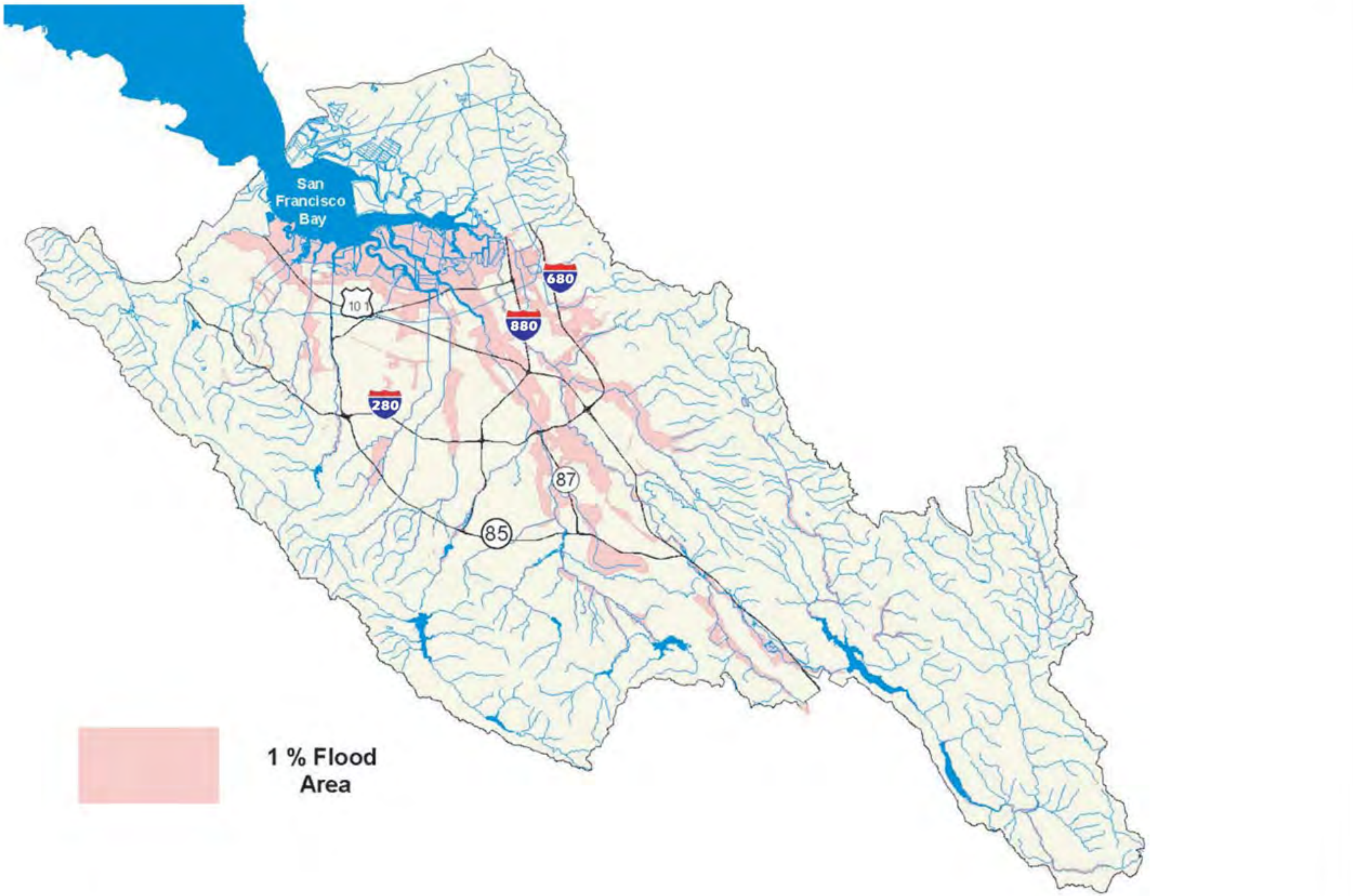
In the 1960s and 1970s, many flood management projects were built to protect fast-growing areas in Santa Clara Valley. In the early 1980s, an El Niño winter caused catastrophic flooding in areas where projects had not yet been completed. The severity of the flooding led to approval by the public of a 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.




Source: Santa Clara Valley Water District

Watershed Characteristics Report

**FIGURE 8-3**
**Flood-Prone Areas in the Santa Clara Basin**

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.

