NO: _____

Draft for Planning Commission review on June 13, 2011

June 28, 2011

SUBJECT: Approval by Resolution of Sunnyvale 2010 Urban Water Management Plan (UWMP)

BACKGROUND

All water agencies are required to prepare an Urban Water Management Plan (UWMP) every five years. The Sunnyvale 2010 UWMP (Attachment A), and an approving resolution (Attachment B), are included with this report.

The UWMP describes and evaluates sources of water supply, efficient uses of water, demand management measures, implementation strategy and schedule, and other relevant information and programs, as required by law.

Sunnyvale last updated its UWMP in 2005 (RTC 05-387). The 2010 UWMP is brought to Council in 2011 consistent with other California water agencies. One of the key aspects of the 2010 UWMP is a required plan of how the City will attain the goals of Senate Bill 7 (SB7), which mandates that most agencies must reduce their per capita water consumption at least 20% by 2020. Methods to reach SB7 compliance were not completed by the State until December 2010, and all water agencies were therefore granted a 6 month extension in order to complete a compliant report for the 2010 cycle. Approval of the 2010 UWMP is required by July 1, 2011. Council is being asked to approve the attached resolution approving the 2010 update to the City's Urban Water Management Plan.

EXISTING POLICY

The relevant City goals, policies and action statements are identified in **Section 3.1.1 Water Resources** of the Council Policy Manual, involving water supply, conservation, distribution and quality.

The State regulation requiring the Urban Water Management Plan is the California Water Code, Division 6, Part 2.6, Sections 10610 through 10656.

DISCUSSION

The 2010 UWMP was prepared to provide a comprehensive update to the 2005 UWMP and to include new legislatively mandated language and calculations.

The State Department of Water Resources will use the information provided by all water providers in their UWMPs to make projections on water usage and determine the status of water conservation efforts throughout the state.

The 2010 UWMP was prepared primarily by HydroScience Engineers in coordination with City staff and interested stakeholder groups. It builds upon previous updates, incorporates relevant water management issues and addresses supply and demand projections for the next 20 years within our community. The UWMP includes demand management measures to promote more efficient water use practices, and conservation within our community.

The sections of the 2010 UWMP are:
Section 1 Plan Preparation
Section 2 System Description
Section 3 System Demand
Section 4 System Supplies
Section 5 Water Supply Reliability, and Water Shortage Contingency Planning
Section 6 Demand Management Measures

In total, the UWMP provides an overview of the entire Sunnyvale water system, and identifies interdependencies with adjacent cities and regional water supplies. No new policies are proposed for the City in the 2010 UWMP. Instead, the plan provides a framework of the water utility management to continue to meet the latest state and federal legislation relating to public water systems. Also included are contractual obligations for long term water supply, and interim water allocations, such as in the 2009 contract with the SFPUC.

Some of the overall changes to the water contracts and agreements and requirements since the last update in 2005 include:

- The new 25 year Water Service Agreement (WSA) between the City and the San Francisco Public Utilities Commission (SFPUC).
- The Water System Improvement Plan (WSIP), undertaken by the SFPUC to update and seismically retrofit its infrastructure to increase the reliability of water delivery to its customers, has come a long way in design and construction.
- Cooperative efforts between the City and the Bay Area Water Supply and Conservation Agency (BAWSCA) to develop short and long term supply allocations to meet individual agency and area water conservation goals, known as the Water Conservation Implementation Plan (WCIP).
- In conjunction with BAWSCA developing interim water supply allocations (ISA) for BAWSCA agencies through 2018 in alignment with SFPUC determination to limit water supply until 2018.

- Senate Bill 7 (SB7), signed by the Governor in 2010, requiring water suppliers to reduce per capita water usage by 20% by the year 2020. (Calculations included in the plan indicate that the City is currently already meeting the 20% reduction in per capita water usage and needs only to maintain the current level of usage to meet legislatively mandated targets.)

FISCAL IMPACT

There is no fiscal impact for approval of the 2010 UWMP. There will be normal water construction and repair, operation, and maintenance work continuing, as before. All such work is subject to budget, or special project approval by Council. However, delaying approval of the plan could incur costs on some future water projects. If Council does not adopt the 2010 UWMP by June 30, 2011, the City is ineligible for any water related grant money, State or Federal, until the next UWMP update, in 2015.

PUBLIC CONTACT

Public contact was made by posting the Council agenda on the City's official notice bulletin board outside City Hall, at the Sunnyvale Senior Center, Community Center and Department of Public Safety; and by making the agenda and report available at the Sunnyvale Public Library, the Office of the City Clerk and on the City's Web site. A draft version of the 2010 UWMP has been posted on the City website since June 10, 2011. Also, State mandated announcements were sent to all other regional water provides to allow for coordination of water supplies and demands.

ALTERNATIVES

1. City Council adopt the attached Resolution approving the 2010 Urban Water Management Plan as presented, and direct staff to forward the UWMP to the California State Department of Water Resources.

2. City Council does not approve the 2010 UWMP and directs staff to request an extension from the State Department of Water Resources in order for staff to revise the plan.

RECOMMENDATION

Staff recommends Alternative No. 1: City Council adopt the attached Resolution approving the 2010 Urban Water Management Plan as presented, and direct staff to forward the UWMP to the California State Department of Water Resources.

The attached 2010 UWMP has been prepared to meet all state requirements and to correctly depict the Sunnyvale water supply and distribution system and related issues. Approval of the report would be consistent with the 2011-2012 City of Sunnyvale budget, identifying programs and projects, as well as policies and procedures already part of City operations. Therefore, staff recommends approval of the 2010 UWMP.

Reviewed by:

_____

Marvin A. Rose, Director, Public Works Department
Prepared by: James G. Craig, Field Services Superintendent

Approved by:

_____

Gary Luebbers,
City Manager

Attachments

A. 2010 Urban Water Management Plan
B. Draft Resolution

ATTACHMENT A

City of Sunnyvale

2010 Urban Water Management Plan

Draft, May 2011

Prepared for

City of Sunnyvale
Department of Public Works
221 Commercial Street
Sunnyvale, CA 94088

Prepared by

HydroScience Engineers
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HydroScience Engineers

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SECTION 1 – PLAN PREPARATION

1.1 INTRODUCTION

The City of Sunnyvale's (City) 2010 Urban Water Management Plan (UWMP) was prepared to provide a comprehensive update to the 2005 UWMP, which was adopted by City Council on December 20, 2005. The 1983 California Urban Water Management Act (Act), also referred to as Assembly Bill (AB) 797, requires all urban water suppliers who directly serve 3,000 or more customers or who provide 3,000 or more acre-feet of water per year, to prepare a UWMP every five years.

This plan will enable the State Department of Water Resources (DWR) to make projections on water usage and determine the status of water conservation efforts throughout the State. Although the efficient use of water supplies is a statewide concern, the planning and implementation of such use can best be accomplished at the local level.

The 2010 update to the City's 2005 UWMP builds upon previous updates, incorporates relevant water management issues and addresses supply and demand projections for the next 25 years within the City. It incorporates State legislative mandates that have been enacted, in particular Senate Bill (SB) X7-7, the Water Conservation Act of 2009, and AB 1420 Water Demand Management Measures. These legislative mandates target a 20% water use reduction per capita by 2020. Specific requirements include identifying the base daily per capita water use (baseline), urban water use target, interim water use target, and compliant daily per capita water use.

The 2010 UWMP must also include information on water deliveries and uses; water supply sources; efficient water uses; and demand management measures, including implementation strategy and schedule. DWR has the responsibility for the review and certification process of the UWMP pursuant to the Act. A current UWMP is required in order to be eligible for a water management grant or loan administered by DWR, the State Water Resources Control Board, or the Delta Stewardship Council.

The goals of the 2010 UWMP update include:

- To provide a valuable resource tool to be used by policy makers at city, county, and local government levels to facilitate making sound and consistent decisions relating to water management and regional growth in the area.
- To meet all Federal and State regulatory requirements.
- To update the City's water conservation plan and projections for future conservation efforts.
- To identify communication links between key departments at both City and County levels, and to strengthen ties for cooperatively addressing water supply and land use planning issues.
- To continue and solidify relationships with other retailers and wholesalers to better address issues concerning water supply and demand.

1.2 PLAN ORGANIZATION

The 2010 UWMP is organized as recommended in the *Guidebook to Assist Urban Water Suppliers to Prepare a 2010 Urban Water Management Plan* dated March 2011 to expedite review and approval by DWR. The sections contained in the 2010 UWMP are as follows:

- Section 1 – Plan Preparation
- Section 2 – System Description
- Section 3 – System Demands
- Section 4 – System Supplies
- Section 5 – Water Supply Reliability & Water Shortage Contingency Planning
- Section 6 – Demand Management Measures

1.3 COORDINATION

The City participates in area and regional planning with the Bay Area Water Supply and Conservation Agency (BAWSCA), the San Francisco Public Utilities Commission (SFPUC) and the Santa Clara Valley Water District (SCVWD). Sunnyvale also participates in basin-wide groundwater and conservation planning with SCVWD. SCVWD provides management of local groundwater resources and contracts for imported water to the County. Participation in these planning efforts helps ensure that the City will receive an adequate amount of water to provide for its residents and businesses. It also provides for drought-condition planning and coordination with the rest of the region so that no particular water provider is unduly impacted by lack of water.

The City contacted the SFPUC (through BAWSCA) and the SCVWD for assistance with its UWMP and at the same time provided those agencies with pertinent data for their own plans.

The City encouraged the involvement of social, cultural and economic community groups during the preparation of the 2010 UWMP. Specific efforts were made to send out a public notification mailer to all community groups, including public and private water suppliers. BAWSCA agencies were notified of the 2010 preparation process. The City directed these agencies to the location of the Draft UWMP and solicited comments and suggestions.

The City published its intention to update the 2005 UWMP, and invited public comments on the City's Web page. The City also published a notice of intention in the San Jose Mercury News. Copies of notices for participation in the 2010 UWMP preparation can be found in **Appendix A**.

A Notice of Preparation of the UWMP was sent to the following agencies listed in **Table 1-1**.

Table 1-1: List of Notified Agencies

Agency Name	
ALAMEDA COUNTY WATER DISTRICT	LOS TRANCOS COUNTY WATER DISTRICT
CITY OF HAYWARD	MID-PENINSULA WATER DISTRICT
CITY OF MILPITAS	NORTH COAST COUNTY WATER DISTRICT
CITY OF MOUNTAIN VIEW	SKYLINE COUNTY WATER DISTRICT
CITY OF PALO ALTO	WESTBOROUGH WATER DISTRICT
CITY OF SANTA CLARA	CALIFORNIA WATER SERVICE COMPANY
STANFORD UNIVERSITY	GREAT OAKS WATER COMPANY
PURISSMA HILLS WATER DISTRICT	SAN JOSE WATER COMPANY
CITY OF BRISBANE	CITY OF SAN JOSE
CITY OF BURLINGAME	CITY OF GILROY
CITY OF DALY CITY	CITY OF MORGAN HILL
TOWN OF HILSBOROUGH	COUNTY OF SANTA CLARA
CITY OF MENLO PARK	SAN JOSE/SANTA CLARA WATER POLLUTION PLANT
CITY OF MILLBRAE	
CITY OF REDWOOD CITY	BAY AREA WATER SUPPLY & CONSERVATION AGENCY
CITY OF SAN BRUNO	
COASTSIDE COUNTY WATER DISTRICT	SAN FRANCISCO PUBLIC UTILITIES COMMISSION
ESTERO MUNICIPAL IMPROVEMENT DISTRICT	
SANTA CLARA VALLEY WATER DISTRICT	GUADALUPE VALLEY MUNICIPAL IMPROVEMENT DISTRICT
CITY OF EAST PALO ALTO	

1.4 PLAN ADOPTION AND IMPLEMENTATION

The public hearing and consideration of adoption of the 2010 UWMP will take place on June 28, 2011 during a normal City Council session. Upon adoption of the 2010 UWMP by City Council, implementation will take place as identified in this document. Submission of the adopted UWMP to DWR will take place within 30 days from the date of adoption. The UWMP will be made available to the public via the internet at www.sunnyvale.ca.gov within 30 days of submission to DWR and will be submitted to the California State Library. The adopted resolution is included in **Appendix B**.

SECTION 2 – SYSTEM DESCRIPTION

2.1 HISTORY

The City of Sunnyvale was incorporated in 1912 and became an official charter city in 1950. When the City was incorporated in 1912, its population was approximately 1,500 and the entire municipal water system relied exclusively on groundwater for its potable water supply source. The original water supply source was from a privately-owned well at the Joshua Hendy Iron Works Factory in Sunnyvale. By 1926, a total of three wells were operational, none of which is in use today. During World War II, the Federal government awarded several war contracts that led to the development of the Central Water Plant and groundwater well.

