Never doubt that a small group of thoughtful, committed citizens can change the world; indeed it is the only thing that ever has.

Margaret Mead

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. It condenses a larger and much more detailed report, which is referenced throughout this volume as “**Volume One Unabridged**.” Chapter numbers and major sections in this report correspond to those in the unabridged version. Those who need or want the much greater detail found in Volume One Unabridged should contact the Project Coordinator for the Watershed Management Initiative at the address below.

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, send in the response card at the back of this report or contact:

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Watershed Management Plan

Volume One
Watershed Characteristics Report

SANTA CLARA BASIN

WMI

WATERSHED
MANAGEMENT INITIATIVE

Prepared by the
Santa Clara Basin Watershed Management Initiative

May 2000

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Chapter 1
Introduction

*This chapter introduces the **Santa Clara Basin Watershed Management Initiative (WMI)** and its goals, and provides a brief general description of the characteristics of the Basin. It also briefly describes the other volumes to be produced in support of the initiative.*

This report parallels Volume One Unabridged in structure and, besides this chapter, includes:

- **Chapter 2** - "Report Preparation Process" (omitted here except for a very brief summary).
- **Chapter 3** - "Cultural Setting of the Santa Clara Basin" describes the human settlement and development of the Basin.
- **Chapter 4** - "Land Use in the Santa Clara Basin" describes present and proposed uses of the land within the Basin and how natural and human forces affect these uses.
- **Chapter 5** - "Organizational Setting" details local government and regulatory agencies, environmental organizations, business community groups, and others with interest in WMI activities.
- **Chapter 6** - "Regulatory Setting" discusses the responsibilities and actions of the many agencies that make decisions about water-related resources.
- **Chapter 7** - "Natural Setting" discusses the geography, geology, soils, climate, and hydrology of the Basin, and habitats for both vegetation and wildlife.
- **Chapter 8** - "Water Management in the Santa Clara Basin" describes the institutions that manage water in the Basin, their facilities and practices.

The Santa Clara Basin (hereafter usually called simply "the Basin") is defined as San Francisco Bay (the Bay) south of the Dumbarton Bridge, and the 840 square miles of land that drain to it.

1.1 Santa Clara Basin Watershed Management Initiative

Purpose

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 streams. 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 in the watershed.

The WMI was established in 1996 by the U.S. Environmental Protection Agency (EPA), State Water Resources Control Board (State Board), and San Francisco Bay Regional Water Quality Control Board (Regional Board), working with local government agencies and special interest groups. It is a pilot project for California's Watershed Management Initiative, 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 in its work by a group of stakeholders: individuals and representatives of organizations with a stake or interest in the outcome of the WMI. Stakeholders include representatives of local, state, and federal government agencies; business, agricultural, and industry associations; and environmental and civic groups.

Goals of the Watershed Management Initiative

The key goals of the WMI include:

- 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.

The WMI work plan calls for four volumes of the Watershed Management Plan to be prepared. Figure 1-1 gives a graphic view of the contents and relationships of the four volumes, which are:

Volume One, "Watershed Characteristics Report," describes the general physical and political characteristics of the Basin, including land use, regulatory aspects, and water management facilities.

Volume Two, "Watershed Assessment Report," will describe the condition of two watersheds and one subwatershed within the Basin (Guadalupe River, San Francisquito Creek, and Upper Penitencia Creek, respectively) in specific detail. Information concerning conditions in the Baylands area will also be included.

Volume Three, "Watershed Action Alternatives Report," will evaluate the results of various assessments, identify and develop possible actions, and evaluate them as to their feasibility, costs, and time requirements.

Volume Four, "Watershed Action Plan," will set out what has been agreed upon to meet the stakeholder goals.

1.2 Location and Characteristics of the Santa Clara Basin

General Characteristics

The Santa Clara Basin – San Francisco Bay south of the Dumbarton Bridge and the 840 square miles that drain to it – is bounded by the crest of the Diablo Mountains on the east and the crest of the Santa Cruz Mountains to the west and south. About 1.9 million people live in the Basin, nearly half of them in the city of San Jose. The Basin includes about half of Santa Clara County plus small parts of San Mateo and Alameda counties. All or part of 20 cities lie within the Basin (Figure 1-2).

Until World War II, the Basin was devoted almost exclusively to agriculture. 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 the northern part of the Basin is largely residential, commercial, and industrial; the southern portion remains largely rural and is devoted to cattle ranching, water-supply catchments, and scattered low-density residential development.

Watersheds

For the purposes of the WMI, the Basin has been divided into 13 watersheds and the Baylands (Figure 1-3). The 13 watersheds are associated with the main streams in the Basin and the lands that drain to them. The Baylands consists of 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 Penetencia 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.

[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).

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 watersheds lie wholly within Santa Clara County. 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.

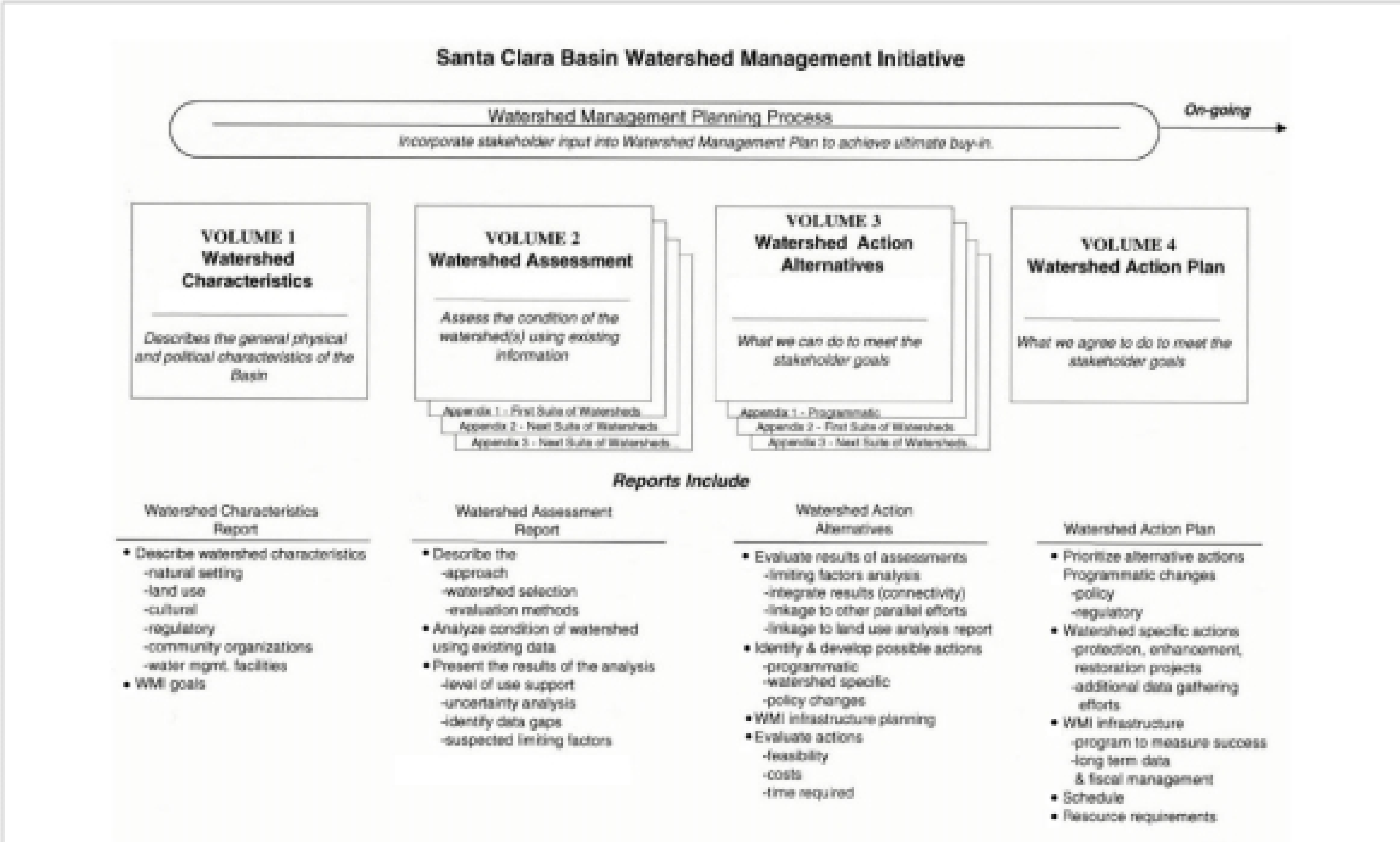
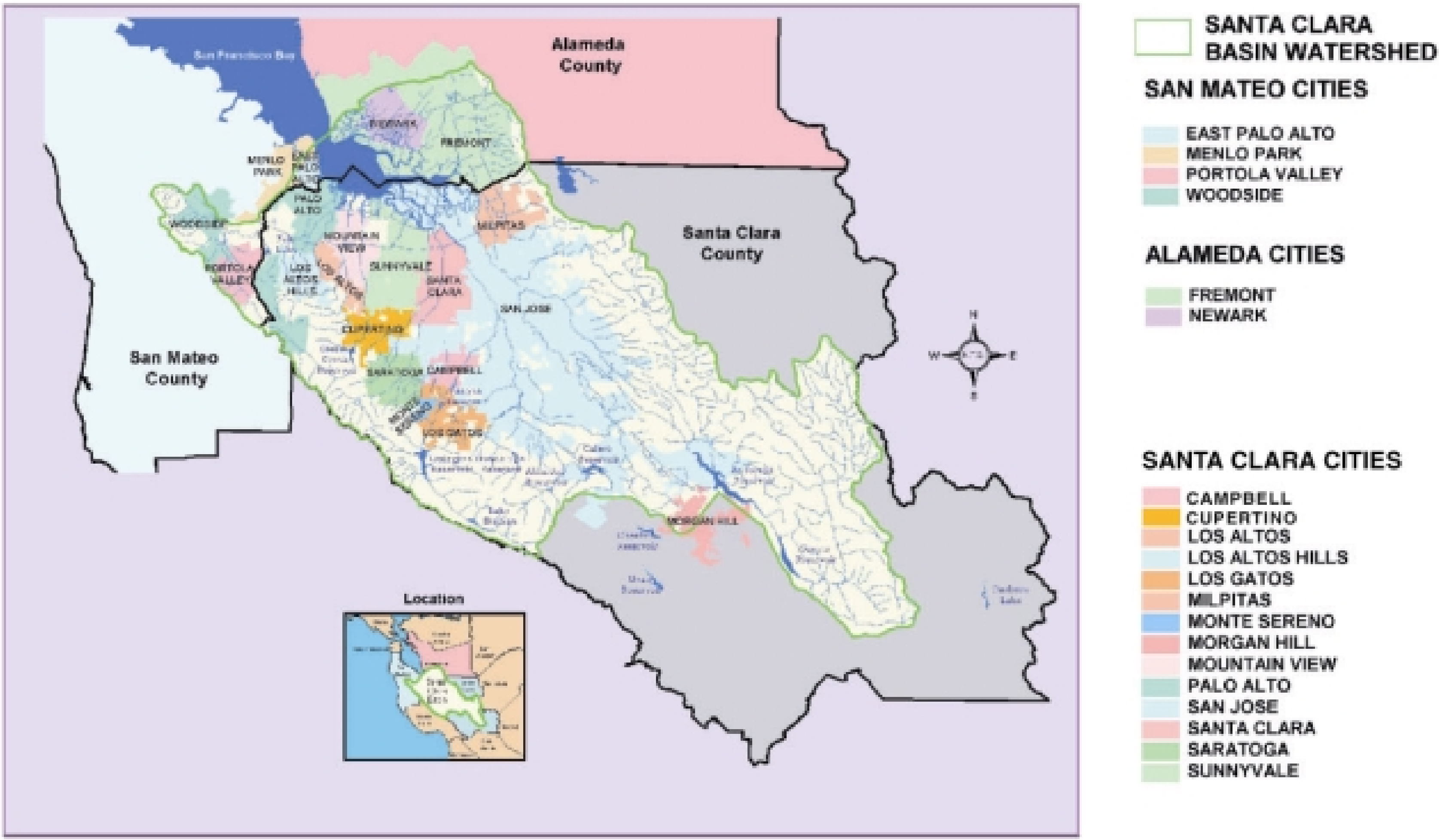
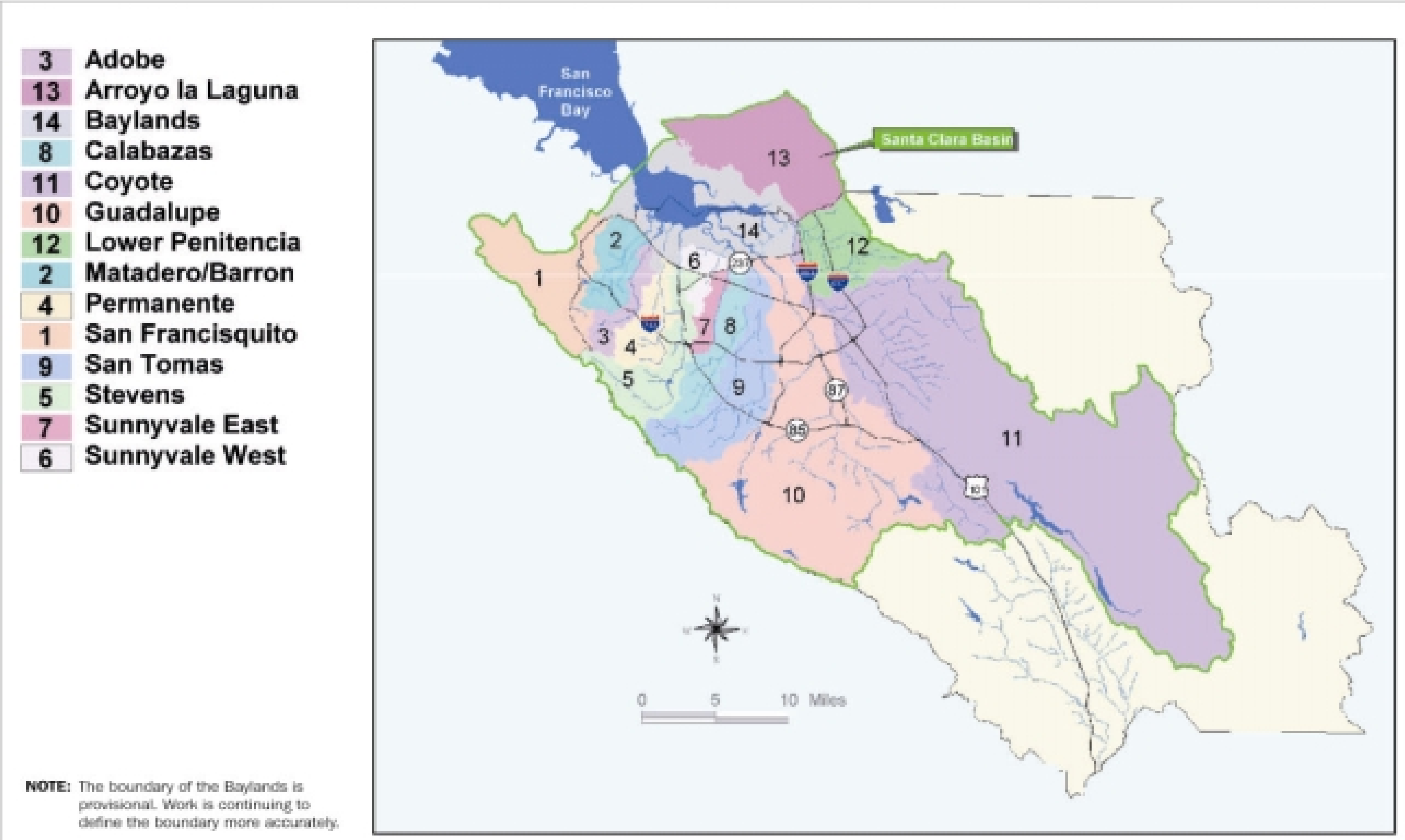


FIGURE 1-1
Major Elements of the Watershed Management Plan



Source: Santa Clara Valley Water District

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



Source: Santa Clara Valley Water District

FIGURE 1-3
Santa Clara Basin Watershed Boundaries

Chapter 2
Report Preparation Process

This chapter describes briefly how the report was prepared and reviewed.

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 Volume One Unabridged, on which this report is based. Volume One Unabridged is based on work prepared by various subgroups of the Core Group and the Watershed Assessment Consultant; all sections were reviewed by stakeholders. The work of preparing this report was done by WMI's Report Preparation Team (RPT).

The Core Group consists of the following public agencies, business and trade associations, and civic and environmental groups and programs, referred to within the WMI as signatures:

- California Department of Fish and Game
- California Restaurant Association/Dairy Belle Freeze
- CLEAN South Bay
- City of Cupertino
- City of Palo Alto
- City of San Jose
- City of Santa Clara
- City of Sunnyvale
- Guadalupe-Coyote Resource Conservation District
- Home Builders Association of Northern California
- League of Women Voters
- Salmon and Steelhead Restoration Group
- San Francisco Bay Bird Observatory
- San Francisco Bay Regional Water Quality Control Board
- San Francisco Estuary Institute
- San Francisquito Creek Coordinated Resources Management and Planning

- San Jose-Silicon Valley Chamber of Commerce
- Santa Clara County
- Santa Clara County Cattlemen's Association
- Santa Clara County Farm Bureau
- Santa Clara County Streams for Tomorrow
- Santa Clara Valley Audubon Society
- Santa Clara Valley Transportation Authority
- Santa Clara Valley Urban Runoff Pollution Prevention Program
- Santa Clara Valley Water District
- Silicon Valley Manufacturing Group
- Silicon Valley Pollution Prevention Center
- Silicon Valley Toxics Coalition
- U.S. Army Corps of Engineers
- U.S. Department of Agriculture Natural Resources Conservation Service
- U.S. Environmental Protection Agency
- Western Waters Canoe Club

Subgroups of the WMI were set up for the following purposes:

- **Bay Modeling and Monitoring.** Develop sound scientific and technical strategies to 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.

- **Budget and Personnel.** Ensure that necessary resources are provided for the implementation of the WMI.

- **Communications.** Ensure that decision-makers are informed and engaged throughout the WMI process, so that the outcome of the effort is supported.

- **Data Management.** Ensure that WMI stakeholders have access to available data and information resources that are necessary to support the WMI's goals.

- **Flood Management.** Identify and integrate flood management issues as 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.

- **Outreach.** Identify, coordinate, and initiate an effective outreach program about the WMI.

- **Planning.** Provide broad overall planning for the implementation of the WMI within the framework of Core Group direction and serve as "guardian" for stakeholder interests.

- **Regulatory.** Improve long-term regulatory certainty by integrating and prioritizing the permit recommendations of the other subgroups. Serve as a discussion and recommendation forum for the Basin's permitting issues.

- **Report Preparation Team.** Plan preparation of the four volumes comprising the Watershed Management Plan (including this Watershed Characteristics Report and the Watershed Assessment Report).

- **Watershed Assessment.** Provide a solid scientific foundation for watershed planning.

- **Wetlands Advisory Group.** Promote integration of wetland management actions into the overall Watershed Management Plan being developed by the WMI, and provide technical assistance on project and program development as needed. This goal 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 RPT and Core Group for all WMI products.

Chapter 3
Cultural Setting of the Santa Clara Basin

This chapter outlines the cultural history of the Basin, provides some highlights of current community characteristics, and gives a brief look at the expected demographic and economic future.

3.1 Summary of Santa Clara Basin Cultural History

Perhaps six millennia after it had assumed its present general shape, San Francisco Bay (and the Basin) began to be changed markedly by the action of humans. Between 1850 and 1880, an estimated billion yards of sediment washed down from hydraulic mining in the Sierra foothills. Filling for urban development and other uses also began about 1850; by 1950 as much as a third of the Bay had either been filled to create dry land or diked to create salt ponds. Major exploitation of groundwater in the Basin began in the 1860s as farmers began growing water-intensive fruit crops. By the first decades of the 1900s the Basin was a major agricultural area, but in succeeding decades the landscape was increasingly dominated by residential, commercial, and industrial growth.

Native Americans

Human occupation of the Basin is evident as early as 10,000 years ago, but little is known about this period. When the Spanish arrived in the Bay region in the latter 18th century, the Basin was inhabited by Native Americans of the Puichon, Tamien, and Alson Ohlone 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 distributed through the Bay Area in village groups of 20 to 200 individuals. These tribelets were loosely allied along family lines with the other groups in their tribelet. The Ohlone were hunter-gatherers, living in both semipermanent villages and more specialized seasonal camps, and employing a wide range of hunting and foraging strategies. Ohlone settlements in the Basin tended to cluster along creeks, particularly perennial streams, and along the margins of the marshes. Archaeologically, occupation sites most often appear as “shell middens,” organically rich deposits of earth and shell that often include human remains and other 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. They did not farm, but collected a wide variety of plant foods. They used plant materials skillfully and extensively for shelter, clothing, twine and nets, boats, and finely made basketry. The Ohlone were part of an extensive trade network. For example, obsidian brought from far off in the Sierra

Nevada and eastern California, as well as from closer sources near Santa Rosa, is fairly common at archaeological sites in the Basin.

The entry of the Spanish in 1769 and the mission period that followed disrupted the Ohlone culture, but nonetheless many Ohlone retained their cultural identity. A significant cultural revival has occurred in recent decades, and Ohlone representatives actively take part in most local archaeological projects.

Spanish and Mexican Periods

Land-based exploration of the Basin began in the late 1760s when Spanish explorers made their way north from Monterey in search of sites where they could establish missions. Traffic through the area increased markedly with the establishment of the Spanish mission and presidio at San Francisco in 1776. A year later Mission Santa Clara was established on the west bank of the Guadalupe River, close to a perennial source of water. Later that year Pueblo San Jose de Guadalupe was established upstream, as a support community to provide food for the military garrisons in the area. The 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. 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.

After Mexico gained independence from Spain in 1821-23 and secularized the missions in 1834, a larger stream of settlers began to flow in, seeking land for new ranchos. Mexican independence also opened the state to foreign trade and 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. Many of the Mexican grantees had to struggle to hold their lands as rival claimants and squatters flowed in. The United States looked toward this territory for westward expansion, and in 1848 it (with much other territory) was ceded to the U.S. by the Treaty of Guadalupe Hidalgo, which ended the Mexican War.

California Gold Rush Era

The hordes of ’49ers, and their suppliers in a booming San Francisco, needed to be fed, and the fertile lands of the Basin became very attractive. Farms began to specialize in field crops - barley, hay, and wheat. The commerce of the region was sent by boat from Alviso to San Francisco. Rail lines connected San Jose with San Francisco, the East Bay, and points east. Invention of the refrigerated railroad car in the 1880s led to new emphasis on profitable, if perishable, fruit tree crops - by the mid-1880s lands on which grains had 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.

The Twentieth Century

In the first 3 decades of the 20th century, Santa Clara Valley became the leading fruit producing area in California. Fruit drying and packing, and later canning, became important industries. After the disastrous San Francisco earthquake and fire of 1906, many businesses relocated southward and the small farm communities of the area began to grow.

Beginning in the 1920s, the automobile contributed significantly to increased suburban growth and to the development of the highway network in the Basin. Most state and federal highways were built by the mid-1940s; the Basin's first freeways were built in the 1950s. Regional population, still based primarily on agriculture, grew steadily. The small farm communities became small urban and industrial centers; San Jose, well positioned for both urban and agricultural centers, flourished.

Establishment of the naval air station at Moffett Field in Mountain View the early 1930s acted as a catalyst for 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.

Diking off and filling of lands along San Francisco Bay, begun in the nineteenth century, accelerated in the twentieth as the region's economy grew. Some diked-off lands were developed as salt ponds, and several sewage treatment plants and sanitary landfills were built on such land.

Silicon Valley

Engineers at Stanford University, who as World War II began had already begun research relevant to the fledgling electronics industry, helped establish the first electronics firms in the Basin. "Silicon Valley" had been born, if not yet named. 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 nation's fastest growing urban areas. As Palo Alto's industrial land filled, the electronics and the new semiconductor industry began to move south; by 1970, the northern valley was the industrial belt, the southern part a focus for residential and support development.

As industry grew, so did population and the demand for housing, service industries, and transportation. More and more land was converted from agricultural to residential and multiple urban uses, and the trend accelerated as agriculture became less and less lucrative in comparison with these uses. By the 1980s agriculture had largely been pushed to the margins of the Basin.

In recent years, a number of factors have constrained economic development, including the high cost of housing, a labor shortage due to lack of affordable housing, traffic congestion, and regional opposition to urban sprawl. Some communities have adopted urban growth boundaries and policies to encourage building affordable housing. Increased emphasis is being given to improving mass transit as a way to reduce traffic congestion and air and water pollution.

Figure 3-1 shows the pattern of urbanization from the middle of the last century to the late 1990s.

3.2 Demographic and Cultural Inventory

Because the Basin's boundaries do not coincide with county boundaries, data from Santa Clara County are used below as a surrogate for the Basin as a whole, unless otherwise indicated.

Existing Community Characteristics

Population, Age, and Households

Santa Clara County is the most populous county in the Bay Area, with about one fourth of the total population. The Association of Bay Area Governments (ABAG) expected the total population of the county to reach 1.74 million by year 2000, up about 16 percent since 1990. San Jose is the largest incorporated city in the county and has more than half of the county population. The other largest 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 2000 (see Tables 3-1 through 3-5).

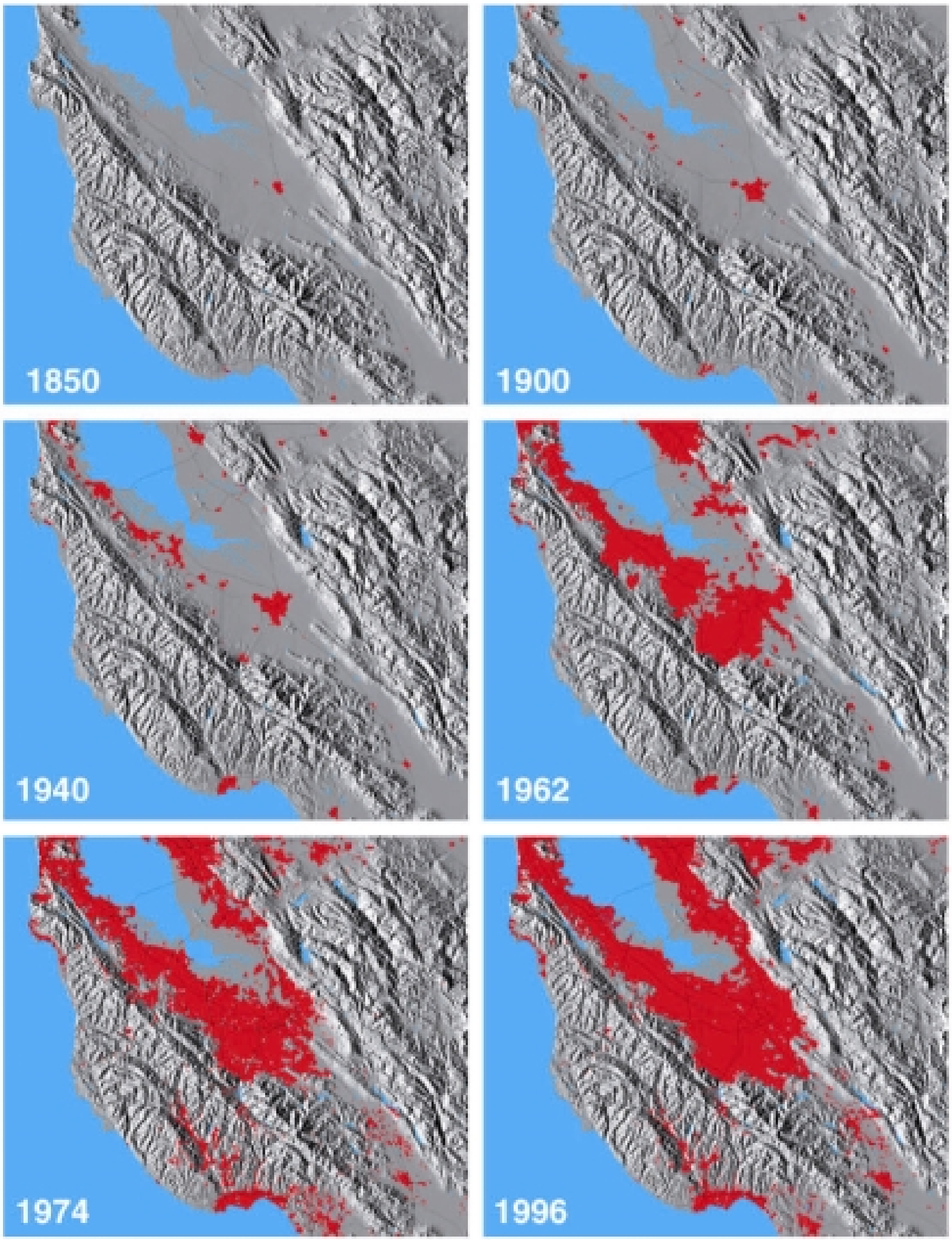
Table 3-1
Population Statistics

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

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%

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



Source: Santa Clara County

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%

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%

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%

Income

Median income in Santa Clara County in 1995 was $53,400, U.S. Census Bureau records show. ABAG data show mean household income in 1990 was $70,262; this amount was estimated to rise to $88,700 by 2005 due to a number of factors including rising wages, a growing percentage of high-income wage earners in their 40s and 50s, more workers per household, and a decreasing percentage of entry-level, low-wage workers. Between communities in the county, mean household incomes ranged from $57,831 to $215,293 in 1990.