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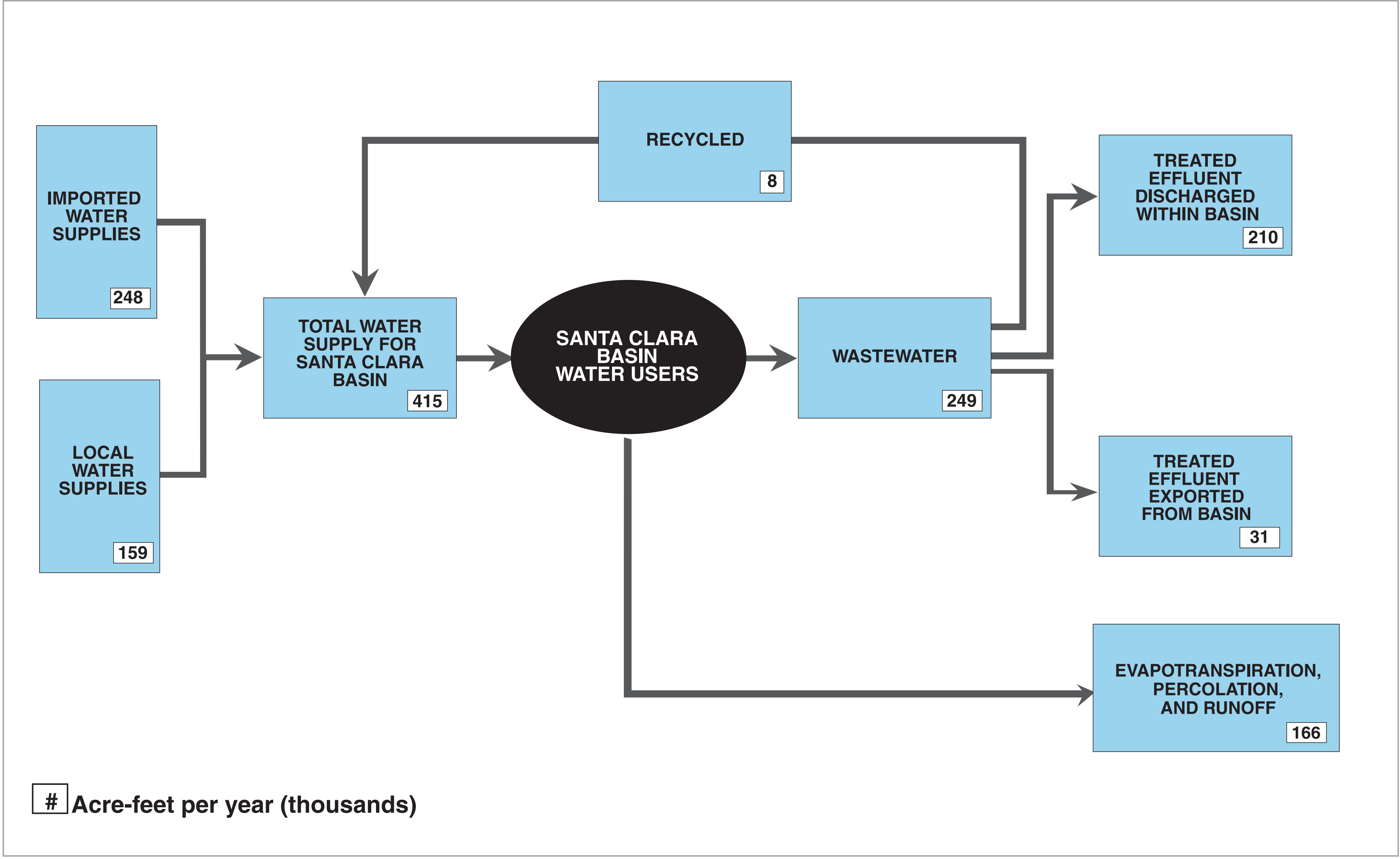


Source: *Santa Clara Valley Water District*



**FIGURE 8-4**
*Water Balance Diagram for the Santa Clara Basin*

# Attachments

**A –** Acronyms/Abbreviations

**B –** Glossary

**C –** Production Credits and Acknowledgments

# Attachment A
# Acronyms/Abbreviations

| | |
|---|---|
| ABAG | Association of Bay Area Governments |
| AC Transit | Alameda County Transit |
| ACCWP | Alameda Countywide Clean Water Program |
| ACFCWD | Alameda County Flood Control and Water District |
| ACOE | U.S. Army Corps of Engineers |
| ACWD | Alameda County Water District |
| AGR | agricultural supply |
| APCD | Air Pollution Control District |
| AQMD | Air Quality Management District |
| ASBS | Areas of Special Biological Significance |
| AWQR | Annual Water Quality Report |
| BAAQMD | Bay Area Air Quality Management District |
| BART | San Francisco Bay Area Rapid Transit |
| Basin | Santa Clara Basin |
| Basin Plan | Water Quality Control Plan for the San Francisco Basin |
| BASMAA | Bay Area Stormwater Management Agencies Association |
| Bay | San Francisco Bay |
| Bay Area | San Francisco Bay Area |
| BCDC | San Francisco Bay Conservation and Development Commission |
| BMM | Lower South Bay Monitoring and Modeling Subgroup |
| BMP | best management practice |
| BU | beneficial use |
| Cal-EPA | California Environmental Protection Agency |
| CALFED | CALFED Bay-Delta Program |
| CalTrans | California Department of Transportation |
| CAO | Cleanup and Abatement Order |
| CAP | Consolidated Action Plan |
| CARA | California Rivers Association |
| CARB | California Air Resources Board |
| CARA | California Rivers Assessment |
| CCMP | (San Francisco Estuary) Comprehensive Conservation and Management Plan |
| CCR | Consumer Confidence Report |
| CDFG | California Department of Fish and Game |
| CDO | Cease and Desist Order |
| CEQA | California Environmental Quality Act |
| CFR | Code of Federal Regulations |
| cfs | cubic feet per second |
| CNDDB | California Natural Diversity Data Base |

| | |
|---|---|
| COA | Condition of Approval |
| COG | Council of Governments |
| COLD | cold freshwater habitat |
| COMM | ocean, commercial, and sport fishing |
| CPP | Continuing Planning Process |
| CRMP | Coordinated Resources Management and Planning |
| CUP | Conditional Use Permit |
| CWA | Clean Water Act |
| CWHR | California Wildlife-Habitat Relationship |
| CWC | California Water Code |
| CZARA | Coastal Zone Act Reauthorization Amendments |
| CZMA | Coastal Zone Management Act |
| Delta | Sacramento-San Joaquin River Delta |
| DPR | Department of Pesticide Regulation |
| DU | dwelling unit |
| DWR | Department of Water Resources |
| EIR | Environmental Impact Report |
| EIS | Environmental Impact Statement |
| EPA | U.S. Environmental Protection Agency |
| ESA | Endangered Species Act |
| ESC | erosion and sediment control |
| EST | estuarine habitat |
| Estuary | San Francisco Bay Estuary |
| FAHCE | Fisheries and Aquatic Habitat Collaborative Effort |
| FEMA | Federal Emergency Management Agency |
| FFDCA | Federal Food, Drug, and Cosmetic Act |
| FIFRA | Federal Insecticide, Fungicide, and Rodenticide Act |
| FQPA | Food Quality Protection Act |
| FRSH | freshwater replenishment |
| GP | General Plan |
| GIS | Geographic Information System |
| GCRCD | Guadalupe-Coyote Resource Conservation District |
| GWR | groundwater recharge |
| HCD | Department of Housing and Community Development |
| HCP | Habitat Conservation Plan |
| hhhw | household hazardous waste |
| HOV | high occupancy vehicle |
| IND | industrial service supply |
| LA | load allocation |
| LAFCOs | Local Agency Formation Commissions |
| LUS | Land Use Subgroup |
| MAA | Management Agency Agreement |
| Magnuson Act | Magnuson-Stevens Fishery Conservation and Management Act of 1976 |
| MAR | marine habitat |
| MFR | multiple-family residential |