At the close of World War II, Sunnyvale began to grow very quickly. By the early 1950s, demand for water surpassed the supplies available from groundwater and led to overdraft of the aquifers. As a direct consequence of the overdraft of the groundwater, land subsidence in the northern region of the City was at 0.3 feet per year. By 1952, the population had grown to 10,000, and it was at that time that Sunnyvale entered into a contractual agreement with the City and County of San Francisco for delivery of imported SFPUC water. That same year, three connections were made to the SFPUC supply to serve as a primary water source, to be supplemented by the now seven City-owned and operated wells located throughout the City. In the 17 years that followed, the City population grew to 96,000. Sunnyvale realized the need for an additional water supply source, and contracted with the SCVWD for two connections to the SCVWD's West Pipeline. By 1970, the City had developed three of its four current water supply sources (SFPUC/Hetch Hetchy, SCVWD Central Valley Project water, and City-owned wells).

As the demand for water was steadily on the rise during the period of 1970 through the mid-1980s, the City expanded the number of Hetch Hetchy connections to its current total of six. Sunnyvale also added two well water producing facilities, which gave the City a total of 11 City-owned and operated wells at that time.

The City also expanded its interconnections with surrounding water utilities in the immediate area to ensure a sustainable water supply during times of emergencies, thus adding to the system's reliability. The City has, at the present time, connections to the cities of Mountain View, Cupertino and Santa Clara, as well as to the California Water Service Company

The water demand reached an all-time-high in 1987 and demand was expected to increase, reaching approximately 36,000 acre-feet per year (AFY) at the projected system build-out. The six-year drought that started in the late 1980s and ended in the mid 1990s brought about many changes in water usage, which came largely from the industrial sector. Conservation measures and a recycled water program adopted by the City were some of the most important drought-induced changes. Changes in the economic dynamics of the area occurring after 2001 brought about new reductions to the water demand. Current projections for the water system build-out expect a slow increase to less than 30,000 AFY over the next 30 years.

2.2 ORGANIZATION STRUCTURE

The City operates under a council-manager form of government. Council, as the legislative body, represents the entire community and is empowered by the City Charter to formulate citywide policy. Seven Council members are elected at large by City voters for numbered seats and serve four-year terms. The City Charter limits Council members to serving two consecutive terms. The Mayor and Vice Mayor are selected from among the ranks of the Council and serve two year and one year terms respectively.

The City Manager is appointed by Council and serves as the Chief Executive Officer, responsible for day-to-day administration of City affairs and implementation of Council policies. Boards and commissions, through public meetings, advise the City Council on policy issues. The City Council meetings are open to the public with few exceptions as allowed by law and take place between one and four Tuesdays per month.

The City's water utility is managed, operated, and maintained by the Field Services Division of the Department of Public Works. This Division is responsible for the purchase and distribution of potable and non-potable water as well as construction of new and replacement infrastructure.

2.3 CLIMATE

The City enjoys a generally mild, temperate climate with relatively low levels of precipitation. Daytime temperatures range from the high 70's during the summer to typically not less than 50°F in the winter. Climate information for the area is illustrated in **Table 2-1** below.

Table 2-1: Local Climate Data

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Standard Monthly Average ET_o[1] (inches)	1.35	1.87	3.45	5.03	5.93	6.71	7.11	6.29	4.84	3.61	1.80	1.36	49.35
Average Rainfall (inches)	2.12	2.07	1.93	0.93	0.05	0.08	0.05	0.14	0.25	1.14	2.09	1.71	12.56
Average Max Temperature (°F)	59.0	62.4	65.8	68.7	75.9	79.3	81.7	81.9	79.3	72.4	60.1	57.0	70.5
Average Min Temperature (°F)	39.3	41.6	43.6	44.1	48.4	51.6	54.6	54.5	53.2	48.2	41.2	38.7	46.7

1. ETo = Evapo Transpiration is the loss of water to the atmosphere by the combined processes of evaporation (from soil and plant surfaces) and transpiration (from plant tissues).

2.4 SERVICE AREA POPULATION

The City provides water service to a population of approximately 140,450 people. City population is projected to increase approximately 16% in the next 25 years. Population estimates as shown in **Table 2-2** were calculated using the DWR methodology 2, Category 1 since the City's service area overlaps the City boundaries by more than 95%. The population estimates are from the May, 2010 data provided by the State Department of Finance (DOF).

Table 2-2: Population Projections for City of Sunnyvale

	2010	2015	2020	2025	2030	2035
City Population	141,099	141,700	147,300	152,000	157,900	163,300

2.5 DEMOGRAPHICS

The City is a diverse community with a residential population of approximately 140,450, of which approximately 118,500 are estimated to be of working age. Residents are generally well educated, with approximately 67% having some level of college education.

The City has one of the highest incomes per household in the nation, coupled with one of the lowest crime rates for a city of its size. It has a solid economic base, and poverty levels in the City have remained consistently lower than those of Santa Clara County or the State. With its Silicon Valley location, the City has a solid high-tech presence having transitioned from agricultural to defense to the current high tech economy. It has remained on the cutting edge of Silicon Valley's innovation. The top industries in the City include information services (25%), manufacturing (24%), and retail trade (10%), though the City is home to growing clusters of emerging technology companies in the high-tech and biotechnology industries.

The following are some other demographic factors:

- Total employment generated by City businesses is estimated to be 85,400.
- The average household income is approximately $79,926.
- There are over 55,000 housing units. With a complete build-out of housing units per Sunnyvale's General Plan, the number of housing units would increase to 63,580 units. In 20 years, it is expected that net new housing units would increase by between 5,500 and 6,700 units.
- Existing commercial and industrial development accounts for 35.4 million square feet. With a complete build-out of commercial and industrial property, according to the General Plan, the square footage would increase to 49 million. The average annual net new development is expected to be 215,000 square feet for an 81% build-out in 20 years.

2.5.1. Low-Income Housing

With over 1,200 units, Sunnyvale has actively supported affordable rental housing utilizing a variety of local, State and Federal funds, and works extensively with non-profit housing developers in the ownership and management of its projects. Rent-restricted housing in Sunnyvale includes both publicly subsidized affordable housing, generally assisted with any combination of Federal, State, local, and/or private subsidies, and deed-restricted rental units provided through the City's Below Market Rate (BMR) program. Sunnyvale's BMR program currently requires rental developments consisting of nine or more units to provide a minimum of 15% of the project's units at rents affordable to low-income households for a period of 55 years.

Additional detailed demographic data can be found in **Appendix C**.

2.6 SERVICE AREA DESCRIPTION

The City of Sunnyvale has an approximate area of 24 square miles and is located in Santa Clara County, just minutes from the City of San Jose and approximately 40 miles south of the City and County of San Francisco. The City retails potable drinking water and non-potable water within the City limits. California Water Service Company (Cal Water), an investor-owned water utility, retails potable drinking water from Cal Water owned groundwater wells in pocket areas of the City (see **Figure 2-1**).

2.6.1. Distribution System

The City owns, operates, and maintains a water supply and distribution system worth in excess of $200 million. The system is a closed network consisting of three different pressure zones. Sunnyvale's elevation varies from sea level at the northern end of town to approximately 300 feet above sea level at the southwest corner of town. Zone I extends roughly from El Camino Real northward to the San Francisco Bay and is supplied primarily by SFPUC water. Zone II consists of everything south of Zone I with the exception of the southwest corner of the City and is served by a supply mixture of SFPUC water, City groundwater wells, and SCVWD treated water. Zone III serves the southwest section of town with Hollenbeck Avenue on the east side and Fremont Avenue on the north side and is served by a combination of SCVWD treated water and City well water. The conveyance system extends over 300 miles in length, with pipe diameters ranging from 4 inches to 36 inches.

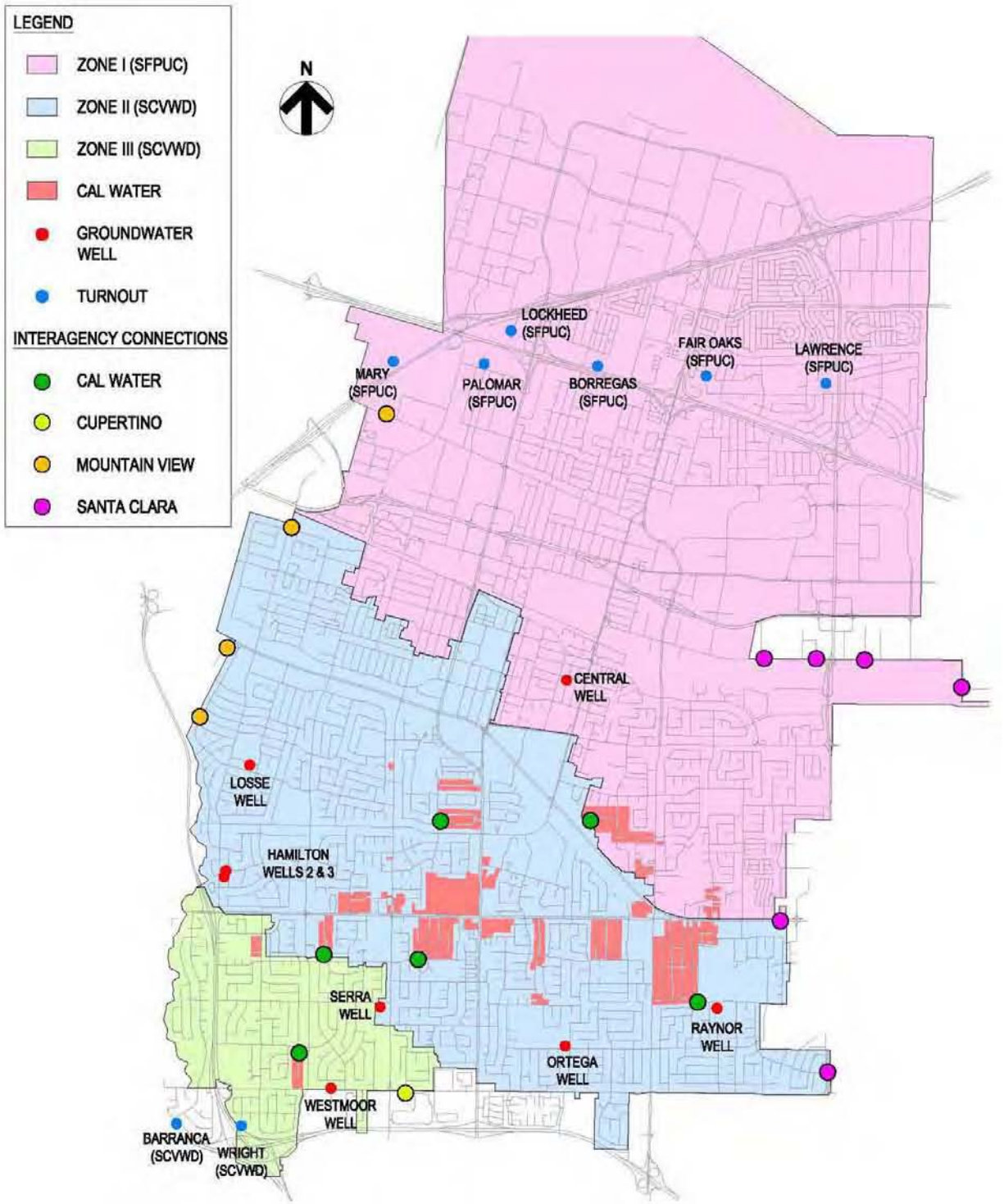
Water pressure within the distribution system is maintained within a range of 40 pounds per square inch (psi) to 105 psi throughout all three zones. A Supervisory Control and Data Acquisition (SCADA) system allows the City to maintain a balanced system, generally keeping water deliveries between those pressure readings.

Zone I receives direct downstream pressure from the SFPUC pipeline system with an operating pressure of approximately 130 psi, though that pressure is reduced through the use of pressure regulating valves before it is delivered to customers.

Several pocketed areas within the City boundaries, located primarily along Fremont Avenue and Sunnyvale-Saratoga Road, receive water from Cal Water. These areas were at one time part of unincorporated Santa Clara County, but have since been annexed by the City. Cal Water produces its own water from wells the company owns exclusively. The City, through a cooperative effort, provides emergency connections to Cal Water's system to improve fire flows when needed.

There are ten potable water storage reservoirs at five different locations throughout the City with a total storage capacity of 27.5 million gallons. There is also one recycled water reservoir with a storage capacity of two million gallons. This volume of water can meet at least one day of average water demand during the summer and up to two days of average water demand during the winter for the entire City.

Figure 2-1: City of Sunnyvale Service Area Map



SECTION 3 – SYSTEM DEMANDS

3.1 HISTORICAL WATER USE

Water use varies throughout the years depending on several natural factors including the weather and the extension of seasons, but is also dependent on other factors such as business climate and the economy. Recognizing long-term general trends in water requirements is valuable in projecting future supply needs.