Spoken Languages

English is the predominant spoken language in the Basin. Based on data from Santa Clara public schools, the five primary languages other than English that are spoken in homes in the county are Spanish, Vietnamese, Tagalog, Cantonese, and Laotian.

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 predominantly Chinese, followed by Filipinos, Vietnamese, Japanese, and Asian Indians. ABAG projections show this group making up 25 percent of county population by 2005; California Department of Finance projections show them accounting for 33 percent by 2015.

Hispanics, a multiracial group, made up about 21 percent of the county population in 1990 and are 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.

Projected Community Characteristics

Projected Population Growth

The county is expected to continue growing, but at slower rates than in the past. By 2010, population is expected to reach 1.86 million, and by 2020 to reach 1.9 million, an increase of about 190,900, or 11 percent, with 85,310 new households (15 percent). Growth between 2000 and 2010 will average less than 20,000 per year, a moderate rate associated with moderate employment growth and housing development. 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.

Other demographic changes expected by 2005 include increases in the size of the average household, the percentage of population over 64, and the Hispanic and Asian populations, with a corresponding decline in the percentage of Caucasians.

Projected Economic Growth

High-technology jobs will continue to fuel most of the county's employment growth. From 2000 to 2010 the county is expected to add 128,000 jobs, an average of 1.2 percent annually. About 51 percent of the new jobs will be in the manufacturing sector. The service sector will also grow strongly. Between 2010 and 2020, the county will add 89,400 further jobs, about 40 percent of them in manufacturing and 38 percent in service jobs. Overall, job growth in Santa Clara County will outpace new employed residents by 55,000, the largest projected gap between new residents and new jobs of any county in the Bay Area.

Chapter 4
Land Use in the Santa Clara Basin

This chapter includes an overview of current issues relating to land use and watershed protection in the Santa Clara Basin. Its primary purpose is to help urban planners, development project reviewers, and other stakeholders understand the effects of how land use effects watersheds. Section 6.7 of Chapter 6 ("Regulatory Setting") in Volume One Unabridged provides additional information needed to develop a land-use element of a watershed management plan.

4.1 Effects of Land Use on Watersheds

Overview: Spatial Pattern Matters

Land use powerfully impacts the beneficial uses of creeks, rivers, and estuaries. Understanding the effects of land use is essential to effective watershed management planning. To assess the effects in a meaningful way requires careful analysis at the watershed level. Rural watershed management plans generally consider spatial relationships – how close are grazing lands or manure storage to streams? These plans also consider social and demographic aspects – who owns the land and who takes care of it? By contrast, federal mandates for urban areas generally require use of "best management practices"; little systematic analysis has taken place of spatial relationships between land uses and streams in urban areas, nor integration of how social and economic factors affect these spatial relationships. Yet the impacts of urbanization are closely linked to the spatial pattern of development. Pattern matters more than the proportion of the entire watershed that is urbanized, and more than the relative proportions of urban land uses.

Urbanization causes by far the most severe impacts on the Basin's creeks, rivers, baylands, and estuaries (Figure 4-1). Nonurban land uses are important, but the biggest challenge will be to preserve and enhance streams in urban areas. Nor can the effects of urbanization be reduced to questions of pollutants per acre. A host of interrelated changes must be considered, changes that accelerate runoff, alter patterns of erosion and deposition, and alter the flow of water, sediment, and nutrients between riparian areas and streams.

Most municipalities in the Basin have made preservation of aquatic resources a goal of their comprehensive plans. They have the authority to undertake a variety of initiatives, but currently do not have a methodology for developing and carrying out measures at the appropriate watershed-wide scale. To develop such a methodology, it is necessary to examine the spatial patterns of urban development, their social causes, and their ecological consequences.

Effects of Urbanization on Santa Clara Basin Watersheds

Despite a number of studies of various parameters of Basin streams, no overall assessment of aquatic ecosystems has been made. Volume Two of this Watershed Management Plan (Watershed Assessment Report) will offer just such an assessment of three pilot watersheds, and Volume One Unabridged identifies generalized effects of land use on streams in the Basin. Chapter 7 of this report describes the Basin's presettlement flora and fauna and changes following development.

Land uses change the characteristics of a watershed when, individually or in combination, they alter its structure or impair key ecological functions. The chain of events has been described as follows: changes in land use lead to changes in the shapes and contours of streams, thence to changes in the way water flows through them and how they carry and deposit sediment, with the result of changing the way stream habitats function.

Suburban sprawl is characterized by segregation of land uses, overall low density, and dependency on automobiles for transportation. These characteristics have a direct effect on the water quality and natural resources in the watershed. Vast areas covered by houses and workplaces affect watersheds principally by altering the way they drain. Particularly significant is the narrowing of streamside corridors, and their division into noncontinuouus segments by roads and other development.

Urbanization and Imperviousness

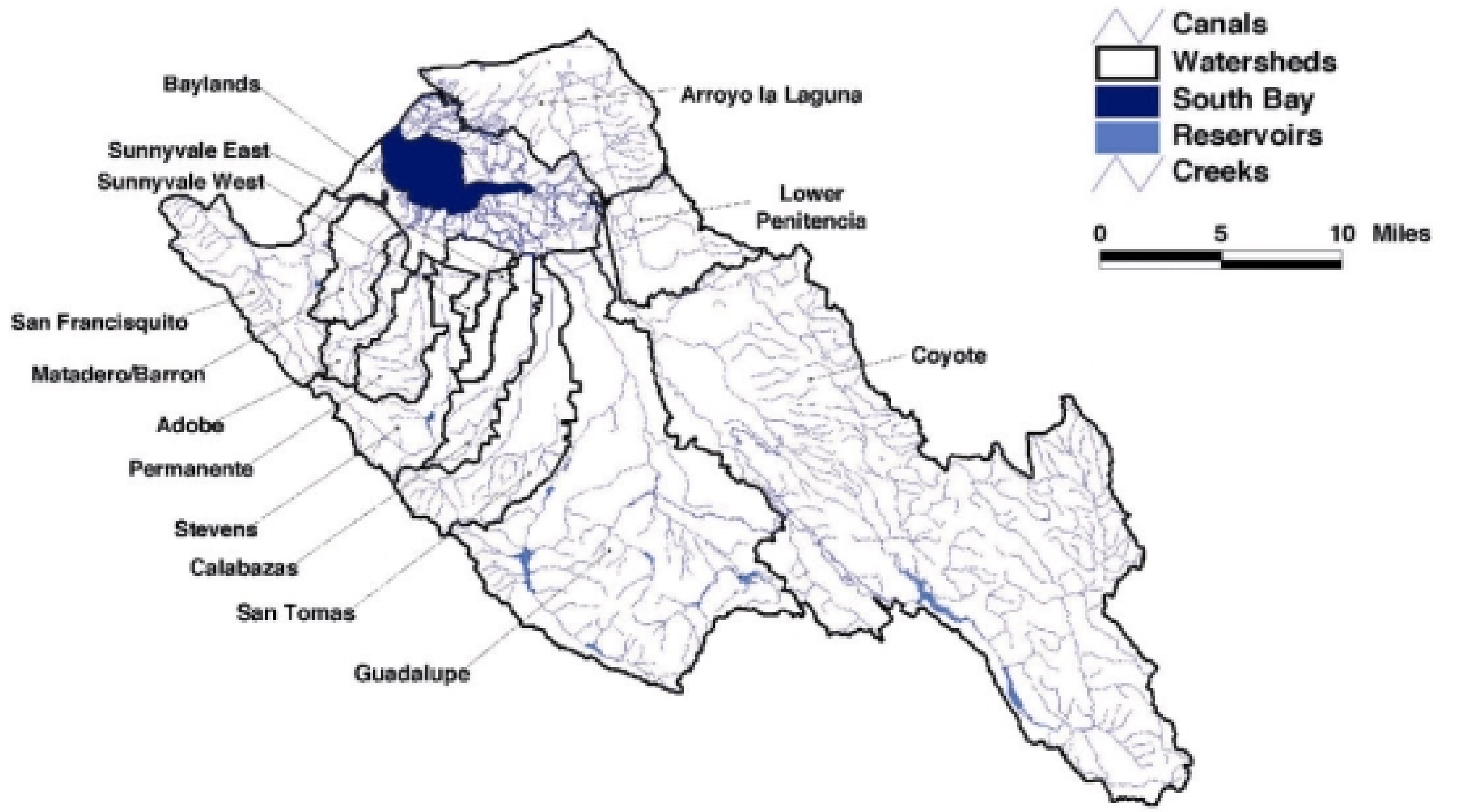
A major effect of urbanization is imperviousness. This term is applied to surfaces – roads, sidewalks, rooftops, parking lots – that prevent or inhibit rainfall from sinking into groundcover and groundwater. Urbanization and increased imperviousness can produce smaller, more frequent floods. During extreme events, increased imperviousness has little effect on flows. The reason is that at such times rainfall saturates the natural soils and renders them effectively impervious. But urbanization and increased imperviousness can increase smaller, more frequent floods – 1.5- to 2-year floods – by up to 10 times, particularly during smaller storms and in smaller streams.

Greater imperviousness is also correlated to reduced habitat quality, as measured by biological indices. To understand how this process happens it is necessary to examine the relationship between imperviousness and stream configuration.

Changes to Stream Structure and Disconnection from Floodplains

The most significant and characteristic impacts of land use to Santa Clara Valley streams are:

- Destabilization of streambeds and banks (caused by the change in amount of timing and flows as the result of increased impervious cover), increased drainage density, and changes to sediment inputs
- Agricultural and urban encroachment on riparian corridors



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

Source: EOA, Inc. for SCVURPPP

FIGURE 4-1
Hydrologic Features in the Santa Clara Basin

- Gravel quarry operations
- Disconnection of streams from floodplains, caused by erosive downcutting of streambeds and by construction of channels and levees

Imperviousness is most significant during the smaller but more frequent storm events because these bankfull flows most strongly influence stream characteristics. They do the major “work” of a perennial stream in moving sediment and thereby determining the stream’s form. The configuration of the Santa Clara Valley, a gently sloping plain underlain by alluvial gravels interspersed with clays, was created by this work of streams, carrying sediment down from hillsides. The relatively flat alluvial plain was created (and in geologic time, is being *re*created) by streams moving back and forth over the valley floor.

Besides doing this “work,” periodic flooding is essential to some riparian plants such as 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 and extends streamflows longer into the summer.

Riparian Areas

“Riparian” may be simply defined as “streamside”; also see explanation in Section 4.3. The effect of land use on riparian areas is well stated in the City of San Jose’s Riparian Corridor Policy Study (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 Basin.

Summary: Effects of Urbanization

The pattern of urbanization in the Basin – a continuous urbanized area across the valley floor – is key to the overall effects of land use on the watershed. The effects on waterbodies are not so much due to the intensity of land use as to the fact that the land is developed without considering the natural structure and functions of stream corridors.

Opportunities to Change Land Use and Development Patterns

Changing Land Use Patterns to Preserve and Enhance the Watershed

To preserve and enhance the watershed will require changing land use in the Basin so that more intensely urbanized areas are separate from broad, continuous streams. Floodplains should be reconnected to streams, where feasible, and development in the floodplain should accommodate flooding. Such changes may take many decades, but efforts are already under way to alter the urban fabric. Most land use changes required to meet these objectives dovetail, rather than conflict, with the changes needed to enhance the watershed.

Changes in the Basin's land use patterns should not be tied to a utopian vision should rather be carried out through practical application and improvement of existing policies and initiatives.

Linking Development/Redevelopment to Watershed Enhancement

(The WMI Land Use Subgroup has developed a generalized approach to making land use changes that favor watershed enhancement. See Section 4.1 of Volume One Unabridged.)

Methods for Reducing Impacts from Developed Sites

Site Design Considerations

Efforts to reduce the impact of developed sites are shifting their emphasis to limiting imperviousness, and to dispersing and infiltrating runoff rather than collecting and treating it. Proposed methods tend to mix urban planning and design objectives – for example, control of sprawl and a more pedestrian-oriented urban environment – with site planning and design methods. A study in Washington suggested such things as cluster development and policies to limit sprawl and provide public transit; imperviousness of developed sites would be reduced by narrower streets and alleys and the use of permeable paving and structural parking.

Design standards must mature beyond "do what you can, where you can." If urban watersheds are to be managed effectively, site location and drainage to streams need to be explicitly considered. Imperviousness may be less important in a low-lying district where drainage is pumped over a levee to a tidal slough but critical in a medium-density area with moderate slopes and an intact riparian corridor.

Reducing Impacts from Existing Land Uses

The Santa Clara Valley Urban Runoff Pollution Prevention Program helps the Santa Clara Valley Water District (Water District) and the municipalities in the part of the county that drains to the Bay to carry out measures to keep urban runoff pollutants from entering the stormdrain system. Similar programs exist in San Mateo County and Alameda County. Each municipality sets up a program to eliminate illegal discharges to drains and to control pollutants in runoff from urban activities. The Program and the municipalities take part in the WMI Land Use Subgroup's work as part of a joint effort to develop procedures to protect and enhance the streams, wetlands, and South Bay most effectively. The Program and municipalities also participate in other aspects of the WMI.

Summary

Land use in the Basin is characterized by continuous urban development on the valley floor. The primary effects on watersheds are increased imperviousness, increased frequency of flooding, destabilized stream configurations, disconnection of streams from floodplains, and loss of riparian corridors. Pollutants and toxicity are a secondary concern.

Improving the streams in the urbanized parts of the Basin will require reconnecting streams with floodplains, where feasible, and restoring riparian cover. To do so will require changing land use patterns in the Basin, which can best be accomplished through consensus and practical extension of existing policies and initiatives. In new and redeveloped areas, low-impact site design, where appropriate, will be most effective when aimed at a specific location within a subwatershed. Similarly, municipal urban runoff pollution prevention programs will be most effective when they are targeted to subwatershed-scale objectives.

4.2 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 boundary revisions. The previous boundaries on which the analysis was based are shown on Figure 4-2. 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.

This section describes the distribution of existing and projected land uses in the Basin. It discusses how both natural and human factors influence the distribution of such use. Patterns of existing and projected land use were analyzed at four scales: the Basin as a whole, watersheds, subwatersheds, and municipal jurisdictions (Figure 4-2).

Existing Land Use

In the following discussion, residential development is stated in terms of dwelling units (DU) per acre (ac): DU/ac, as defined by ABAG. Following are brief statements of land uses in each watershed; see Section 4.2 of Volume One Unabridged for more detail.

Santa Clara Basin

The Basin has a distinct transition in land use at 600 to 800 feet above sea level. Areas above this threshold (upper zone) have steeper slopes and are largely forest and rangeland; below this threshold (lower zone) an urbanized landscape dominates (Figure 4-2).

In the upper zone, forest predominates on steeper slopes and rangeland on moderate slopes. In the western Basin hills, forest occupies 2 to 10 times as much area as rangeland. In the eastern hills, rangeland commonly occupies 10 to 40 times as much area as forest; at high elevations, however, somewhat more forest than rangeland occurs.

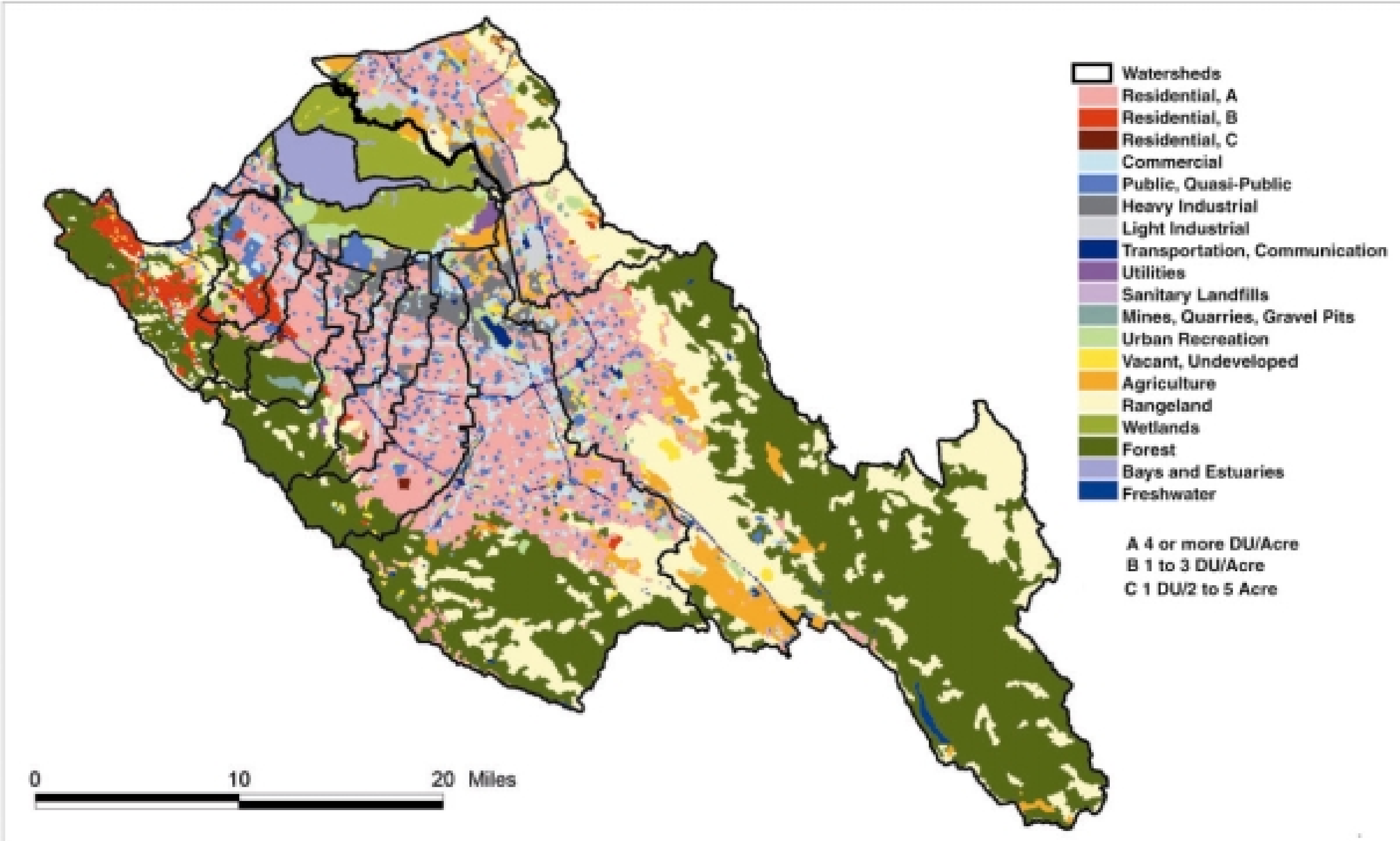
In the lower zone, high-density residential communities occupy most of the Basin floor. A relatively small amount of moderate-density housing is in the northwestern corner of the Basin and an even smaller amount is in the southwestern portion. Commercial land uses are found throughout the Basin floor, concentrated along federal, state, and county highways. Public and quasi-public land uses are more evenly dispersed than commercial land uses. Industrial areas are clustered near the Bay and along major transportation corridors. Agricultural uses occur either near the Baylands or on the urban fringe, mainly on the east side. See Tables 4-1 and 4-2.

West Side

Westside headwaters originate in the Santa Cruz Mountains. Upper watersheds are primarily non-urbanized with a high ratio of forest to grassland; lower watersheds are urbanized. Watersheds are typically long and slender.

Stevens Creek watershed in its upper zone is permeable undeveloped forest or rangeland. This watershed has the highest percentage of legally protected area. The lower zone is typical of west-side watersheds, with high-density residential use predominating; commercial and public/quasi-public developments are interspersed. Contiguous commercial development is also prevalent along State Highway 82. Industrial development is concentrated in the downstream area near U.S. Highway 101.

San Francisquito Creek watershed is shaped like a large funnel collecting water from mountains and draining to the Bay. The upper zone is also undeveloped, primarily forest and rangeland. Permeable, protected land drains to all headwaters of Los Trancos Creek. This watershed has a greater proportion of moderate-density housing than any other, and a more heterogeneous mix of land uses throughout. The transition from the upper to the lower zone is unique because land use shifts from primarily natural conditions to moderate, rather than high-density, residential



Source: EOA, Inc. for SCVURPPP

Watershed Characteristics Report

FIGURE 4-2
Existing Land Uses in Santa Clara Basin Watersheds

WMI Santa Clara Basin

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

Existing Land Uses	Percent of Land Uses in Basin
Residential, 4 or more DU/Acre	21.5
Residential, 1 to 3 DU/acre	1.8
Residential, 1 DU/2 to 5 acres	0.1
Residential Subtotal [1]	*23.4*
Commercial	3.1
Public, Quasi-Public	2.5
Industry – Heavy	2.9
Industry – Light	1.3
Transportation, Communication	1.0
Utilities	0.2
Landfills	0.0
Mines, Quarries	0.2
Industrial/Commercial Subtotal [1]	*11.2*
Agriculture	2.4
Forest	0.9
Rangeland	3.9
Urban Recreation	34
Vacant, Undeveloped	20
Wetlands	4.4
Open Space Subtotal [1]	*65.0*
Bays, Estuaries	0.0
Fresh Water	0.4

[1]Subtotals reflect land uses included in projected development (Table 4-3) and may be compared.

development. Moreover, unlike in most other watersheds in the Basin, large contiguous areas of forest and rangeland are found in the lower zone, along with some agriculture. Stanford University owns 35 percent of the watershed.

Guadalupe River watershed, like other watersheds on the west side, is largely undeveloped in its upper zone, but a greater than typical proportion of this area (three-quarters) is legally protected. Virtually all headwaters drain from permeable, protected areas. Unlike in other watersheds, numerous pockets of high-density residential development occur in the upper zone. Land use in the lower zone is typical of the west side (see description under Stevens Creek). Exceptional to this watershed is the presence of agriculture in the lower zone.

Adobe Creek watershed is about 40 percent undeveloped, primarily forest in the upper zone. The lower zone is almost exclusively high-density residential development.

Permanente Creek watershed, too, is about 40 percent undeveloped, primarily forest in the upper zone. About half of the creek-miles in the upper zone drain protected, permeable areas. Mine/quarry/gravel and light industrial land uses protrude into the forested upper zone. A greater diversity and broader distribution of land uses exist in the lower zone on the southwest side of Interstate 280, than in Adobe Creek watershed. The central area is principally high-density residential development.

San Tomas watershed has only a moderate proportion of forest and rangeland in its upper zone, of which about two-thirds are legally protected. The lower zone is typical of westside watersheds. This watershed includes the largest contiguous area of low-density housing in the Basin. Virtually all the area along U.S. Highway 101 is industrial.

Matadero/Barron watershed has a very small upper zone, most of it high- or moderate-density residential. Both the diversity and distribution of land uses are greater than for most other watersheds; forest, grassland, and moderate-density residential areas extend to the valley floor.

Calabazas Creek watershed is another with a small upper zone, but it is mostly undeveloped forest or rangeland, or vacant/undeveloped land. Unique to this watershed are several areas of heavy industry in the upper zone. The lower zone is principally high-density residential.

Valley Floor

With headwaters in the Santa Cruz Mountains, the valley floor watersheds are confined to the lower zone (Basin floor). Few natural areas exist, and industrial and commercial development is very high.

Sunnyvale West watershed lacks both forest and rangeland but has a very high percentage of urban recreation area (second only to the Baylands), approximately one-quarter of it legally protected. The watershed has a greater proportion developed with industrial and commercial uses than any other in the Basin.

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 Franci-squito	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

Sunnyvale East watershed closely resembles the lower zones of the westside watersheds (see Stevens Creek description), but a greater proportion of this watershed is developed as commercial, public/quasi-public, and industrial.

East Side

Eastside headwaters originate in the Diablo Range. The upper watershed area are non-urbanized and have a high ratio of rangeland to forest; the lower watershed areas are urbanized. These watersheds are broader than westside watersheds.

Lower Penitencia watershed is about 50 percent permeable land uses, but less than a quarter is legally protected. Land use in the upper zone is typical of eastside watersheds: small pockets of residential development and vacant/undeveloped land, and agriculture amidst undeveloped areas with a high ratio of rangeland to forest. Most of the lower zone is high-density residential. Industrial development mostly lies as scattered or large contiguous areas near Interstate 880.

About a third of the **Arroyo la Laguna watershed's** lower zone is wetland, legally protected, so a high percentage of the entire watershed is undeveloped. This watershed has the largest percentage of area under cultivation.

Coyote Creek watershed contains the largest contiguous agricultural areas in the Basin and a huge proportion of undeveloped land in its upper zone. The composition and distribution of land uses are similar to other eastside watersheds. The upper zone is mainly rangeland and forest, about one-third legally protected. Urbanized land use is confined to the downstream region of the lower zone and several small areas in the lower zone near the mainstem of Coyote Creek.

Baylands

The Baylands are a unique area in the Basin because they drain both the Santa Cruz Mountains and the Diablo Range, are relatively undeveloped, are mostly at or near sea level, and are over 50 percent wetland, about one third of it legally protected. About three-fourths of this area is permeable and undeveloped. The periphery is surrounded, rather than bisected, by major transportation corridors including U.S. Highway 101, Interstate 880, and State Highway 237.

Municipalities

Most municipalities except for Milpitas and San Jose are more than 90 percent built out (counties and municipalities in the Basin are indicated on Figure 1-2). The following land use patterns are observed for municipalities:

- Residential is the major land use in westside communities and in San Jose.
- Commercial land use is less than 12 percent in all communities.
- Industrial land use is greatest (17-21 percent) in Milpitas, Sunnyvale, Mountain View, and Santa Clara.

- Public/Institutional land use is greatest in Palo Alto (26 percent); other municipalities range between zero and 13 percent.
- Vacant/Agriculture land use is greatest in unincorporated areas of the county (73 percent) and relatively high in Milpitas and Saratoga at 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 – 21 percent).

Projected Growth by Watersheds

Projections indicate that in the next two decades, the northeastern section of the Basin - Arroyo la Laguna and Lower Penitencia watersheds - will experience the greatest growth in both residential and industrial/commercial land use (Table 4-3, Figures 4-3 and 4-4). The northwestern corner and much of the eastern Basin will also see considerable residential development. Industrial/commercial development will continue to dominate in the valley floor, increasing most in the Baylands and lower watersheds in south and central areas on the west side of the Basin. By 2020, most watersheds will be 90 to 95 percent built out, placing a greater requirement on redevelopment. San Francisquito Creek and eastside watersheds will provide the greatest acreage for new development.

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

"Riparian corridor" is a term developed to convey the importance of both aquatic and terrestrial resources ecologically linked to river systems. No standard definition exists and municipalities have used various approaches. The City of San Jose's Riparian Corridor Policy Study (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, alder, box elder, Fremont cottonwood, bigleaf maple, western sycamore, and oaks. Stream channels include all perennial and intermittent streams shown as a solid or dashed blue line on U.S. Geological Survey topographic maps, and ephemeral streams or 'arroyos' with well defined channels and some evidence of scour or deposition."

Riparian corridors provide a variety of important benefits for both wildlife and humans. They can:

- 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.