| | |
|---|---|
| mgd | million gallons per day |
| MHCP | (San Diego) Multiple Habitat Conservation Program |
| MHHW | mean higher high water |
| MHW | mean high water |
| MIGR | fish migration |
| MPO | Metropolitan Planning Organization |
| MROSD | Mid-Peninsula Regional Open Space District |
| MSCP | (San Diego) Multiple Species Conservation Program |
| msl | mean sea level |
| MTBE | methyl tert-butyl ether |
| MTC | Metropolitan Transportation Commission |
| MTL | mean tide level |
| MUN | municipal and domestic supply |
| NAV | navigation |
| NCCP | Natural Community Conservation Planning |
| NEPA | National Environmental Policy Act |
| NMFS | National Marine Fisheries Service |
| NOAA | National Oceanic and Atmospheric Administration |
| NPDES | National Pollutant Discharge Elimination System |
| NPS | nonpoint source |
| OEHHA | Office of Environmental Health Hazard Assistance |
| PCPA | Pesticide Contamination Prevention Act |
| PDR | Purchase of Development Rights |
| PIP | Public Information and Participation |
| PMC | Pacific Municipal Consultants |
| Porter-Cologne Act | California Porter-Cologne Water Quality Control Act of 1969 |
| POTWs | Publicly Owned Treatment Works |
| ppt | parts per thousand |
| PRO | industrial process supply |
| PUD | Planned-Unit Development |
| QA/QC | quality assurance/quality control |
| RARE | preservation of rare and endangered species |
| REC-1 | water contact recreation |
| REC-2 | noncontact water recreation |
| Regional Board | San Francisco Bay Regional Water Quality Control Board |
| RIC | Single-family residential cluster zone (Cupertino) |
| ROW | right-of-way |
| ROWD | Report of Waste Discharge |
| RPT | Report Preparation Team |
| RTP | Regional Transportation Plan |
| SANDAG | San Diego Association of Governments |
| SCBWM1 | Santa Clara Basin Watershed Management Initiative |
| SCVTA | Santa Clara Valley Transportation Authority |
| SCVURPPP | Santa Clara Valley Urban Runoff Pollution Prevention Program |
| SEIDS | Stormwater Environmental Indicator Pilot Demonstration |

| | |
|---|---|
| SDWA | Safe Drinking Water Act |
| SFEI | San Francisco Estuary Institute |
| SFEP | San Francisco Estuary Project |
| SFR | single-family residential |
| SFWD | San Francisco Water Department |
| SHELL | shellfish harvesting |
| SMARA | Surface Mining and Reclamation Act |
| SOI | sphere of Influence |
| SOV | single occupancy vehicle |
| SPWN | fish spawning |
| SSO | site-specific objective |
| State Board | State Water Resources Control Board |
| TAC | Technical Advisory Committee |
| TDM | Transportation Demand Management |
| TDR | Transfer of Development Rights |
| TEA-21 | Federal Transportation Equity Act for the 21st Century |
| TIP | Traffic Intensity Performance (Standard) |
| TMDL | total maximum daily load |
| TRPA | Tahoe Regional Planning Agency |
| TSM | Transportation System Management |
| UAA | use attainability analysis |
| USFWS | U.S. Fish and Wildlife Service |
| USGS | U.S. Geological Survey |
| WAC | Watershed Assessment Consultant |
| WARM | warm freshwater habitat |
| WAS | Watershed Assessment Subgroup |
| WATAC | Watershed Assessment Technical Advisory Committee |
| Water District | Santa Clara Valley Water District |
| WDR | Waste Discharge Requirement |
| WHR | (CA) Wildlife-Habitat Relationships System |
| WILD | wildlife habitat |
| WLA | Waste Load Allocation |
| WMI | (Santa Clara Basin) Watershed Management Initiative |
| WWTP | Wastewater Treatment Plant |

# Attachment B
# Glossary

| Term | Definition |
|---|---|
| **Accuracy** | The correctness of the data, the closeness of the measure or computed value to its true value. Measures how close results are to a true or expected value and can be determined by comparing analysis of a standard or reference sample to its actual value. |
| **Alluvial** | Deposited by running water. |
| **Alluvial Fan** | Fan-shaped deposit formed by a stream where its velocity decreases abruptly, as at the mouth of a ravine or at the foot of a mountain, allowing suspended sediment to settle out. |
| **Alluvial Plain** | Level or gently sloping surface of sediments laid down by streams. |
| **Anadromous** | Refers to fish that migrate from saltwater to span in freshwater. |
| **Aquifer** | Geological formation that holds or conducts groundwater. |
| **Augmented Summer Flow** | Summer flows augmented by reservoir or pipeline releases. An example of an augmented flow system is the Guadalupe River. |
| **Basin** | A management area encompassing a number of individual watersheds that share a common receiving water or large drainage basin. Designations based upon the U.S. Geological Survey classification system. Santa Clara Basin is designated as Hydrologic Cataloging Unit No. 18050003. |
| **Basin Plan** | In accordance with the California Water Code, water quality control plans are adopted by the individual Regional Water Quality Control Boards (Regional Boards) for their respective region. The Basin Plan serves as the primary guidance and policy document to establish designated uses for waterbodies in the region. It contains descriptions of the legal, technical, and programmatic basis for regulation. The plan includes an inventory of beneficial uses of the waters and water quality objectives to ensure reasonable protection of beneficial uses and prevention of nuisance. Basin Plans are generally updated every 3 years and are approved by the State Water Resources Control Board State Board (State Board), California Office of Administrative Law, and ultimately the U.S. Environmental Protection Agency (EPA). |