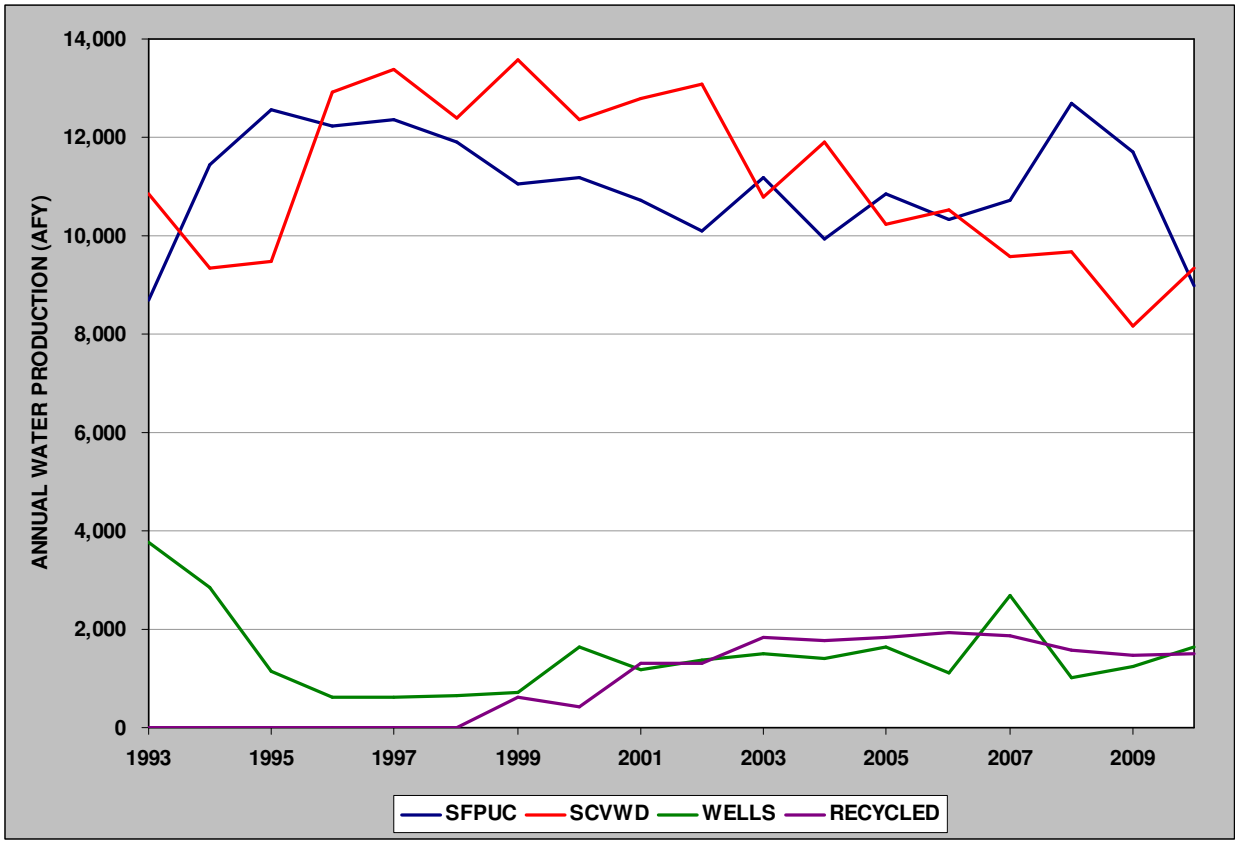
Water use in Sunnyvale generally increased during the period of 1993 to 2001 and steadily decreased since 2002 in response to drought-related conservation measures, economic factors and based on contractual limitations previously negotiated. The City converted its traditional sewer treatment plant in the mid 1990's to allow for the production of recycled water and began using recycled water in 1999, supplementing the overall water supply. The City strategically plans its purchases of water from SCVWD and SFPUC based on cost, so the increase in deliveries from one source will generally be accompanied by a decrease from the other. **Table 3-1** reflects the total annual water production in acre-feet per year (AFY) by the City since 1993.

Table 3-1: Historical and Present Water Production (AFY)

Year	SFPUC Hetch Hetchy	SCVWD	Local Wells	Recycled Water	Total Water Production
1993	8,690	10,866	3,786	0	23,343
1994	11,451	9,360	2,867	0	23,679
1995	12,552	9,491	1,132	0	23,176
1996	12,216	12,915	616	0	25,747
1997	12,372	13,389	630	0	26,391
1998	11,916	12,378	667	0	24,962
1999	11,058	13,577	713	639	25,987
2000	11,192	12,372	1,649	437	25,649
2001	10,730	12,773	1,189	1,317	26,008
2002	10,096	13,094	1,367	1,296	25,852
2003	11,195	10,773	1,521	1,823	25,311
2004	9,927	11,916	1,395	1,783	25,021
2005	10,868	10,232	1,631	1,851	24,582
2006	10,322	10,524	1,113	1,928	23,887
2007	10,723	9,587	2,696	1,874	24,879
2008	12,675	9,675	1,006	1,576	24,932
2009	11,720	8,176	1,231	1,486	22,613
2010	8,982	9,331	1,629	1,523	21,465

Figure 3-1 (below) is a graphical depiction of the annual water production from the City's four water supply sources during the period of 1993 to 2010.

Figure 3-1: Annual Water Production 1993-2010 (AFY)



3.2 BASELINE WATER USE

In accordance with the Water Conservation Act of 2009, water suppliers must identify a 10 or 15-year water use period for use as the basis for calculating their Base Daily Water Use. This value serves as the baseline for computing future required reductions in gallons per capita per day (gpcd). By 2015, the per capita water use in the retailer's service area must be reduced by ten percent (10%) from the baseline. By 2020, per capita water use must be reduced by twenty percent (20%). In addition, the legislation requires that suppliers must use come up with a 5 year baseline period to calculate minimum water use reductions.

For recycled water retailers, there is the option to use a base period of up to 15 years for calculating their Base Daily Water Use. The baseline determination is dependent upon recycled water use during 2008 as a percentage of total water use. If the recycled water use in 2008 was greater than 10% of the total water use, the retailer has the option to use a 15 year baseline. Based on Sunnyvale's 2008 recycled water use, the City is not eligible for the 15-year base period. Thus, the baseline water use is calculated using a 10-year base period.

The base period determination is shown in **Table 3-2**. The selected period of 1995 to 2004 is representative of long-term water use for the City. The 5-year base period used to calculate the minimum water use reduction requirement is also shown on **Table 3-2**. The period from 2003-2007 was selected for the City's 5-year base.

Table 3-2: Base Water Use Periods

Parameter	Value
2008 total water deliveries	24,932 AFY
2008 total volume of delivered recycled water	1,576 AFY
2008 recycled water as a percent of total deliveries	6%
Number of years in base period[1]	10 years
Year beginning base period range	1995
Year ending base period range	2004
Number of years in base period	5 years
Year beginning base period range	2003
Year ending base period range	2007

1. The City is not eligible for the 15-year base period based on the recycled water use during 2008.

Table 3-3 and **Table 3-4** show the water use rates for each year within the 5 and 10-year baseline periods as well as the base daily per capita water use for each use range.

Table 3-3: Base Daily per Capita Water Use (10-year Range)

Year	Service Area Population	Gross Water Use (MGD)	Daily per capita water use (gpcd)
1995	124,333	20.69	166
1996	125,841	22.98	183
1997	128,168	23.56	184
1998	129,464	22.28	172
1999	131,127	23.20	177
2000	131,760	22.90	174
2001	132,524	23.22	175
2002	132,580	23.08	174
2003	132,343	22.60	171
2004	133,242	22.34	168
Baseline per capita water use (1995-2004)			**174**

Table 3-4: Compliance Base Daily per Capita Water Use (5-year Range)

Year	Service Area Population	Gross Water Use (MGD)	Daily per capita water use (gpcd)
2003	132,343	22.60	171
2004	133,242	22.34	168
2005	132,725	21.95	165
2006	133,544	21.33	160
2007	135,721	22.21	164
Baseline per capita water use (2003-2007)			**165**

The baseline per capita water use for the period of 1995-2004 is 174 gpcd as shown on **Table 3-3**. The population estimates were calculated using the DWR methodology and Department of Finance (DOF) data. Baseline per capita water use during the 5-year compliance period is calculated to be 165 gpcd, as shown on **Table 3-4**. Because the 5-year baseline per capita water use is greater than 100 gpcd, the minimum water use reduction requirement must also be calculated. The calculation is used to determine whether the City's 2015 and 2020 water use targets meet the minimum water use reduction requirement (per Section 10608.22 of the California Water Code).

3.3 WATER USE TARGETS

Four methods are allowed by Water Conservation Bill of 2009 for calculating the 2015 and 2020 water use targets. The first method was used (wherein per capita daily water use in 2020 is 80% of the base daily per capita water use), because it is the most applicable to available data as well as the water use and demographic characteristics of the service area. The target 2020 per capita water use target cannot exceed 95% of the five-year compliance baseline water use. Target water use in 2015 should be 90% of the base daily per capita water use.

A summary of the baselines, targets, and Method 1 minimum water use reduction values are presented in **Table 3-5**.

Table 3-5: Base Daily per Capita Water Use (5-year Range)

Parameter	Daily per capita water use (gpcd)
Baseline per capita water use (1995-2004)	174
Baseline per capita water use (2003-2007)	165
2020 minimum water use target (95% of 5-year baseline)	157
Method 1 2015 water use target (90% of 10-year baseline)	157
Method 1 2020 water use target (80% of 10-year baseline)	139

The Method 1 2020 target of 139 gpcd is below the minimum water use target of 157 gpcd; therefore, no adjustment to the 2020 target is necessary.

3.4 WATER DEMANDS AND DEMAND PROJECTIONS

The City of Sunnyvale categorizes its water accounts into five broad customer categories: single-family, multi-family, commercial (incorporating industrial and institutional), irrigation, and fire services. The commercial sector includes all non-residential accounts that are not classified as irrigation.

Past, current, and projected water use in the City are summarized by classification of the water delivered to all customers in **Table 3-6**, and by source in **Table 3-7**. Population is a primary factor affecting urban water demand. Since 2005, the number of service connections has increased by more than 1,500 for residential and commercial accounts. Single-family residential connections increased by 446, nearly a 20% increase; multi-family residential connections increased by 278, over a 17% increase; and commercial/institutional connections increased by 941, nearly a 50% increase. Landscape irrigation connections have decreased from 786 to 588 connections while recycled water landscape irrigation connections increased by 31 to 112. "Other" connections, historically fire-lines, have decreased from 862 to 108 connections. The present and projected water demands for the City are shown in **Table 3-6**. The decrease in demand from 2005 to 2010 can be attributed to economic downturn.

Table 3-6: Past, Current, and Projected Water Use by Customer Type (AFY)

Customer Type	2005	2010	2015	2020	2025	2030	2035
Single family residential	8,264	7,023	6,555	6,393	6,341	6,378	6,378
Multi-family residential	6,047	8,309	7,755	7,563	7,502	7,545	7,545
Commercial	9,035	4,261	4,507	5,334	6,485	8,100	8,100
Irrigation	642	970	905	883	876	881	881
Other (Firelines)	946	911	850	829	823	827	827
Total Potable	**24,934**	**21,474**	**20,573**	**21,002**	**22,026**	**23,731**	**23,731**

While the number of irrigation connections decreased since 2005, the water usage in that category increased during the same period. This is due to several factors, including the combining of water meters for greater efficiency and the increased use by large customers such as golf courses and athletic fields.

Table 3-7: Projected Demand by Source (AFY)

Service Area	2005	2010	2015	2020	2025	2030	2035
SFPUC	10,868	8,982	10,003	10,003	10,003	10,003	10,003
SCVWD	10,232	9,331	9,570	9,999	11,023	12,728	12,728
Wells	1,631	1,629	1,000	1,000	1,000	1,000	1,000
Total Demand	**24,582**	**21,464**	**20,573**	**21,002**	**22,026**	**23,731**	**23,731**

Water loss within the City's distribution system can occur from various causes such as leaks, breaks, malfunctioning valves and the difference between the actual and measured quantities

from water meter inaccuracies. Other losses come from legitimate uses such as water/sewer main and hydrant flushing, tests of fire suppression systems and street cleaning.

The system losses experienced by Sunnyvale's water distribution system have historically been between 4% and 8% and are thus substantially lower than the 10% losses normally experienced by systems in urban areas (AWWA, Water Resource Planning; Manual of Water Supply Practices M50, 2001, p33), as shown on **Table 3-8**. Ninety-five percent of public water distribution systems experience losses between 7 and 15%. The system loss projections and total demand projections contained in this UWMP assume a future system loss percentage of approximately 6%, which represents a conservative estimate based on the actual system losses historically experienced by the City.

Table 3-8 provides all other water uses and losses that are not accounted for in the past, current, and projected demands associated with user demand. Saline water intrusion barriers, groundwater recharge, and conjunctive use are not shown below since these uses are managed by SCVWD and are reflected in SCVWD's UWMP for the entire County.