Table 4-3

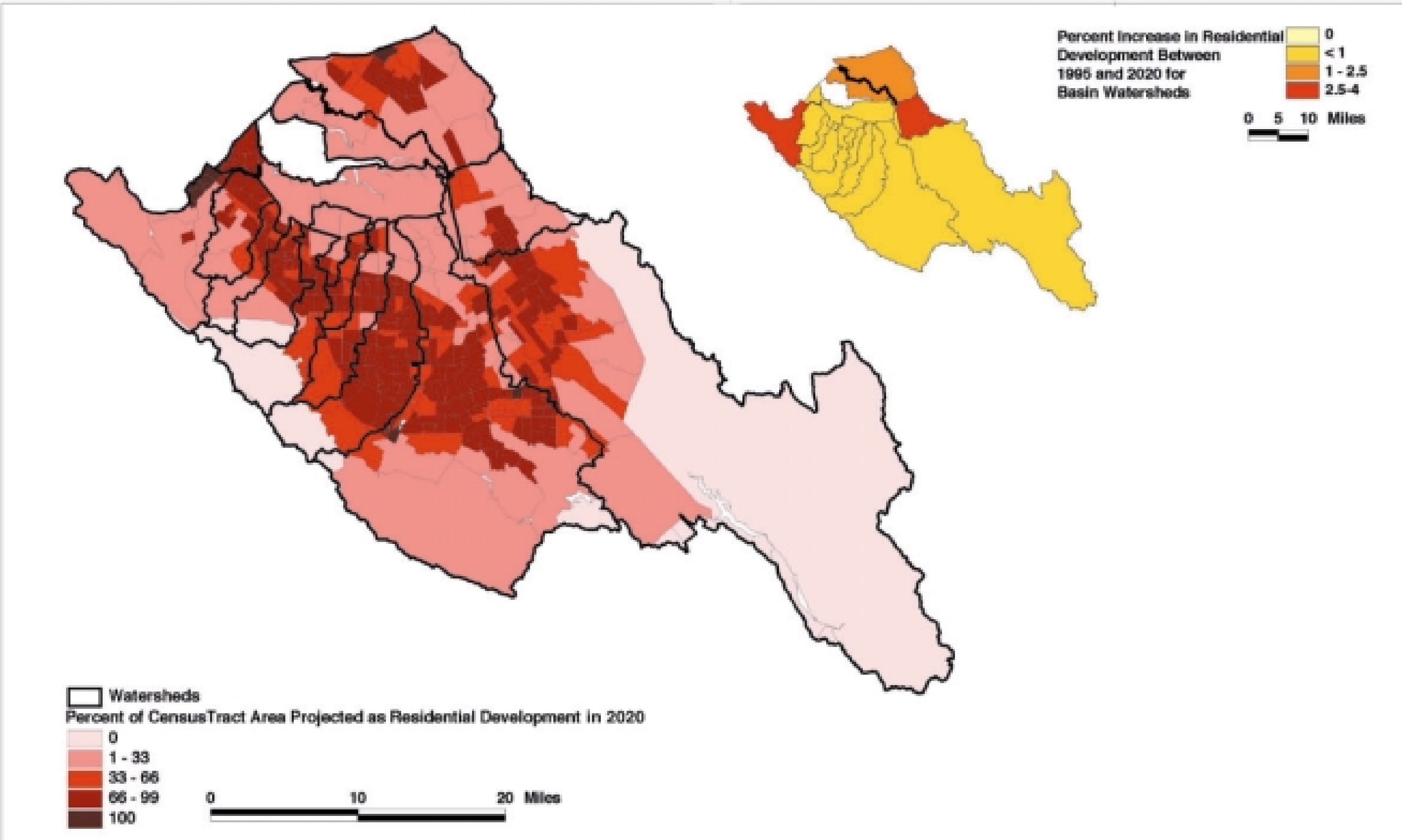
Projected Residential, Industrial, and Commercial Development in Santa Clara Basin Watersheds, 1995-2020[1,2]

	Residential							Industrial and Commercial						Residential, Industrial/ Commercial
Watersheds	**Area (ac)**	**Available for Development (ac)**	**Projected Devel-oped (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 Devel- oped[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*

[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, and 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. Percent buildout represents the percent of watershed land *designated for respective land use classes that will have been developed by 2020.*

[2]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.

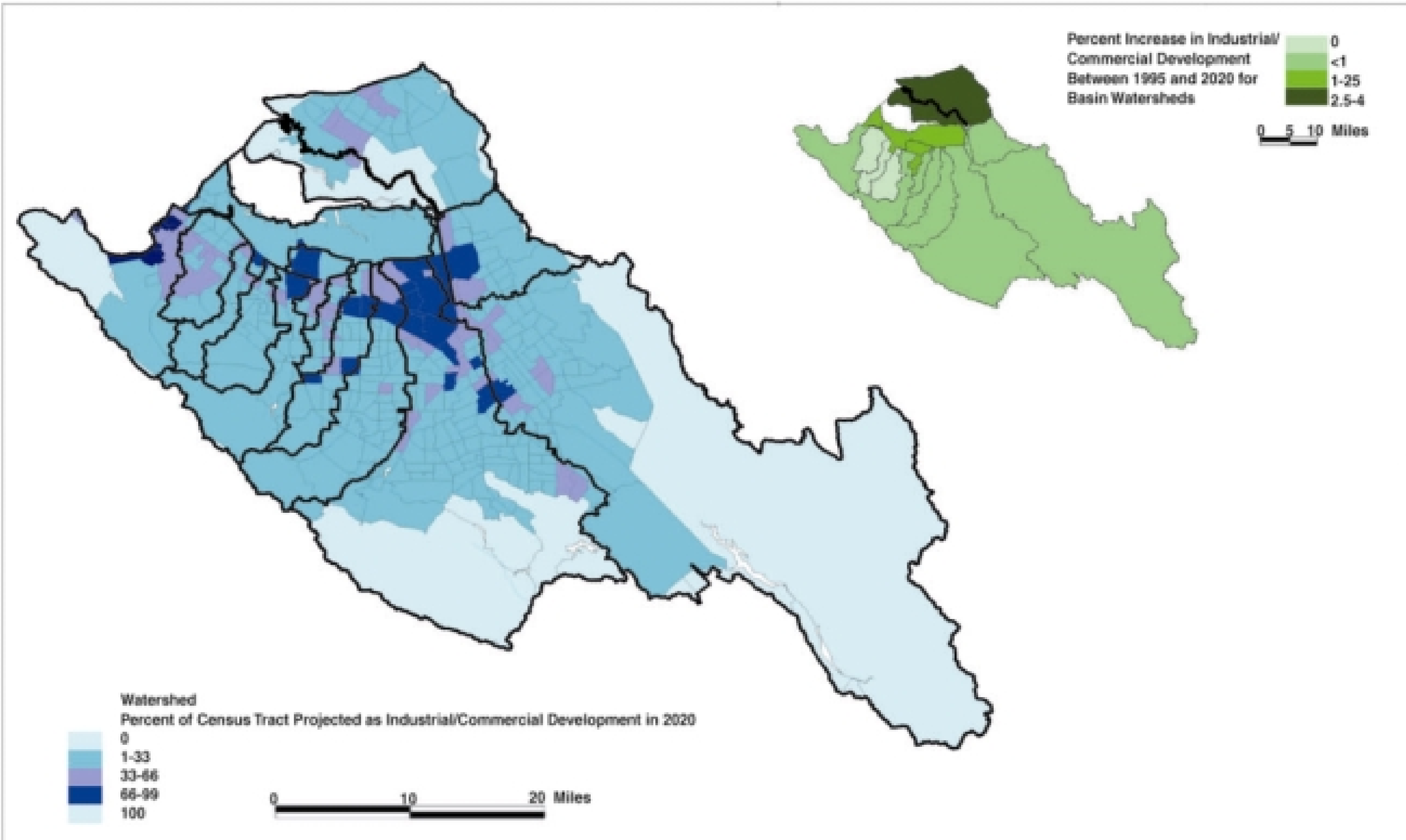
[3]Projected developed acreage may include some redevelopment acreage. Because a single estimate of redevelopment acreage was provided for residential, commercial, and industrial land use classes, the percentage of projected development that could occ



Source: EOA, Inc. for SCVURPPP

Watershed Characteristics Report

FIGURE 4-3
Residential Development Projections, 1995-2020, in Santa Clara Basin Watersheds



Source: EOA, Inc. for SCVURPPP

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

- Provide a storage area for floodwaters.
- Preserve open space and aesthetic surroundings.

Preserving riparian corridors often competes with other land uses, especially in growing urban areas. To address this problem, many Basin municipalities have established either numeric or nonnumeric development setbacks. Some numeric setbacks are 100 feet from creek center beds; others are wider – 100 feet from the edge of riparian vegetation or the top of streambank, whichever is wider. Nonnumeric setbacks use language to describe buffers between adjacent land uses and natural creekside areas.

But at least as important as the width of riparian corridors is keeping them connected along their lengths, something often overlooked in setting policies. In highly urbanized areas corridors are often fragmented, particularly by road crossings that disrupt habitat and introduce disturbances and pollutants to streams. The total amount of land within riparian corridors in the Basin varies somewhat by watershed (Table 4-4).

Table 4-4
Acreage of Riparian Corridors by Watershed[1]

Watershed	Acres	Percentage of Watershed
Adobe	614	8
Arroyo la Laguna	6,090	13
Baylands[2]	4,970	24
Calabazas	777	6
Coyote	16,900	8
Guadalupe	8,980	8
Lower Penitencia	1,110	6
Matadero/Barron	602	6
Permanente	826	7
San Francisquito	1,910	7
San Tomas	1,830	6
Stevens	1,820	10
Sunnyvale East	163	4
Sunnyvale West	389	8

[1] Analysis was completed prior to the provisional revision of the Baylands boundary; therefore, values depicted for the Baylands and Arroyo la Laguna watersheds do not reflect revised boundaries.
[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 predominantly saltwater, they were included in this analysis because the definition given in *California Riparian Systems* (Warner 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. See Volume One Unabridged for a complete discussion.

Methods

See Section 4.3 of Volume One Unabridged for discussions of methods used for such things as riparian corridor mapping, identifying land uses in riparian corridors; creeks, canals, and reservoirs within Water District jurisdiction; and other subjects.

Results

Although the relative proportions of land uses within each watershed's riparian corridors vary, several patterns exist:

- Westside watersheds that drain the upper elevation zone of the Santa Cruz Mountains have a high proportion (~39 – 64 percent) of forested riparian corridors.
- Eastside watersheds that drain the Diablo Range have a high proportion (~22 – 46 percent) of rangeland, mostly in upper watershed areas.
- For most westside and eastside watersheds, high-density residential land use comprises the second greatest proportion of former riparian corridors.
- The two westside, valley floor watersheds, Sunnyvale East and Sunnyvale West, both have moderately high proportions (~15 percent) of heavy industrial land use in their riparian corridor areas.
- The Baylands riparian corridors are mostly occupied by wetlands (~67 percent) and by urban recreation (~18 percent).

Discussion

Investigators have demonstrated how, in studying relationships between land use and aquatic communities, the scale of investigation influences the findings. They found land use within 50 meters of tributaries to correlate more closely with the health of biological communities and instream structure than land use measured within 125 meters – or within entire subwatersheds. As mentioned, finer resolution land use data would provide more precise estimates of land use acreages, notably for long, narrow features such as streams and roads. A comprehensive creek coverage mapped at fine resolution would also help accurately map riparian corridors. The Water District is currently developing a coverage that will include all creeks in the Basin at 1:500 scale.

In addition to analyzing patterns of land uses within watersheds and riparian corridors, it is useful to consider potential impacts associated with instream flood control and water supply infrastructure including dams, modified channels, and fish ladders.

Chapter 5
Organizational Setting

This chapter sets forth the range of organizations – environmental, educational, business and industrial, recreational, agricultural, and governmental – that interact and communicate, and have general and specific interests in the issues and activities that affect the WMI.

The Santa Clara Basin, home to an estimated 1.9 million people, is an area of opportunity and growth - and also of significant challenges. Among these are threats to the watershed's natural environment and source water quality. In response, regional, state, and federal entities continue to enact and implement regulations designed to protect the environment and quality of life.

The WMI is committed to protecting the Basin watershed and coordinating and streamlining the approach to watershed-related regulations. To meet these and other WMI goals, communication between the various communities of the Basin 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 briefly listed here and spelled out in more detail in Table 5-1 in Volume One Unabridged share many priorities with WMI and, thus, represent potential partnerships for delivering information and making positive things happen.

Table 5-1 in Volume One Unabridged is intended as a resource guide and planning tool. Contact information is provided, along with organizational mission and funding sources where available. It is anticipated that Table 5-1 will require periodic updating as new groups are added and existing organizations change. Information will be found under the following headings in Volume One Unabridged.

5.1 Environmental Organizations

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

The list in Table 5-1 includes the following environmental organizations:

- Alameda Creek Alliance
- Audubon Society – Santa Clara Valley Chapter
- Audubon Society – Sequoia Chapter
- Bay Area Action
- Bay Area Ridge Trail Council
- California Native Plant Society-Santa Clara Valley
- California Trails and Greenways Foundation
- Citizens Committee to Complete the Refuge
- CLEAN South Bay
- Committee for Green Foothills
- Communities for a Better Environment
- Earthwatch California
- Friends of Stevens Creek Trail
- Greenbelt Alliance (South Bay Office)
- Land Trust for Santa Clara County
- National Fish and Wildlife Foundation (California branch)
- Our City Forest
- Peninsula Conservation Center Foundation
- Peninsula Open Space Trust (POST)
- Responsible Organized Mountain Pedalers (ROMP)
- San Francisco Bay Bird Observatory
- San Francisco Bay Wildlife Society
- San Francisquito Creek Coordinated Resource Management and Planning (CRMP)
- Santa Clara County Streams for Tomorrow
- Santa Clara Valley Water District: Adopt-A-Creek Program
- Santa Clara Valley Water District: Creek Connections Action Group
- Save the Bay (Save San Francisco Bay Association)
- Save the Redwoods League
- Sempervirens Fund
- Silicon Valley Bicycle Coalition
- Silicon Valley Pollution Prevention Center
- Silicon Valley Toxics Coalition
- The Bay Trail
- The Trail Center
- United New Conservationists
- Urban Creek Council – Santa Clara County

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 in the Basin currently teach and promote watershed-based programs. These programs are an excellent resource for educators, planners, public resource management agencies, and the general public, for content, program development, and funding information. These resources are described in Table 5-1 in Volume One Unabridged in two subsections: Centers, and Organizations and Programs.

The list in Table 5-1 includes the following educational organizations:

- Adopt-A-Watershed
- Bay Area Action
- Biodiversity Resource Center
- Bio-Integral Resource Center (BIRC)
- Browning-Ferris Industries - The Recyclery
- California Coastal Commission: Adopt-A-Beach
- California Department of Fish and Game - Project WILD
- California State Department of Fish and Game
- Center for Development of Recycling
- Children's Discovery Museum of San Jose
- City of Cupertino Public Works & Parks and Recreation Departments
- City of San Jose Environmental Services Department
- City of San Jose, San Jose Regional Parks
- City of Sunnyvale Baylands Park
- City of Sunnyvale, Water Pollution Control Plant (WPCP)
- Common Ground Organic Garden Supply
- Coyote Creek Riparian Station
- Coyote Point Museum
- Deer Hollow Farm
- Don Edwards San Francisco Bay National Wildlife Refuge
- Emma Prusch Farm Park
- Environmental Volunteers
- Green City Project
- GreenTeam of San Jose
- GreenWaste Recovery, Inc.
- Hayward Area Recreation and Park District
- Hidden Villa
- Hidden Villa Environmental Education Program
- Home Composting Education Program for Santa Clara County
- Jasper Ridge Biological Preserve

- Marine Science Institute
- Mid-Peninsula Regional Open Space District
- National Audubon Society
- Our City Forest
- Palo Alto Baylands Park
- Palo Alto Regional Water Quality Control Plant
- Peninsula Conservation Center Foundation
- San Francisco Bay Model Visitor Center
- San Francisco Bay Savers Program
- San Francisco Estuary Institute
- Santa Clara County Household Hazardous Waste Program
- Santa Clara County Integrated Waste Management Program
- Santa Clara County Parks and Recreation
- Santa Clara County Pollution Prevention Program
- Santa Clara Valley Audubon Society
- Santa Clara Valley Environmental Partners
- Santa Clara Valley Urban Runoff Pollution Prevention Program
- Santa Clara Valley Water District
- Sempervirens Fund
- Sierra Club - Loma Prieta Chapter
- Sulphur Creek Nature Center
- Technology Museum of Innovation
- Tri-City Ecology Center
- University of California Cooperative Extension Master Gardeners of Santa Clara County
- University of California Cooperative Extension Urban Horticulture
- USA Waste Management of San Jose
- Walden West Outdoor School
- Water Education Foundation
- Water Education Foundation: Project WET
- Wildlife Education and Rehabilitation Center (WERC)
- Youth Science Institute

5.3 San Francisco Bay Estuary-Wide Organizations

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 a next-door neighbor to several major Bay Area cities. Estuary-wide organizations, listed in Table 5-1 in Volume One Unabridged, provide information 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.

The list in Table 5-1 includes the following estuary-wide organizations:

- Aquatic Outreach Institute
- Bay Area Stormwater Management Agencies Association (BASMAA)
- CALFED Bay-Delta Program
- Friends of the Estuary
- San Francisco Estuary Project

5.4 Universities and Colleges

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

The list in Table 5-1 includes the following universities and colleges:

- California State University, San Jose
- Foothill-De Anza Community College District
- San Jose-Evergreen Community College District
- Santa Clara University
- Stanford University
- University of California at Berkeley
- University of California at Santa Cruz
- West Valley-Mission Community College District

5.5 Business and Industry Trade Organizations

For the WMI to meet its objectives, all community sectors must be represented. A vital sector is business/industry. Input from these stakeholders benefits overall development of the 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 in Volume One Unabridged in these categories: Chambers of Commerce, Labor Groups, and Business Groups and Associations.

The list in Table 5-1 includes the following business and industry trade organizations:

- Alameda Business Association
- American Electronic Association
- Building Industry Association
- Building Trades
- California Avenue Area Development Association
- California Restaurant Association

- Campbell Chamber of Commerce
- Cupertino Chamber of Commerce
- Filipino American Chamber of Commerce
- Gilroy Foundation
- Hispanic Chamber of Commerce of Santa Clara Valley
- Home Builders Association of Northern California
- Indo-American Chamber of Commerce--Northern California
- Japantown Business Association
- Joint Venture Economic Development Roundtable
- Joint Venture: Silicon Valley Network
- Korean American Chamber of Commerce of Silicon Valley
- Landscape Advisory Committee
- Los Altos Board of Realtors
- Los Altos Chamber of Commerce
- Los Gatos Chamber of Commerce
- Milpitas Chamber of Commerce
- Morgan Hill Chamber of Commerce
- Mountain View Chamber of Commerce
- Palo Alto Chamber of Commerce
- Portugese Chamber of Commerce
- San Jose Downtown Association
- San Jose Japanese Chamber of Commerce
- San Jose/Silicon Valley Chamber of Commerce
- Santa Clara Chamber of Commerce
- Santa Clara County Association of Realtors
- Santa Clara County Black Chamber of Commerce
- Saratoga Chamber of Commerce
- Semiconductor Industry Association
- Silicon Valley Manufacturing Group
- South Bay Central Labor Council
- Story Road Business Association
- Sunnyvale Chamber of Commerce
- Tri-County Apartment Association
- Willow Glen Business and Professional Association

5.6 Community Organizations and Foundations

Along with environmental and business groups, community organizations are able to organize and influence public opinion, develop positions on various issues, and provide or locate possible sources of funding. In Table 5-1 in Volume One Unabridged is information on voting, taxpayer, advisory and neighborhood organizations, as well as foundations.

The list in Table 5-1 includes the following community organizations and foundations:

- AT&T Foundation
- Ben & Jerry's Foundation
- Columbia Foundation
- Common Counsel Foundation
- Community Foundation of Silicon Valley
- Compton Foundation
- Fred Gellert Foundation
- Knight Foundation
- Leagues of Women Voters of Santa Clara County
- Santa Clara County Taxpayers Association
- Santa Clara Valley Water Commission
- Santa Clara Valley Water District
- The David and Lucile Packard Foundation
- The Hewlett Foundation
- United Neighborhoods of Santa Clara County

5.7 Water Sport and Recreation Groups

The Basin boasts a great many recreational opportunities including hiking, fishing, boating, bicycling, waterskiing, and more. Because recreation is one of the beneficial uses being evaluated in the watershed assessment, the perspective of recreation and water sports stakeholders is particularly important.

The list in Table 5-1 includes the following water sport and recreation groups:

- Bay Area Sea Kayakers
- California Trout
- California Waterfowl Association
- California Fisheries Restoration Foundation
- Ducks Unlimited
- Salmon and Steelhead Restoration Group
- San Jose Flycasters
- Santa Clara County Horsemen's Association
- Santa Clara Valley Waterski Club
- Trout Unlimited
- United Anglers of California
- Western Waters Canoe Club

5.8 Agricultural Organizations

Long before "Silicon Valley," Santa Clara Valley was known as "The Valley of Heart's Delight." 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. Most of the Basin is now urbanized, but agriculture is still a significant user of land and water. Agricultural land is viewed in many ways, including green space or agricultural "reserve" areas, and as a potential user for recycled water. In addition, farmers, growers, and ranchers constitute a key audience concerning watershed and groundwater protection, and are key stakeholders with the opportunity to contribute to significant improvements in the watershed.

The list in Table 5-1 includes the following agricultural organizations:

- Cattleman's Association
- Santa Clara County Farm Bureau
- Santa Clara Valley Water District, Agricultural Water Advisory Committee

5.9 Government Agencies

Many local government officials are WMI signatories and stakeholders. 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 communication with local, state, and federal government entities is of utmost importance. In Table 5-1 in Volume One Unabridged, this section is organized as follows: City Governments, County Governments, Special Districts, and Regional/State/Federal Nonregulatory Agencies.

The list in Table 5-1 includes the following government agencies:

- Alameda County Board of Supervisors
- Alameda County Resource Conservation District
- Alameda County Water District
- Association of Bay Area Governments (ABAG)
- Campbell City Council
- Council of Bay Area Resource Conservation Districts, Alameda County Resource Conservation District
- Cupertino City Council
- East Bay Regional Park District
- Guadalupe-Coyote Resource Conservation District
- Loma Prieta Resource Conservation District
- Los Altos City Concil
- Los Altos Hills City Council

- Los Gatos City Council
- Mid-Peninsula Regional Open Space District
- Milpitas City Council
- Monte Sereno City Council
- Morgan Hill City Council
- Mountain View City Council
- Palo Alto City Council
- Palo Alto Regional Water Quality Control Plant
- Purissima Hills Water District
- San Francisco Bay Regional Water Quality Control Board
- San Jose City Council
- San Jose/Santa Clara Water Pollution Control Plant
- San Mateo County Board of Supervisors
- San Mateo County Resource Conservation District
- San Mateo County Transit District
- Santa Clara City Council
- Santa Clara County Board of Supervisors
- Santa Clara County Open Space Authority
- Santa Clara Valley Transportation Authority (VTA)
- Santa Clara Valley Water District
- Saratoga City Council
- State of California Department of Fish and Game (Marine Region)
- Sunnyvale City Council
- U.S. Army Corps of Engineers
- U.S. Department of Agriculture Natural Resources Conservation Service
- U.S. Environmental Protection Agency, Region 9
- U.S. Geological Survey

5.10 Media

The WMI does its own outreach and coordinates with related agencies and programs. However, as assessment work is completed, attention from local news media will greatly help to promote WMI goals and bring watershed protection issues to a larger audience. In addition, information from the watershed assessment will also likely be of interest to environmental and business media.

The list in Table 5-1 includes the following media:

- Associated Press
- Bay City News
- Bay TV
- CalTrans Public Information Officer
- City of Campbell Public Information Officer
- City of Cupertino Public Information Officer
- City of Gilroy Public Information Officer
- City of Los Altos Public Information Officer
- City of Milpitas Public Information Officer
- City of Monte Sereno Public Information Officer
- City of Morgan Hill Public Information Officer
- City of Mountain View Public Information Officer
- City of Palo Alto (Public Works Department)
- City of San Jose Public Information Officer
- City of Santa Clara Public Information Officer
- City of Saratoga Public Information Officer
- City of Sunnyvale Public Information Officer
- County Office of Emergency Services
- El Observador
- KBAY
- KCBS
- KDTV 14
- KGO
- KGO TV 7
- KICU TV 36
- KION (Salinas)
- KKUP
- KLIV
- KNTV 11
- KPFA
- KPIX TV 5
- KQED
- KRON TV 4, San Francisco
- KSBW (Gilroy)
- KSBW (Salinas)
- KSTS 48
- KTEH 54
- KTVU 2
- La Oferta Review

- Los Altos Town Crier
- Los Gatos Weekly
- Metro Newspapers
- Milpitas Post
- Morgan Hill Times
- Mountain View Voice
- Palo Alto Daily
- Palo Alto Weekly
- Peninsula Bureau
- San Francisco Chronicle
- San Francisco Examiner
- San Jose Business Journal
- San Jose Mercury
- Santa Clara County Parks and Recreation Public Information Office
- Santa Clara Valley Weekly
- Saratoga News
- South Bay Bureau
- Spartan Daily
- The Dispatch (Gilroy)
- Times Newspaper Group
- Town of Los Altos Hills Public Information Officer
- Town of Los Gatos Public Information Officer

Chapter 6
Regulatory Setting

This chapter gives an overview of the regulatory framework for watershed management in the Basin. It indicates the various agencies at all governmental levels whose programs, responsibilities, and activities bear on such management.

The waters and adjacent lands of the Basin are covered by many environmental regulations and programs. A wide variety of activities – construction, industrial operations, commercial activities, and habitat restoration - may require permits depending on their nature and location (for example, near a streambank or in a wetland). This chapter discusses the institutional and legal framework for decisions about water-related resources. In addition, regulatory authorities are presented as they relate to watershed management (Table 6-1). Chapter 6 in Volume One Unabridged gives more detail on all aspects. These areas are discussed:

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

6.1 Regulation of Water Quality

Federal and state laws and regulations 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 called the Clean Water Act, or CWA) regulate pollution primarily through 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. The authority for implementing water quality control programs in California is delegated by the EPA to the state and implemented through the Porter-Cologne Act by the State Board. In addition, the California Fish and Game Code has provisions regarding water pollution, streambed alteration, and resulting impacts to aquatic life and waterfowl. An overview of these laws and regulations and agencies is presented below, and in greater detail in *Regulatory Analysis for the San Francisco Estuary* (San Francisco Estuary Project 1992).

Federal 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.

In the CWA, Congress established those programs to regulate water quality:

- The National Pollutant Discharge Elimination System (NPDES) program controls wastewater dischargers by incorporating water quality standards and technology-based effluent limitations in discharge permits.

- The National Pretreatment Program controls discharges to public treatment works using technology-based effluent limitations.

- The most recent (1987) amendments to the CWA established a framework for regulating municipal and industrial stormwater discharges under the NPDES program. In 1990, EPA published final regulations requiring municipalities with populations over 100,000 to obtain NPDES permits for stormwater discharges. (See discussion of stormwater management in Chapter 8.)

- The 1987 amendments also established the Section 319 Nonpoint Source Management Program because it was recognized that remaining water quality pollution problems stemmed from urban runoff, agriculture, and other diffuse sources. This program required states and localities to identify and assess water quality problems on a watershed-by-watershed basis. Section 319 also provides grant funding to states and localities to support a wide range of activities including technical assistance, financial assistance, education, training, technology transfer, demonstration projects, and monitoring. The State Board developed its first nonpoint source assessment report in 1988, identifying nonpoint source water quality problems. The State Board's WMI is an outgrowth of this approach.

When issuing permits to discharge to a stream, bay, or any waterbody, the responsible agency must ensure that these water quality standards are met to prevent pollution from adversely affecting water quality or aquatic life.

Table 6-1
Summary of Laws, Regulations, and Permits

Topic	Regulations and Legislation	Associated Permits	Lead Agencies
Water Quality	Federal Clean Water Act California Porter-Cologne Act	Waste Discharge Requirements Industrial Pretreatment Permit NPDES Municipal Stormwater Permit NPDES Wastewater Permit	State Water Resources Control Board 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 Consumer Confidence Report Public Water Supply Permits	Cal-EPA, 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 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 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; local general plans, zoning ordinances; 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 California Pesticide Contamination Prevention Act Food Quality Protection Act	Pesticide registration Applicator certification	California Department of Pesticide Regulation
Air Quality	Federal Clean Air Act; 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 LAFCOs

Table 6-2
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		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
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
National Marine Fisheries Service						C						
Fish and Wildlife Service	C					C		L				

L = Lead agency, with permitting, enforcement, or implementing authority
C = Commenting agency to the lead agency

States are required to identify waters for which technology-based effluent limitations are not stringent enough to meet the applicable water quality standard. Once these waters are identified, states must then priority-rank these waters, taking into account the severity of the pollution and the beneficial uses of the waters.

For all waters thus identified, states are required to establish "total maximum daily loads," or TMDLs. These set the total amount of each pollutant that can be discharged into a waterbody without violating water quality standards.

Every even-numbered year, each state must submit to EPA a so-called Section 305(b) report. The report must describe the quality of the waters of each watershed. It must state the environmental and economic costs and benefits of the actions needed to meet desired water quality standards and the date such objectives will be achieved.

California State Laws to Protect Water Quality

Few changes in the regulatory strategies established under the Porter-Cologne Act were required by adoption of the CWA, except that it gave the EPA the responsibility to oversee water quality control activities of the state. As noted, the EPA has delegated this authority to the state and the State Board as the state water quality agency.

The Porter-Cologne Act was enacted by the California Legislature in 1969 to:

- Implement federal directives requiring classification of state waters by beneficial use.
- Adopt water quality objectives to ensure the beneficial uses are met.
- 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 as its control mechanism. The Act creates a water quality control program administered regionally but overseen through statewide coordination and policy. The State Board provides guidance and oversight to the Regional Boards through statewide regulations, plans, policies, and administrative procedures. State and Regional Boards carry out their authority through specific "Basin Plans," which:

- Designate beneficial uses.
- Set water quality objectives to protect beneficial uses.
- Establish programs to achieve these objectives.

The plans may prohibit the discharge of certain types of waste in specified areas under specified conditions. Discharge prohibitions may be adopted for nonpoint sources such as surface runoff, or for direct discharges to surface water or groundwater. The Act also requires the State Board to adopt a "State Policy for Water Quality Control," including water quality objectives directly affecting water projects.

The Porter-Cologne Act authorizes the State and Regional Boards to regulate activities affecting water quality through the issuance of waste discharge requirements (WDRs) for any discharge to surface waters or to land, and federal NPDES permits for wastewater discharges to surface water. Any entity discharging or proposing to discharge waste that could affect the quality of waters of the state must submit a report to the Regional Board unless they waive the filing. Regional Boards have the discretion to act in a site-specific manner; they generally refrain from imposing WDRs on dischargers that implement best management practices in accordance with a State Board or Regional Board order.