| Term | Definition |
|---|---|
| **Baylands** | Tidal wetlands bordering the Bay that lie between mean low water and the highest observed tide.<br>The Wetlands Advisory Group considers Baylands to be the shallow water habitats around the Bay between the maximum and minimum elevations of the tides. They are the lands that are touched by the tides, plus the lands that would be tidal in the absence of any levees, seawalls, or other human-made structures that block the tides.[1] |
| **Beneficial Use** | A waterbody's beneficial uses are the resources, services, and qualities of aquatic systems that are the ultimate goals of protecting and achieving high water quality. The Regional Board is charged with protecting all these uses from pollution and nuisance that may occur as a result of waste discharges in the region. The beneficial uses of surface waters, groundwaters, marshes, and mudflats listed below serve as a basis for establishing water quality objectives and the discharge prohibitions or conditions necessary to attain them. |
| Agricultural Supply (AGR) | Uses of water for farming, horticulture, or ranching, including, but not limited to irrigation, stock watering, or support of vegetation for range grazing. |
| Areas of Special Biological Significance (ASBS) | Areas designated by the State Board. These include marine life refuges, ecological reserves, and designated areas where the preservation and enhancement of natural resources requires special protection. In these areas, alteration of natural water quality is undesirable. |
| Cold Freshwater Habitat (COLD) | Uses of water that support coldwater ecosystems, including, but not limited to preservation or enhancement of aquatic habitats, vegetation, fish, or wildlife, including invertebrates. |
| Estuarine Habitat (EST) | Uses of water that support estuarine ecosystems, including but not limited to, preservation or enhancement of estuarine habitats, vegetation, fish, shellfish, or wildlife (e.g., estuarine mammals, waterfowl, shorebirds), and the propagation, sustenance, and migration of estuarine organisms. |
| Fish Migration (MIGR) | Uses of water that support habitats necessary for migration, acclimatization between freshwater and saltwater, and protection of aquatic organisms that are temporary inhabitants of waters within the region. |
| Fish Spawning (SPWN) | Uses of water that support high quality habitats suitable for reproduction and early development of fish. |
| Freshwater Replenishment (FRSH) | Uses of water for natural or artificial maintenance of surface-water quantity or quality. |

[1] The definition of "Baylands" proposed by the Wetlands Advisory Group is a more refined definition that may be used in future reports and is consistent with the San Francisco Bay Area Wetlands Ecosystem Goals Project report.

| Term | Definition |
|---|---|
| Groundwater Recharge (GWR) | Uses of water for natural or artificial recharge of groundwater for purposes of future extraction, maintenance of water quality, or halting saltwater intrusion into freshwater aquifers. |
| Industrial Process Supply (PRO) | Uses of water for industrial activities that depend primarily on water quality. |
| Industrial Service Supply (IND) | Uses of water for industrial activities that do not depend primarily on water quality, including but not limited to, mining, cooling water supply, hydraulic conveyance, gravel washing, fire protection, and oil well repressurization. |
| Marine Habitat (MAR) | Uses of water that support marine ecosystems, including but not limited to, preservation or enhancement of marine habitats, such as kelp, fish, shellfish, or wildlife (e.g., marine mammals, shorebirds). |
| Municipal and Domestic Supply (MUN) | Uses of water for community, military, or individual water supply systems, including but not limited to, drinking water supply. |
| Navigation (NAV) | Uses of water for shipping, travel, or other transportation by private, military, or commercial vessels. |
| Noncontact Water Recreation (REC-2) | Uses of water for recreational activities involving proximity to water, but not normally involving contact with water where ingestion is reasonably possible. These uses include, but are not limited to, picnicking, sunbathing, hiking, beachcombing, camping, boating, tide pool and marine life study, hunting, sightseeing, or aesthetic enjoyment in conjunction with the above activities. |
| Ocean, Commercial, and Sport Fishing (COMM) | Uses of water for commercial or recreational collection of fish, shellfish, or other organisms intended for human consumption or bait purposes. |
| Preservation of Rare and Endangered Species (RARE) | Uses of water that support habitats necessary for the survival and successful maintenance of plant or animal species established under state and/or federal law as rare, threatened, or endangered. |
| Shellfish Harvesting (SHELL) | Uses of water that support habitats suitable for the collection of crustaceans and filter feeder shellfish (e.g., clams, oysters, and mussels) for human consumption, commercial, or sport purposes. |
| Warm Freshwater Habitat (WARM) | Uses of water that support warmwater ecosystems, including but not limited to, preservation or enhancement of aquatic habitats, vegetation, fish, or wildlife, including invertebrates. |
| Water Contact Recreation (REC-1) | Uses of water for recreational activities involving body contact with water where ingestion of water is reasonably possible. These uses include, but are not limited to, swimming, wading, waterskiing, skin and scuba diving, surfing, whitewater activities, fishing, and uses of natural hot springs. |