Table 3-8: Additional Water Uses and Losses (AFY)

Water Use	2005	2010	2015	2020	2025	2030	2035
Recycled Water	1,851	1,523	1,400	1,525	1,650	1,775	1,775
System Losses	1,496	1,288	1,234	1,260	1,321	1,423	1,423
Total	**3,374**	**2,811**	**2,634**	**2,785**	**2,971**	**3,198**	**3,198**

3.4.1. Low Income Housing Water Use Projection

Section 10631.1(a) of the California Water Code requires that the water use projections specifically identify the projected water use for lower income single-family and multi-family residential homes. The City projects that there will be 1,361 Affordable Housing rentals, 229 Below Market Rate (BMR) rentals, and 434 BMR ownership units in 2015 based on the current number of units and the various BMR and Affordable Housing restrictions and expirations, which apply to current and new developments. Projections for additional units beyond 2015 are unknown at this time.

Projected water use is based on the number of units, the average household size within the City, and the projected water use factors. Projected water use factors are based on the forecasted populations and water demands through 2035. **Table 3-9** provides the water use projection for lower income households within the City service area (these demands are already included in **Table 3-6** and **Table 3-7**).

Table 3-9: Lower Income Estimated Current and Projected Water Use (AFY)

Customer Type	2015	2020	2025	2030	2035
Single family residential (BMR Units)	161	158	161	167	167
Multi-family residential (Affordable Housing + BMR Units)	591	580	590	612	612
Total Water Use	**752**	**738**	**751**	**779**	**779**

Average Household Size of 2.56, Community Economic Profile, June 2010, City of Sunnyvale

3.4.2. Water Demand Projections for Wholesale Water Agencies

No water was sold to other agencies. **Table 3-10** (below) depicts the projected demands given to each wholesale water agency from which the City receives water. A copy of the documentation provided to the wholesale agencies is provided in **Appendix D**.

Table 3-10: Water Demand Projections for Wholesale Water Agencies (AFY)

Customer Type	Contracted Volume	2015	2020	2025	2030	2035
SFPUC	10,003	10,003	10,003	10,003	10,003	10,003
SCVWD	10,409	9,570	9,999	11,023	12,728	12,728

3.5 WATER USE REDUCTION PLAN

As part of the Water Resources Sub-Element of the City's General Plan, the City has a long range goal for water conservation. The Sub-Element states the following:

> ***GOAL B: Water Conservation –*** *Promote more efficient use of the City's water resources to reduce the demands placed on the City's water supplies*
>
> ***Policy B.1:*** *Lower overall water demand through the effective use of water conservation programs designed to increase water use efficiency in the residential, commercial, industrial and landscaping arenas, partnering with our wholesalers.*
>
> ***Action Strategies***
> - *B.1a: Develop staged conservation plans that will effectively respond to periods of water shortages or droughts. The plans will include the use of restrictions tailored to the level of conservation required, and will be coordinated with other concerned agencies.*
> - *B.1b: Keep the community regularly advised as to the status of the City's water supply, how they can achieve conservation goals, and how the community is progressing toward those goals.*
> - *B.1c: Develop partnerships with other agencies and participate in their programs to achieve regional water conservation goals.*
> - *B.1d: Support the Ahwanne Water Principles put forward by the Local Government Commission (LGC) in 2005 and participate in the continued update of the principles to promote the efficient use of the City's water resources.*
> - *B.1e: Develop comprehensive plans that employ tools such as individual water metering and demand based pricing to encourage conservation.*

Current water use is at approximately 136 gpcd, which is less than the 2020 target of 139 gpcd. Assuming that the City can maintain or improve water use on a per capita basis, then the City is on target to meet the 2020 objective.

In an effort to decrease overall system demand, the City is currently working (in cooperation with SCVWD and other agencies) on water conservation education and outreach programs. Specifically, the City and/or its partnering agencies are implementing outreach and education to residential and commercial water users regarding water-wise and drought resistant landscaping and the increased use of recycled water. The details of each water use reduction program and the City's implementation plan are further discussed in **Section 6** (Demand Management Measures).

SECTION 4 – SYSTEM SUPPLIES

4.1 SOURCES OF SUPPLY

The City has three sources of potable water supply: purchased surface water from SFPUC, purchased treated surface water from SCVWD, and groundwater from seven, City-owned and operated wells. One additional well remains on stand-by for emergencies. An additional source of non-potable water comes from the City's Water Pollution Control Plant in the form of recycled water. The City also has distribution system inter-ties to the cities of Cupertino, Mountain View, and Santa Clara as well as to California Water Service Company through service connections located within city boundaries that are reserved for use in case of an emergency.

Figure 4-1 represents the percentage of water supply from each source for Calendar Year 2010 and **Table 4-1** depicts the current and planned water supplies for the City.

Figure 4-1: City of Sunnyvale Sources of Water Supply

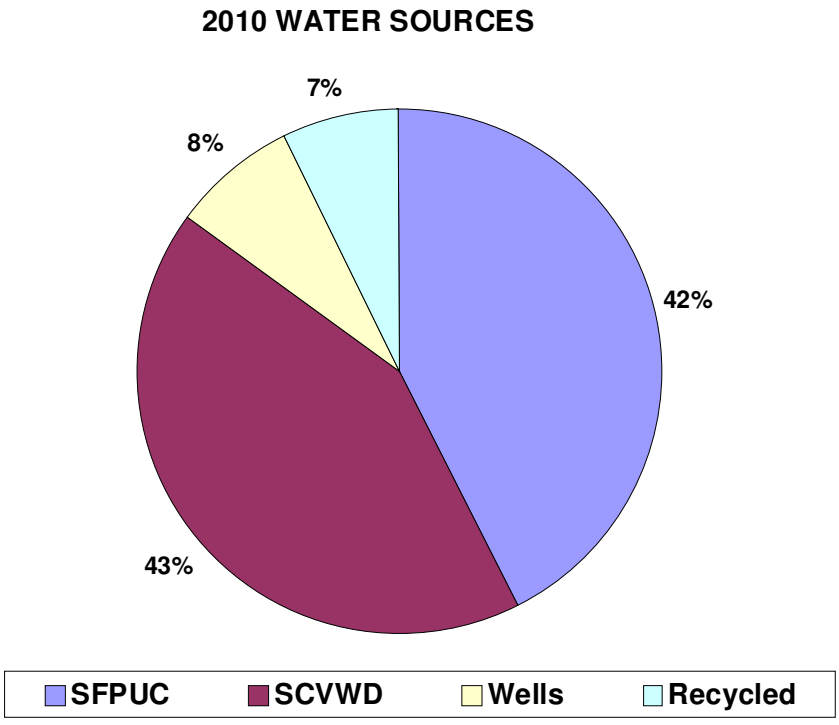


Table 4-1: Water Supplies – Current and Projected in a Normal Year (AFY)

Water Supply Sources	2010	2015	2020	2025	2030
SFPUC	8,982	10,003	10,003	10,003	10,003
SCVWD	9,331	9,570	9,999	11,023	12,728
Groundwater	1,629	1,000	1,000	1,000	1,000
Recycled Water	1,523	1,400	1,525	1,765	1,775
Total Supply	**21,465**	**21,973**	**22,527**	**23,791**	**25,506**

As **Table 4-1** indicates, recycled water supplies are expected to drop slightly by 2015 due to an expected reduction in the production of recycled water by the City's Water Pollution Control Plant (WPCP) due to outages during capital improvements. The increase projected thereafter is largely due to aggressive efforts by the City to encourage the use of recycled water for non-potable uses.

4.2 SFPUC – WHOLESALER (SURFACE WATER)

The City receives water from the City and County of San Francisco's Regional Water System (RWS), operated by SFPUC. This supply is predominantly from the Sierra Nevada, delivered through the Hetch Hetchy aqueducts, but also includes treated water produced by the SFPUC from its local watersheds and facilities in Alameda and San Mateo Counties.

The amount of imported water available to the SFPUC's retail and wholesale customers is constrained by hydrology, physical facilities, and the institutional parameters that allocate the water supply of the Tuolumne River. Due to these constraints, the SFPUC is very dependent on reservoir storage to ensure ongoing reliability of its water supplies.

The SFPUC serves its retail and wholesale water demands with an integrated operation of local Bay Area water production and imported water from Hetch Hetchy. The local watershed facilities are operated to capture local runoff.

The business relationship between the SFPUC and its wholesale customers is largely defined by the "Water Supply Agreement between the City and County of San Francisco and Wholesale Customers in Alameda County, San Mateo County and Santa Clara County" (WSA) entered into in July 2009 (WSA). This new 25 year WSA replaced the Settlement Agreement and Master Water Sales Contract that expired in June 2009. The WSA addresses the rate-making methodology used by the SFPUC in setting wholesale water rates for its customers in addition to addressing water supply and water shortages for the RWS.

The WSA is supplemented by an individual Water Supply Contract between SFPUC and each individual retailer, also entered into in July 2009. These contracts also expire in 25 years.. The City of Sunnyvale has an Individual Supply Guarantee (ISG) of 12.58 MGD (or approximately 14,100 acre feet per year). Although the WSA and accompanying Water Supply Contract expire in 2034, the ISG (which quantifies San Francisco's obligation to supply water to its individual wholesale customers) survives their expiration and continues indefinitely. The Sunnyvale contract also includes a minimum purchase amount of 8.93 MGD (10,003 AFY), which Sunnyvale agrees to buy, regardless of whether sales drop below this level.

As previously stated, the WSA provides for a 184 million gallon per day (MGD, expressed on an annual average basis) Supply Assurance to the SFPUC's wholesale customers. This Assurance is subject to reduction, to the extent and for the period made necessary by reason of water shortage, due to drought, emergencies, or by malfunctioning or rehabilitation of the regional water system. The WSA does not guarantee that San Francisco will meet peak daily or hourly customer demands when their annual usage exceeds the Supply Assurance. The SFPUC's wholesale customers have agreed to the allocation of the 184 MGD Supply Assurance among themselves, with each entity's share of the Supply Assurance set forth on Attachment C to the WSA.

The Water Shortage Allocation Plan between the SFPUC and its wholesale customers, adopted as part of the WSA in July 2009, addresses shortages of up to 20% of system-wide use. The Tier 1 Shortage Plan allocates water from the RWS between San Francisco Retail and the wholesale customers during system-wide shortages of 20% or less. The WSA also anticipated a Tier 2 Shortage Plan adopted by the wholesale customers which would allocate the available water from the RWS among the wholesale customers. The Tier 2 agreement was completed and approved by all the wholesale customers in March, 2011.

4.3 SCVWD – WHOLESALER (SURFACE WATER)

SCVWD supplies the City of Sunnyvale with treated surface water through an entitlement of imported Central Valley Project (CVP) water and the State Water Project (SWP), as well as surface water from local reservoirs. The current contractual agreement between the City and SCVWD sunsets in 2051. It was effective in 1976 with a 75 year term.

SCVWD's imported water is conveyed through the Sacramento-San Joaquin Delta then pumped and delivered to the county through three main pipelines: the South Bay Aqueduct, which carries water from the SWP, and the Santa Clara Conduit and Pacheco Conduit, which bring water from the federal CVP.

SCVWD has a contract for 100,000 AFY from the SWP, and nearly all of this supply is used for municipal and industrial (M&I) needs. The CVP contract amount is 152,500 AFY. However, the actual amount of water delivered is typically significantly less than these contractual amounts and depends on hydrology, conveyance limitations, and environmental regulations. On a long-term average basis, 83% of the CVP supply is delivered for M&I use, and 17% is delivered for irrigation use. Actual deliveries from imported sources vary significantly depending on hydrology, regulatory constraints to protect water quality as well as fish and wildlife, and other factors. SCVWD routinely acquires supplemental imported water to meet the county's needs from the water transfer market, water exchanges, and groundwater banking activities.

Local runoff is captured in local reservoirs for recharge into the groundwater basin or treatment at one of SCVWD's three water treatment plants. The total storage capacity of the District reservoirs is approximately 170,000 AF without the Department of Safety of Dams (DSOD) restrictions. Water stored in local reservoirs provides up to 25% of Santa Clara County's water supply. Reservoir operations are coordinated with imported Bay-Delta water received from the SWP and the CVP.

Table 4-2 represents the existing and planned wholesale water supply as determined by the City.

Table 4-2: Wholesale Supplies – Existing and Planned Treated Water Sources (AFY)

Wholesale Sources	Contracted	2015	2020	2025	2030	2035
SFPUC	10,003	10,003	10,003	10,003	10,003	10,003
SCVWD	10,409	9,570	9,999	11,023	12,728	12,728
Total	**20,412**	**19,573**	**20,002**	**21,026**	**22,731**	**22,731**

4.4 GROUNDWATER

The City of Sunnyvale has seven operating wells and one well on stand-by for emergencies. The seven wells are used by the City as a supplemental source to the imported SFPUC and SCVWD water supplies.