Implementing Agencies

At the federal level, the EPA has primary management responsibility for control of sources of pollution through the CWA. As stated above, in California the EPA has delegated its authority to the State Board and the Regional Boards. These agencies have regulatory and enforcement authority over state programs for sources of pollution (Tables 6-2 and 6-3). The Porter-Cologne Act assigns the State Board overall responsibility and directs the Regional Boards to establish and enforce standards in 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, which have the responsibility to establish stormwater management programs in their municipalities, following federal guidelines. In addition, the California Department of Fish and Game has some enforcement authority through the Fish and Game Code, which prohibits the discharge of any substance or material that may adversely impact fish, plant, or bird life.

Beneficial Uses

The San Francisco Bay Regional Board, in consultation with state and local authorities, designates existing and potential beneficial uses for significant surface water and groundwater bodies in the region. A fuller discussion of beneficial uses will be found in Section 6.1 of Volume One Unabridged. Brief definitions of beneficial uses are presented here in alphabetical order, using their abbreviations. A brief discussion of beneficial use designations in the Basin is provided in Section 7.3.1 of this report.

- **(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.

Table 6-3
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	ceres.ca.gov/bcdc/
California Department of Toxics Substance Control	(510) 540-3919	www.dtsc.ca.gov
California Department of Fish and Game	(707) 944-5500	www.dfg.ca.gov
California Department of Health Services	(916) 445-0498	www.dhs.cahwnet.gov/ps/ddwem
California Integrated Waste Management Board	(916) 255-2296	www.ciwmb.ca.gov
California Department of Pesticide Regulation	(916) 445-4300	www.cdpr.ca.gov
California Department of Water Resources	(916) 653-5791	www.dwr.water.ca.gov
U.S. Fish and Wildlife Service (Pacific Region)	(503) 231-6828	pacific.fws.gov
National Marine Fisheries Service (Southwest Regional Office)	(562) 980-4000	swr.ucsd.edu
California State Office of Historic Preservation	(916) 445-8006	www.calhist.org

- **(ASBS) Areas of Special Biological Significance.** Areas designated by the State Water Resources Control Board.

- **(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.

- **(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.

- **(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.

- **(FRSH) Freshwater Replenishment.** Uses of water for natural or artificial maintenance of surface water quantity or quality. (Note: 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.

- **(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.

- **(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).

- **(MIGR) Fish Migration.** Uses of water that support habitats necessary for migration, acclimatization between fresh water and saltwater, and protection of aquatic organisms that are temporary inhabitants of waters within the region.

- **(MUN) Municipal and Domestic Supply.** Uses of water for community, military, or individual water supply systems, including, but not limited to, drinking water supply.

- **(NAV) Navigation.** Uses of water for shipping, travel, or other transportation by private, military, or commercial vessels.

- **(PRO) Industrial Process Supply.** Uses of water for industrial activities that depend primarily on water quality.

- **(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.

- **(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.

- **(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.

- **(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.

- **(SPWN) Fish Spawning.** Uses of water that support high quality aquatic habitats suitable for reproduction and early development of fish.

- **(WARM) Warm Freshwater Habitat.** Uses of water that support warm water ecosystems including, but not limited to, preservation or enhancement of aquatic habitats, vegetation, fish, or wildlife, including invertebrates.

- **(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.

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 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 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.

Laws and Regulations

Drinking water quality in California is governed by the federal SDWA, California SDWA, and Title 22. Amendments to the federal SDWA 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 new drinking water standards based on better science and risk assessment.

To protect water sources, states are required to prepare assessment programs that define the areas that supply public drinking water, and to evaluate water system susceptibility to contamination.

The 1996 amendments also required the EPA to list potential contaminants not subject to proposed or final national regulation, known or anticipated to occur in public water systems, which may require future regulation. In March 1998, EPA published its final Drinking Water Contaminant Candidate List. This list named 10 microbiological contaminants and 50 chemical contaminants. Should EPA decide to regulate a contaminant on the list it must publish a final standard for that contaminant within 3½ years.

EPA is also required to put two new public right-to-know activities in effect:

- Public drinking water system operators must give public notice within 24 hours of discovering acute contamination such as nitrates, fecal coliform, and waterborne diseases that can seriously affect human health with short exposure.

- All public water systems must produce and publicize to their customers a yearly Consumer Confidence Report that tells 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 to customers that substantially meets the new EPA regulations; in the year 2000 they must reformat their reports to fully conform to the new EPA model.

The California Safe Drinking Water and Toxic Enforcement Act, better known as Proposition 65, applies to certain chemicals and business activities. Regulations putting the Act in effect were issued in 1988 and have been amended numerous times since. There are 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.

Implementing Agencies

At the federal level, EPA has primary responsibility for enforcing the federal SDWA. In California it has delegated this authority to the Department of Health Services.

The California Environmental Protection Agency (Cal-EPA) has been designated by the governor as the lead governmental agency to put Proposition 65's provisions into effect. Within Cal-EPA, the Office of Environmental Health Hazard Assistance is responsible for such 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

An overview of the regulatory framework for water rights and the implementing agencies is presented below. A more comprehensive discussion of all elements pertaining to managing California's water systems can be found in *Regulatory Analysis for the San Francisco Estuary* (San Francisco Estuary Project 1992).

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 not adjacent to water. In 1928, California amended its constitution to make both systems of water rights 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.

Implementing Agencies

Federal and state governments, local municipalities, and private entities operate water storage and diversions. At the federal level, the Bureau of Reclamation manages the Central Valley Project and has the largest role. At the state level, the Department of Water Resources (DWR) manages the State Water Project and plays a key role. At the local level, water supply districts and irrigation districts are instrumental in managing 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 California Department of Fish and Game (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), the National Marine Fisheries Service, and the U.S. Geological 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

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* (San Francisco Estuary Project 1992).

Laws and Regulations

CWA Section 404 is the principal federal program regulating activities that affect the integrity of wetlands. It requires that permits be obtained to discharge dredged or fill material into U.S. waters, including wetlands; certain farming, maintenance, and construction activities that do not discharge dredged or fill material are exempt. In addition, the use of nationwide general permits for certain categories of activities allows the ACOE to approve such activities without case-by-case reviews. Permit applications are reviewed by the ACOE and accepted if they are determined to comply with the necessary guidelines and have undergone a public review.

Projects that affect fish and wildlife habitats also require permits from the CDFG. The Lake and Streambed Alteration Program requires that the Department be notified of 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, an agreement must be obtained.

Other agencies that may have responsibilities involving projects that affect waterways include the State Lands Commission, the State Board, the ACOE, and the San Francisco Bay Conservation and Development Commission. Examples of activities occurring in wetlands that require permits include commercial, industrial, and residential development; power plants and transmission lines; and construction of pipelines and railroad crossings. Agencies responsible for these permits, besides some already named, include local governments, the State Reclamation Board, the California Energy Commission, the Public Utilities Commission, and the Department of Housing and Community Development.

Within the Basin, the Water District has local permitting jurisdiction 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 planned within 50 feet of any watercourse that drains more than 320 acres.

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. All three definitions 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. 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 6-4).

Implementing Agencies

The ACOE and the EPA both have regulatory responsibilities relating to wetlands. The CWA 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 by disposal of dredged spoil or fill. The State Board, with recommendations from the Regional Board, is responsible for certifying that ACOE activities will not adversely impact water quality. The Regional Board imposes waste discharge requirements on wetlands fill and waterway modification projects. Within the Basin, other agencies with jurisdiction include the State Lands Commission, the State Board, the San Francisco Bay Conservation and Development Commission, the CDFG, and the Water District.

6.5 Regulation of Endangered Species

Activities that could jeopardize threatened and endangered species are regulated under federal and state 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 protect it and develop recovery plans that would allow it to be removed from the list. Agencies are prohibited from authorizing or carrying out any action that would jeopardize a listed species or modify its critical habitat.

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. The ESA requires that the USFWS or National Marine Fisheries Service be consulted before actions that may adversely affect designated critical habitat are taken. To protect listed species, permitting requirements may be adjusted to promote their recovery and protection. In addition, federal actions in carrying out the law may affect or limit the quantity of water diverted under a state-issued water right permit. The ESA prohibits taking of listed animals without authorization; incidental-take permits were developed to allow nonfederal projects that may result in the taking of listed species to go forward.

Table 6-4
Federal Wetlands Definitions

Federal Definition	Institutional Use of Definitions	Legislative Origin and Purpose
USFWS (Cowardin et al. 1979): *"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."* *"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: USFWS State: CDFG[2] Local: San Francisco Estuary Institute[3] San Francisco Estuary Project[4]	No direct legislative origin or authority.[5] Developed to conduct the National Wetlands Inventory (1981)
USACE/ EPA, 1977: 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: ACOE EPA State: State/Regional Water Quality Control Boards CDFG[2] Local: 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: The Food Security Act contains the following definition: *The term "wetland", except when such term is part of the term "converted wetland", means land that—* *(A) has a predominance of hydric soils;* *(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* *(C) under normal circumstances does support a prevalence of such vegetation.* *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] Hydric soils and hydrophytic vegetation are further defined.	Federal: Natural Resources Conservation Service USACE[8] State: none Local: none	1985 Food Security Act as amended (1990) Primary method used to delineate wetlands on agricultural lands 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.

California’s endangered species statute contains provisions for adding and removing species from the state list of threatened, endangered, or candidate species. Like the federal law, the state law prohibits the import, export, taking, or possessing of listed species without an incidental-take permit.

As more aquatic species that live in 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 establish 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, stricter restrictions such as more stringent water quality criteria could be imposed on entities regulated under a federal program. These restrictions could include additional monitoring to determine the effects of pollutants on the endangered or threatened species.

Implementing Agencies

The USFWS and the National Marine Fisheries Service have regulatory authority over the federal ESA. The CDFG is the state regulatory agency in charge of implementing California's ESA statute.

6.6 Regulation of Fisheries

Laws and Regulations

The Fish and Game Code contains several provisions designed to protect fisheries. The code states the policy of the state to promote development of local fisheries and distant-water fisheries based in California. Elements of the policy include maintenance of sufficient populations of all species to insure their continued existence, maintenance of a sufficient resource to support sport fishing, and development of commercial aquaculture. The code also requires the owner of any dam to allow sufficient water at all times to pass through a fishway, or in the absence of a fishway, allow sufficient water to pass over, around or through the dam, to protect any fish below the dam. The CDFG has the primary responsibility for protecting the state's fisheries.

6.7 Regulation of Land Use

Land use planning and regulation are the principal means of managing the effects of land use change on estuarine systems. In California this has been carried out using three basic tools: general plans, zoning ordinances, and subdivision ordinances. A very brief overview of Basin-wide land use planning is presented below. *Regulatory Analysis for the San Francisco Estuary* (San Francisco Estuary Project 1992) has a more detailed discussion of this subject, plus information on state laws and enabling legislation and regional plans and planning agencies.

California Environmental Quality Act

The California Environmental Quality Act (CEQA) of 1970 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. 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. CEQA requires changes in projects to prevent environmental impacts that are avoidable. However, projects that impact the environment can be approved if economic, social, or other conditions make mitigation efforts infeasible. Although the CEQA process generally focuses on a project-by-project analysis, tiered EIRs can be developed.

Basin-Wide Planning (General Plans)

The California Planning, Zoning, and Development Law requires that counties and general law cities prepare a general plan. These plans must include seven basic elements: 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, and flood and wildfire hazards, along with policies to protect the community from these hazards. General plan elements must be internally consistent. Similarly, the municipality's other development rules (e.g., specific plan, policies, ordinances, zoning regulations) must be consistent with the general plan.

Local Planning Policies

In addition to general plans, local planning policies include zoning ordinances and subdivision maps. Zoning ordinances are designed to translate the general plan's broad policies into specific requirements for individual parcels of land. Zoning regulations can be used to separate a municipality into districts within which the municipality regulates how the land is used, and the type and design−in terms of height, bulk, and density−of building. The Subdivision Map Act (California Government Code Sections 66410 et seq.) sets up a procedure that local governments must use when considering subdividing land into more than four separate parcels. In addition, local jurisdictions typically have their own specific policies, such as riparian corridor policies, to address local land use-related issues.

The Subdivision Map Act (California Government Code Sections 66410 et seq.) allows municipalities to regulate and control the design and improvements of subdivisions that are generally greater or equal to five parcels, by requiring such subdivisions to have a tentative and final or parcel map. Under the Subdivision Map Act, municipalities are given the ability to regulate the land use type and design of subdivisions, including street alignments, grades, and widths; drainage and sanitary facilities including alignments and grades thereof; location and site of right-of-ways, fireroads, and firebreaks; lot size and configuration; traffic access; grading; park and recreational land dedications; and other requirements to ensure consistency with 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; attach conditions of approval based on the results of the CEQA review; require reasonable offsite and onsite improvements; and implement, with an appropriate ordinance, public improvement standards in residential subdivisions if the standards do not exceed the municipality's own standards.

6.8 Regulation of Transportation

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. Its focus is to improve safety, protect and enhance communities and the environment, and advance economic growth through efficient and flexible transportation. Elements that deal 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. TEA-21 provides a funding source to state and local governments for transportation projects and programs to help meet requirements of the Clean Air Act. In addition, it ensures the establishment of a monitoring network for fine particle evaluation.

Implementing Agencies

In the Bay Area, TEA-21 is carried out by the Metropolitan Transportation Commission, which is the transportation planning, coordinating, and financing agency for the nine-county Bay Area. It functions as both the regional transportation planning agency and, for federal purposes, as the region's metropolitan planning organization. It is responsible for the Regional Transportation Plan, a comprehensive blueprint for the development of mass transit, highway, airport, seaport, railroad, bicycle, and pedestrian facilities. The Commission is coordinating a regional effort to address transportation needs, called the Bay Area Transportation Blueprint for the 21st Century.

6.9 Regulation of Vector Control (Mosquito Abatement)

Mosquito monitoring and abatement in California is generally undertaken at the local level. California Public Health Codes give local districts wide latitude in determining the level of threat posed and the extent of abatement necessary. The agencies performing these duties generally arise from joint powers agreements between cities. There are three local districts in the Basin, one in each county. Santa Clara County Vector Control also has established programs targeting other pests, including wildlife such as raccoons, opossums, and skunks.

If mosquito population levels are determined to be a potential threat to local health and comfort, a district 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. The degree of enforcement is often left to local discretion, and can vary widely between districts. 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, trying to educate property owners on mosquito source control rather than litigate against them, and to abate sources before problems arise. Property owners are liable for the costs of any abatement procedures on their property.

6.10 Regulation of Pesticides

Pesticide use in California is regulated by two federal acts and the California Food and Agricultural Code. The agency with primary responsibility for these programs is the California Department of Pesticide Regulation (DPR). The DPR entered into a cooperative agreement in 1997 with the State Board to protect water quality from pesticide use. Federal and state regulations implemented by the DPR and the cooperative agreement between the DPR and the State Board are discussed briefly below and somewhat more fully in Section 6.10 of Volume One Unabridged.

Federal Regulation of Pesticides

Pesticide products must be registered federally before distribution or sale. Registration includes submission of required data by the person seeking registration, evaluation and acceptance of these data by the EPA, submission of a proposed label by the registrant, review and acceptance of the final labeling by the EPA, establishment of a tolerance (maximum residue level) for pesticides used on food or feed commodities, and classification by the EPA of the pesticide product for restricted use or general use as appropriate.

California State Regulation of Pesticides

The Food and Agriculture Code has an extensive pesticide program that enables the DPR to evaluate and register pesticide products before their use in the state, monitor the sales within the state, and regulate and record their use. State law requires the DPR to thoroughly evaluate and register pesticides before they are sold or used in California. During the evaluation and registration process, the DPR evaluates potential water quality problems associated with uses of pesticides, including use on sites where runoff from irrigated fields is likely to carry pesticides into surface waterways. The DPR gives special attention to the potential for toxicity to aquatic life and to factors that may interfere with attaining water quality objectives. If the 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.

California Department of Pesticide Regulation/State Water Resources Control Board Management Agency Agreement

In 1997, the State Board and the DPR entered into an agreement, the Management Agency Agreement, to work together to protect water quality from the potential adverse effects of pesticides. Pesticides have been found to be a significant contributor to water pollution through both agricultural and urban runoff. The Management Agency Agreement is part of an effort to make state programs, and their overlapping as well as their sometimes conflicting authorities, better serve the goal of addressing water quality problems and their resultant impacts on the aquatic environment and human health. The Management Agency Agreement 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

Deposition from the air is one source of several watershed pollutants including dioxins, pesticides, and some heavy metals. Motor vehicle emissions may ultimately enter water, through rainfall or dry deposition. Thus, air quality control may have a direct impact on water quality.

Air quality is regulated at the federal level by the EPA under the Clean Air Act, which requires 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 meeting standards.

At the state level the California Air Resources Board (CARB) is charged with implementing the Clean Air Act, 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.

California's Health and Safety Code currently provides for four types of air pollution control districts: (1) countywide districts having geographic boundaries within a single county, (2) unified districts comprising several adjoining counties, (3) regional districts, similar in structure to unified districts but with representatives from cities within the region on the governing board, and (4) air quality management districts. Air quality in the Bay Area is regulated by the Bay Area Air Quality Management District, which comprises all or part of nine counties in the area and is responsible for enforcing standards and regulating individual sources.

The Clean Air Act and local implementation plans do not directly address air impacts on water quality. Even so, the CARB and the Bay Area Air Quality Management District were cooperating with the San Francisco Estuary Institute and the Bay Area Stormwater Management Agencies Association on air deposition pilot projects in 1999.

6.12 Regulation of Local Agency Formation

There are 12 Local Agency Formation Commissions (LAFCOs) in the San Francisco Estuary, those in the Basin being the Alameda, San Mateo, and Santa Clara LAFCOs. These commissions are influential in determining land use changes and urban growth patterns. They have no direct land use planning or regulatory authority, but they do determine the provisions of urban services and the limits of where urban expansion may occur. Because changing land use from rural to urban may affect the amount and types of pollutants that reach the estuary, LAFCOs have an important role in determining what pollutants are carried to the estuary. The LAFCO delineates a line around each city or special district in the county, which is deemed to be that entity's "sphere of influence." An annexation to a city or special district can occur if it is within the entity's sphere of influence.

6.13 Flood Management and Control

Flood control activities may directly impact wildlife and aquatic habitats in the watershed. Agencies responsible for flood management include local flood control districts such as the Water District in Santa Clara County, the DWR, and the Federal Emergency Management Agency (FEMA).

FEMA is the federal agency responsible for responding to natural disasters and emergencies including flooding. Its mission is to reduce loss of life and property and protect the nation's critical infrastructure from all types of hazards through a comprehensive, risk-based emergency management program of mitigation, preparedness, response, and recovery.

While the DWR has statewide responsibility for flood control, flood management in California is primarily conducted by local flood control districts. The Water District is responsible for flood management in Santa Clara County. It undertakes a wide variety of flood protection. Typical projects include floodplain zoning, maintaining existing facilities, levee, bypass, and floodwall construction and structural work in channels with rock, gabions, concrete, earth lining, or other material.

California's Water Code contains provisions for building works, improvements, levees, or check dams to prevent overflow and flooding; for protecting and reforesting watersheds; for conserving floodwaters; and for constructing projects outside the county if the rivers or streams affected flow in or through more than one county. The code also has provisions on watershed protection and flood prevention projects. They 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 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.

Chapter 7
Natural Setting

This chapter describes the natural setting of the Basin and its plants and animals, paying particular attention to the individual watersheds.

7.1 Santa Clara Basin Natural and Ecological History

Geography

The Santa Clara 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). (See Figures 1-2 and 1-3.) It is bounded on the west by the Santa Cruz Mountains and on the east by the Diablo Range. All 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, between East Palo Alto and Fremont.

The Santa Cruz Mountains are a complex of steep ridges ranging up to almost 4,000 feet and separating the Basin from the Pacific coastline. Santa Clara Valley, which makes up the lowland portion of the Basin, lies between the forested, east-facing slopes of these mountains and the drier grasslands, chaparral, and oak savanna on the west-facing slopes of the Diablo Range. That range in turn separates the Basin from San Joaquin Valley. The southern end of the Basin is near Morgan Hill where the alluvial fan of Coyote Creek forms a low drainage divide. Runoff on the north side flows to the Bay; runoff on the south flows to the Pajaro River and Monterey Bay.

The Basin is comprised of 13 major watersheds plus the Baylands and the South Bay. The watersheds are described beginning later in this chapter and more fully in Section 7.2 of Volume One Unabridged. The vast majority of the Basin is in Santa Clara County. The northwestern portion of the Basin (most of San Francisquito Creek watershed) is in southern San Mateo County, and the northeastern portion (Arroyo la Laguna watershed) is in Alameda County.

Geology

Located in one of the most seismically active areas in the world, the Basin lies 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. The geology is complex but the overall picture is fairly straightforward: Santa Clara Valley is a large trough that has been filled by gravel, sand, silt, and clay eroded from the adjacent mountains. The structure of the area is controlled by faulting, the trend of which is northwesterly, as is common in California.

Over the last 10,000 years, the gravel, sand, silt and clay eroded from the mountains have been deposited in the valleys of the Basin. This material, referred to as the “young alluvium” is an important groundwater-bearing unit of the Basin, more than 1,500 feet deep in Santa Clara Valley.

For perhaps 30,000 years the southern part of Santa Clara Valley has been shaped largely by rivers. In the northern part a major influence has been glacial meltwater carried down the Sacramento River, which has created blue-gray deposits of bay mud extending well into the northern portion of the Basin. Today, the Bay has retreated from its maximum extent and significant areas of these deposits stand exposed as dry land.

Mineral deposits, mines, and quarries can play important roles in the water quality of a watershed. Of particular note in the Basin are a number of inactive mercury mines, most them in the vicinity of New Almaden. In the recent past, alluvial gravels have been quarried in many parts of the Basin, but today only two active quarries remain.

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. These factors have combined in many ways and many different individual soils have developed in the Basin.

A useful way to group soils is based on physiographic land divisions, which take into account both the topography and the origin of landforms. On this basis, soils in the Basin form on five major types of landforms:

- **Alluvial fan soils** form from sediment 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 clay in the subsoil. These soils are some of the most desirable agricultural land.

- **Basin-land soils** 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 well drained and sometimes contain alkali deposits that render them unfit for agricultural use. The northern portion of the Basin, adjacent to the Bay, has a large proportion of basin-land soil.

- **Low terrace land** is found in many places around the edges of Santa Clara Valley, occupying terrace positions somewhat above the general level of the valley floor. Most of these soils are remnants of older valley-filling materials; they tend to have significant percentages of clay in their subsoil and can be difficult for both roots and water to penetrate.

- **High terrace land** occurs along the edges of the valley, merging into the hills and occupying older, higher terraces. These areas are usually somewhat rolling, and the soils are more fully developed and more erosive than those on lower terraces.

- **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 Range and Santa Cruz Mountains. Some of the flatter areas are farmed or grazed, but these soils are presently of little agricultural importance and support a diverse range of natural plants and animals.

Climate and Hydrology

The Basin has a Mediterranean climate, with a wet season from approximately November through April and minimal rainfall during May through October. Average rainfall varies greatly due to topography: parts of the Santa Cruz Mountains receive 40 to 60 inches per year, while central Santa Clara Valley averages 13 to 14 inches. Averages can be misleading, however, because of seasonal variations and fairly frequent droughts. For example, yearly rainfall in San Jose over the last 100 years or so has ranged from about 6 to over 30 inches. Temperatures in the Basin tend to be mild, rarely far below freezing in the valley flat. North of San Jose, average summer temperatures seldom go above 90°F.

Many short-term droughts of 5 to 7 years have occurred just within the last 100 years, and studies of tree rings indicate at least three 10- to 20-year periods of below-average precipitation since the mid-1500s. Although in other regions drought is considered a temporary aberration, in much of California and in the Basin drought should serve as a basis for planning.

The percentage of precipitation carried away by streams as runoff varies greatly and depends on factors such as topography, the character of the soil, the depth to groundwater, and the density of urbanization. It is estimated that 16 to 34 percent of the precipitation that falls in various portions of the Basin runs off. The amount that infiltrates the soil and rocks is also highly variable, dependent upon many of the same factors.

Historically, most creeks in the Basin were dry during the summer. As patterns of water use and water importation have evolved, many creeks have experienced increased summer flow. Today some are perennial in their lower reaches due to urban runoff or high groundwater. Some flow due to artesian wells, springs, water releases, and urban runoff. 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.

Flooding is another common process that plays a major role in the Basin; this subject is discussed in Chapter 8.

Plants and Plant Habitats

Historical Perspective

Before the arrival of the Spanish, the Basin had a rich variety of plant communities and wildlife habitats. Tall stands of native bunchgrasses covered vast meadowlands and dotted the savannas. Rivers and streams draining into the Bay supported large estuaries and tule marshes. Along the lower salty margins of the Bay were vast pickleweed and cordgrass marshes. In Santa Clara Valley were oak-studded grassy plains and small streams, prone to flooding in the winter and drying in the summer, which ran alongside banks densely wooded with willows, cottonwoods, and sycamores.

Changes Due to Human Activity

The arrival of European settlers dramatically changed the distribution and species composition of the plant communities in the Basin. The displacement of native perennial grasslands by European nonnative, annual grassland species is well known. The once heavily forested foothill areas were significantly reduced by lumbering in the middle to late 1800s. As settlement continued, natural stands of vegetation were converted for agricultural use, and much of the agricultural land was later replaced by urban development.

The human impact that has modified Bayland habitats the most drastically has been the development of the salt industry. South Bay salt ponds were diked beginning in 1854 and by the 1930s significant portions of the South Bay's tidal marsh habitat had been converted to diked salt ponds. The discharge of freshwater from wastewater treatment plants has also had an impact on South Bay habitats, converting acres of tidal salt marsh dominated by pickleweed and cordgrass to brackish marsh dominated by alkali bulrush.

Invasive nonnative plant species have been introduced in the Basin by humans. Such species displace the native or indigenous plants and lower the habitat value for wildlife. Periwinkle, an invasive vine, has become established in the understory of many woodlands, forests, and streambanks. In the lower South Bay, smooth cordgrass is a potentially serious invasive perennial grass in low tidal marsh and open mudflats. Perennial pepperweed is a serious invasive species of South Bay brackish marshes.

Plant Habitat Descriptions

The habitat/vegetation types described in this report represent a refinement of the habitat types in the Santa Clara County General Plan. That plan refers to four broad groupings of habitats:

- Baylands habitats (including estuaries, mudflats, salt marshes, salt ponds, and levees)
- Freshwater habitats (including flowing streams, riparian zones, freshwater marshes, and lentic zones)
- Grassland/Savanna habitats
- Chaparral/Forest habitat (including chaparral, mixed evergreen forest, redwood forest,

foothill woodland, and closed-cone pine forest)

Tidal Marsh Habitats

Tidal marsh habitat occurs in undiked areas and in tidal reaches of rivers and streams that are open to complete tidal action. In the more saline parts of the South Bay, tidal marsh is referred to as tidal salt marsh. In the more brackish areas with significant freshwater influence it is referred to as tidal brackish marsh.

Salt marshes border the mudflat community and are composed of a rich community of algae, diatoms and invertebrates as well as wetland vegetation. Mudflats and salt marshes are generally found between mean low water 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 from about mean sea level up to the extreme high tide line. Because the water-saturated soils contain little oxygen and have high salt concentrations, plants that successfully live therein are uniquely adapted to this challenging environment. Dominant plant species include Pacific cordgrass and perennial pickleweed. 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 where fresh water mixes with saltwater and are one of the most restrictive types of habitat due to the extreme fluctuations in salinity. During heavy rains they may be almost entirely flooded by freshwater, while in the summer and fall saltier tidal waters predominate. This limits the variety of plants to those that can tolerate inundation by both fresh and salty water. Dominant plants are bulrush and cattail.

The primary wetlands of the lower South Bay are the northern coastal salt marsh and the coastal brackish marsh. Coastal salt marsh is restricted to a zone from just below mean tide level to the level of the highest tides; typical plant species associated with the coastal salt marsh are salt grass, pickleweed, cordgrass, and gum plant. Tidal brackish marsh often occurs in flatlands where fresh water and saltwater mix. Cattails, California bulrush, and alkali bulrush dominate the low marsh. A diverse assemblage of species including bulrushes, spike rush, Baltic rush, silverweed, and salt grass dominates the middle marsh. Common pickleweed, salt grass, gumplant, and alkali-heath characterize the high marsh. Perennial pepperweed is a serious invasive species of South Bay brackish marshes.

Baylands Habitats - Diked Wetlands

The South Bay has many acres of diked wetlands. These historical tidal marshes are isolated from tidal influences due to levees or dikes, but maintain wetland features. A mosaic of pickleweed marsh, bare ground and higher elevation salt marsh plant species occupies most of these areas, but also weedy/ruderal plant species often preponderate. Most of these areas reverted to wetland habitat after being abandoned by farmers.

Freshwater Wetlands

In contrast to brackish water marshes, freshwater wetlands are a less demanding environment for plants and animals to grow and live in. Freshwater marshes occur wherever water slows down and accumulates, even on a temporary or seasonal basis. They may form around springs, ponds, and along slow-moving creeks and rivers. They occur in lowland areas and usually feature shallow water that is often clogged with dense masses of vegetation. Typical plant species include cattail, California bulrush, common tule, and various species of rush and sedge. Vernal pools may support endimic or rare and endangered plant species such as the Contra Costa goldfield and Lobb's aquatic buttercup.