| Term | Definition |
|---|---|
| Wildlife Habitat (WILD) | Uses of waters that support wildlife habitat, including but not limited to, the preservation and enhancement of vegetation and prey species used by wildlife, such as waterfowl. |
| **Biological Index** | A method of measuring the aquatic health of a site (for fish or macro-invertebrates) by scoring each of several biological metrics and calculating overall index number. Overall health is assigned based on comparison with similar index or indices as measured at reference station(s). |
| **California Water Code (CWC)** | California water laws and enforcement mechanisms are codified in the CWC. The CWC establishes general state powers over water, water quality requirements, and water distribution. The water quality portion of the CWC, also known as the Porter-Cologne Water Quality Control Act (Division 7 of the CWC), provides the regulatory framework for regulation of waste discharges to surface water and groundwater. The Porter-Cologne Act is implemented by the State Board and the nine Regional Boards. |
| **Cease and Desist Order (CDO)** | A CDO is an administrative enforcement action issued by the Regional Boards when a discharger violates waste discharge requirements, NPDES permit requirements, or the Basin Plan. CDOs may restrict or prohibit the volume, type, or concentration of waste that might be discharged. CDOs may be issued directly by a Regional Board, after notice and hearing, or in accordance with the procedure set forth in CWC Section 13302. CDOs are typically issued for continuous discharges, whereas Cleanup and Abatement Orders (CAOs) are issued pursuant to Section 13304 for one-time or finite discharges. |
| **Channelization** | General term for various modifications of a stream channel (deepening, straightening, etc.) that are usually intended to increase the velocity of water flow, the volume of the channel, or both. |
| **Clean Water Act (CWA)** | The Federal Water Pollution Prevention and Control Act, or Clean Water Act (33 United States Code §1251et seq.), was first passed in 1948. In its present form, it was passed as the Federal Pollution Control Act Amendments of 1972. The CWA is limited to surface waters and does not regulate groundwater or nonfederal water. The purpose of enacting the CWA was to restore and maintain the chemical, physical, and biological integrity of U.S. water. The CWA is structured to control or eliminate surface-water pollution and establishes uniform standards for Publicly Owned Treatment Works (POTWs), direct industrial discharges, and indirect industrial discharges. Other programs under the CWA require reporting and cleanup of oil and chemical spills in surface water (Spill Prevention Control and Countermeasure programs), establishing uniform industrial pretreatment standards with local enforcement, controlling toxic pollutant discharges, and regulating dredging and filling of wetlands. |

| Term | Definition |
|---|---|
| **Comparability** | The extent to which data can be compared between sample locations or periods of time within a project or between projects. |
| **Completeness** | The comparison between the amount of valid, or usable, data originally planned to be collected, versus how many were collected. |
| **Core Group** | The decision-making body for the Santa Clara Basin Watershed Management Initiative. The Core Group is made up of representatives from local, state, and federal government, civic groups, business and industry, and environmental groups. |
| **Correlated Uses** | Basin Plan beneficial uses that share with the primary use similar data needs for the assessment. |
| **Data Gaps** | Missing data sets (e.g., water temperature for a stream) or missing data categories (e.g., water quality parameters for a stream). |
| **Data Management** | The efficient use of software, hardware, and human resources to provide accurate watershed data for inventory, assessment, and monitoring programs. |
| **Data Quality Objectives** | Quantifiable criteria for measurement sensitivity, bias, reproducibility, completeness, and representatives. |
| **Data Sets** | Specific data collected for a given purpose. |
| **Design Flow** | The flow of water from a drainage area that, on the average and over a long period of time, has a 1 percent chance (probability of 0.1) of being equaled or exceeded in any given year. It is sometimes referred to as the 100-year flood but should not be thought of as an event that occurs regularly every $100^{th}$ year. |
| **Designated Uses** | The beneficial uses specified in state-adopted water quality standards for a waterbody or segment thereof. Such designated uses may or may not presently be attained. Each Regional Board in California designates or assigns beneficial uses to waterbodies and then develops policies to protect those uses. |
| **Direct Measures** | Data types that provide a relatively direct measure of the extent to which a waterbody supports a beneficial use and/or stakeholder interest (adapted from Table 4, Work Group A memo of January 25, 1999). |
| **Effluent** | Outflow or discharge, as from a wastewater treatment plant. |
| **Environmental Indicators** | Measurements and indices used to assess existing environmental conditions, indicate general environmental trends over time, and measure the effectiveness of environmental management programs. Environmental indicators may be physical and hydrologic, chemical, and biological. |
| **Estuary** | Semi-enclosed coastal body of water that has a free connection with the open sea and within which saltwater is measurably diluted with fresh water derived from land drainage. |

| Term | Definition |
|---|---|
| **Fish Ladder** | Series of ascending pools that let fish swim upstream around or over a dam. |
| **Flood Management** | Design, construction, and maintenance of flood control facilities to minimize damage from floods. |
| **Flood Protection** | Flood Protection consists of activities, including planning, which reduce the potential for flood damages to homes, schools, businesses, transportation networks, and other public and private buildings and infrastructure, implemented in a practical, cost-effective, and environmentally sensitive manner. Flood protection activities include both corrective measures and preventive measures. Corrective measures include, but are not limited to, activities such as construction of levees, floodwalls, detention facilities, and flood proofing. Additionally, ongoing maintenance activities such as sediment removal, vegetation control, and erosion prevention and/or repairs are necessary on all facilities to keep them operating as intended. Preventative measures include, but are not limited to, activities such as floodplain zoning, subdivision ordinances, floodplain preservation, habitat and open-space preservation, and education. |
| **Floodway (Planned)** | Natural or modified watercourses consisting of a combination of stream channel and adjacent areas planned to convey floodflows. The Federal Emergency Management Agency defines Regulatory Floodways as the stream channels and adjacent areas within which encroachments are prohibited if they would raise calculated water surface elevations by 1.0 foot or more. A Planned Floodway would include the stream channel and adjacent areas planned to convey high flows but may also be used for other compatible uses. For example, these uses might include recreation and/or agriculture. |
| **Floodplain** | A flat region or valley floor surrounding a stream channel into which the stream overflows during flooding. |
| **Geomorphology** | The study of characteristics and development of landforms; as used in this volume, generally the landforms themselves. |
| **Geospatial Data** | Data referenced to the earth’s surface by a mathematical coordinate system, enabling the location of data with known spatial accuracy. |
| **Groundwater** | Subsurface water that occurs beneath the water table in soils, and geologic formations that are fully saturated. |
| **Habitat** | The area in which an organism or ecological community lives. |
| **Impediment of Concern** | An environmental condition (e.g., temperature) that is outside a suitable range that is generally required for the waterbody to support a primary use. |