In addition to supplying the City with groundwater, the SCVWD provides the City with basin-wide groundwater and conservation planning assistance. Local groundwater supplies up to half of the county's water supply during normal years. The groundwater basin in Santa Clara County is not adjudicated and has not been identified or projected to be in overdraft by DWR.

Conjunctive use management is a practice by which the groundwater basin is pumped more in drier years and then replenished (or recharged) during wet and average years. Groundwater is replenished naturally from rainfall and augmented by SCVWD-operated recharge operations. Conjunctive use helps protect the groundwater basin from overdraft, land subsidence, and saltwater intrusion and provides critical groundwater storage reserves.

Within Santa Clara County, SCVWD manages two groundwater subbasins that transmit, filter, and store water: the Santa Clara Subbasin (DWR Subbasin 2-9.02) and the Llagas Subbasin (DWR Subbasin 3.301). In its water supply planning, the District frequently splits the Santa Clara Subbasin into two subareas, the Santa Clara Plain and the Coyote Valley. Although part of the same subbasin, these two subareas have different groundwater management challenges and opportunities and are in different groundwater charge zones.

These subbasins contain young alluvial fill formation and the older Santa Clara Formation. Both formations are similar in character and consist of gravel, sandy gravel, gravel and clay, sand, and silt and clay. The coarser materials are usually deposited along the elevated lateral edges of the subbasins, while the flat subbasin interiors are predominantly thick silt and clay sections inter-bedded with smaller beds of clean sand and gravel. The City's groundwater comes from the Santa Clara Plain subarea of the Santa Clara Subbasin. A general discussion of this subarea is provided below.

4.4.1. Santa Clara Plain

The Santa Clara Plain is part of the Santa Clara Subbasin, located in a structural trough that is bounded by the Santa Cruz Mountains to the west and the Diablo Range to the east. The Plain,

which is approximately 22 miles long, narrows from a width of 15 miles near the county's northern boundary to about half a mile wide at the Coyote Narrows, where the two ranges nearly converge. The Plain has a surface area of 225 square miles. The Santa Clara Plain is approximately 15 square miles smaller than the Santa Clara Subbasin (Basin 2-9.02) as defined by the DWR in Bulletin 118, Update 2003 since it does not include the Coyote Valley portion of the Santa Clara Subbasin. Although hydraulically connected, SCVWD refers to the Coyote Valley separately since it is in a different groundwater charge zone and has fewer water supply options than the Santa Clara Plain. The Plain underlies the northern portion of Santa Clara County and includes the majority of the streams and recharge facilities operated by SCVWD (SCVWD UWMP, 2010).

In April of each year, when the quantity of imported water available to SCVWD by contract and the local water yield can be estimated somewhat accurately, SCVWD estimates the carryover storage. Based on the calculated carryover capacity and anticipated customer demand, SCVWD reviews and modifies its groundwater management strategy in order to maintain adequate water in the basin and avoid subsidence. A copy of SCVWD Groundwater Management Plan adopted in 2001 can be found in **Appendix E**.

Groundwater is extracted by way of wells, either owned or operated by area retailers or private property owners. The allowable withdrawal of groundwater by the City depends on a number of factors, including withdrawals by other water agencies, the quantity of water recharged and carry-over storage from the previous year. **Figure 4-2** illustrates the groundwater basin in relationship to the City's groundwater wells. **Table 4-3** shows historic metered groundwater pumping data for the City from 2006 to 2010.

Table 4-3: Groundwater – Volume Pumped (AFY)

Basin Name	2006	2007	2008	2009	2010
Santa Clara Plain Subarea	1,113	2,696	1,006	1,231	1,629
% of Total Water Supply	5%	11%	4%	5%	8%

The projected amount of groundwater to be pumped by the City is shown on **Table 4-4**.

Table 4-4: Groundwater – Projected Volume to be Pumped (AFY) [1]

Basin Name	2015	2020	2025	2030	2035
Santa Clara Plain Subarea	1,000	1,000	1,000	1,000	1,000
% of Total Water Supply	4.55%	4.44%	4.22%	3.92%	3.92%

1. The City is studying the economic and operational feasibility of drilling more groundwater wells in the years to come. Should the additional wells be drilled, these projections will change.

4.5 TRANSFER OPPORTUNITIES

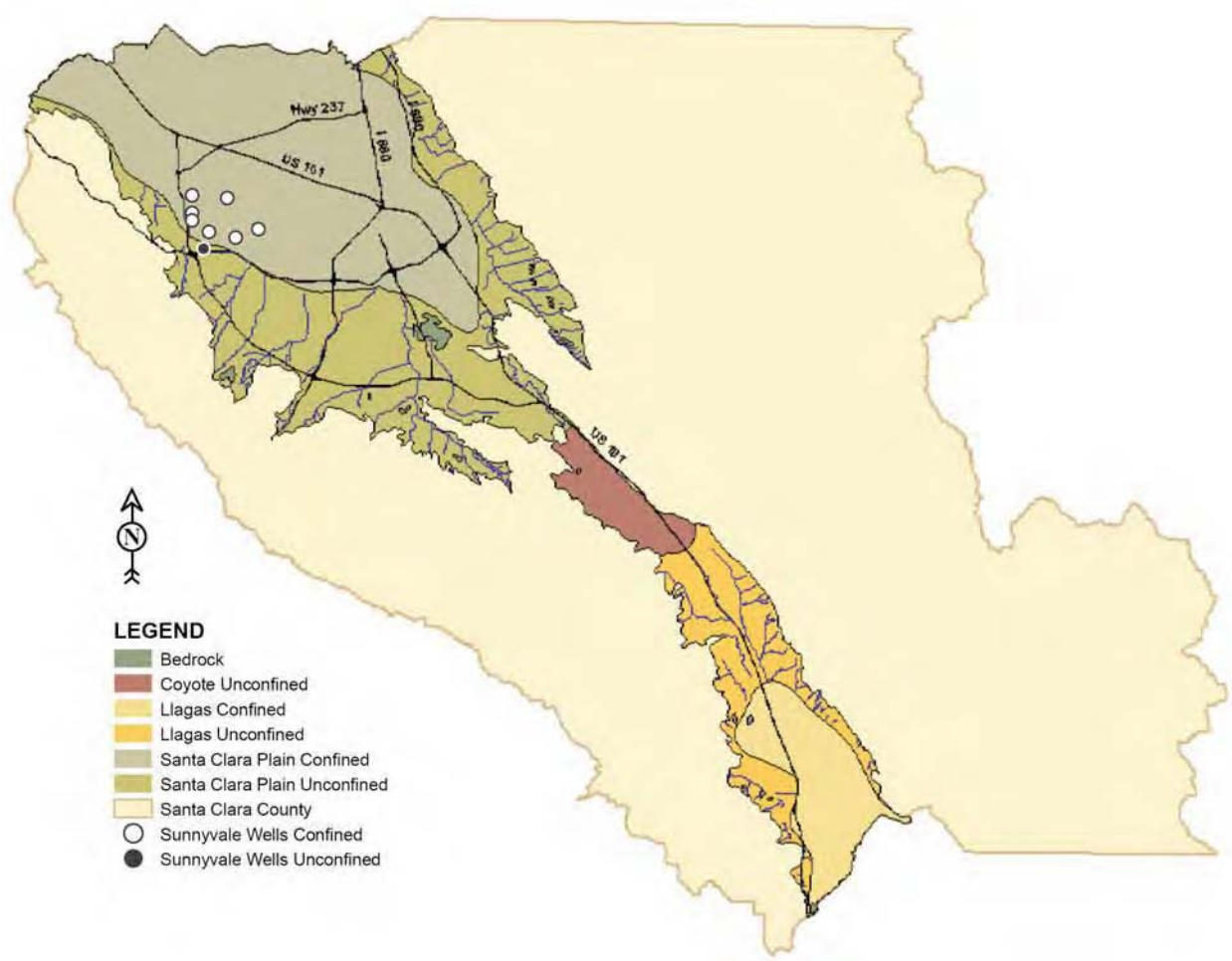
The City is currently connected to the cities of Cupertino, Mountain View and Santa Clara and to California Water Service Company through service connections located within Sunnyvale for use during emergency situations.

Table 4-5: Transfer and Exchange Opportunities [1]

Transfer Agency	Transfer or Exchange	Short Term or Long Term	Proposed Volume (gpm)
City of Cupertino	Emergency Transfer	Short Term	0
City of Mountain View	Emergency Transfer	Short Term	0
City of Santa Clara	Emergency Transfer	Short Term	0
California Water Service Company	Emergency Transfer	Short Term	0

1. The City is not proposing to transfer or exchange any water other than in the case of emergency.

Figure 4-2: Santa Clara County Groundwater Basin and City Groundwater Wells



The majority of the transfer/exchange opportunities are managed by the wholesalers, SFPUC and SCVWD. In general, SFPUC has the ability to purchase additional water from the Tuolumne River and those sellers south of the Delta with water rights or entitlements to water diverted from the Delta. Water can also be purchased upstream of the Delta from sellers along the Sacramento, Feather, Yuba, American and San Joaquin Rivers and their tributaries.

SCVWD routinely uses short-term water transfers to increase water supplies in times of shortage. At present, SCVWD has two long-term transfer agreements, one entered into in 1998 with both the Pajaro Valley Water Management Agency and the Westlands Water District, and another entered into in 2010 with the Patterson Irrigation District. Details of these agreements can be found in Section 5 of this Plan. In addition, details regarding wholesaler transfers and exchanges can be found in each individual wholesaler's UWMP.

4.6 DESALINATED WATER OPPORTUNITIES

Both SFPUC and SCVWD are working together with the East Bay Municipal Utilities District, Contra Costa Water District, and theZone 7 Water Agency as the Bay Area Regional Desalination Project (BARDP). BARDP may consist of one or more desalination facilities that would remove salt from seawater or other brackish water sources, with an ultimate total combined capacity of up to 80 MGD. Desalination would provide a potential potable water supply for municipal and industrial use. The goals are to:

- Increase supply reliability by providing water supply when needed from a regional facility.
- Provide additional source of water during emergencies such as earthquakes or levee failures.
- Provide a supplemental water supply source during extended droughts.
- Allow other major facilities, such as treatment plants, water pipelines, and pump stations, to be taken out of service for maintenance or repairs.

Pre-feasibility studies and pilot testing have been completed. It is estimated that the environmental study will be completed by 2012 followed by design and permitting in 2013 and construction completed by 2015. Additional details regarding desalinated water opportunities can be found in the SFPUC and SCVWD UWMPs.

4.7 RECYCLED WATER OPPORTUNITIES

The City of Sunnyvale has developed a recycled water program which today serves parks, golf courses and the landscaping needs of diverse industries. A wastewater reclamation program was developed in 1991 when the City first identified short-term goals of recycling wastewater of 20% to 30% of high-quality effluent from the Sunnyvale Water Pollution Control Plant (Plant). The long-term goal of the City is to reuse 100% of all wastewater (15 MGD) generated from the Plant to reduce all flows to the bay, as stated in the 2000 Recycled Water Master Plan.. This goal, if attained, would involve the export of water to a location or agency outside the City limits. The Plant has a design flow capacity of 29.5 MGD for treatment of wastewater from the City.

The City has completed Phases I and II of the 2000 Recycled Water Master Plan, which now serves Baylands Park, Lockheed/Martin Area, the Sunnyvale Municipal Golf Course, and other parks and industrial areas in the northern part of the City. A storage tank was built in the Year 2000 to allow for more recycled water to be developed and stored in order to keep up with demand on the system once the area is built out. Possible extensions to serve the south end of the City and also Cupertino and Los Altos may be evaluated in the future.

4.7.1. Treatment and Disposal of Wastewater

The Plant is located at 1444 Borregas Avenue and is designed for an ultimate flow capacity of 29.5 MGD, though current flows through the plant average approximately 15 MGD. The amount of influent wastewater handled by the Plant varies with the time of day and with the seasonal changes in demand.

The Plant collects wastewater from the sanitary sewer system which must then be treated before it can be discharged to the lower San Francisco Bay. This treatment occurs at the Plant, which is an advanced tertiary treatment plant consisting of the following processes:

- Primary Treatment (Sedimentation)
- Secondary Treatment (Oxidation)
- Tertiary Treatment (Filtration and Disinfection)

These processes provide treatment to a level that will meet NPDES discharge requirements. Most of the treated water is discharged to the south San Francisco Bay via the Guadalupe slough. Approximately 10% of the Plant flow is treated to a higher level to meet the necessary recycled water quality, and is delivered to customers for non-potable uses, primarily irrigation.

Sunnyvale has experienced a slight decrease in Plant influent over the past five years, but anticipates a steady level of 15 MGD for plant influent over the next 25 years.

Table 4-6 presents the total amount of wastewater that is collected and treated as well as the amount that is treated to meet recycled water standards. This information is projected out to 2035.