Nonnative Grasslands

Today the majority of the Basin's grasslands are dominated by nonnative annual plant species, including many European grasses. Native grasslands have been reduced significantly by the invasion of weedy annual and broad-leaved grasses, including wild oat, soft chess, ripgut brome, sheep sorrel, and filaree. Some nonnative grasslands intermingle with oak woodland habitats and form a vegetation mosaic often referred to as a savanna.

Native Grasslands

In some areas such as the remote hilltops at Grant Ranch County Park, where shallow soils or rocky outcrops are less accessible by cattle, native grasslands survive. Those grasslands growing on serpentine soils and outcrops are a special type. Apparently the native perennial bunch grasses can tolerate shallow and/or rocky soils better than the European grasses and, therefore, can compete against them.

Scrubs and Chaparrals

Scrub habitats tend to be less dry than chaparrals and consist of 2- to 6-foot-tall shrubs. Most of these habitats occur at lower elevations than chaparrals. Northern coastal scrub is the most abundant scrub type. Chaparral plant communities tend to be found in dry areas with shallow soil profiles, particularly on south- and west-facing slopes; they are characterized by 3- to 10-foot-tall shrubs and shrubby trees. Some herbaceous plants grow under them. Most chaparrals require periodic fires for optimum health and stability.

Riparian Habitats

Riparian habitats are distributed along the banks and/or floodplains of rivers and creeks. Plant composition and width of the corridor vary, depending on the steepness of the channel and the frequency of flooding. Common native riparian trees include sycamore, cottonwood, and willow. Riparian habitats have been significantly reduced from their historical extent. Due to the limited extent of the remaining habitats and their value for wildlife, federal, state, and county government agencies consider them a sensitive and protected resource.

Woodland Habitats

These habitats occur primarily in the foothills and are typically composed of various species of oak trees. Trees are more widely spaced and tend to be lower than in forest habitats; therefore, the herbaceous understory may be well developed in undisturbed areas.

Broadleaved Upland Forests

Broadleaved upland forests in the Basin include mixed evergreen forest, black oak forest, tan oak forest, California bay forest, and coast live oak forest. Forests are primarily 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 of oaks, madrone, and California bay occur on the east-facing slopes of the Santa Cruz Mountains.

Coniferous Forests

Coniferous forests include Coulter pine, Douglas fir, knobcone pine, upland ponderosa pine, and upland redwood forests. Coast redwood forest is mainly distributed in the Santa Cruz Mountains, in ravines, along stream sides, and in areas moistened by coastal fog. Stands of ponderosa pine forest, foothill/gray pine forest, and Coulter pine forest occur in the higher elevations of the Diablo Range.

Agricultural Lands

Lands devoted to agriculture include orchards, vineyards, field crops, grazing lands, and irrigated pastures. Remnants of large orchards are scattered in residential areas and in foothill regions that are less subject to development. Common fruit crops include prune, cherry, apricot, walnut, and pear. Cultivated lands were reduced by a third between 1947 and 1961, and the decrease has continued. Grazing lands still occur.

Urban Habitat

Urban forest primarily refers to landscaped residences; planted street trees such as elm, ash, liquid amber, pine, and palm; and parklands. Nonnative or cultivated plant species predominate. An invasive nonnative, the tree-of-heaven, has become established in yards and vacant lots in the San Jose area. Portions of Palo Alto and San Jose have mature trees that in some areas form contiguous canopies.

Special Plant Species

These are plants that are legally protected under the state and federal Endangered Species Acts or other regulations, or species considered to be of concern by the resource agencies and/or the scientific community. The Santa Clara County General Plan lists 43 endangered and threatened plants.

The endangered coyote ceanothus has been recorded at Anderson Reservoir and in the Morgan Hill area. The Mount Hamilton area is known for rare plants such as the Mount Hamilton thistle, the Mount Hamilton coreopsis, and the Mount Hamilton jewelflower. The CDFG's Natural Diversity Data Base lists 39 “special plant species, subspecies or varieties” known to occur in Santa Clara County.

Wildlife and Wildlife Habitats

Historical Accounts of Wildlife

Early settlers were amazed by the wildlife in the South Bay estuary. Herds of thousands of elk, pronghorn, and black-tailed deer inhabited the grasslands, marshes, shrub, and chaparral habitats around the South Bay. California sea lions and harbor seals hauled out and pupped in extensive rookeries in the South Bay. Into the early 1900s settlers described waterfowl so numerous that one could not see the water; at times the sky was said to be so dark with migrating waterfowl that it would “black out.” Between 1860 and 1900 bald eagles nested near La Honda and were commonly seen foraging in all the counties along the Bay. California condors were regularly seen and California grizzly bears were one of the most frequently mentioned large mammals.

Changes Due to Human Activity

Throughout the history of human habitation in the Bay Area, human activity has impacted the regional wetlands. The earliest impacts caused by Native Americans were relatively minor compared to those caused later by European settlers. At the time of the first Spanish settlements in the late 1700s, the Bay’s natural estuarine system spread 1,300 contiguous and undisturbed square miles. Tidal marshes covered over 850 square miles, including the expansive freshwater and brackish marshes of the Sacramento-San Joaquin River 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.

Alteration of native habitats for large-scale agriculture began with the arrival of the first missions in 1777 and the construction of a dam on the Guadalupe River near Mission Santa Clara for irrigation. Fruit trees and grapes were also cultivated. By 1866 artesian wells could no longer meet water demands. As early as 1845 livestock grazing had altered natural grasslands within the entire Basin to such an extent that native perennial grasses were already being replaced by European annuals associated with cattle feed. Estuarine habitat shrank due to diking for agriculture and salt production, sedimentation from intense hydraulic gold mining in the Sierra Nevada, and displacement by fill for residential, industrial, and commercial development, garbage dumps, and sewage plants. By 1985, the historical 1,300 square miles of wetlands had declined to patchy habitats totaling a little under 232 square miles.

Wildlife Habitat Descriptions

Because of its diverse habitat types and relatively undeveloped upper watersheds and Baylands, the Basin has many permanent and seasonal populations of wildlife species. Following are general descriptions of wildlife resources by habitat type.

Lower South San Francisco Bay

The Bay provides foraging habitat for harbor seals and California sea lions as well as diving birds such as brown pelicans, double-crested cormorants, surf scoters, and terns. Surface water also provides resting habitat for both resident and migratory birds. Water quality is very different today than it was historically, because the diversion of water from local streams has altered salinity gradients where the streams enter the Bay. Additionally, large quantities of freshwater flow into the Bay from municipal wastewater treatment plants, changing the habitat type and function of tidal marshes.

Baylands Habitats – Tidal/Brackish Wetlands

Although the Bay estuary system is still the largest on the West Coast, available wildlife habitat has been significantly reduced into patches — a serious problem, especially for terrestrial vertebrates such as the endangered salt marsh harvest mouse and vagrant shrew. Continued habitat fragmentation is of serious concern to the viability of plant and animal species as genetic flow becomes bottlenecked or reproductively isolated.

The Baylands are an important resting and foraging stop for at least 100 species of birds that migrate along the Pacific Flyway. Roughly 17 terrestrial vertebrates forage in the salt marshes during low tides, including the raccoon, vagrant shrew, striped skunk, grey fox, gopher snake, and the endangered salt marsh harvest mouse.

Baylands Habitats – Tidal Flats

During high tides these flats provide foraging habitat for many species of fish; during low tides they are major feeding areas for shorebirds. Mudflats comprise the largest area of tidal flat habitat and support an extensive community of diatoms, worms, and shellfish. The South Bay is the region’s most important area for shorebirds, which mainly feed across tidal flats.

Baylands Habitats – Salt Ponds, Levees, and Dikes

Ponds created to produce salt provide an important habitat for many species of resident and migratory wildlife, particularly birds. The ponds are of primary importance to migratory shorebirds and waterfowl, and they also provide year-round foraging habitat for a number of resident species. More than 40 species of birds are considered to be common in the salt pond habitat. 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.

During the winter when shallow standing water occurs, these 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.

While diked marshes act as immigration and emigration filters for many species, for many others they may provide the only corridors for movement between tidal wetlands.

Freshwater Habitat

Surface water sources provide drinking water for wildlife and excellent breeding areas for aquatic amphibians. Various swallows and bats drink and forage on insects over reservoirs and freshwater marsh areas. Raccoons forage for adult and larval amphibians, fish, and crayfish. The availability of surface water in dry habitats is also important for sustaining mammal populations. 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. Numerous small ponds constructed to water livestock in the foothills of the Diablo Range, depending on their seasonality, serve as important breeding habitat for amphibians and foraging habitat for garter snakes, mammals, and birds.

Freshwater Wetlands

Freshwater marshes, springs, and seeps provide wildlife with drinking water and are excellent breeding areas for aquatic amphibians if sufficient water is available. If standing water is present, small mammals drink from marshes.

Native and Nonnative Grasslands

Both types of grassland are important foraging resources for a wide variety of 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. Consequently, grasslands are valuable aerial foraging sites for raptors such as hawks and owls, bats, swallows, American kestrels, and flycatchers. Grasslands provide good escape cover, food, nesting material, and nest concealment. They are productive habitats for small mammals, which in turn provide a prey base for coyotes, gray foxes, badgers, long-tailed weasels, bobcats, skunks, and snakes. The value to wildlife of native and nonnative grasslands is similar, but native grasses increase the habitat value for certain native wildlife.

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 such as deer rely on scrub habitats for foraging and cover. Coastal scrub plant communities also provide a diversity of flowering plants that are used by hummingbirds and butterflies. Chaparral habitats are found on higher elevation ridges and are generally drier than scrub habitats. Herbivorous wildlife often obtains water by foraging on common chaparral plants that bear fruit, such as manzanita or coffeeberry, or by foraging on green leaves.

Riparian and Bottomland Habitat

One of the highest levels of wildlife species diversity and abundance in California is associated with riparian (streamside) habitats, which have been identified by the CDFG as a habitat of special concern because they are a diminishing resource - at least 89 percent of the riparian areas that existed in California 140 years ago have been lost.

Amphibians are more numerous and diverse in this habitat. Where deciduous trees such as willows, cottonwoods, and sycamores are prevalent, the abundant insects these plants attract create areas especially suitable for neotropical migrants that feed on these insects to replenish their migratory fat reserves. 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.

Invasive exotic plant species have become established in many urban riparian areas of the Basin. 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-Digger Pine)

Oak woodlands are considered critical habitats for many bird and mammal species. Important habitat features include acorns and the presence of cavity-bearing trees. Birds that depend on acorns as a seasonal food include acorn woodpeckers, scrub jays, band-tailed pigeons, and California quail. The natural cavities of mature oak trees are important to cavity-nesting birds and small mammals. Also, mature oak forests typically contain standing dead trees, valuable resources for woodpeckers that prefer dead trees and limbs for roost and nest sites.

Broadleaved Forest and Coniferous Forest

These forests have varying wildlife values; in general, the diversity and abundance of wildlife are highest where vegetation is highly stratified, offering a greater variety of niches. Evergreen forest mixed with scrub communities creates a highly stratified mosaic of high value to wildlife. Bird species richness and abundance is high in the mixed evergreen forest where the understory is stratified and dense. An important feature of the mixed evergreen forest is the abundance of fallen limbs and logs, important as cover, nesting, roosting, and foraging substrate.

All the diurnal raptors in this habitat are state species of special concern; they include golden eagles, Cooper's hawks, and sharp-shinned hawks. Microclimates resulting from the shade of canopy trees and the presence of downed woody debris offer suitable breeding and cover sites for many amphibians. The mixed evergreen forest provides a high diversity of reptiles with abundant prey and cover. Representative mammal species that use 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.

Agricultural Land

Orchard and vineyard fruits attract birds, raccoons, foxes, and coyotes. Unplowed orchards and vineyards provide foraging, cover and denning sites for foxes, burrowing owls, ground squirrels, gophers, mice, and snakes. Insects are important pollinators of blossoms to ensure fruit. Owls and other raptors feed on rodents and insects of the orchard and vineyards. Old buildings and barns around orchards often provide habitats for bats and owls.

Urban Forest

A limited number of mostly nonnative animals 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 agricultural escapes that provide a food source for both native and nonnative wildlife species.

Special Wildlife Species

The CDFG reports that 25 “special animal species and/or subspecies” (including invertebrates but not fish) are known to occur in Santa Clara County. “Special” here describes categories listed or proposed as endangered, plus others considered to be species of special concern.

Fish and Aquatic Habitats

Historical Perspective

Marshlands bordering the Bay now total about 75 square miles; in 1850 they covered 300 square miles. This shrinkage is of major significance. More than just food factories for wildlife, wetlands filter and cleanse water flowing into the Bay, and their enormous absorptive capacity stores floodwater that would otherwise damage cropland or residential areas. They help control sedimentation and erosion. They are an extremely valuable natural resource.

The major, direct impact on the Baylands in the Basin during the past 75 years has been the development of the salt industry. By the 1930s, over 99 square miles had been diked for salt production, a use that continues, although much more slowly. Freshwater discharges from wastewater treatment plants into the South Bay present another ongoing concern. Over the last 20 years approximately 270 acres of tidal salt marsh have been converted to brackish marsh 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.

Changes Due to Human Activity

Native fish populations began to decline in the 1940s, concurrent with a dramatic increase in human population. Humans have altered conditions for native fish through water diversions that reduce streamflows, dams that create passage barriers, water quality degradation due to wastewater treatment, and increased erosion and sedimentation that reduces the quantity and quality of habitat critical for spawning and aquatic insect (food) production. Nonnative species and populations have increased dramatically in the past few decades and now outnumber native species in most watersheds. They have been introduced for a variety of reasons such as mosquito control, pet releases, fishing, game-fish prey, and accident.

Humans have altered Bay habitats by filling wetlands, constructing salt ponds, and reducing and redirecting freshwater flows from streams. Toxins are introduced through rural and urban runoff. Untreated sewage is no longer discharged into the Bay but even treated sewage affects aquatic habitat by consuming oxygen and adding organic materials and pollutants. Historically, the Bay supported large fisheries of Dungeness crabs, starry flounder, oysters, and clams. Bay shrimp and herring roe are the only commercially viable fisheries left.

Aquatic Habitat Descriptions

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 to spawn) and marine fish share the waters common to the Delta, North Bay, and South Bay. Following are descriptions of fish and aquatic life in the Basin by habitat type.

Lower South San Francisco Bay (Open Waters) and Baylands Habitats

Aquatic habitat in the Bay includes marshes, tidal mudflats, sloughs, salt ponds, and open water. Most marine life either depends directly on mudflats and marshes for its sustenance or depends on them indirectly by feeding on detritus or other marine life nourished there. The Bay supports nearly 100 species of fish. Some spend their entire life cycle in the Bay, others enter the Bay for a specific life stage. Anadromous steelhead, salmon, and lamprey are present during their migrations to the ocean as young and from the ocean as adults. Fifteen species of fish are common to the salt and brackish marshes of the Bay, but 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.

Over more than a century many nonnative species have been introduced intentionally or accidentally into the Bay. The Asian clam is a new arrival that may have a widespread impact. First observed in 1986, it most likely arrived as larvae in the ballast water of a cargo ship from Asia. It consumes huge quantities of zooplankton, a primary food source for fish larvae, and may impact fish abundance in future generations.

Freshwater Habitats: Flowing Water

Basin streams are home to 11 native and 19 nonnative species of fish. The abundance and distribution of native species have been reduced significantly through human impacts. Most headwater reaches and tributaries remain less disturbed than mainstem streams and lower reaches. Aquatic habitat in forested headwater streams provides cool stream temperatures, high dissolved oxygen and cover including riparian vegetation, overhanging banks or roots, and pools. Dams have isolated many upper watershed streams; while native fish can persist in these streams, migratory fish such as steelhead can no longer use these tributaries for spawning as most reservoirs lack fish ladders.

All mainstem streams and lower tributary reaches are altered significantly by human impacts including water diversions, channelization, flood-control projects, loss of riparian vegetation, and increased rates of sedimentation. Nonnative fish are generally better adapted to such conditions.

Freshwater Habitats: Standing Water

Lake-like freshwater habitat occurs predominantly in permanent and seasonal in-channel impoundments. These habitats tend to have higher temperatures and lower dissolved oxygen than adjacent flowing water habitat. The habitat found in reservoirs and in-channel percolation ponds tends to favor nonnative fish; these fish can prey on native fish and invade adjacent stream habitat. For example, largemouth bass may prey on juvenile steelhead.

Reservoirs provide habitat for some native fish and can provide rearing habitat for nonmigratory rainbow trout if cool temperatures, dissolved oxygen, and food resources are available. In-channel percolation ponds have the potential to provide rearing habitat for juvenile steelhead but only a few possible steelhead were captured during a 5-year study.

Special Fish Species

The steelhead trout has been federally listed as threatened in Basin streams. Rainbow trout live full time in freshwater streams but retain the genetic potential to once again become a steelhead population if migration passage is restored.

7.2 Waterbodies of the Santa Clara Basin

Waterbodies of the Basin include the rivers and creeks that drain its 13 separate watersheds, the southern portion of the lower South Bay, and the wetlands surrounding the South Bay. Nine major lakes/reservoirs and other smaller reservoirs are located on creeks at mid-elevations in the watershed. Isolated wetlands are also present throughout the Basin.

Lower South San Francisco Bay

The waterbodies of the lower South Bay and Baylands include the open water (saltwater) south of the Dumbarton Bridge and the wetlands surrounding the South Bay. The term “Baylands” refers to a number of wetland ecosystems and encompasses many different types of habitat. Baylands in the northern 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 here not only alters the distribution of tidal, brackish, and fresh waters but also provides a unique habitat of “higher ground” within the marsh plain.

Open Waters, Mudflats, and Tidal Sloughs

Hydrologists divide the San Francisco Estuary into a northern reach, where water circulation and salinity is largely determined by the flows from the Sacramento and San Joaquin rivers, and a southern reach, the South Bay, which receives far less water from its tributaries. The Basin includes the southern end of the South Bay. In this nearly enclosed basin, the tides cause the water to slosh back and forth like water in a bathtub, causing the tidal range at the extreme southern end to approach 8.5 feet. With little freshwater flowing in, the southern portion of the South Bay is relatively stagnant, especially south of Dumbarton Bridge. Areas with large discharges and poor water circulation, such as the lower South Bay, and which in summer receive more treated wastewater than river water, are thought to be particularly vulnerable to pollution.

Most of the Bay is extremely shallow and portions of the South Bay are especially so. In some South Bay shallows the Bay floor has enormous numbers of broken oyster shells, but nearly everywhere else the bottom is a slick, sticky ooze of fine silts and clays, commonly referred to as Bay mud.

Santa Clara Basin Watersheds

The Basin's 13 watersheds are defined as "hydrologic unit[s] that drain to tidal waters of the San Francisco Bay, including tributaries and land areas above reservoirs." This section gives a general understanding of them, their resource values, and problems. They are presented in counterclockwise order starting in the northwestern corner.

San Francisquito Creek watershed drains approximately 45 square miles of northwestern Santa Clara and southeastern San Mateo counties. The creek itself flows 12.5 miles from Searsville Dam to the Bay; along with Los Trancos Creek it divides San Mateo and Santa Clara counties. The creek lies within the Water District and San Mateo County flood-control zones.

Floods have grown more severe because of sedimentation downstream, caused by tidal action and deposition from upstream. Sediment also interferes with local drainage, blocking pipes and culverts. Until 1998 the largest recorded flood was in December 1955; six floods between 1910 and that year did only light damage because development was sparse. After a flood in April 1958, interim protection measures were carried out above and below U.S. Highway 101. In places the lower channel was lined with sacked concrete and protected with berms or low floodwalls; close to the Bay it has been widened and leveed. The creek flooded again in 1998, when the highest flows on record caused over $28 million in property damage in Santa Clara County alone.

A Coordinated Resources Management and Planning process has been under way, producing a draft watershed management plan and a report addressing alternative solutions for flooding and erosion. Over 30 organizations are signatories to the process of preserving the resources of San Francisquito Creek watershed.

On the upper watershed, scattered oak and madrone woodlands intermingle with grassland, in some areas forming a savanna. Residential development here is light; the relatively flat valley floor is heavily developed. Native trees in the riparian corridor include valley oak, coast live oak, willows, and California buckeyes. Common native riparian shrubs include coffeeberry, ocean spray, and creeping snowberry.

This watershed is famous for its reproducing steelhead population, but extremely high natural sedimentation rates and erosion due to human settlement are concerns. Future flood-control measures and development on Stanford property will need to preserve passage. Besides steelhead, native fish are the California roach, Sacramento sucker, hitch, speckled dace, threespined stickleback, and prickly sculpin; seven nonnative species exist. The threatened California red-legged frog lives along the creek.

The upper **Matadero/Barron Creeks watershed** is located on the lower elevation, northeast-facing slopes of the Santa Cruz Mountains. Matadero Creek drains an area south of the San Francisquito Creek watershed. Barron Creek is parallel to and south of Matadero Creek; its watershed lies to the north of the Adobe Creek watershed. The two 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 7-1.

Matadero Creek originates near the town of Los Altos Hills and flows in a northeasterly direction through the residential, commercial, and industrial areas of Palo Alto and unincorporated areas of Santa Clara County. Downstream of 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, approximately 11 of mountainous land and 3 of gently sloping valley floor.

In the late 1930s, the City of Palo Alto purchased land for what is known as the Palo Alto Flood Basin, a 600-acre tidal basin immediately northeast of U.S. Highway 101. In the early 1940s the creek was extended as an earth ditch out to the Bay. Following the flood of 1955, the channel was lined with concrete to increase its capacity and prevent erosion. Downstream of Alma Street, Matadero Creek is entirely a man-made channel.

Flooding occurred along Matadero and Barron creeks in 1941, 1952, 1955, 1958, 1973, and 1983. In 1958 the Water District constructed an earth channel with sacked concrete side slopes from U.S. Highway 101 to Greer Road and varying sizes of concrete-lined channel from there to El Camino Real. Further flood-control work was done in succeeding years.

The upper reaches of Matadero Creek traverse oak woodlands and grassland savanna. Native tree species 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 by bank stabilization and flood-control structures.

<u>Barron Creek</u> originates in the residential areas of Los Altos Hills and flows northeasterly through Palo Alto to join Adobe Creek just upstream of U.S. Highway 101. Barron Creek is primarily an urban watershed with a drainage area of about 3 square miles. Before the 1920s it did not flow all the way to the Bay but turned northeast to join Matadero Creek; in the late 1920s or early 1930s a channel was dug all the way to the Bay. Thus, the downstream portion of the creek is an artificial alignment from Amaranta Avenue to U.S. Highway 101. Many modifications were made to the channel in the late 1950s. Barron Creek flooded 7 times between 1956 and 1983.

Adobe Creek watershed is in northwestern Santa Clara County, rising on the northeasterly facing slopes of the Santa Cruz Mountains near Montebello Ridge, above 2,600 feet. The creek drains approximately 10 square miles, roughly 7½ mountainous and the rest on the valley floor. The main stem is joined by three forks: middle, west, and north; other upper tributaries are Moody and Purissima creeks. The majority of the creek's flow is produced by rainfall in the higher elevations. The steep terrain causes brief, high-intensity runoff during most major storms. Historic floods resulting in damage occurred in 1952, 1955, 1983, 1986, and 1995. A map of the watershed is shown on Figure 7-2.

Much of the upper watershed is open space; the remainder is occupied by low-density residential development. No reservoirs have been built on Adobe Creek. The valley floor portion 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. The Creek is joined by Barron Creek west of U.S. Highway 101 and (with Barron and Matadero Creeks) flows into the Palo Alto Flood Basin.

Many changes have been made in channel alignment. In all cases, the creek was moved to change a meandering course across a historic floodplain into a straightened channel at the edge of a development. In 1959 the Water District constructed a concrete channel between Alma Street and El Camino Real. In 1988, Los Altos, Los Altos Hills, and the Hidden Villa Trust received a grant from the DWR to develop a comprehensive restoration plan for the creek from El Camino Real to the headwaters. The plan contains specific measures to restore and enhance riparian habitat and other biological values and control streambank erosion.

The upper, less developed portion of the watershed in Los Altos Hills is primarily chaparral and broadleaved upland forest dominated by madrone and oak; some grassland areas also exist. Riparian vegetation along the creek from Montebello Ridge to El Camino Real forms an almost continuous riparian corridor of trees and shrubs along both banks. From El Camino Real to the

Table 7-1*
Beneficial Uses of Waterbodies in the Santa Clara Basin

	BENEFICIAL USE (see Section 6.1 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: SF Bay RWQCB. 1995. SF Regional Water Quality Control Plan, Table 2-5.
*WMI stakeholders have identified errors and omissions both in the use designations and the waterbodies as listed in this table.
Legend: E = Existing Beneficial Use, P = Potential Beneficial Use, L = Limited Beneficial Use

Bay, riparian vegetation does not occur due to the channelization of the creek. Channelization, flood-control, and physical barriers such as culverts have drastically reduced fish habitat in the creek

Permanente Creek watershed lies south of the Adobe Creek watershed and north of the Stevens Creek watershed; it drains approximately 17 square miles on the northeast-facing slopes of the Santa Cruz Mountains. The headwaters lie just to the east of Black Mountain, elevation 2,800 feet, on Montebello Ridge. The creek is approximately 13 miles long and flows through Los Altos and Mountain View to discharge into the South Bay via Mountain View Slough. Flows of up to 1,500 cubic feet per second are diverted to Stevens Creek by the Permanente Creek Diversion, built in 1959. Much of the streambank within Mountain View has been treated with artificial materials for bank stabilization and flood control. A map of the watershed is shown on Figure 7-3.

Stevens Creek watershed is bounded on the northwest by the Permanente Creek watershed and on the southeast by the Calabazas Creek watershed. The creek originates at about the 2,500-foot elevation on the northeast-facing slopes of the Santa Cruz Mountains just to the east of Skyline Boulevard. From here it flows southeasterly for 5½ miles before swinging northeast and then north to Stevens Creek Reservoir. From Stevens Creek Dam, the creek flows northward about 13 miles to the Bay. The watershed drains approximately 38 square miles, including almost 9 square miles of the Permanente Creek Basin, whose peak flows were diverted to Stevens Creek in 1959. The upper watershed is bisected by the San Andreas fault, through which Stevens Canyon has formed. A map of the watershed is shown on Figure 7-4.

Two tributary channels flow into the creek downstream of Stevens Creek Dam, the more significant of which is Permanente Creek Diversion, which diverts a maximum flow of 1,550 cubic feet per second from Permanente Creek into Stevens Creek and is its major tributary on the valley floor. The Water District uses the streambed between Stevens Creek Reservoir and El Camino Real for recharging the groundwater basin. The creek flows in a defined channel through Cupertino, Los Altos, Sunnyvale, and Mountain View and into the South Bay north of Moffett Field. Much of the creek as it crosses Mountain View is channelized and artificial materials are used for bank stabilization and flood control.

The predominant plant community in the highest elevations is broadleaved upland forest. Downstream from Stevens Creek Reservoir the stream gradient becomes less steep and the riparian corridor is wider. Typical riparian tree species include box elder, arroyo willow, red willow, cottonwood, western sycamore, valley oak, and coast live oak. Stevens Creek supports a native fish fauna in its upper reaches, which includes resident rainbow trout, California roach, and Sacramento sucker. Nonnative fish are more common in the middle and lower reaches. The creek is also thought to support a reproducing population of steelhead.

Sunnyvale West and **Sunnyvale East watersheds** are two artificial channels constructed by the Water District to provide drainage for a large area in Sunnyvale. Sunnyvale West Channel watershed is to the east of Stevens Creek and drains into Moffett Channel, thence into Guadalupe Slough. Sunnyvale East Channel watershed is to the west of Calabazas Creek and also empties into Guadalupe Slough. Maps of the watersheds are shown on Figures 7-5 and 7-6.

Calabazas Creek watershed drains 20 square miles in the northwestern Basin, south of the Stevens Creek watershed on the northeast-facing slopes of the Santa Cruz Mountains. Calabazas creek is 13.3 miles long and flows northeast into Guadalupe Slough. From approximately 2,000 feet it falls steeply in the mountains, resulting in brief but high-intensity runoff in most major storms. It then flattens as it crosses the valley floor through a heavily urbanized area. Major tributaries include Prospect, Rodeo, and Regnart creeks. A map of the watershed is shown on Figure 7-7.

Calabazas Creek has a history of chronic flooding. On December 22, 1955, over 160 homes were flooded to a depth of up to 3 feet in Sunnyvale alone. More recent flooding has occurred in 1978, 1980, 1983, 1986, 1995, and 1998. The majority of recent flooding is attributed to inadequate culverts, easily blocked by debris or overwhelmed by floodflow.

Both sedimentation and erosion have been problems. 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 stream flows. 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.