| Term | Definition |
|---|---|
| **Imperviousness** | Term applied to surfaces – roads, sidewalks, rooftops, parking lots – that prevent or inhibit rainfall from sinking into groundcover and groundwater. |
| **Incidental Take Permit** | A permit that allows taking of a listed species for scientific purposes or to enhance the propagation or survival of the affected species, including but not limited to, acts necessary for the establishment and maintenance of experimental populations or any taking otherwise prohibited by Section 9 of the Federal Endangered Species Act if such taking is incidental to, and not the purpose of, the carrying out of an otherwise lawful activity (from Section 10, Exceptions, of the Federal Endangered Species Act). |
| **Levee** | Raised bank along a stream channel. Some streams form low, natural levees, but often they are artificial, constructed to protect the floodplain. |
| **Lower South Bay** | The portion of the San Francisco Bay Estuary located south of Dumbarton Bridge. |
| **Main Water Mass** | The main water mass is defined conceptually as that area of the Lower South Bay that has physical, chemical, and biological characteristics that are generally different than slough areas. |
| **Metadata** | Information that describes the accuracy and/or precision, the format, units of measurement, etc. of a set of data. The information can also contain the methods or protocols used to obtain the data and any other information that may limit the applicability of a data set. |
| **Metric** | A measurable physical, chemical, or biological attribute of a natural system. |
| **Mixing Zone** | A mixing zone is an area where an effluent discharge undergoes initial dilution and is extended to cover the secondary mixing in the ambient waterbody. A mixing zone is an allocated impact zone where water quality criteria can be exceeded as long as acutely toxic conditions are prevented. |
| **MTBE (methyl tert-butyl ether)** | A gasoline additive. |
| **National Pollution Discharge Elimination System (NPDES)** | The NPDES is a federal program requiring permits for the discharge of pollutants from any point source into the waters of the U.S. The NPDES program is required by the CWA and regulations for the program are set forth in 40 Code of Federal Regulations (CFR) Part 122. EPA is the primary authority for the NPDES permit program. However, California has been delegated authority to implement the NPDES program through the Regional Boards. |

| Term | Definition |
|---|---|
| **Natural Summer Flow** | Stream reaches that support steelhead and resident trout during low flow periods in absence of flow augmentation. Examples of natural summer flow stream systems are San Francisquito Creek and watersheds above most reservoirs. |
| **Permeable** | As used here, soil or rock that can be permeated or penetrated by water. |
| **Porter-Cologne Act** | The California Porter-Cologne Water Quality Control Act was enacted by the state legislature in 1969 to implement federal directives requiring classification of state waters by beneficial use, adopt water quality objectives, and formulate plans to achieve the objectives. |
| **Precision** | Describes the degree of agreement among repeated measurements of the same characteristic. It may be determined by calculating the standard deviation, or relative percent difference, among samples taken from the same place at the same time. |
| **Primary Indicators** | Data types that are considered reliable indicators of important environmental conditions that affect the extent to which a waterbody may support beneficial uses and stakeholder interests. A reliable indicator is defined as an indicator for which a generally accepted threshold value exists and, therefore, it is clear how data for that indicator will be evaluated in the assessment (adapted from Table 4, Work Group A memo of January 25, 1999). |
| **Primary Use** | Basin Plan beneficial uses or other stakeholder uses that form the foundation for the watershed assessment. |
| **Qualitative Data** | Descriptive information, usually in narrative format. |
| **Quality Assurance** | The system of activities that gives assurance that quality control is being carried out effectively to meet data quality objectives. A continuous evaluation of data and the performance of the production system form samples to finished data. |
| **Quality Assurance Plan (for data collection)** | The objective of a quality assurance plan is to maximize the probability that environmental data will meet or exceed the objectives established for data quality. It is a document that presents a systematic approach to data acquisition and data management and can be used as a reference to monitor performance of various measurement systems to maintain statistical control, to provide rapid feedback so that corrective measures can be taken before data quality is compromised, and to verify that the reported data are sufficiently complete, comparable, representative, unbiased, and precise so as to be suitable for their intended uses. |
| **Quality Control** | The system of activities that control the quality of data so they meet the needs of the user. Quality control operates to make sure that the data produced are satisfactory, adequate, and dependable and meet data quality objectives. |