Table 4-6: Recycled Water – Wastewater Collection and Treatment (AFY)

Type of Wastewater	2005	2010	2015	2020	2025	2030	2035
Total wastewater collected and treated	17,016	15,515	19.212	19,324	19,548	19,548	19,548
Volume that meets recycled water standard	811	866	1,105	1,411	1,800	2,298	2,298

Table 4-7 describes the wastewater disposal method used other than for recycled water.

Table 4-7: Non-Recycled Wastewater Disposal (AFY)

Method of Disposal	Treatment Level	2010	2015	2020	2025	2030	2035
South San Francisco Bay	Tertiary	865	1,129	1,443	1,817	2,267	2,267

4.8 POTENTIAL AND PROJECTED USE, OPTIMIZATION PLAN WITH INCENTIVES

4.8.1. Water Recycling Program

The California Water Code requires the use of recycled water in place of potable water whenever it is economically and technically feasible. Recycled water is also a reliable source of supply for non-potable uses during a drought.

With the State of California growing at a rate of 2% a year and the Santa Clara County area growing at 6% a year, it is necessary to look to alternative supplies to help augment existing limited water supplies in the County. Significant water reuse can also provide an alternative to unrestricted discharge, thereby helping to comply with discharge requirements, while at the same time avoiding the costs required to build new wastewater treatment facilities.

4.8.2. Current Uses of Recycled Water- Completed Projects

The City has completed Phase I and some of Phase II (IIa and IIb) of the Recycled Water Master Plan. The Baylands Park distribution facilities were first constructed during Phase I of the program. The pipelines consist of 24,200 feet of pipe ranging from 12-inch to 36-inch lines extending from the Plant east to Baylands Park and west to the Sunnyvale Golf Course. Recycled water deliveries to these two locations began during the summer of 1996. Work later progressed to include remaining targeted customers including Lockheed/Martin, Sunnyvale SMaRT© Station, and the Caltrans interchange at US101 and SR237. Phase I also included pipelines to connect the Moffett Golf Course and could possibly serve the NASA/Ames Research Center in the near future.

Phase IIa pipelines include 34,000 feet of piping to serve landscape uses in the Moffett Park Area north of Highway 237 plus the first 3,000 feet of the 24-inch "east main" connection which extends south from Caribbean Drive. This phase of the project was completed in October 1996. Approximately 140 potential customers have been identified in the Phase IIa area, with a total demand of 0.41 MGD.

Phase IIb pipeline completes the 24-inch transmission main between Caribbean Drive and Kifer Avenue. A two million-gallon storage tank has been constructed to hold recycled water at Wolfe Road and Kifer Avenue.

Table 4-8 compares the actual 2010 uses of recycled water to the projected uses in the 2005 UWMP.

Table 4-8: Recycled Water – 2005 UWMP use projection compared to 2010 actual (AFY)

User Type	2010 Actual Use	2005 Projection for 2010
Landscape	761	775
Wildlife Habitat	0	0
Other (WPCP operations)	657	900
Other (Hydrants)	14	5
Total	**1,432**	**1,680**

4.8.3. Benefits of Recycled Water

The use of recycled water provides for the following benefits:

- Potable water users benefit since more water becomes readily available for the potable supply.
- All Sunnyvale residents benefit from securing a long-term adequate water supply to sustain economic growth and ensure public health.
- Recycled water users benefit by avoiding strict conservation requirements and water use restrictions during times of drought and by paying less than the cost of potable water.
- All water users benefit from bringing in another water source to augment supplies.
- Area wetlands benefit from reduced fresh water discharges into the saline wetlands.

4.8.4. Recycled Water Optimization

The City of Sunnyvale recycled water program is designed to distribute recycled water throughout the City for irrigation of schools, parks, golf courses, and businesses. The recycled water distribution system currently consists of approximately 43,000 feet of 12-inch through 36-inch transmission mains (possible future extensions) and over 34,000 feet of 8-inch distribution lines. Areas in Sunnyvale served by the system are shown in **Figure 4-3**.

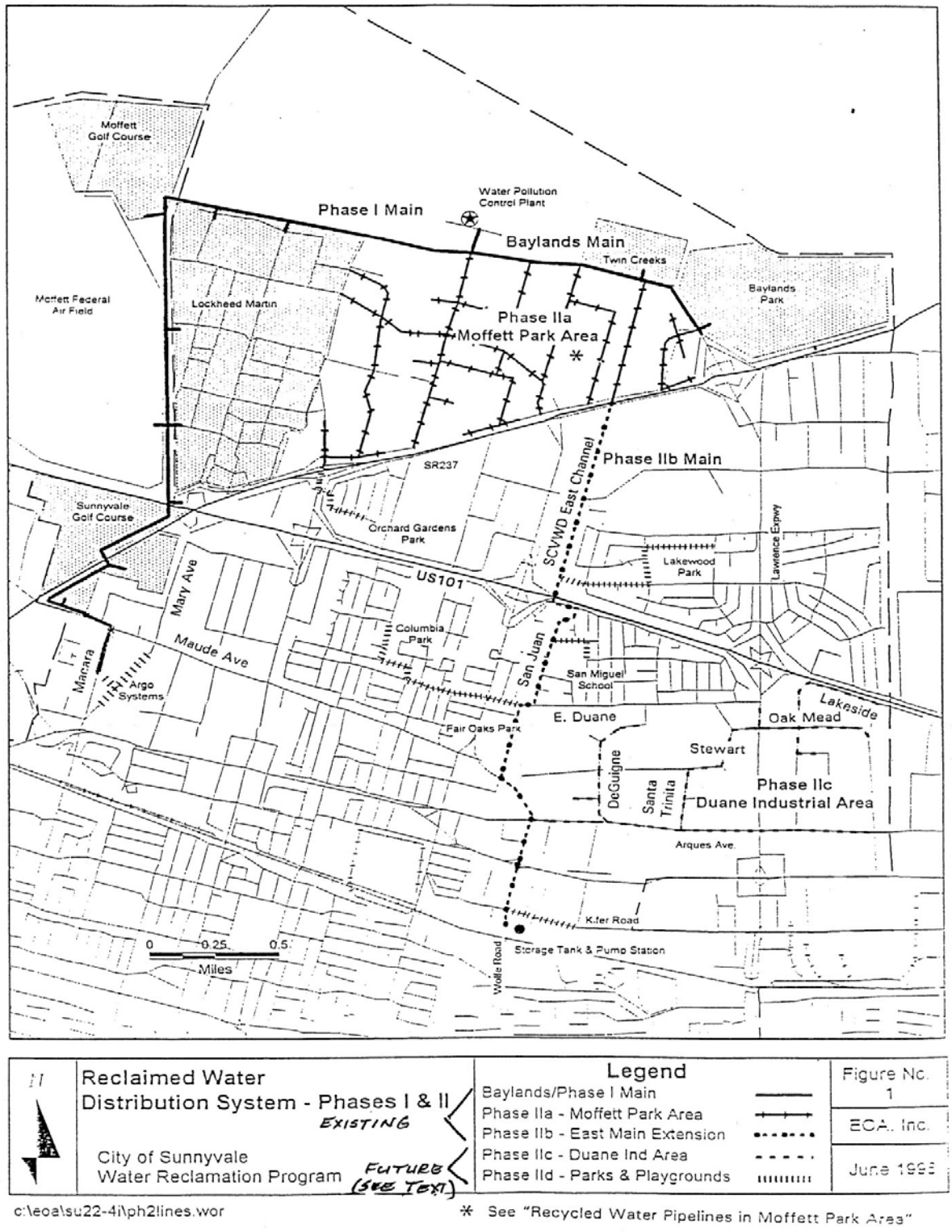
The Phase IIb Main pipeline and Phase II Pumping and Storage Facilities located at Wolfe Road and Kifer Avenue are complete. The storage tank at Kifer Avenue created two million gallons of recycled water storage to assist in meeting demands on the system. Pipelines designated as Phase IIc and Phase IId on **Figure 4-3** represent possible future extensions of the system.

Estimates of recycled water demand for sites within the City are based on actual or projected irrigation use, as determined by the review of City water billing records. For sites outside Sunnyvale, estimates are based on the facility area or by comparison to other similar sites within the City. Pipeline alignments were selected to minimize overall piping requirements, and to accommodate a phased approach to construction. **Table 4-9** lists the potential future use of recycled water.

Table 4-9: Recycled Water – Potential Future Use (AFY)

Use Type	Description	2015	2020	2025	2030	2035
Irrigation	Parks, Golf Course, Schools, etc.	870	870	870	870	870
Industrial	Cooling Towers, Environ-mental Enhancements	2	3	3	3	3
Wildlife Habitat	Stream Flow Augmentation	0	0	5	5	5
Other (WPCP)		806	905	900	900	900
Other (Hydrants)		2	2	2	2	2
	Total	**1,680**	**1,780**	**1,780**	**1,780**	**1,780**

Figure 4-3: Recycled Water System with Potential Future Extensions



4.8.5. Recycled Water Incentives

The City promotes the use of recycled water through its price structure. Recycled water is priced at 90 percent of the prevailing, first-tier potable water rate. The City intends to continue this financial incentive in the foreseeable future, as possible.

Division 7, Chapter 7 of the California Water Code, known as the Water Recycling Law, provides a legal basis for mandating the use of recycled water. The law states that the use of potable water for non-potable purposes (including irrigation) constitutes a waste or unreasonable use of water if recycled water of suitable quality is available at reasonable cost. Based on State law, some jurisdictions have implemented "mandatory use" policies through local ordinance. Sunnyvale's use of the market technique of providing recycled water at a 10 percent discount and assistance in making on-site modifications (retrofits), along with an active public education process and a user-friendly permit process have resulted in significant expansion of the system. With few exceptions, the pricing policy has been successful in encouraging prospective users to convert to the limited use of recycled water in those areas where it is available. A re-occurrence of drought conditions could be expected to further enhance interest in recycled water.

Table 4-10: Methods Used to Encourage Recycled Water Use

Methods	Check if Used
Retrofit assistance	X
Grants	
Dual plumbing standards	X
Permit process enhancement	X
Regional planning	
Incentive program	
Long-term contracts (price/reliability)	
Pricing policy (i.e. rate discounts)	X
Prohibit specific fresh water uses	
Low-interest loans	
Public education/information	X
Require recycled water use	

4.8.6. Projected Future Uses of Recycled Water

The remaining phases will be developed as part of the City's Capital Improvement Program (CIP), in coordination with all other water and infrastructure needs.

For instance, Phase IIc was proposed for the East Duane Industrial area. Demand in this area has been measured at approximately 0.6 MGD. However, this area is involved in redevelopment to high density residential, and the potential potable and non-potable uses will need to be reevaluated.

Phase IId would consist of constructing 20,000 feet of 8-inch distribution piping from Phase I and Phase IIb mains to serve several City parks and industrial customers adjacent to Phase I and Phase IIb. Sites include Orchard Park, Fair Oaks Park, Columbia Park, Lakewood Park, San Miguel Playground, and several users on Kifer Avenue. The estimated demand is approximately 0.12 MGD.

Southwest Sunnyvale, via the West Main, would require an extension of the west main southward from Sunnyvale Golf Course and would permit service to parks, playgrounds, City landscape, industrial customers, and homeowner associations located in the southwest portion of Sunnyvale. Major users would include Cannery Park, De Ana Park and School, Las Palmas Park, San Antonio Park, Serra Park, Washington Park, Fremont High School, Mango School, Sunnyvale Civic Center, shopping centers at Washington and Mary and Mary and Fremont, Woodgate and Sunset Homeowners Associations (HOAs) and other HOAs located just off Sunnyvale-Saratoga Road south of Fremont Avenue. The total recycled water demand for this phase is estimated to be 0.45 MGD. Approximately 14 miles of pipeline to include a 12-inch main and 4-inch to 8-inch distribution piping would be required.

Southeast Sunnyvale, via the East Main, would permit use at additional parks, playgrounds, City landscape, industrial customers, and HOAs. Major users would include Sunken Gardens Golf Course, Peterson High School, Ortega Park, Columbia Park, Murphy Park, Raynor Park, the Sunnyvale Community Center, Ellis School, Palmer College, Sunset Oaks HOA, Roundtree HOA, IKOS, Signetics, Town Center, Westinghouse and the shopping area at Wolfe/Reed/Old San Francisco Road area. The total recycled water demand is estimated to be 0.74 MGD. Approximately 14 miles of pipeline to include a 12-inch main and 4-inch to 8-inch distribution piping would be required.

4.8.7. Los Altos and Cupertino Areas

Further extension of the east and west mains to sites outside the City limits would reach a number of potential customers in the Cupertino and Los Altos areas as indicated in Figure 5.31. The estimated recycled water demand in this area is approximately 1.2 MGD.