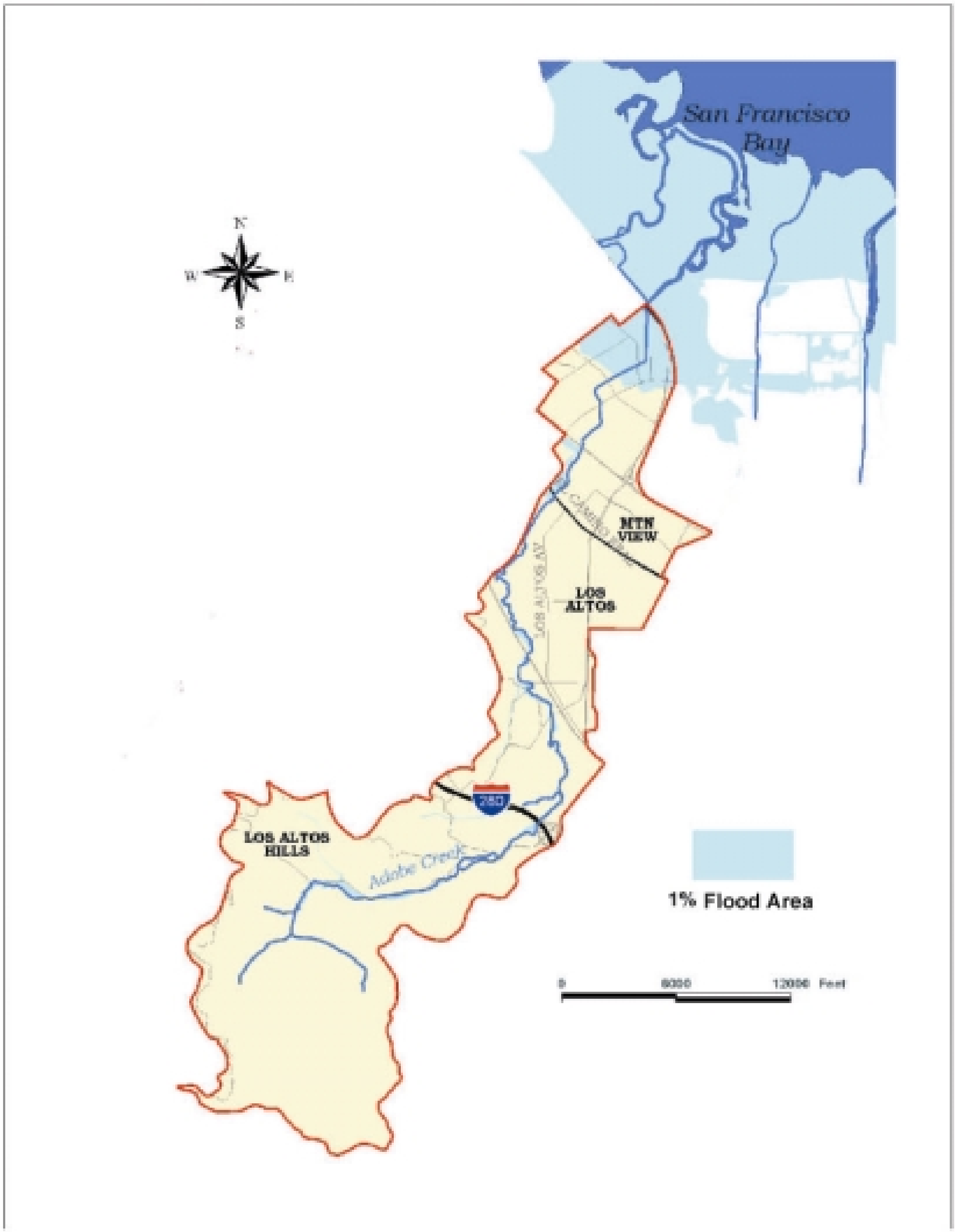
The northernmost portion of Calabazas Creek from El Camino Real to Guadalupe Slough was relocated by farmers along straight property lines before 1900, and has been relocated or modified 3 times since. After the 1955 flood, the Water District realigned the creek (in 1958) to its original outfall in Guadalupe Slough.

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 concrete-lined channel was constructed between U.S. Highway 101 and El Camino Real. The same year, commercial developers realigned the creek between Stevens Creek Boulevard and Vallco Parkway in a concrete box culvert, and between Interstate 280 and Vallco Parkway in an earth channel. In 1980, Calabazas Creek from Guadalupe Slough to U.S. Highway 101 was enlarged by constructing an earth channel with levees.

FIGURE 7-1
Matadero and Barron Creeks Watershed Map

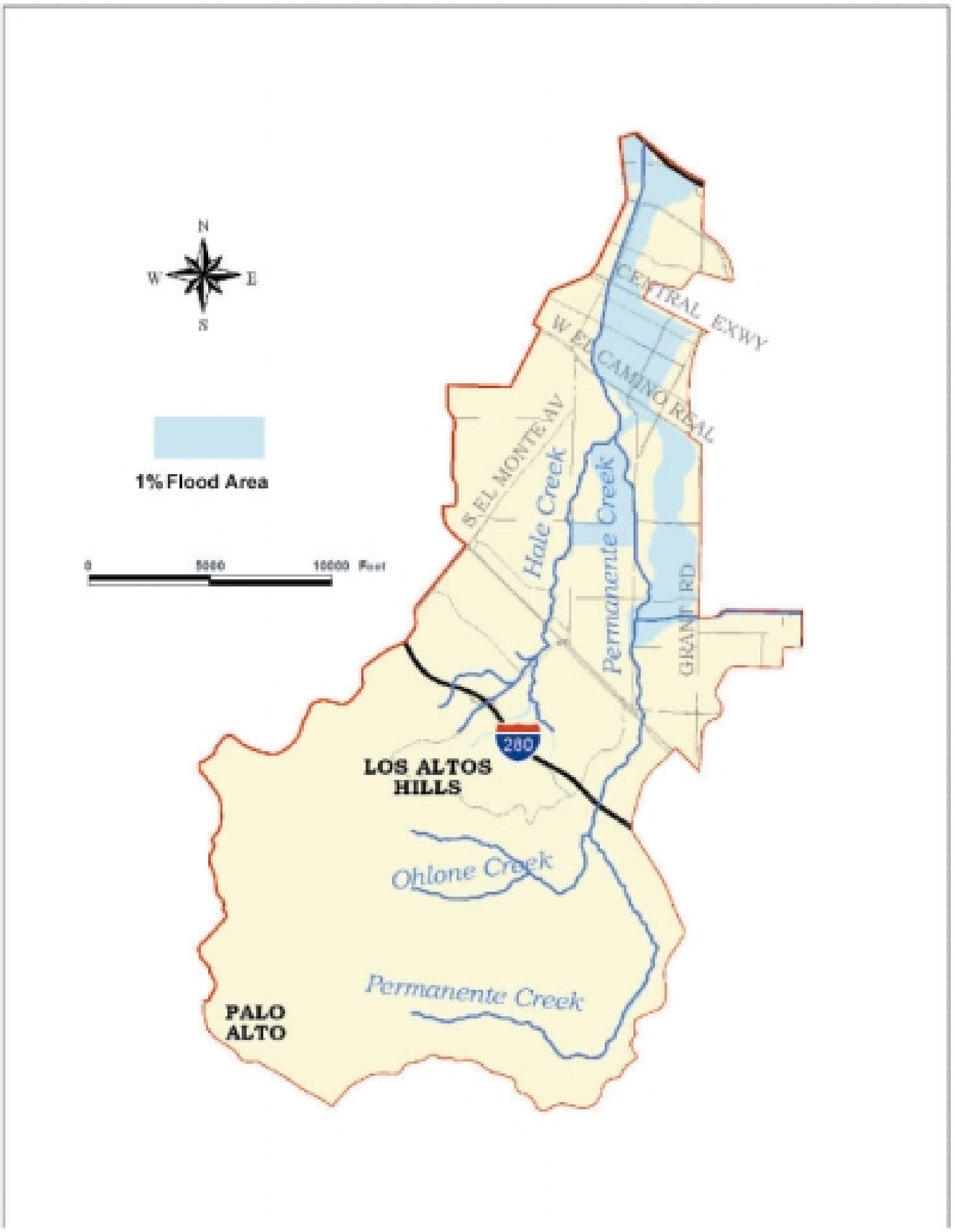
Source: Santa Clara Valley Water District

FIGURE 7-2
Adobe Creek Watershed Map

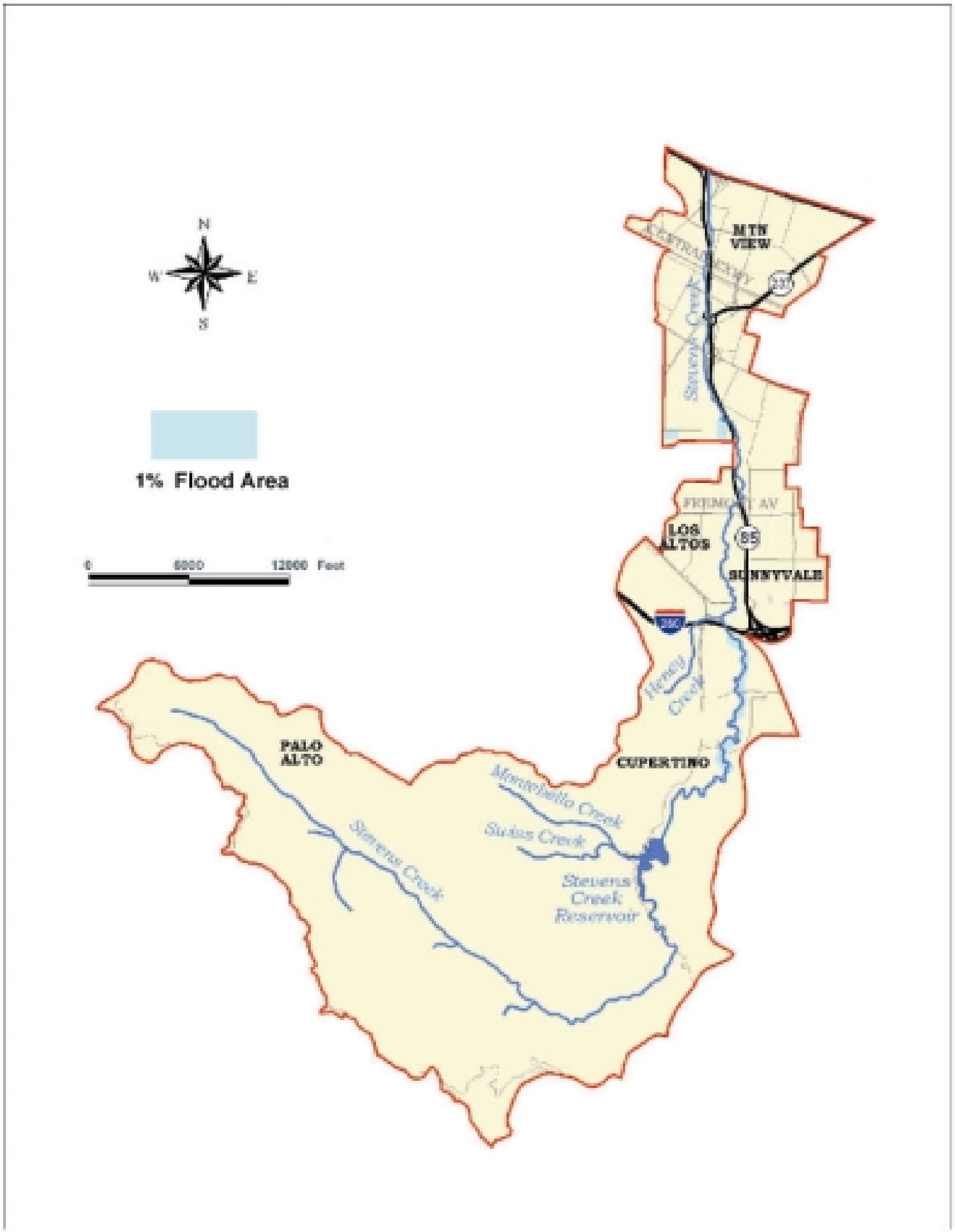


Source: Santa Clara Valley Water District

FIGURE 7-3
Permanente Creek Watershed Map



Source: Santa Clara Valley Water District



Source: Santa Clara Valley Water District

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.

The uppermost portion of Calabazas Creek watershed is chaparral and broadleaved upland forest, but most of the creek travels through agricultural and urban areas. Lower reaches of the riparian corridor from the Guadalupe Slough to U.S. Highway 101 are composed of riparian scrub/forest. Mosquito fish are the only fish recorded in Calabazas Creek.

San Tomas Aquino/Saratoga Creek watershed drains an area of 45 square miles. Saratoga Creek joins San Tomas Aquino Creek in Santa Clara just south of Monroe Street. A map of the watershed is shown on Figure 7-8.

<u>San Tomas Aquino Creek</u> begins in the foothills of the Santa Cruz Mountains and flows north through the cities of Campbell and Santa Clara. It then flows into the upper (southern) end of Guadalupe Slough. A levee-raising project was completed on the creek from the Bayshore Freeway to Guadalupe Slough in the early 1980s. Besides 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. Hitch is the only native fish captured during limited sampling; 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.

<u>Saratoga Creek</u> drains approximately 17 square miles on the northeast-facing slope of the Santa Cruz Mountains. The watershed begins at approximately 3,100 feet along Skyline Boulevard. The upper watershed is a bowl-shaped area about 4½ miles across at its widest. The lower watershed from Saratoga to the confluence with San Tomas Aquino Creek varies between ¼ mile and 1 mile wide.

Saratoga Creek is a little over 15 miles long. It is steep in the mountainous areas and flattens to a minimal slope across the valley floor. The point where Saratoga Creek joins San Tomas Aquino Creek is about 40 feet above mean sea level.

The earliest flood of record was in 1861. Other floods occurred in 1892, 1910, 1940, 1943, 1955, and 1958. The largest recorded flood was on December 22, 1955, when a peak flow of 2,730 cubic feet per second was recorded at a gage in Saratoga.

Flood-control channel improvements were completed on the lowermost reach of Saratoga Creek in 1980. Between 1984 and 1986 a 3-mile section between Pruneridge Avenue and Cabrillo Avenue was modified to increase capacity. The channel was excavated and a gabion lining was installed. Native vegetation has been planted within and above the gabions.

The upper portions of the watershed are vegetated with broadleaved upland forest, especially mixed evergreen forest including redwood and Douglas fir and chaparral. Common riparian tree species along the upper reaches include white alder, big leaf maple, and California bay. Scattered Douglas fir and coast redwoods also occur along some of the drainage courses.

Three native fish species - resident rainbow trout, hitch, and Sacramento sucker - and two nonnative species, rainwater killifish and mosquito fish, have been collected in Saratoga Creek. The creek is a historic steelhead stream, and the rainbow trout are of steelhead origin.

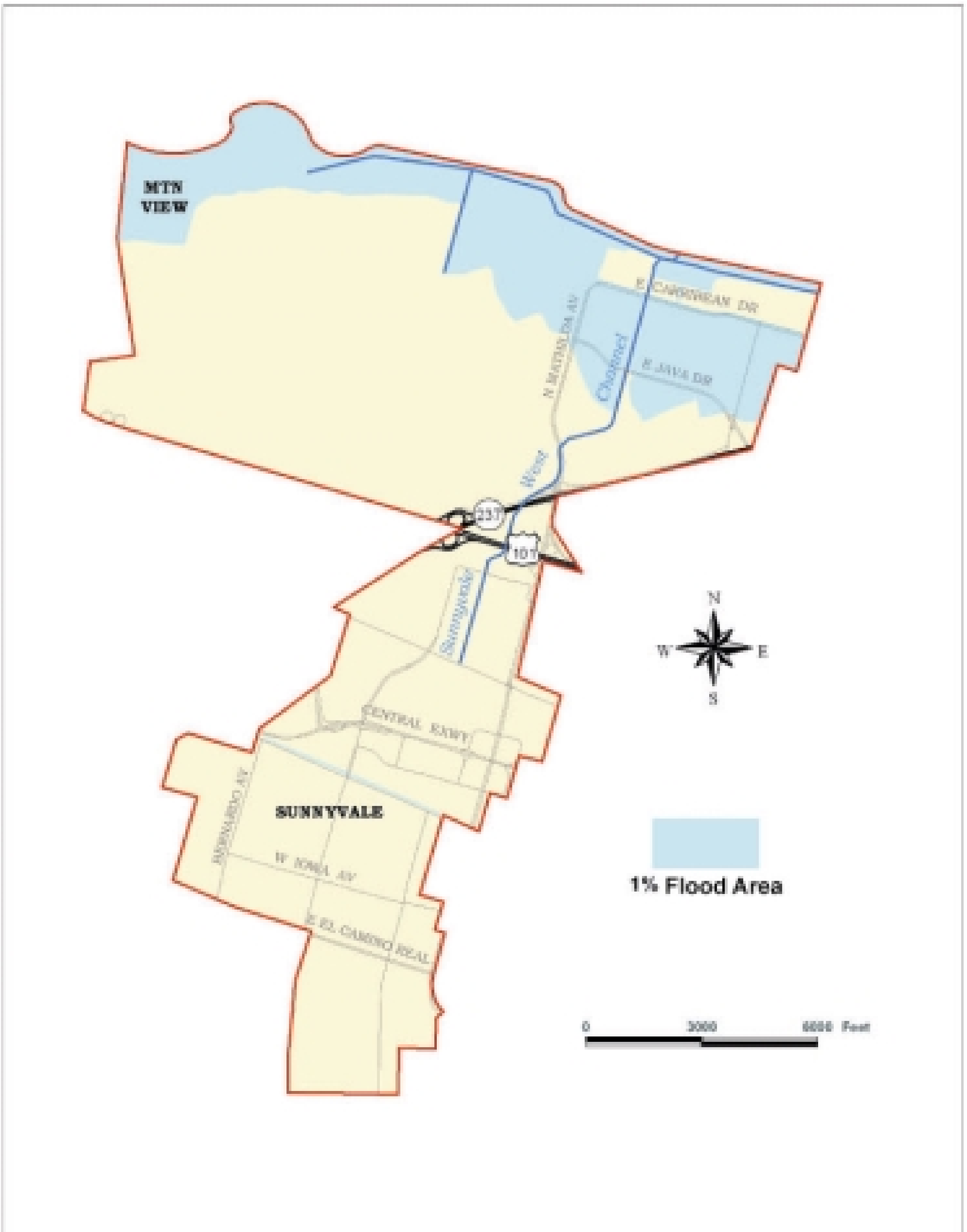
Guadalupe River watershed headwaters are in the eastern Santa Cruz Mountains near the summit of Loma Prieta, elevation 3,790 feet. A map of the watershed is shown on Figure 7-9.

Guadalupe River begins at the confluence of Alamitos Creek and Guadalupe Creek, just downstream of Coleman Road in San Jose. From here it flows north approximately 14 miles through heavily urbanized portions of San Jose, eventually discharging to the Bay via Alviso Slough. South of State Highway 237, the watershed has a total drainage area of approximately 170 square miles. Three tributaries join the Guadalupe River as it flows north towards San Francisco Bay: Ross, Canoas, and Los Gatos creeks. Los Gatos Creek joins the Guadalupe River in downtown San Jose.

This river played an important role in the settlement of San Jose and has been subject to modification from as early as 1866, when a canal was dug to alleviate flooding and improve conditions for rapidly expanding orchards. In the early 1960s, Canoas and Ross creeks were realigned. As part of the 1975 Almaden Expressway construction project, about 3,000 feet of channel was widened and moved eastward; the original channel was filled to allow construction of the northbound expressway.

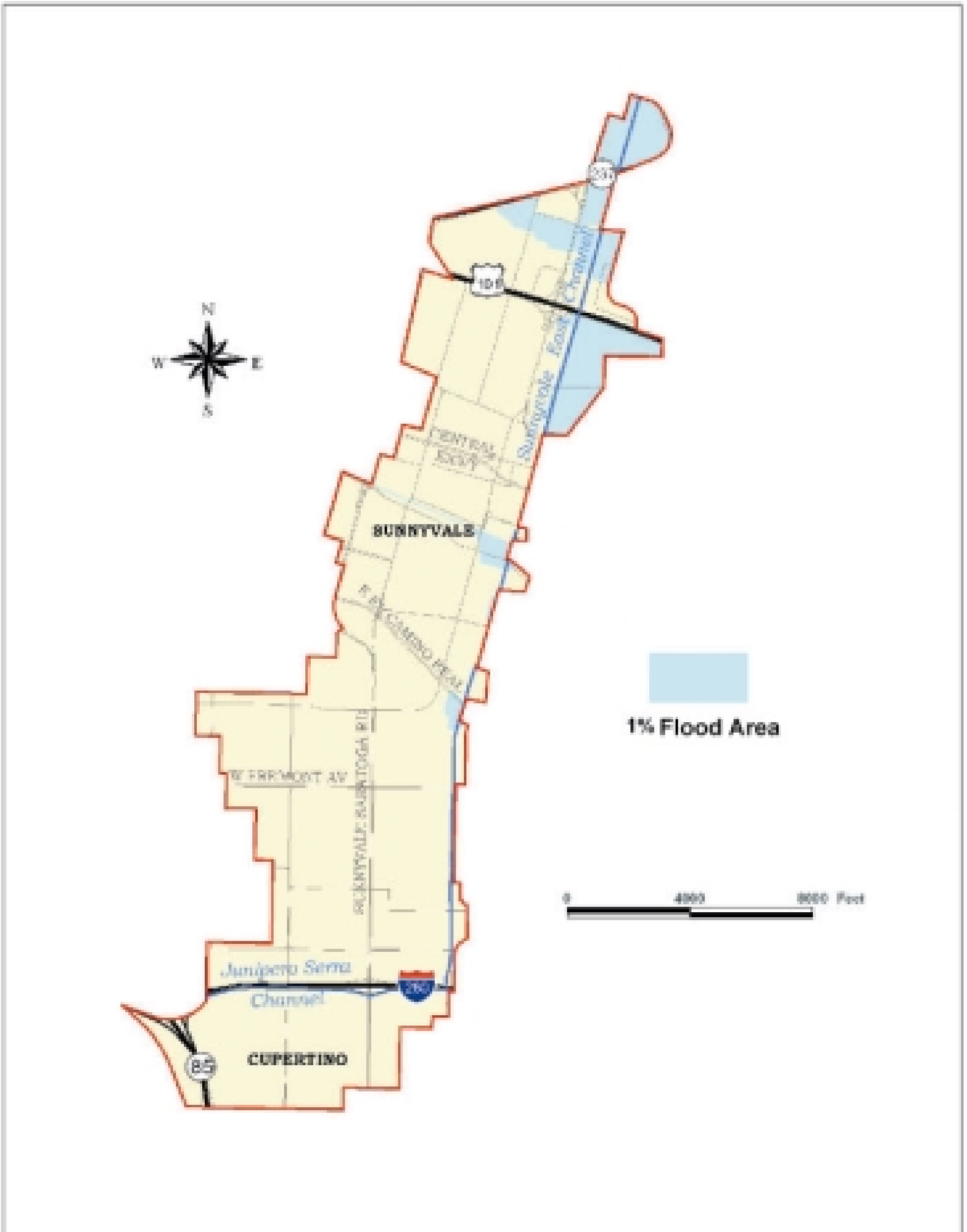
The written history of flooding in the Basin dates to the founding of Mission Santa Clara and Pueblo San Jose de Guadalupe in 1777. Accounts of flooding were recorded in 1779, 1862, 1867, 1869, and 1911. The storm of December 1955 caused widespread flooding throughout the Basin, the Guadalupe River alone inundating some 5,200 acres. Flooding would have been even more severe if the upstream storage reservoirs had not been nearly empty prior to the storm. Major flooding also occurred in April 1958, when floodwaters covered portions of downtown San Jose to a depth of up to 4 feet. In recent years, the Guadalupe River has flooded San Jose communities during the winters of 1980, 1982, 1983, and 1995.

Six major reservoirs are in this watershed: Calero Reservoir on Calero Creek, Guadalupe Reservoir on Guadalupe Creek, Almaden Reservoir on Alamitos Creek, Vasona Reservoir, Lexington Reservoir, and Lake Elsman on Los Gatos Creek. These reservoirs, all built for water conservation and storage, also provide varying amounts of flood control.



Source: Santa Clara Valley Water District

FIGURE 7-6
Sunnyvale East Watershed Map



Source: Santa Clara Valley Water District

FIGURE 7-7
Calabazas Creek Watershed Map

Source: Santa Clara Valley Water District

FIGURE 7-8
San Tomas Aquino Creek Watershed Map

Source: Santa Clara Valley Water District

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. Prior to 1995 the Water District used temporary dams to enhance instream recharge. In 1995 the District lost its permits for the operation of such dams and has not been able to get them renewed. The District has an active project to reevaluate its recharge operation and make recommendations on what elements need to be added.

Riparian areas along the river on the valley floor contain native arroyo willow, Fremont cottonwood, box elder, western sycamore, red willow, and sandbar willow. Garden/orchard escapees and invasive nonnative species are prevalent in the urban riparian corridors.

The valley floor reaches of the river provide important habitat for birds, including mourning doves, downy woodpeckers, Nuttall's woodpeckers, red-shouldered hawks, Pacific-slope flycatchers, chestnut-backed chickadees, and northern orioles. Diversity is reduced where the riparian corridor is narrow and native understory vegetation is absent or localized. 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 has been altered significantly by reservoirs, passage barriers, flood-control projects, and other channel modifications. Six of the seven native fish that occurred historically still occur, but nonnative fish dominate the system. Fifteen nonnative species have been collected.

The river supports a remnant run of steelhead, but the population had declined significantly by 1962 following construction of reservoirs on all main tributaries. From the time dams were installed in the river system up until 1999 steelhead were confined to the mainstem of the Guadalupe River and lower Los Gatos Creek, with limited spawning and rearing habitat. A small run of chinook salmon occurs in the Guadalupe River. At present it is unclear as to the origin of the Guadalupe River run of chinook salmon. Chinook young spend only a few months in freshwater and leave the system before the summer months, when rearing conditions are marginal.

Over the past few years, passage conditions have been improved at several locations. The Water District modified the Alamitos Drop Structure and installed a fish ladder in 1999, which has provided potential access to over 16 miles of steelhead spawning and rearing habitat in Guadalupe and Alamitos creeks. To fully realize that potential it will be necessary to address smaller barriers and passage obstructions that occur on Guadalupe and Alamitos creeks.

<u>Los Gatos Creek</u> rises on the north-facing slopes of the Santa Cruz Mountains and varies in elevation from 3,483 feet at the peak of Mount Thayer to about 90 feet at the creek's confluence with the Guadalupe River. The drainage area totals approximately 55 square miles; the watershed above Vasona Dam encompasses about 44 square miles.

Lexington Reservoir is on Los Gatos Creek about 11 miles upstream of its confluence with the Guadalupe River. Lake Elsman is upstream of Lexington Reservoir.

The San Andreas fault cuts northwest across the watershed of Los Gatos Creek just upstream of Lexington Reservoir. 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.

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 steep and the riparian corridor is narrow. In the lower watershed, the creek passes through Los Gatos, Campbell, and San Jose and much of the riparian corridor has been fragmented by bank stabilization for flood control. Drop structures are barriers to steelhead migration on this historic steelhead stream.

Alamitos Creek and its major tributary, Arroyo Calero Creek (often simply called Calero Creek), are in the Almaden Valley, a northwest-trending valley within the larger Santa Clara Valley, and drain approximately 38 square miles. Alamitos Creek originates in the Santa Cruz Mountains at around 3,800 feet; from its source, the creek first flows northwesterly to Almaden Reservoir.

From Almaden Reservoir, Alamitos Creek flows northeast to its confluence with Calero Creek. The stream gradient is moderately steep. At the confluence, Alamitos Creek turns slightly more westward and continues along a moderately steep gradient to its confluence with Guadalupe Creek, where the resultant stream becomes known as the Guadalupe River.

Major floods occurred in the Alamitos and Calero Creek watersheds in 1931, 1937, 1940, 1941, 1943, 1945, 1952, 1955, 1958, 1962, 1967, and 1968, and some of these caused significant damage. The worst damages occurred just before Christmas in 1955.

Alamitos Creek was widened and levees were built from Bertram Road bridge downstream to its confluence with Guadalupe Creek, approximately 6 miles, in the late 1970s.