| Term | Definition |
|---|---|
| **Quality Control Coordinator** | The Quality Control Coordinator will oversee that the Watershed Management Initiative work is conducted using the appropriate quality control and assurance methods. They will provide quality control training to the Core Group and subgroups, and approve and monitor the quality assurance/quality control plans developed by the subgroups, Report Preparation Team, and other work groups. |
| **Quantitative Data** | Data measured in units that can be subjected to statistical analysis or can be used in developing or applying numerically based models. |
| **Regional Water Quality Control Board (Regional Board)** | Nine Regional Boards were established in 1967, along with the State Board, to manage water quality in California and for administrating the state and federal water pollution control laws. California's governor appoints a nine member board for each region, whose members serve 4-year terms. Board members represent and act on the behalf of the region and must reside or have a principal place of business within the region. The Regional Board's overall mission is to protect surface waters and ground water of the state. The Regional Board's responsibilities include implementing the NPDES permit program, addressing regional water quality concerns, and coordinating with other public agencies that are concerned with water quality control.<br><br>The San Francisco Bay Regional Board regulates surface water and groundwater quality in the San Francisco Bay area. The area under the San Francisco Bay Regional Board's jurisdiction comprises all of the San Francisco Bay watersheds, including portions of the San Mateo and Marin county coasts, extending to the mouth of the Sacramento-San Joaquin River Delta. |
| **Representativeness** | The extent to which measurements actually represent the true environmental condition or population at the time a sample was collected. |
| **Riparian** | Pertaining to the banks and other adjacent, terrestrial (as opposed to aquatic) environs of freshwater bodies, watercourses, and surface-emergent aquifers (e.g., springs, seeps, oases), whose imported water provide soil moisture significantly in excess of that otherwise available through local precipitation – soil moisture to potentially support a vegetation distinguishable from that of the adjacent drier uplands. |
| **Riparian Corridor** | Relating to a stream channel and particularly the vegetation along its banks; see Section 4.3. |
| **San Francisco Estuary Institute (SFEI)** | A nonprofit research organization chartered through the Comprehensive Conservation and Management Plan (CCMP) for the San Francisco Estuary, to conduct regionwide monitoring of the Estuary and its tributary watersheds. |

| Term | Definition |
|---|---|
| **Santa Clara Basin** | The administrative unit used by the Regional Board to designate the beneficial uses of the waterbodies and watersheds that drain into the portion of the San Francisco Bay south of Dumbarton Bridge. The Basin includes portions of Santa Clara, San Mateo, and Alameda counties. |
| **Santa Clara Basin Watershed Management Initiative (WMI)** | The initiative was established in 1996 by the EPA, the State Board, and the San Francisco Bay Regional Board as a pilot project for a statewide effort to manage water resources at the watershed scale. The purpose is to develop and carry out a program that takes account of all human activities that influence water quality. More fully described on page 1-1. |
| **Savanna** | A flat grassland. |
| **Scale** | In the context of the watershed assessment work plan, scale refers to size of an area being assessed and will depend upon the amount and type of data available as well as the type of analysis being conducted. |
| **Secondary Indicators** | Data types that are considered less reliable measures or indicators of less important environmental conditions that affect the extent to which a waterbody can support beneficial uses and/or stakeholder interests (adapted from Table 4, Work Group A memo of January 25, 1999). |
| **Site-Specific Objective (SSO)** | Provisions in the CWA, CWC, and Basin Plan allow for developing water quality SSOs for chemical constituents when an area is considered unique from the rest of the Basin and when existing water quality criteria cannot be applied. Available scientific information, monitoring data, latest EPA guidance, local environmental conditions, and impacts caused by bioaccumulation are considered when developing SSOs. |
| **Slough Areas** | Slough areas are conceptually defined as the tidally influenced tributary areas of the Lower South Bay. |
| **Special-Status Species** | Species identified as rare, threatened, endangered or other wise of concern based on California Environment Quality Act Guidance 15380, which includes federal status, California status, California Department of Fish and Game listing, or California Native Plant Society listing. |
| **Stakeholder** | As used here, stakeholders are individuals and organizations with a stake or interest in the outcome of the WMI. |
| **State Water Resources Control Board (State Board)** | The State Board administers water rights, water pollution control, and water quality functions for the state as part of the California Environmental Protection Agency. It provides policy guidance and budgetary authority to the Regional Board, which conducts planning, permitting, and enforcement activities. The State Board shares authority for implementation of the federal CWA and the state Porter-Cologne Act with the Regional Boards. |

| Term | Definition |
|---|---|
| **Stream Channel Morphology** | Stream channel morphology refers to the shape, form, and composition of a channel, which are directly influenced by eight major variables including channel width and depth, flow velocity and discharge, bed slope, roughness of channel materials, sediment load, and sediment size. A change in any one of these variables can initiate a series of channel adjustments, which can cause changes in other variables, resulting in an alteration of channel pattern and aquatic habitat types. Significant changes in channel form occur when variables that influence channel morphology are outside of a normal or acceptable range of variation. |
| **Subwatershed** | In a land area that drains to many ordered streams or channels, a sub-watershed is the land area that drains to only one stream or channel within the system. |
| **Surface Waters** | Freshwater rivers, streams, and lakes (collectively described as inland surface waters), estuarine waters, and coastal waters. |
| **Sustainable Population** | A population in dynamic equilibrium with various ecological relationships (predator/prey, competition, birth-death, recruitment, etc.) and resilient enough to withstand natural perturbations in environmental conditions such as climate change and habitat modification. |
| **Take** | To harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in any such conduct (from Section 3, Definitions, of the Federal Endangered Species Act). |
| **Technical Advisory Panel** | A panel of outside professionals representing a variety of fields related to the project that meet regularly (e.g., quarterly) and give advice overall on the project design, execution, and conclusions. The panel would be comprised of people with sufficient scientific or technical background to provide guidance of general technical nature and to be at the interface of management or policy and science. They need to translate complex concepts coming from the experts in a particular field to policy makers. |
| **Technical Review Committee** | A committee of outside professionals with a specific expertise that are brought in to review products of other experts hired to do scientifically complex studies or to discuss a specific issue. This committee would meet as needed. These professionals should have tenure somewhere and no stake in any outcome other than maintaining scientific integrity, advancing public debate, and telling the truth. |