4.8.8. Technical and Economic Feasibility of Future Recycled Water Projects

Landscape irrigation: Opportunities for the expanded use of recycled water for irrigation are ultimately limited by the total City-wide irrigation demand and the seasonal nature of such demand. The total irrigation demand, including residential use, is estimated to be in the range of 5-6 MGD on an average annual basis. Service to individual residences is not practical from a cost or administrative standpoint, although service to apartment complexes and homeowners associations (HOAs) may be feasible. Excluding individual residences, the total potential City-wide irrigation demand is approximately 3.4 MGD; demand on a peak summer day may be two to three times this amount. However, because of the high cost of pipelines and other infrastructure, not all of this demand can be served in a cost effective manner. The larger sites (primarily City parks) provide the main driver for expansion of the distribution network.

Industrial/Commercial Process Use: Recycled water is a suitable source of water for a variety of commercial/industrial processes, including use in cooling towers, wet scrubbers, boilers, car washes, commercial laundries, and other processes. To date, such uses have not developed to

any significant degree in Sunnyvale. Nevertheless, the City will continue to encourage such non-irrigation uses.

4.8.9. Recycled Water Streamflow Augmentation and Groundwater Recharge

Non-irrigation uses such as streamflow augmentation and groundwater recharge represent long-term options and solutions that could potentially accommodate large amounts of recycled water flow. Such activities are being evaluated by SCVWD, in its capacity as the groundwater management agency for Santa Clara County. SCVWD has initiated a public outreach program to assess public acceptance. SCVWD also intends to form a technical committee to evaluate water quality issues as it relates to the use of recycled water for groundwater recharge. Studies to be conducted by SCVWD will provide recommendations on treatment technologies and alternatives, conveyance and storage systems, project capital and operating costs, and permitting requirements.

4.8.10. Recycled Water Coordination

Since the early 1990s, the City of Sunnyvale has produced and sold recycled water for non-potable purposes in the northern part of the City service area. A separate master plan was developed for recycled water, detailing the level of treatment, types of uses, and possible expansion phases for the provision of recycled water throughout the City. From 1993 to 2008, the SCVWD provided financial assistance and support by underwriting some of the operational costs for the City's recycled water system. This assistance was provided in acknowledgement of the savings to the SCVWD by avoiding the need to purchase new sources of water that might otherwise be necessary without the benefit of recycled water to substitute for potable water for non-potable uses.

CDPH and the State Water Resources Control Board regulate the production and use of recycled water in the State of California. The City provides all required reports, as mandated, including a Recycled Water Program Master Plan (2000), and Recycled Water Annual Reports. Recycled water provided by the City meets the requirements of California Code of Regulations Title 22 as disinfected tertiary treated water.

4.9 FUTURE WATER PROJECTS

The City's water supply comes mainly from the two wholesale providers, SCVWD and SFPUC. Groundwater is typically used to offset peak daily demands and for emergency purposes such as drought conditions and wholesale water service interruptions. As such, as a water retailer, Sunnyvale has no current capital projects that would add new potable water supply. The 20-year budget includes a groundwater well study that will look into the need to drill additional wells. If the study concludes that the City would benefit from more groundwater wells, a project may be set up at that time.

SECTION 5 – WATER SUPPLY RELIABILITY & WATER SHORTAGE CONTINGENCY PLANNING

5.1 WATER SUPPLY RELIABILITY

5.1.1. Reliability of Well Water

Protecting the local groundwater basins is critical to maintaining water supply reliability in the County of Santa Clara, especially when random risks are considered. The basins supply nearly half of the water used annually in the County and also provide emergency reserve for droughts or outages.

SCVWD's Groundwater Management Plan ensures that local groundwater resources are sustained and protected. Groundwater management encompasses activities and programs that identify and mitigate contamination threats to the groundwater basin, replenish and recharge groundwater supplies, prevent groundwater overdraft and land subsidence, and sustain storage reserves. SCVWD programs to sustain and protect groundwater resources are described in detail in the SCVWD's Groundwater Management Plan of 2001 included as **Appendix E** of this document.

5.1.2. Reliability of Treated Water Provided by SCVWD

To maintain water supply reliability and flexibility, SCVWD's water supply includes a variety of sources including local groundwater, imported water and local surface water. SCVWD has an active conjunctive water management program to optimize the use of groundwater and surface water, and to prevent groundwater overdraft and land subsidence.

Several factors have the potential to negatively impact reliability, including: hydrologic variability, climate change, invasive species, infrastructure failure, regulatory actions as well as institutional, political and other uncertainties. Hydrologic uncertainties influence the projections of both local and imported water supplies and the anticipated reliability of those supplies. Supply analyses performed by SCVWD are based on the assumption of historical patterns of precipitation. The development of SCVWD projects and programs to meet future needs takes hydrologic variability and climate change into account.

Under any climate change scenario, SCVWD may need to consider additional treatment options to respond to water quality impacts associated with increased salinity in the Delta. SCVWD may also need to consider additional storage to take advantage of more wet-season water, additional supplies to replace reduced water supply from existing sources, and additional water transfers (depending on water market impacts).

In determining the long-range availability of water, consideration must be given to the vulnerability of imported supplies to the effects of prolonged state-wide drought and environmental impacts. Reductions by DWR or the U.S. Bureau of Reclamation (USBR) to SCVWD allocations of State Water Project (SWP) or Central Valley Project (CVP) – San Felipe Division water may result in a temporary supply shortfall for the City and other SCVWD retailers.

Water demands could be met with groundwater, additional imported water supply, water conservation measures, and with expanded recycled water use.

SCVWD obtains its local and imported water supplies from a variety of sources to maintain maximum efficiency, flexibility, and reliability. SCVWD augments natural groundwater recharge with a managed recharge program to offset groundwater pumping, sustain storage reserves, and minimize the risk of land subsidence. Through these recharge activities, SCVWD works to keep groundwater basins "full" to protect against drought. Storing surplus water in the groundwater basins enables part of the supply to be carried over from wet years to dry years. SCVWD also has a contract for 100,000 AFY from the SWP, and 152,500 AFY from the CVP. However, the actual amount of water delivered is typically significantly less than these contractual amounts and depends on hydrology, conveyance limitations, and environmental regulations, including regulatory constraints to protect water quality as well as aquatic wildlife. On a long-term average basis, 83% of the CVP supply is delivered for municipal and industrial use, and 17% is delivered for irrigation use. SCVWD routinely acquires supplemental imported water to meet the county's needs from the water transfer market, water exchanges, and groundwater banking activities.

In May 1996, SCVWD approved an agreement with Semitropic Water Storage District (Semitropic) to store 45,000 AF of SWP water in Semitropic's groundwater basin on behalf of SCVWD. In 1997, SCVWD approved a long-term agreement with Semitropic. In the fourteen years since this agreement was approved, SCVWD has banked water in ten of the years, while withdrawing water in only four. The agreement allows SCVWD to maximize the economic value of its imported water contracts by fully utilizing water that might otherwise have to be turned back to the SWP or CVP. For example, in 2006, a very wet year, SCVWD was able to store nearly 58,000 AF of imported water for use in future dry years. The total storage capacity available to SCVWD in the Semitropic Water Bank is 350,000 AF and the current storage balance as of May 2010 is 151,123 AF (SCVWD, 2010 UWMP).

If demands are anticipated to reach the upper end of the demand range, SCVWD could consider additional long-term transfers. At present, SCVWD has two agreements that are classified as long-term transfers. In 1998, SCVWD and two other agencies (Pajaro Valley Water Management Agency and Westlands Water District) jointly participated in the permanent assignment of 6,260 AF from Mercy Springs Water District, an agricultural CVP contractor. Under the agreement, SCVWD has an option for dry-year supplies totaling at least 20,000 AF over a 20-year period. The dry-year option may continue for subsequent terms depending on the future plans of Pajaro Valley Water Management Agency.

In 2010, SCVWD entered into a four-year agreement with Patterson Irrigation District, a contractor in the San Joaquin Valley with a reliable CVP supply based on their San Joaquin River water rights. The total amount that will be transferred over the term of the agreement is 13,350 AF, with flexible annual deliveries of at least 4,000 AF.

5.1.3. Reliability of Treated Water Provided by SFPUC

The amount of imported water available to the SFPUC's retail and wholesale customers is constrained by hydrology, physical facilities, and the institutional parameters that allocate the water supply of the Tuolumne River. Due to these constraints, the SFPUC is very dependent on reservoir storage to ensure the reliability of its water supplies.

The SFPUC serves its retail and wholesale water demands with an integrated operation of local Bay Area water production and imported water from Hetch Hetchy. In practice, the local watershed facilities are operated to capture local runoff. The following describes allocation of SFPUC water supply during drought conditions.

5.1.3.1 Water Shortage Allocation Plan

In July 2009, in connection with the WSA, the wholesale customers and the City of San Francisco adopted a Water Shortage Allocation Plan (WSAP) to allocate water from the regional water system to retail and wholesale customers during system-wide shortages of up to 20% (the "Tier One Plan"). The Tier One Plan replaced the prior Interim WSAP, adopted in 2000, which also allocated water during shortages up to 20%. The Tier One Plan also allows for voluntary transfers of shortage allocations between SFPUC and any wholesale customer and between wholesale customers themselves. In addition, water "banked" by a wholesale customer, through greater than required reductions in usage, may also be transferred.

Tier One Drought Allocations

The Tier One Plan, which allocates water between San Francisco and the wholesale customers collectively, distributes water based on the level of shortage:

Table 5-1: Distribution of Water Based on Level of System-Wide Reduction

Level of System Wide Reduction in Water Use Required	Share of Available Water	
	SFPUC Share	Wholesale Customers Share
5% or less	35.5%	64.5%
6% through 10%	36.0%	64.0%
11% through 15%	37.0%	63.0%
16% through 20%	37.5%	62.5%

The Tier One Plan will expire at the end of the term of the WSA, unless extended by San Francisco and the wholesale customers.

Tier Two Drought Allocations

The wholesale customers have negotiated and adopted the "Tier Two Plan," the second component of the WSAP which allocates the collective wholesale customer share among each of the 26 wholesale customers. This Tier Two allocation is based on a formula that takes multiple factors into account for each wholesale customer, including:

- Individual Supply Guarantee;
- Seasonal use of all available water supplies; and
- Residential per capita use.

The water made available to the wholesale customers collectively will be allocated among them in proportion to each wholesale customer's Allocation Basis, expressed in million gallons per day (MGD), which in turn is the weighted average of two components. The first component is

the wholesale customer's Individual Supply Guarantee, as stated in the WSA, and is fixed. The second component, the Base/Seasonal Component, is variable and is calculated using the monthly water use for three consecutive years prior to the onset of the drought for each of the wholesale customers for all available water supplies. The second component is accorded twice the weight of the first, fixed component in calculating the Allocation Basis. Minor adjustments to the Allocation Basis are then made to ensure a minimum cutback level, a maximum cutback level, and a sufficient supply for certain wholesale customers.

The Allocation Basis is used in a fraction, as numerator, over the sum of all wholesale customers' Allocation Bases to determine each wholesale customer's Allocation Factor. The final shortage allocation for each wholesale customer is determined by multiplying the amount of water available to the wholesale customers collectively under the Tier One Plan, by the wholesale customer's Allocation Factor.

The Tier Two Plan requires that the Allocation Factors be calculated by BAWSCA each year in preparation for a potential water shortage emergency. As the wholesale customers change their water use characteristics (e.g., increases or decreases in SFPUC purchases and use of other water sources, changes in monthly water use patterns, or changes in residential per capita water use), the Allocation Factor for each wholesale customer will also change. However, for long-term planning purposes, each wholesale customer shall use as its Allocation Factor, the value identified in the Tier Two Plan, when adopted. The Tier Two Plan will expire in 2018 unless extended by the wholesale customers.

5.1.3.2 Water System Improvement Program

In order to enhance the ability of the SFPUC water supply system to meet identified service goals for water quality, seismic reliability, delivery reliability, and water supply, the SFPUC has undertaken the Water System Improvement Program (WSIP), approved October 31, 2008. The WSIP will deliver capital improvements aimed at enhancing the SFPUC's ability to meet its water service mission of providing high quality water to customers in a reliable, affordable and environmentally sustainable manner. Many of the water supply and reliability projects evaluated in the WSIP were originally put forth in the SFPUC's Water Supply Master Plan (2000).

A Program Environmental Impact Report (PEIR) was prepared in accordance with the California Environmental Quality Act for the WSIP. The PEIR, certified in 2008, analyzed the broad environmental effects of the projects in the WSIP at a program level and the water supply impacts of various alternative supplies at a project level. Individual WSIP projects are also undergoing project specific environmental review as required.

In approving the WSIP, SFPUC adopted a Phased WSIP Variant for water supply that was analyzed in the PEIR. This Phased WSIP Variant established a mid-term water supply planning milestone in 2018 when SFPUC would reevaluate water demands through 2030. At the same meeting, SFPUC also imposed the Interim Supply Limitation, which limits the volume of water that the member agencies and San Francisco can collectively purchase from Regional Water System (RWS) to 265 MGD until at least 2018. Although the Phased WSIP Variant included a mid-term water supply planning milestone, it did include full implementation of all proposed WSIP facility improvement projects to insure that the public health, seismic safety, and delivery reliability goals were achieved as soon as possible.