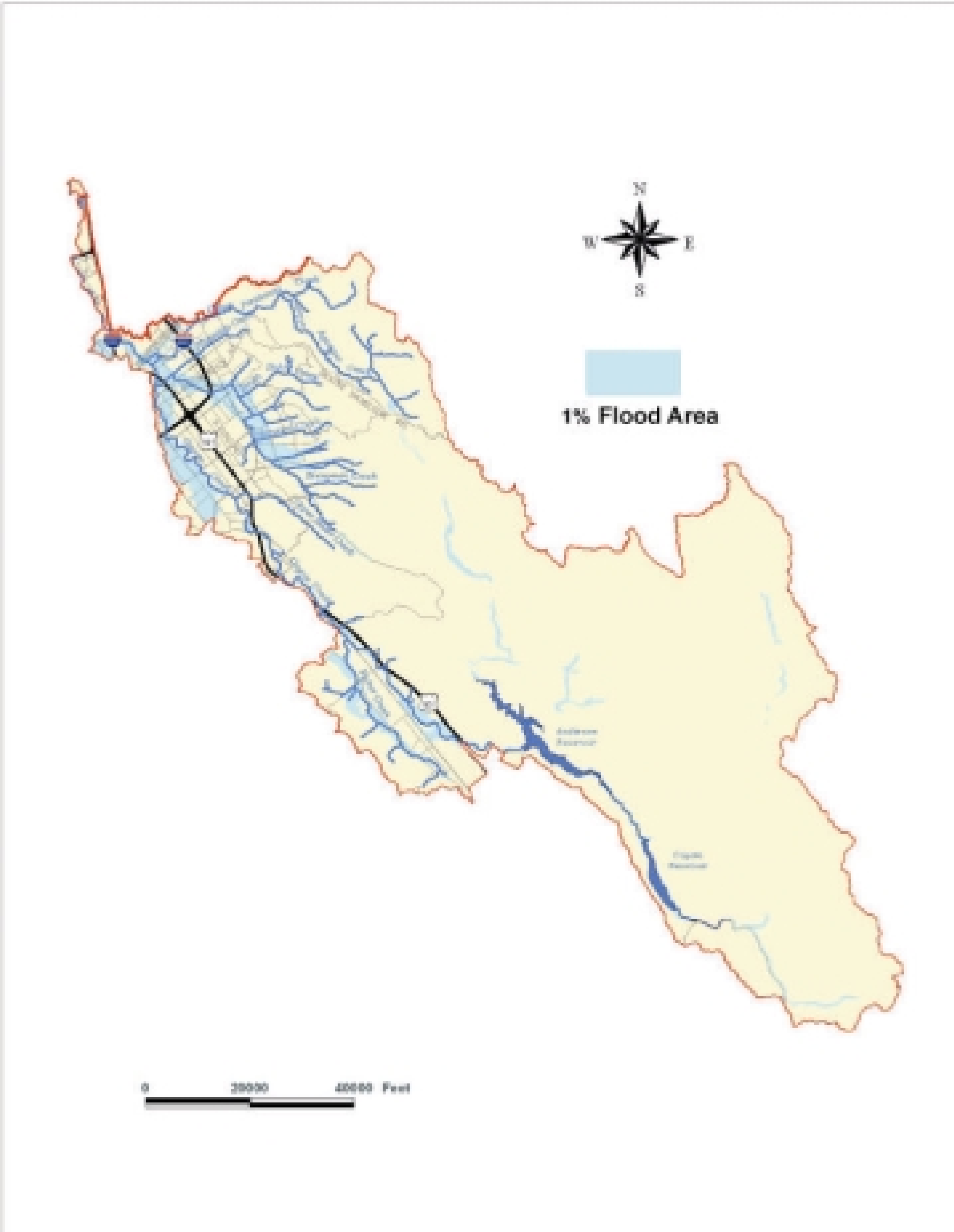
Randol Creek, Greystone Creek, and Golf Creek enter Alamitos Creek downstream of Calero Creek. The lower reaches of each stream were modified by flood protection works in the 1970s.

Santa Teresa Creek begins in the Santa Teresa Hills and flows northwest into Calero Creek. A section of Santa Teresa Creek was also widened in the late 1970s.

Nearly the entire Guadalupe Creek watershed above Guadalupe Reservoir is underlain by the Franciscan Formation and its related serpentine beds. The Masson Dam diversion is currently being installed with a fish ladder and screens on the diversion.

FIGURE 7-9
Guadalupe River Watershed Map

Source: Santa Clara Valley Water District



Source: Santa Clara Valley Water District

Coyote Creek watershed is the largest watershed in the Basin, covering approximately 320 square miles and draining most of the west-facing slope of the Diablo Range. The creek originates in the mountains of the Diablo Range northeast of Morgan Hill and flows northwest approximately 42 miles before entering the South Bay. A map of the watershed is shown on Figure 7-10.

Two major reservoirs lie in the upper watershed: Coyote, the upper reservoir, built in 1936, and Anderson Reservoir, built in 1950. Nine major tributaries to Coyote Creek lie 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 Coyote Dam accounts for about 75 percent of the total runoff for the entire Anderson/Coyote watershed.

After leaving the mountains, Coyote Creek flows about 30 miles northwest along the floor of the Santa Clara Valley to the Bay. Major tributaries downstream of Anderson Dam include Fisher, Upper Silver, Lower Silver, and Upper Penitencia creeks. The boundary between the mountains and the alluvial plain is sharply defined. Tributary creeks flowing out of the mountains must cross this plain to reach Coyote Creek.

Coyote Creek flows through unincorporated, predominately agricultural but rapidly urbanizing land between Morgan Hill and San Jose. It then flows through the urbanized areas of San Jose close to the Bay.

The lower reaches of the creek have been partially modified for flood protection. Setback levees and a high-flow bypass channel have been built between Montague Expressway and Dixon Landing Road. Many acres of young riparian forest habitat have been planted along this section by the Water District as mitigation for habitat lost in building the flood-control project. The overall result of the flood-control project is a wider, more diverse riparian corridor than existed when adjoining lands were farmed up to the streambanks. Near the Bay a transition occurs from a freshwater to an estuarine environment; the channel and adjacent Baylands contain many acres of brackish marsh, salt marsh, and mudflats.

Coyote Creek receives freshwater discharged from the San Jose-Santa Clara Water Pollution Control Plant just upstream from its confluence with the Bay. Some of this freshwater is pushed back upstream by incoming tides. The result is that during low flow periods tidal water in lower Coyote Creek is less saline than it otherwise would be. Over the years this has converted some 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.

Alteration of the creek began before 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. In spite of alterations over nearly a century, lower Coyote Creek is considered the highest quality riparian corridor remaining in the South Bay region.

Coyote Creek has had and still has the most diverse native fish fauna among the Basin watersheds. Native fish species in the drainage are steelhead/rainbow trout, Pacific lamprey, California roach, hitch, Sacramento blackish, Sacramento sucker, threespined stickleback, prickly sculpin, riffle sculpin, and Sacramento perch. Steelhead are rare. While less common than in Guadalupe River, chinook salmon have been observed in Coyote Creek since the mid-1980s. Numerous migration barriers for steelhead and salmon exist on Coyote Creek and its tributaries, including permanent dams, seasonal dams, drop structures, and dry stream reaches. Anderson Dam is the impassable terminal barrier on the mainstem.

Coyote Creek streamflows are extensively regulated. Downstream of Anderson Reservoir, water is diverted into a 6-mile canal and discharged for groundwater recharge in Metcalf Pond and the Ford Road ponds. Consequently, the reach between Anderson Reservoir and Metcalf Pond runs dry in all but the wettest years. Downstream of the percolation ponds, the stream channel runs dry or intermittently most summers. Lower reaches are fed by groundwater, but water quantity and quality are low. Much of the mainstem Coyote Creek provides only marginal aquatic habitat for native fish, other aquatic organisms and aquatic invertebrates. Habitat conditions were somewhat more conducive to nonnative fish.

Upper Penitencia Creek joins Coyote Creek about 10 miles from the Bay. The total watershed is about 24 square miles. The upper watershed occupies about 21 square miles and includes the principal tributary, Arroyo Aguague. Slopes are steep and the canyons are deep and narrow. The small Cherry Flat Reservoir is in the upper watershed. After leaving the Los Buellis Hills, the creek flows westward across the alluvial plain for about 3½ miles before joining Coyote Creek at an elevation of 80 feet.

Much of the riparian habitat has been preserved and represents one of the few remaining contiguous riparian corridors connecting the Diablo Range to Coyote Creek. The upper stream reaches provide cool stream temperatures, riffle habitats, and riparian vegetation necessary for successful steelhead spawning and rearing. Resident rainbow trout occur here. Passage was improved recently at the Noble Avenue diversion, a frequent barrier in past years.

Lower Silver Creek originates at about 1,200 feet in the low foothills southeast of San Jose and drains 43.5 square miles. It flows north-northwest to meet Coyote Creek near U.S. Highway 101.

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. The only two major creeks in the watershed are Lower Penitencia Creek and Berryessa Creek. A map of the watershed is shown on Figure 7-11.

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, splitting the creek into two streams, Upper Penitencia and Lower Penitencia. Lower Penitencia Creek is in northeastern Santa Clara County, bounded by Berryessa Creek to the east and Coyote Creek to the west. It flows northerly from Montague Expressway to its confluence with Coyote Creek near the intersection of Interstate 880 and Dixon Landing Road.

Major tributaries are the East Penitencia Channel and Berryessa Creek, the latter the major drainage channel for the mountainous portion of the watershed.

In 1955 the Water District built the portion of Lower Penitencia Creek from the confluence with Coyote Creek to Spence Avenue. The earth channel from there to Sylvia Avenue was constructed in 1962. In 1965, the Water District constructed the channel from Sylvia Avenue to Old Oakland Highway. Also in March 1965, the Water District board approved a new flood-control facility known as East Penitencia Channel. To be constructed in lieu of that portion of Lower Penitencia Creek south of Montague Expressway, this channel was built by the county as part of the Montague Expressway project in 1973. Further channel modifications to increase the creek's capacity followed.

The Berryessa Creek drainage basin covers about 22 square miles in the northeastern portion of the Basin. The creek flows westerly from its headwaters in the Diablo Range at about 2,000 feet. Below the foothills it continues westerly through San Jose and Milpitas and turns north before flowing into Lower Penitencia Creek. It is an intermittent stream, usually dry during the summer.

The upper portion of the watershed, in the foothills of the Diablo Range, generally consists of grassland habitat with patches of upland broadleaved forest dominated by oak, madrone, and California bay trees in ravines and drainages. The lower reaches are surrounded by grasslands, agricultural lands, or urban habitat.

The **Arroyo la Laguna watershed** is a composite of several small watersheds in southern Alameda County, all of which discharge into the Bay north of Dixon Landing Road. These "subwatersheds" drain the west-facing slopes of the Diablo Range north of the Alameda/Santa Clara County line. The lower portions of these watercourses, not all of them named, have been modified for flood control and drainage and many no longer follow their original alignments.

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.

Laguna Creek Basin is the name used to describe an area within the City of Fremont that is drained by Laguna Creek and a network of channels. This area discharges to Mud Slough, which then discharges into Lower Coyote Creek. The basin covers approximately one-third of Fremont's land area. Mission, Morrison, Cañada del Aliso, and Agua Caliente creeks, as well as city storm drains throughout the Irvington District, all drain into Laguna Creek. Most of Laguna Creek and its tributaries are maintained flood-control channels managed by the Alameda County Flood Control and Water Conservation District.

Significant erosion and sedimentation occur at several locations within this watershed. Near the origins of Cañada Del Aliso in the Diablo Range, a substantial landslide has occurred that threatens homes and sends significant amounts of sediment to the creek and its receiving waters, Laguna Creek.

Lakes and Reservoirs

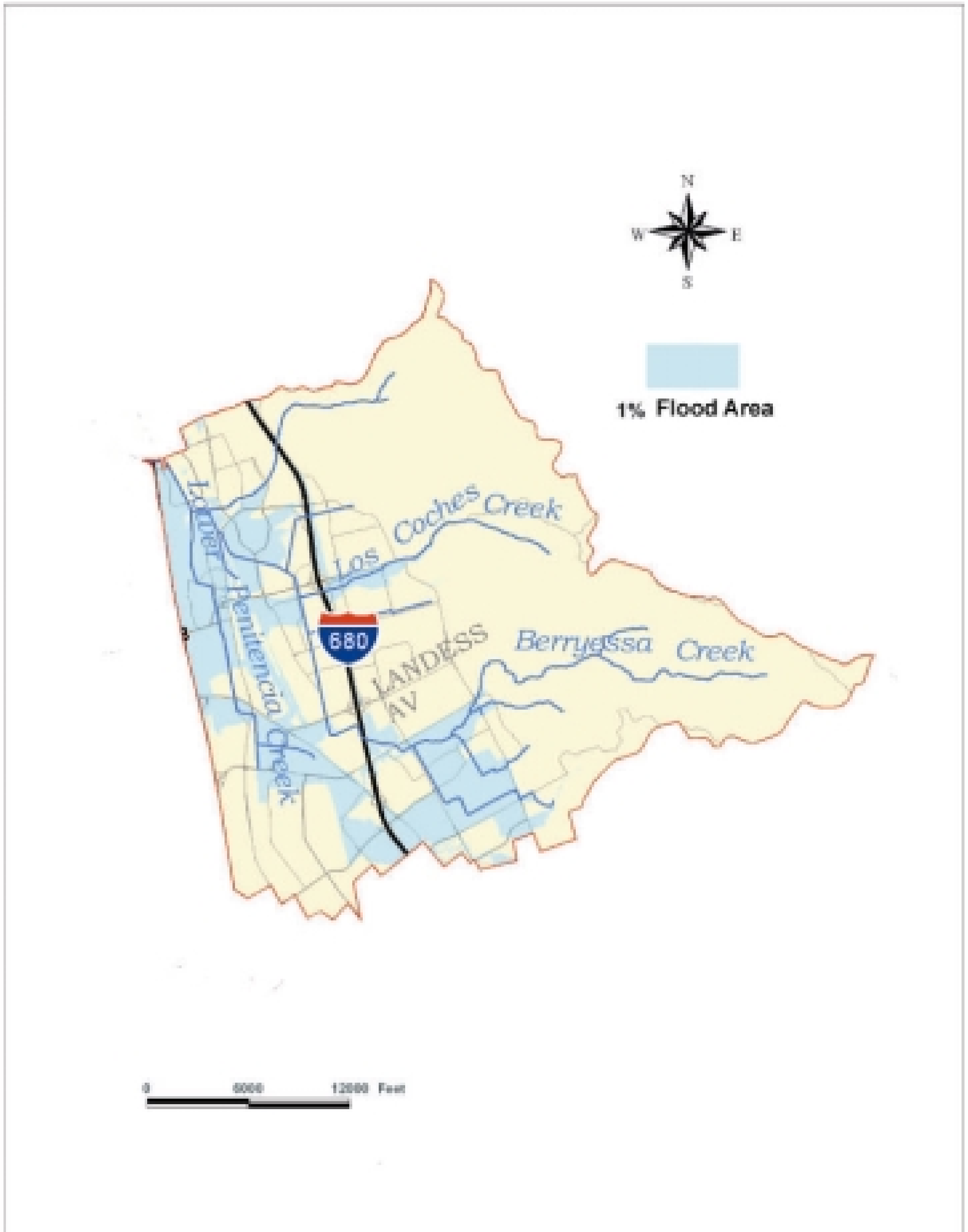
The Basin contains many lakes, reservoirs, and ponds. Most of the lakes are really reservoirs, created by dams for water conservation. Stevens Creek, Almaden, Calero, Guadalupe, Vasona, and Coyote reservoirs were built in the mid-1930s to store water for the recharge of the groundwater basin during the summer months. Lakes and reservoirs in the Basin are used extensively for recreation, provide some flood protection, and have significant wildlife habitat value. All the reservoirs owned by the Water District are leased to the Santa Clara County Parks and Recreation Department. Depending on the reservoir, permitted activities include power-boating, sailing, fishing, swimming, and picnicking.

Two small reservoirs are located 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. No reservoirs of any consequence are located in the other watersheds (see Figure 8-1).

Permanent reservoirs not only block upstream migration of fish but also replace flowing-water habitat with lake habitat. These altered environments support the presence of nonnative fish that are adapted to environments with calm water, moderate to low oxygen levels, and warmer temperatures. Reservoirs provide habitat for some native fish adapted to these conditions. 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.

Almaden Reservoir is on Alamitos Road south of San Jose. Completed in 1935, it has an average surface area of 59 acres and a capacity of 1,780 acre-feet.

The reservoir receives waters from 12 square miles of hilly terrain covered with range grass, low bushes, and trees. Its watershed includes Herbert and Barrett creeks flowing into the southwest end of the reservoir; these creeks flow all year. The reservoir releases water to Alamitos Creek for groundwater recharge. Storms or long wet periods often produce more runoff than the



Source: Santa Clara Valley Water District

reservoir can contain; the excess is directed to Calero Reservoir via the Almaden-Calero Canal. The Water District operates this reservoir for water conservation purposes only, but incidental flood-control benefits occur.

Beneficial uses 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 a potential water quality concern.

Anderson Reservoir is about 2 miles northeast of Morgan Hill in Anderson Lake County Park. It was completed in 1950 and is about 7 miles long and up to a ½ mile wide, with an average surface area of 1,245 acres and a capacity of 89,073 acre-feet. The upstream drainage area is approximately 193 square miles.

Coyote Creek flows into the reservoir at the southern end; Otis Canyon 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's principal purpose is to impound stormwater runoff and the flows of several creeks for aquifer recharge. Coyote Reservoir impounds the same principal water source, Coyote Creek, releasing water downstream to Anderson Reservoir, which then releases water to the valley portion of Coyote Creek to recharge the Santa Clara groundwater subbasin through a series of percolation ponds.

Housing developments are located on the southwestern side of Anderson Reservoir. Most are sewered but some are not; certain accidental incidents of sewage spills into the reservoirs have occurred.

Recreational motorboats use Anderson Reservoir and traces of MTBE and oil film are present. The Water District is monitoring MTBE levels and, to control its level, the county Parks and Recreation Department has begun to regulate motorized boating.

Calero Reservoir is just south of the Santa Teresa Hills section of San Jose and east of New Almaden and Almaden Reservoir. Completed in 1935, it has a surface area of 752 acres and a capacity of 10,050 acre-feet. Inflows include Arroyo Calero and Cherry creeks, which flow most of the year at low volume. Cow Creek also contributes part of the year. The reservoir's primary purpose is controlled release of surface runoff for downstream groundwater recharge. The U-shaped reservoir is approximately 5½ long and 2 miles wide at the western end, its widest point. It collects runoff from a 7-square-mile drainage area and also receives surplus surface water from Almaden Reservoir via the Almaden-Calero Canal; Calero Reservoir has a storage capacity 5 times that of Almaden. The area surrounding the reservoir is predominantly grasslands and oak savanna.

Beneficial uses besides groundwater recharge include 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.

Cherry Flat Reservoir is in the Upper Penitencia Creek watershed, upstream from Alum Rock Park. The reservoir was built in 1932 to help solve the problem of recurring floods and drought in the park; it has a storage capacity of 100 acre-feet.

Coyote Reservoir is about 4½ miles east of Gilroy in Coyote Lake County Park. Completed in 1936, it has an average surface area of 648 acres and a capacity of 22,925 acre-feet. It is approximately 3 1/5 miles long and 1,800 feet at its widest point. The reservoir has a 121-square-mile drainage area in the Mount Hamilton foothills, collecting runoff from the ridges to the east and west of the Coyote Creek drainage basin in addition to the flow of Coyote Creek. Water released into Coyote Creek flows north approximately 2 miles to Anderson Reservoir. The prominent geologic feature of the western front range foothills is the northwest-trending seismically active Calaveras fault that underlies Coyote Creek north of the reservoir, as well as underlying nearly the entire length of the reservoir itself.

Beneficial uses include municipal and domestic water supply, agricultural supply, wildlife habitat, warm and cold freshwater habitat, fish spawning, water-contact recreation, and noncontact water recreation.

Guadalupe Reservoir is on the southern boundary of Almaden Quicksilver County Park south of San Jose. The dam is on Guadalupe Creek about 2 miles south of the Almaden Valley area of San Jose. Completed in 1935, it has an average surface area of 79 acres and a capacity of 3,740 acre-feet. The upstream drainage area is approximately 6 square miles. This reservoir impounds Guadalupe Creek in the northern Santa Cruz Mountains. Numerous unnamed intermittent streams drain from this ridge into the reservoir. Primary inflows are Guadalupe Creek, which runs all year at a low volume, and Rincon and Los Capitancillos creeks, which contribute water mainly during flooding.

The reservoir's principal purpose is to provide water to the Alamitos Percolation Pond system downstream. Some incidental flood-control benefits may occur.

Beneficial uses besides groundwater recharge include municipal and domestic water supply, wildlife habitat, warm and cold freshwater habitat, fish spawning, water-contact recreation (fishing from shore or boat), and noncontact water recreation.

Stivers Lagoon is one of a number of freshwater marshes on the east side of the Hayward fault. It formed as a sag pond (an accumulation of groundwater that fills a depression formed by the fault). It lies in a shallow depression of approximately 200 acres and is primarily fed by Mission Creek. Levees were built around the marsh in the 1900s to limit flooding and reduce soil saturation. In the 1930s a channel was excavated through the marsh for flood control. Continued excavation and dredging have allowed the encroachment of upland plant species. Stivers Lagoon now comprises approximately 40 acres and is fed by Mission and Morrison creeks.

Lake Elizabeth was created in 1968 by excavating a portion of Stivers Lagoon, and was expanded to its present 82 acres in 1986. It is owned and operated by the Alameda County Flood Control and Water District as an integral part of the Mission Creek flood-control system. A realigned channel was created for Mission Creek. The lake has slowly filled with sediment; water levels are critically low in summer and do not adequately support water sports such as sailing.

Lake Elsman lies upstream of Lexington Reservoir and has a storage capacity of 6,200 acre-feet. Water releases flow to Lexington Reservoir.

Lake Williams is a small impoundment on Los Gatos Creek immediately upstream of Lexington Reservoir.

Lexington Reservoir is adjacent to State Highway 17 about 1 mile south of Los Gatos. Completed in 1952, it has an average surface area of 404 acres and a capacity of 19,834 acre-feet. James J. Lenihan Dam impounds Los Gatos Creek and numerous other drainages in the watershed; Los Gatos Creek enters the southern end of the reservoir. The upstream drainage area is 37.5 square miles. The principal geologic feature of the vicinity is the San Andreas fault zone running northwest/southeast through the extreme southern end of the reservoir.

The reservoir is roughly 2½ miles long and 3,000 feet wide at its northern end; it discharges north to the Los Gatos Creek channel. Its primary purpose is to store water for groundwater recharge facilities downstream.

Los Gatos Creek above Lexington Reservoir is the most highly developed watershed in the county. Five clusters of development are located within the watershed above Lexington Reservoir. Outside the relatively densely populated areas there are individual houses and estates, plus schools and recreational camps, are located. Analyses of reservoir waters indicate that nutrient load is not a present problem.

Searsville Lake is approximately 12.5 miles upstream from the Bay, in the San Francisquito Creek watershed - the creek begins at the outlet of the dam. Surface area is approximately 35 acres. First dammed in 1892, the lake once covered 90 acres, 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 has gathered on the bottom, reducing depth to just 22 feet at the center.

Stevens Creek Reservoir is located in Stevens Creek County Park just south of Cupertino. Completed in 1935, it has an average surface area of 197 acres, a capacity of 3,465 acre-feet, and is in a 17-square-mile drainage basin. The dam is downstream of the confluence of Stevens Creek and Swiss Creek.

The creek has cut a narrow canyon along the base of Montebello Ridge on the north and Table Mountain on the south. Montebello Ridge is adjacent to the San Andreas Fault zone that crosses within 500 feet of the southern end of Stevens Creek County Park. The reservoir has three primary inflows: Stevens, Swiss, and Firehouse creeks. The first two typically run all year; Firehouse Creek contributes mostly in the rainy season.

The primary purpose of Stevens Creek Reservoir is to impound water to recharge groundwater, but some incidental flood-control benefits may occur. Beneficial uses besides groundwater recharge include municipal and domestic water supply, wildlife habitat, warm and cold freshwater habitat, fish spawning and migration, and noncontact water recreation. Limited recreational activities occur in the reservoir area and the watershed, including a recreation camp.

Vasona Lake/Reservoir lies within Vasona Lake County Park in Los Gatos. The dam is on Los Gatos Creek about 2 miles downstream from Lexington Reservoir, its principal source of water. The watershed drainage area downstream of that reservoir is approximately 6.5 square miles. Completed in 1935, the reservoir has an average surface area of 58 acres and a capacity of 400 acre-feet.

The upper part of the watershed is on the eastern slopes of El Soreno and the northern slopes of St. Joseph's Hill; the lower part consists of the mainly flat Los Gatos area to the north. The lower part of the watershed is well developed and urbanized. The upper part is less urbanized in the steeper portions. Vasona Reservoir is in the alluvial floodplain formed by Los Gatos Creek prior to channelization. It stores water for percolation ponds downstream.

Beneficial uses for Vasona include industrial process supply, navigation, ocean commercial and sport fishing, warm freshwater habitat, fish migration, water-contact recreation, and areas of special biological significance. Park visitors actively use the reservoir and surrounding parklands.

Groundwater Basins

The Basin has extensive groundwater resources. Little water is found in the hard bedrock formations of the mountains and foothills, but groundwater is abundant in the valley. Over millions of years, gravels, sands, and silty sands have filled the valley. Such deposits transmit water easily and constitute good aquifers (water-bearing units), which yield large flows to wells. Most Basin groundwater is good to excellent, suitable for most beneficial uses.

The Basin's groundwater system is composed of two interconnected subbasins. The larger and more important with respect to local water supply is the northern one, the Santa Clara groundwater subbasin. The southern one is the Coyote subbasin, south of the Coyote Narrows (see Figure 8-1).

In the low foothills at the edge of the subbasin, the silt and other materials that compose the aquifers are exposed. In these areas, rainfall, streamflow, and other surface water is able to seep into the aquifer, a process called “recharge,” critical to continued use of the aquifer. From these areas at the edges of the subbasin, groundwater flows downgradient towards the valley flat. Outside the recharge areas, the Santa Clara subbasin is divided vertically into two major water-bearing zones, above and below a very thick layer of clay that prevents groundwater movement between the zones. In most of the Basin, the clay layer is encountered at about 150 feet. Water-bearing units beneath this layer are called confined aquifers and have slightly different hydraulic properties than the unconfined aquifers above. The unconfined aquifers are little used now, but are an important resource that could be used in the future or in an emergency.

The Coyote subbasin, too, is filled with river-deposited sediments. It is interconnected with the Santa Clara subbasin through the Coyote Narrows. Depths to groundwater in this subbasin range from about 40 feet to less than 10 feet. As the subbasin is restricted at the Coyote Narrows, groundwater rises to discharge into Coyote Creek just upstream of the narrows.

The Santa Clara subbasin is a managed groundwater system. To replace water pumped from the aquifer, the Water District recharges the subbasin with local and imported water, using 393 acres of percolation ponds throughout the county. Seasonal dams on creeks and rivers are also used for instream recharge. Besides helping maintain groundwater supplies, recharge ameliorates problems of 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. This phenomenon has occurred extensively in the Santa Clara subbasin during the 20th century. The broad sag of the land surface had centers near downtown San Jose and in the Mountain View-Sunnyvale area and extending into Alviso and Palo Alto.

The recharge program uses storm runoff caught in local reservoirs and Sacramento-San Joaquin River waters imported through the Central Valley Project.

The Alameda County Water District operates a similar recharge program throughout the Fremont area. 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 Basin’s northeastern corner. It 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 in the foothills of the Santa Cruz Mountains from Morgan Hill to Atherton. Groundwater that percolates through fractured bedrock and fault zones is locally important in sustaining summer streamflow needed by vegetation, fish, and other wildlife.

Land Subsidence

Land subsidence in the subbasin was due largely to overpumping of the aquifer. Before 1900 very little water was pumped from wells in the low-lying interior portion of the basin, and what little was pumped was for domestic use. With the development of the deep-well turbine pump and the availability of cheap power, pumping from wells for agricultural irrigation became popular. By 1920, 67 percent of valley land was irrigated. Nearly all the water was pumped from wells. The years from 1920 to 1936 were abnormally dry and, as a result, more and more wells were drilled. The effects of groundwater overdraft were dramatic.

Subsidence in the Basin began around 1920 and continued until 1969. Lands near the Bay sank below sea level, allowing saltwater to intrude upstream through the mouths of rivers and streams and powerfully affecting the stream channel habitat. Subsidence also altered stream gradients, affecting streamflow capacity and costing taxpayers millions of dollars for levees - as the land subsided, levees fronting the Bay and the main streams were raised, often 6 to 10 feet, to prevent flooding. The most serious saltwater intrusion occurred in the Guadalupe River area from Alviso to Montague bridge and in the Palo Alto bayfront area. Subsidence damaged wells in affected areas. Yet another effect was the increased amount of land below sea level. This effect has reduced the extent of the tidal marshes that provide important wildlife habitat; it has also diminished daily tidal exchanges, making the South Bay more stagnant.

Attempts to arrest subsidence have been relatively successful in recent decades. The issue led to creation of the Santa Clara Valley Water Conservation District in 1928, the forerunner of the present 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 construction of water conservation reservoirs in the mountains, groundwater levels and pressures began to rise in 1935 and continued to rise until 1944. Land subsidence slowed from 1937 to 1948. After 1944, water levels again started to decline as increased pumping resulted in overdraft, and subsidence resumed in 1948. With implementation of the groundwater recharge program and importation of surface waters from the state and federal water projects and the Hetch Hetchy system in 1965, pumping from the subbasin was reduced and overdraft was eliminated. Subsidence ceased in 1969 as pressures in the lower aquifer zone started to recover, a trend that has continued for wells in the interior portion of the subbasin. In contrast, wells at the margins of the subbasin have not yet recovered to pre-overdraft levels. The possibility exists, however, that further subsidence could resume with an extended drought.

Groundwater Recharge Facilities

Two types of groundwater recharge facilities occur in the Basin: onstream and offstream. Onstream recharge takes place when rainwater or water released from reservoirs flows into the sandy-gravelly bed of a stream and seeps downward into an aquifer. During summer months, the Water District releases water from its reservoirs, allowing it to flow downstream through stream reaches with permeable streambeds. Onstream percolation is enhanced by construction of temporary gravel dams in certain stream reaches, to slow the water and increase percolation.