| Term | Definition |
|---|---|
| **Total Maximum Daily Load (TMDL)** | The TMDL is an analysis used to calculate the maximum pollutant load a waterbody can receive (loading capacity) without violating water quality standards. States require establishing TMDLs for waterbodies where technology-based requirements alone are insufficient to attain water quality standards. TMDLs include allocations of pollutant loads among Waste Load Allocations/Load Allocations (see definition), background loadings from natural sources, and safety margins to ensure achievement of water quality goals. The CWA requires that EPA review and approve TMDLs. |
| **Translator** | Developed as guidance by the EPA, translators are used to calculate a total metal recoverable permit limit from a dissolved metal criterion. Chemical differences between the discharged effluent and the receiving water are expected to result in changes in the partitioning between dissolved and absorbed forms of metal. Therefore, translators were developed to determine what fraction of metal in the effluent is dissolved in the receiving body water. Translators are not designed to consider bioaccumulation of metals. |
| **Uncertainty Analysis** | An evaluation of the uncertainty associated with beneficial use and stakeholder interest support statements. The evaluation is based on various criteria including data quality and data coverage and follows *Guidelines for Preparation of the Comprehensive State Water Quality Assessments (305(b) Reports) and Electronic Updates (*EPA 1997, EPA-841-B-97-002 A,B). |
| **Use Attainability Analysis (UAA)** | UAA is defined in 40 CFR 131 as a structured scientific assessment of factors affecting the attainment of a designated beneficial use (use) which may include physical, biological, chemical, and economic factors. At a minimum, uses are deemed attainable if they can be achieved by imposing effluent limits and by imposing cost-effective and reasonable best management practices for nonpoint source control. Prior to adding or removing a use, or establishing subcategories of a use, the state must provide notice and an opportunity for a public hearing. States may remove a use if the state demonstrates that attaining the use is not feasible according to 40 CFR 131.10(g). |
| **Waste Load Allocation (WLA) and Load Allocation (LA)** | The WLA defines the appropriate discharge conditions that are applied to point sources to attain and protect water quality. WLAs can be developed using steady state or dynamic water quality models. LAs are applied to other nonpoint and background sources. |

| Term | Definition |
|---|---|
| **Water Quality Criterion** | A limit on a particular pollutant or on a condition of a waterbody intended to protect and support a use. When criteria are properly selected and met, it is expected that water quality will protect the designated use. National water quality criteria are recommendations for standards, which are not enforceable unless adopted by states as part of water quality standards. In California, the numeric criteria established as part of water quality standards are known as "water quality objectives." |
| **Water Quality Objective** | Water quality objective means the limits or levels of water quality constituents or characteristics that are established for the reasonable protection of beneficial uses of water or the prevention of nuisance. Water quality objectives are defined by each Regional Board and are specified in the Basin Plan. Generally there are two types of objectives: narrative and numerical. Narrative objectives present general descriptions of water quality that must be attained through pollutant control measures and watershed management. They also serve as the basis for the development of detailed numerical objectives. Numerical objectives typically describe pollutant concentrations, physical/chemical conditions of the water itself, and the toxicity of the water to aquatic organisms (based on water quality criteria). These objectives are designed to represent the maximum amount of pollutants that can remain in the water column without causing an adverse effect on organisms or human health. |
| **Water Quality Standard** | A law or regulation which consists of the beneficial designated use or uses of a waterbody, or segment thereof, and the water quality criteria that are necessary to protect the use or uses of that particular waterbody. Water quality standards also contain an antidegradation policy. Water quality standards are defined under the CWA. In California, water quality objectives are defined under the Porter-Cologne Act, and are the enforceable numeric or narrative portion of the water quality standard intended to protect (a) designated use(s). |
| **Watershed** | The land area that drains into a single stream or system of streams, rivers, or channels. |

| Term | Definition |
|---|---|
| **Watershed Assessment** | The analytical procedures used to determine the degree of "designated use" attainment or impairment based upon a thorough watershed inventory. Under CWA Section 305(b), assessment of an individual waterbody (e.g., a stream segment or lake) means analyzing biological/habitat and physical/chemical data and other information to determine:<br>• The degree of designated use support of the waterbody (fully supporting, fully supporting but threatened, partially supporting, or not supporting)<br>• If designated uses are impaired, the causes(pollutants or stressors) and sources of the problem<br>• Biological integrity using state biological criteria or other measures<br>• Descriptive information such as the type and level of data used in the assessment |
| **Watershed Data** | Information that describes in numeric or geographically referenced format the past or present condition of some watershed characteristic. |
| **Watershed Inventory** | A compilation of watershed data necessary to accurately describe an array of watershed characteristics. |
| **Watershed Management** | An integrated suite of activities designed to maximize beneficial use support within specific watershed management planning areas, taking into account all threats to human health and ecological integrity within the watershed. |
| **Watershed Management Goals** | A set of measurable standards based upon the watershed assessment that measure progress toward beneficial use attainment or impairment reduction. |
| **Watershed Monitoring** | Ongoing data collection and analysis programs used to determine the effectiveness of specific activities implemented to achieve watershed management goals. |
| **Watershed Science Plan** | A set of guidelines for the systematic collection of information describing the past and present state of watershed ecological health. This plan was developed by the SFEI and is currently still in draft form. |
| **Wetlands** | Definitions used by the EPA, the U.S. Army Corps of Engineers, and the U.S. Fish and Wildlife Service vary, but all are based on three conditions: (1) a hydrologic regime typified by standing water, (2) hydric or saturated soils, and (3) the presence of plants adapted to waterlogged soils. The Fish and Wildlife Service definition also recognizes nonvegetated wetlands such as mudlflats, rocky shores, and sandbars. See Table 6-1 for further detail. |
| **Work Product** | A specific product (written report, database, brochure, memo) that results from the activities carried out by subgroups (or their designated representative) as a part of a work plan. |

# Attachment C
# Production Credits and Acknowledgments

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**HOME BUILDERS ASSOCIATION OF NORTHERN CALIFORNIA**

**LEAGUE OF WOMEN VOTERS**

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**SANTA CLARA VALLEY URBAN RUNOFF POLLUTION PREVENTION PROGRAM**

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**WEST VALLEY CLEAN WATER PROGRAM**

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