Offstream recharge occurs in what are commonly called percolation ponds. These are located 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). 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 Penitencia Creek.

Coyote Percolation Pond is in southern San Jose. One of a series of ponds impounding Coyote Creek, it has an average surface area of 30 acres and a capacity of 150 acre-feet.

Los Gatos Percolation Ponds, also called the Camden Percolation Ponds, are within Los Gatos Creek County Park in 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.

In the past the Water District installed gravel spreader dams across streams to enhance groundwater recharge on the Guadalupe River and its tributary Los Gatos Creek, and Coyote, Stevens, and Saratoga creeks. These in-channel percolation ponds remained in place from approximately April to September. Year-round dams were maintained in Coyote Creek.

A 5-year study found that temperatures in the ponds were often marginal for steelhead and would require high food supply to provide rearing habitat. In addition, the habitat in the ponds tended to favor nonnative fishes, which can invade adjacent stream habitat. In-channel percolation ponds may reduce streamflow downstream and maintenance 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.

Beneficial Uses of Waterbodies

The Regional Board, in consultation with state and local authorities, designates existing and potential beneficial uses for significant surface and groundwater bodies in the region. Brief definitions of these beneficial uses are presented in alphabetical order, using their abbreviations, in Chapter 6 of this report.

7.3 Designated Beneficial Uses for the Santa Clara Basin

1995 Basin Plan Designations

The latest Basin Plan (1995) designates specific beneficial uses of surface waterbodies in the Basin, which are presented in Table 7-1. WMI stakeholders have identified errors and omissions in the 1995 plan’s designations. One objective of the WMI process is to work with the Regional Board to improve the Basin Plan through the stakeholder process. Stakeholders’ increased understanding of Basin resources may lead to changes in the designations in Table 7-1.

Conveyance Functions of Water Corridors in the Santa Clara Basin

Communities in the Basin rely on local streams and creeks to convey water. Watershed management planning needs to acknowledge the conveyance function when addressing beneficial uses. The function can be separated into three categories:

- **Dry-Weather Flow Conveyance**. Basin streams and creeks convey natural dry-weather base flows and permitted nonstormwater discharges (e.g., pumped uncontaminated groundwater, potable water line and hydrant flushing, landscape irrigation, air conditioning condensate, and individual residential car washing) to the Bay.

- **Stormwater Conveyance**. During storm events, basin streams and creeks convey runoff from land areas and urban stormwater discharges from stormdrains to the Bay.

- **Groundwater Recharge Supply Conveyance**. The Water District uses Basin creeks, streams, and pipelines to convey recharge water from reservoirs or pipelines to percolation ponds.

Chapter 8
Water Management in the Santa Clara Basin

This chapter describes the institutions, facilities, and practices for managing and supplying water in the Santa Clara Basin, with emphasis on the facilities and practices that most affect hydrology and water quality.

8.1 Introduction

Water in the Basin is managed intensively to meet human needs. Natural surface and groundwater hydrology is manipulated to supply water to homes, businesses, and farms, and to minimize flooding. Surface runoff is impounded, treated, and supplied to customers, or released to recharge basins. Water is also supplied from wells that tap the deep aquifer, the water-bearing layer under much of the Basin. Because the total water resources of the Basin cannot meet local needs, water is imported from the Sacramento-San Joaquin River Delta and the Tuolumne River.

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. Sixty percent is discharged to municipal wastewater collection systems.

Major exploitation of groundwater in the Basin began in the 1860s as farmers began growing water-intensive fruit 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. (See Section 7.2 for more on this subject.)

Flooding is a relatively new concern: before urban development encroached on the floodplains, floodwaters could spread across the land with little harm; now they damage property. To prevent overbank flooding, creek channels have been modified to accommodate larger flows.

8.2 Water Supply

Institutional Arrangements

Three major agencies supply water in the Basin:

- Santa Clara Valley Water District (Water District)
- Alameda County Water District (ACWD)
- City and County of San Francisco Water Department (SFWD)

The Water District is the largest supplier; together with SFWD it provides water in the 12 watersheds wholly within Santa Clara County. The Water District is primarily a wholesaler. It supplies 13 public and private water retailers in the south and central Basin, recharges the groundwater so retailers and others can draw water from their own wells, and supplies some agricultural customers directly. Large retail agencies supplied 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.

ACWD serves the Arroyo la Laguna/Mission Creek watershed in Alameda County and directly supplies customers in Fremont and Newark.

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.

Sources of Water

The Water District gets water from local surface and groundwater sources in the Santa Clara and Pajaro River basins, and from the State Water Project and the federal Central Valley Project. The State Water Project and the Central Valley Project divert water from the Delta. The SFWD wholesales water to a number of retailers with service areas close to its Hetch Hetchy aqueduct, which delivers water from the Tuolumne River and its tributaries. The ACWD gets water from local surface and groundwater, the State Water Project, and the Hetch Hetchy system.

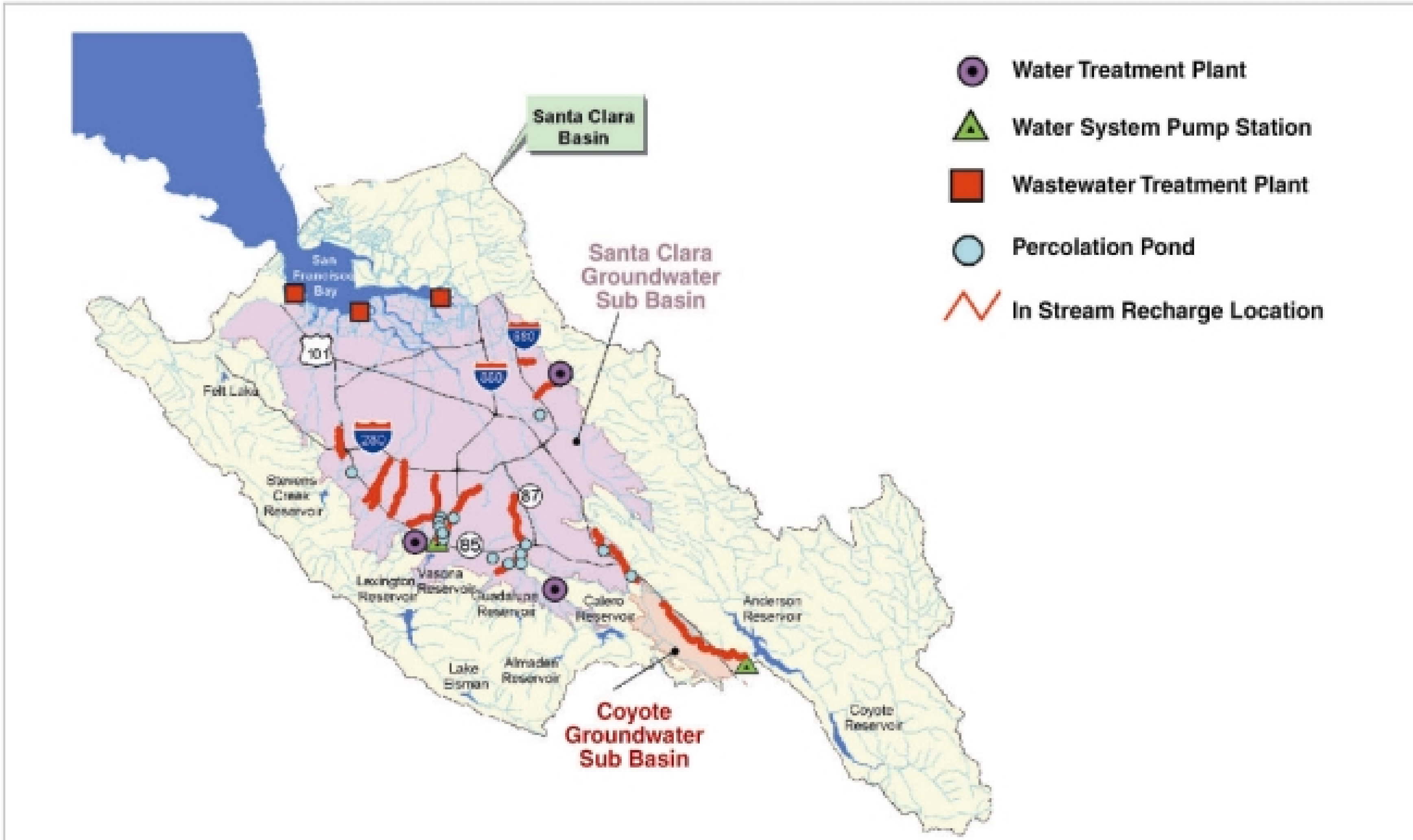
Water Supply Facilities

Surface Water Reservoirs

The Water District operates eight large surface water reservoirs (listed in Table 8-1 and shown on Figure 8-1) in the Basin that conserve runoff for recharge into groundwater basins or treatment and distribution to customers.

Table 8-1
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



Source: Santa Clara Valley Water District

FIGURE 8-1
Reservoirs, Groundwater Recharge Facilities, Groundwater Basins, Water & Wastewater Treatment Plants in the Santa Clara Basin

Artificial Groundwater Recharge Facilities

The Water District owns and operates numerous groundwater recharge facilities in the Basin, discussed in Chapter 7 and shown on Figure 8-1. These facilities percolate both local and imported water into the groundwater basin. Average annual recharge capacity of the facilities is 157,200 acre-feet/year. Instream recharge typically accounts for about half of this amount. The Water District has constructed approximately 36 seasonal spreader dams to pond water in streams for recharging the groundwater basin.

Water Treatment Facilities

Seven water treatment plants serve customers in the Basin (see Figure 8-1). Three of the plants are owned and operated by the Water District to treat imported water and minor quantities of local surface water for delivery to retailers, who in turn supply treated water to homes and businesses. Other treatment plants are owned by ACWD and the San Jose Water Company.

Wells

The Water District does not own or operate municipal drinking water wells, but it carries out measures to protect the groundwater. Currently about 6,700 registered public and private supply wells are located in the county. Over 500 wells are used for public water supply. Most city water departments and investor-owned water utilities get some of their supplies from wells.

Surface Water Diversions

The only direct onstream diversions of local surface waters for municipal purposes in the Basin are on Saratoga and Los Gatos Creeks and are operated by the San Jose Water Company to supply parts of Monte Sereno, Los Gatos, and Saratoga.

Dams

Eleven water supply reservoirs are in the Basin, of which the Water District operates eight, Stanford University operates two, and the San Jose Water Company one. The District operates one diversion structure to provide irrigation.

8.3 Wastewater Management

Institutional Arrangements

Municipalities and special districts are responsible for collecting wastewater from homes and businesses in urban and suburban areas. With the single exception of FMC in Fremont, industrial wastewater is discharged to municipal wastewater collection systems rather than directly to surface waters. Many industries are required to pretreat their wastewater first.

Wastewater Facilities

Treatment and Disposal Systems

Three major municipal wastewater treatment plants are located in the Basin: the San Jose-Santa Clara Water Pollution Control Plant, the Palo Alto Regional Water Quality Control Plant, and the City of Sunnyvale Water Pollution Control Plant (see Figure 8-1). All provide tertiary treatment and discharge effluent to shallow sloughs south of the Dumbarton Bridge.

Water Recycling

Currently, approximately 10 million gallons per day of municipal wastewater is recycled in the Basin, primarily by the City of Santa Clara for landscape irrigation. The Water District and the City of San Jose participate in the South Bay Water Recycling Program, which is developing plans to expand reuse of municipal wastewater from the San Jose-Santa Clara plant.

8.4 Surface Water Management Facilities

When undeveloped land is converted to urban uses, impermeable roofs, roads, and parking lots increase stormwater runoff and the speed with which it reaches streams. Urban living also adds pollutants to stormwater as it flows across roofs and streets. Stormwater was traditionally viewed as uncontaminated, but now it is widely accepted as bearing contaminants. Management of surface water quantity and surface water quality are largely separate, but efforts are in progress to improve the links between the two.

Stormwater Quality Management

In 1987 Congress recognized the potential adverse effects of urban runoff on water quality and amended the CWA to require that NPDES permits be obtained for urban stormwater discharges. Permits require their holders to carry out state-approved management plans designed to control contaminants to the "maximum extent practicable." The plans typically call for a broad range of best management practices, primarily nonstructural "good housekeeping" measures such as street sweeping, catch basin cleaning, litter control, and programs to educate the public about pollution caused by urban stormwater.

The first NPDES permit to discharge stormwater from urban areas in Santa Clara County was issued to the Santa Clara Valley Urban Runoff Pollution Prevention Program, a consortium of 15 government agencies, by the Regional Board in 1990. A revised permit was issued in 1995. The permit area lies entirely within the Basin. Co-permittees are the cities 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. A committee made up of one designated voting representative from each copermittee administers the program, conducts areawide activities and prepares and submits annual reports and other documents to the Regional Board. The co-permittees develop individual urban runoff management plans and are responsible for carrying them out within their jurisdictions.

Flood Management

Institutional Arrangements

Within Santa Clara County, flood management is the responsibility of the Water District. Local drainage systems are the responsibility of cities and counties. The Water District is responsible for managing floodwaters from all creeks and major drainage channels within catchment areas greater than 320 acres.

In late 1999, the Water District, San Mateo Flood Control District, and the cities of Palo Alto, Menlo Park, and East Palo Alto formed a joint power authority to work together to solve flooding problems on San Francisquito Creek, perform regular creek maintenance, and preserve the creek as a community resource.

Historical Flooding

When agriculture was the dominant land use in the Basin, most farmers welcomed flooding, which increased the productivity of soils. As urban land use grew, roads, homes, and businesses were built on floodplains, vulnerable to damage. Replacing permeable soils with impermeable roofs, streets, and parking lots meant more storm runoff, and creeks overflowed more often. Flood management efforts were fragmented until the Santa Clara County Flood Control and Water Conservation District was created in 1951. This agency merged with the Santa Clara Valley Water Conservation District in 1968 to form the Water District, which assumed responsibility for flood management in all of Santa Clara County.

Many flood management projects were built in the 1960s and 1970s. An El Niño winter in the early 1980s caused catastrophic flooding and public approval 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.

Risks remain. In 1995 a fast-rising Guadalupe River prompted evacuation of offices in downtown San Jose. In 1997 over 400 properties on Coyote Creek were flooded. In 1998, flooding occurred along four different creeks. Figure 8-2 shows areas still vulnerable to flooding. This information is also shown on a watershed-specific basis on Figures 7-1 through 7-11.

Flood Management Facilities

The Water District seeks to protect homes and businesses from a flood with a 1 percent chance, or less, of occurring in any given year. This level of protection qualifies homeowners and business for reduced rates under the National Flood Insurance Program. To provide protection from flooding by enabling the channel to convey more floodwater, the Water District modifies stream channels, stabilizes embankments, and raises roadway bridges. Channel modification may include constructing bypass channels, creating floodplains and armoring (for example, rock lining) embankments, and has included lining with concrete. The proportion of modified to unmodified channels within the Basin varies by stream (Table 8-2). Of the 642 miles of creeks and drainage channels managed by the Water District, about 350 miles (55 percent) currently can carry the 1 percent capacity without flooding.

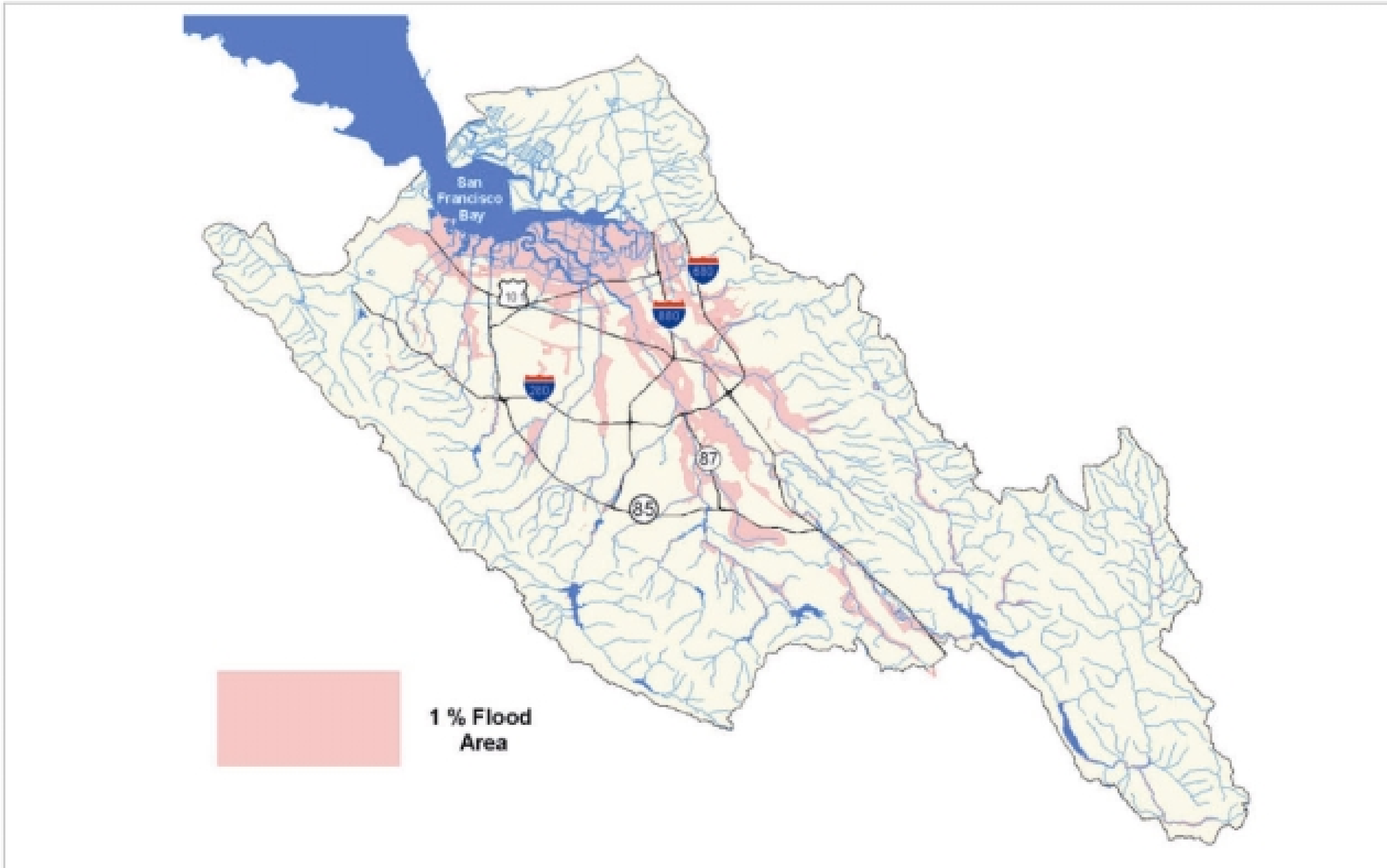
Table 8-2
Channel Characteristics for Santa Clara County Streams [1,2]

Stream	**Length** (miles)	**Percent Concrete- or Rock-Lined Culverted**	**Percent Natural Modified[3]**	**Percent Natural Unmodified**
San Francisquito Creek[4]	15.3	8	10	82
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]	NA	NA	NA	NA

1 Source: Santa Clara Valley 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 is for Santa Clara County only. Information for San Mateo County is in the process of being gathered. See Unabridged Volume One.
5 Information for Arroyo la Laguna is in the process of being gathered. See Unabridged Volume One.

8.5 Water Balance

The term water balance describes the overall movement of water into and out of a watershed. It can be expected to vary from year to year. Approximately 415,000 acre-feet of water are used by humans in the Basin each year, about 240,000 acre-feet (57 percent) of which is imported from outside the Basin (see Figure 8-3). The rest comes from local surface water and groundwater sources. Each water wholesaler serving the Basin has prepared long-range plans for meeting future water needs. For example, in 1996 the Water District prepared a plan that evaluates many options for matching water supply and demand in the next 25 years. Water conservation and recycling are expected to play a much greater role in overall water management in the Basin in the future.

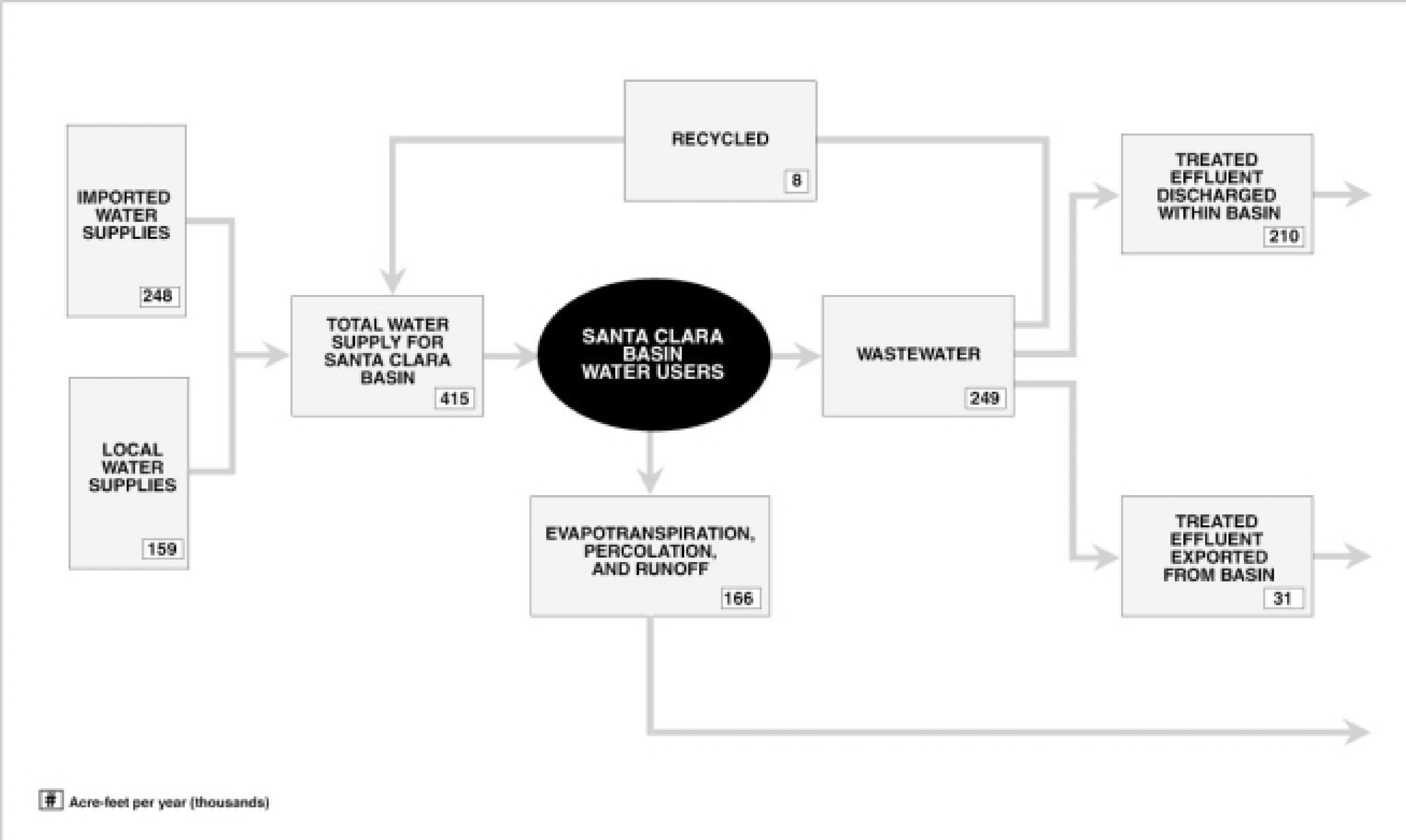


Source: Santa Clara Valley Water District

Watershed Characteristics Report

FIGURE 8-2
Flood-Prone Areas in the Santa Clara Basin

WMI Santa Clara Basin



Source: URS Greiner Woodward Clyde

Watershed Characteristics Report

FIGURE 8-3
Water Balance Diagram for the Santa Clara Basin

Attachments

A – Acronyms

B – Glossary

C – Production Credits and Acknowledgments

Attachment A
Acronyms

ABAG	Association of Bay Area Governments
ACOE	U.S. Army Corps of Engineers
ACWD	Alameda County Water District
Basin	Santa Clara Basin
Bay Area	San Francisco Bay Area
Bay	San Francisco Bay
Cal-EPA	California Environmental Protection Agency
CARB	California Air Resources Board
CDFG	California Department of Fish and Game
CEQA	California Environmental Quality Act
CWA	Clean Water Act
DPR	California Department of Pesticide Regulation
DU	dwelling unit
DWR	California Department of Water Resources
EIR	Environmental Impact Report
EPA	U.S. Environmental Protection Agency
ESA	Endangered Species Act
FEMA	Federal Emergency Management Agency
LAFCOs	Local Agency Formation Commissions
NPDES	National Pollutant Discharge Elimination System
Regional Board	San Francisco Bay Regional Water Quality Control Board
RPT	Report Preparation Team
SCVURPPP	Santa Clara Valley Urban Runoff Pollution Prevention Program
SDWA	Safe Drinking Water Act
SFWD	San Francisco Water Department
State Board	State Water Resources Control Board
TEA-21	Federal Transportation Equity Act for the 21st Century
TMDL	total maximum daily load
USFWS	U.S. Fish and Wildlife Service
Water District	Santa Clara Valley Water District
WDR	Waste Discharge Requirement
WMI	(Santa Clara Basin) Watershed Management Initiative

Attachment B
Glossary

Term	Definition
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 spawn in freshwater.
Aquifer	Geological formation that holds or conducts groundwater.
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 which 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), California Office of Administrative Law, and ultimately the U.S. Environmental Protection Agency (EPA).
Baylands	Tidal wetlands bordering the Bay that lie between mean low water and the highest observed tide. 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]

[1] The definition of "Baylands" proposed by the Wetlands Advisory Group is a more refined definition that may be used in future reports.

Term	Definition
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 of 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 serve as a basis for establishing water quality objectives and the discharge prohibitions or conditions necessary to attain them.
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 §1251 et 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.
Effluent	Outflow or discharge, as from a wastewater treatment plant.
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.
Fish Ladder	Series of ascending pools that let fish swim upstream around or over a dam.
Floodplain	A flat region or valley floor surrounding a stream channel into which the stream overflows during flooding.
Floodway	Natural or modified watercourses consisting of a combination of stream channels and adjacent areas planned to convey floodflows. FEMA 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 feet 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.
Geomorphology	The study of characteristics and development of landforms; as used in this volume, generally the landforms themselves.
Groundwater	Subsurface water that occurs beneath the water table in soils, and geologic formations that are fully saturated.

Term	Definition
Habitat	The area in which an organism or ecological community lives.
Imperviousness	Term applied to surfaces – roads, sidewalks, rooftops, parking lots – that prevent or inhibit rainfall from sinking into groundcover and groundwater.
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.
MTBE (methyl tert-butyl ether)	A gasoline additive.
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.
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 groundwater 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. 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.
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.
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.

Term	Definition
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.
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 Boards, which conduct 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.
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.
Total Maximum Daily Load (TMDL)	The TMDL is the maximum pollutant load a waterbody can receive (loading capacity) without violating water quality standards. States require the establishment of TMDLs for waterbodies where technology-based requirements alone are insufficient to attain water quality standards. TMDLs include allocations of pollutant loads among dischargers, background loadings from natural sources, and safety margins to ensure achievement of water quality goals. The CWA requires that EPA review and approve TMDLs.
Watershed	The land area that drains into a single stream or system of streams, rivers, or channels.
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 mudflats, rocky shores, and sandbars. See Table 6-4 for further detail.

Attachment C
Production Credits

The Watershed Characteristics Report was prepared under the direction of the

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City of San Jose
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City of Sunnyvale

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GUADALUPE-COYOTE RESOURCE CONSERVATION DISTRICT

LEAGUE OF WOMEN VOTERS

SAN FRANCISQUITO CREEK CRMP

SAN FRANCISCO ESTUARY INSTITUTE

CITY OF SAN JOSE

SAN MATEO COUNTY ENVIRONMENTAL HEALTH

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SANTA CLARA VALLEY URBAN RUNOFF POLLUTION PREVENTION PROGRAM

SANTA CLARA VALLEY WATER DISTRICT

U.S. ARMY CORPS OF ENGINEERS, SF DISTRICT

USEPA, REGION 9

WEST VALLEY CLEAN WATER PROGRAM

WESTERN WATER CANOE CLUB

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Date: ___________

Please check the appropriate box:

☐ I would like more information on the Santa Clara Basin Watershed Management Initiative.

☐ I would like more information on the following chapters of the Watershed Characteristics Report:

____ Ch 2- Report Preparation Process
____ Ch 3 - Cultural Setting of the Santa Clara Basin
____ Ch 4 - Land Use in the Santa Clara Basin
____ Ch 5 - Organizational Setting
____ Ch 6 - Regulatory Setting
____ Ch 7 - Natural Setting
____ Ch 8 - Water Management in the Santa Clara Basin

I have the following comments on this report: ____________________

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General Comments: ____

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Phone: ____________ Best to reach me in the ____ day ___ evening.

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SANTA CLARA BASIN
WMI
WATERSHED
MANAGEMENT INITIATIVE

"Working together to protect our watershed"

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____ Ch 6 - Regulatory Setting
____ Ch 7 - Natural Setting
____ Ch 8 - Water Management in the Santa Clara Basin

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