As of July 1, 2010, the WSIP was 27% complete overall, with the planning and design work over 90% complete. The WSIP is scheduled to be completed in December 2015.

Interim Supply Limitation

As part of its adoption of the WSIP, SFPUC adopted a water supply element, the Interim Supply Limitation (ISL), to limit sales from the RWS watersheds to an average of 265 MGD annually through 2018. The wholesale customers' collective allocation under the ISL is 184 MGD and San Francisco's is 81 MGD. Although the wholesale customers did not agree to the ISL, the WSA provides a framework for administering the ISL. Strategies to address wholesale customers' unmet needs resulting from the ISL are discussed in greater detail below.

Interim Supply Allocations

The Interim Supply Allocations (ISAs) refer to each individual wholesale customer's share of the ISL. On December 14, 2010, SFPUC established each agency's ISA through 2018. In general, SFPUC based the allocations on the lesser of the projected fiscal year 2017-18 purchase projections or Individual Supply Guarantees. The ISAs are effective only until December 31, 2018 and do not affect the Supply Assurance or the Individual Supply Guarantees. Sunnyvale's ISA is 9.44 MGD.

As stated in the WSA, the wholesale customers do not concede the legality of SFPUC's establishment of the ISAs and Environmental Enhancement Surcharge, discussed below, and expressly retain the right to challenge either or both, if and when imposed, in a court of competent jurisdiction.

Environmental Enhancement Surcharge

SFPUC plans to establish the Environmental Enhancement Surcharge concurrently with the budget-coordinated rate process. This surcharge will be unilaterally imposed by SFPUC on individual wholesale customers, and SFPUC retail customers, when each agency's use exceeds their ISA and when sales of water to the wholesale customers and City of San Francisco retail customers, collectively, exceeds the Interim Supply Limitation of 265 MGD.

The SFPUC is in the process of developing the methodology and amount of this volume-based charge. The Environmental Enhancement Surcharge will become effective beginning fiscal year 2011-12.

5.1.3.3 Water Conservation Implementation Plan

In September 2009, BAWSCA completed the Water Conservation Implementation Plan (WCIP). The goal of the WCIP is to develop an implementation plan for BAWSCA member agencies to attain the water efficiency goals that the agencies committed to in 2004 as part of the PEIR. The WCIP's goal was expanded to include identification of how BAWSCA member agencies could use water conservation as a way to continue to provide reliable water supplies to their customers through 2018 given the SFPUC's 265 MGD ISL. SFPUC imposed the ISL on October 31, 2008, to limit the volume of water that the BAWSCA member agencies and City of San Francisco can collectively purchase from the RWS to 265 MGD until at least 2018.

Based on the WCIP development and analysis process, BAWSCA and its member agencies identified five new water conservation measures, which, if implemented fully throughout the BAWSCA service area, could potentially save an additional 8.4 MGD by 2018 and 12.5 MGD by 2030. The demand projections for the BAWSCA member agencies, as transmitted to SFPUC on June 30, 2010, indicate that collective purchases from SFPUC will stay below 184 MGD through 2018 as a result of revised water demand projections, the identified water conservation savings, and other actions.

Several member agencies have elected to participate in the BAWSCA regional water conservation programs and BAWSCA continues to work with individual member agencies to incorporate the savings identified in the WCIP into their future water supply portfolios with the goal of maintaining collective SFPUC purchases below 184 MGD through 2018.

5.1.3.4 Long Term Reliable Water Supply Strategy

BAWSCA's water management objective is to ensure that a reliable, high quality supply of water is available where and when people within the BAWSCA service area need it. A reliable supply of water is required to support the health, safety, employment, and economic opportunities of the existing and expected future residents in the BAWSCA service area and to supply water to the agencies, businesses, and organizations that serve those communities. BAWSCA is developing the Long-Term Reliable Water Supply Strategy (Strategy) to meet the projected water needs of its member agencies and their customers through 2035 and to increase their water supply reliability under normal and drought conditions.

The Strategy is proceeding in three phases. Phase I was completed in 2010 and defined the magnitude of the water supply issue and the scope of work for the Strategy. Phase II of the Strategy is currently under development and will result in a refined estimate of when, where, and how much additional supply reliability and new water supplies are needed throughout the BAWSCA service area through 2035, as well as a detailed analysis of the water supply management projects, and the development of the Strategy implementation plan. Phase II will be complete by 2013. Phase III will include the implementation of specific water supply management projects. Depending on cost-effectiveness, as well as other considerations, the projects may be implemented by a single member agency, by a collection of the member agencies, or by BAWSCA in an appropriate timeframe to meet the identified needs. Project implementation may begin as early as 2013 and will continue throughout the Strategy planning horizon, in coordination with the timing and magnitude of the supply need.

The development and implementation of the Strategy will be coordinated with the BAWCSA member agencies and will be adaptively managed to ensure that the goals of the Strategy (i.e., increased normal and drought year reliability) are efficiently and cost-effectively being met.

5.2 FACTORS AFECTING WATER SUPPLY

In addition to droughts, there are other threats to sources of water supply. Sunnyvale relies on their diversification of water supply, continuous work with SFPUC and SCVWD, demand management strategies as discussed in Chapter 6, and the Water Resources Sub-element of the General Plan (included in **Appendix F**) to address these threats.

5.2.1. Global Climate Change

The issue of climate change has become an important factor in water resources planning in the State, and is frequently being considered in urban water management planning activities, though the extent and precise effects of climate change remain uncertain. As described by the SFPUC in its Final Water Supply Availability Study for the City and County of San Francisco, dated October 2009, there is evidence that increasing concentrations of greenhouse gases have caused and will continue to cause a rise in temperatures around the world, which will result in a wide range of changes in climate patterns. Moreover, there is evidence that a warming trend occurred during the latter part of the 20th century and will likely continue through the 21st century. These changes will have a direct effect on water resources in California, and numerous studies have been conducted to determine the potential impacts to water resources. Based on these studies, climate change could result in the following types of water resource impacts, including impacts on the watersheds in the Bay Area:

- Reductions in the average annual snowpack due to a rise in the snowline and a shallower snowpack in the low and medium elevation zones, such as in the Tuolumne River basin, and a shift in snowmelt runoff to earlier in the year;
- Changes in the timing, intensity and variability of precipitation, and an increased amount of precipitation falling as rain instead of as snow;
- Long-term changes in watershed vegetation and increased incidence of wildfires that could affect water quality;
- Sea level rise and an increase in saltwater intrusion;
- Increased water temperatures with accompanying potential adverse effects on some fisheries and water quality;
- Increases in evaporation and concomitant increased irrigation need; and
- Changes in urban and agricultural water demand.

According to the SFPUC (2009), other than the general trends listed above, there is no clear scientific consensus on exactly how climate change will quantitatively affect the state's water supplies, and current models of water systems in California generally do not reflect the potential effects of climate change.

Initial climate change modeling completed by SFPUC indicates that about seven percent of runoff currently draining into Hetch Hetchy Reservoir will shift from the spring and summer seasons to the fall and winter seasons in the Hetch Hetchy basin by 2025. This percentage is within the current inter-annual variation in runoff and is within the range accounted for during normal runoff forecasting and existing reservoir management practices. The predicted shift in runoff timing is similar to the results found by other researchers modeling water resource impacts in the Sierra Nevada due to warming trends associated with climate change.

The SFPUC has stated that based on this preliminary analysis, the potential impacts of climate change are not expected to affect the water supply available from the San Francisco RWS or the overall operation of the RWS through 2030.

SFPUC views the assessment of the effects of climate change as an ongoing project requiring regular updating to reflect improvements in climate science, atmospheric/ocean modeling, and human response to the threat of greenhouse gas emissions. To refine its climate change analysis and expand the range of climate parameters being evaluated, as well as expand the timeframes being considered, the SFPUC is currently undertaking two additional studies. The first utilizes a newly calibrated hydrologic model of the Hetch Hetchy watershed to explore sensitivities of inflow to different climate change scenarios involving changes in air temperature and precipitation. The second study will seek to utilize state-of-the-art climate modeling techniques in conjunction with water system modeling tools to more fully explore potential effects of climate change on the SFPUC water system as a whole. Both analyses will consider potential effects through the year 2100.

5.2.2. Delta Pumping Restrictions

Increases in average temperature due to climate change are generally agreed upon and the impacts of increasing temperature have already been observed. Climate change effects on precipitation are more difficult to predict, with some models forecasting less rainfall for the state and some models forecasting more rainfall. Regardless of the impacts on the total amount of precipitation, rises in average temperature will increase sea level and decrease the snow pack—by far the largest surface water "storage" facility in California. Decreased snow pack and projected earlier spring melts will reduce the amount of water available to meet peak demands in late spring and summer. These changes could decrease imported water and possibly local water supplies, while increasing salinity in the Delta, adversely impacting water quality and Bay-Delta ecosystems.

Based on the SWP Delivery Reliability Report 2009 and associated CALSIM II modeling results, projected imported supplies under climate change conditions from the Delta for average, normal year, dry year and multiple dry years, Delta imports are reduced by three percent on average and four percent over the multiple dry year period compared to the analysis performed without climate change (SCVWD, 2010 UWMP).

5.2.3. Natural Disasters

Disasters such as earthquakes could threaten water delivery infrastructure. SFPUC and SCVWD are taking steps to ensure water supply reliability. Following San Francisco's experience with the 1989 Loma Prieta Earthquake, the SFPUC created a departmental *Emergency Operations Plan* (SFPUC EOP). The SFPUC EOP was originally released in 1992, and has been updated on average every two years. The latest plan update will be released in Spring, 2011. The SFPUC EOP addresses a broad range of potential emergency situations that may affect the SFPUC and that supplements the City and County of San Francisco's EOP prepared by the Department of Emergency Management and most recently updated in 2008. Specifically, the purpose of the SFPUC EOP is to describe the department's emergency management organization, roles and responsibilities and emergency policies and procedures.

In addition, SFPUC divisions and bureaus have their own EOPs that are in alignment with the SFPUC EOP and describe each division's/bureau's specific emergency management organization, roles and responsibilities and emergency policies and procedures. The SFPUC tests its emergency plans on a regular basis by conducting emergency exercises. Through

these exercises the SFPUC learns how well the plans will or will not work in response to an emergency. Plan improvements are based on exercise and sometimes real world event response and evaluation. Also, the SFPUC has an emergency response training plan that is based on federal, state and local standards and exercise and incident improvement plans. SFPUC employees have emergency training requirements that are based on their emergency response role.

5.2.3.1 SFPUC Emergency Drinking Water Planning

In February 2005, the SFPUC Water Quality Bureau published a City Emergency Drinking Water Alternatives report. The purpose of this project was to develop a plan for supplying emergency drinking water in the City after damage and/or contamination of the SFPUC raw and/or treated water systems resulting from a major disaster. The report addresses immediate response after a major disaster. Since the publication of this report, the SFPUC has implemented a number of projects to increase its capability to support the provision of emergency drinking water during an emergency. These projects include:

- Public Information and materials for home and business;
- Designation and identification of 67 emergency drinking water hydrants throughout San Francisco;
- Purchase of emergency related equipment including water bladders and water bagging machines to help with water distribution post disaster; and
- Coordinated planning with City Departments, neighboring jurisdictions and other public and private partners to maximize resources and supplies for emergency response

With respect to emergency response for the SFPUC Regional Water System, the SFPUC has prepared the *SFPUC Regional Water System Emergency Response and Recovery Plan* (ERRP), completed in 2003 and updated in 2006. The purpose of this plan is to describe the SFPUC RWS emergency management organizations, roles and responsibilities within those organizations, and emergency management procedures. This contingency plan addresses how to respond to and to recover from a major RWS seismic event, or other major disaster. The ERRP complements the other SFPUC emergency operations plans at the Department, Division and Bureau levels for major system emergencies.

The SFPUC has also prepared a *SFPUC-Suburban Customer Water Supply Emergency Operations and Notification Plan*. The plan was first prepared in 1996 and has been updated several times, most recently in July of 2010. The purpose of this plan is to provide contact information, procedures and guidelines to be implemented by the following entities when a potential or actual water supply problem arises: the SFPUC Water Supply and Treatment Division (WS&TD), Water Quality Bureau (WQB), and SFPUC wholesale customers, BAWSCA, and City Distribution Division (CDD – considered to be a customer for the purposes of this plan). For the purposes of this plan, water quality issues are treated as potential or actual supply problems.

Power Outage Preparedness and Response

SFPUC's water transmission system is primarily gravity fed, from the Hetch Hetchy Reservoir to the City and County of San Francisco. Within San Francisco's in-city distribution system, the key pump stations have generators in place and all others have connections in place that would allow portable generators to be used.

Although water conveyance throughout the RWS would not be greatly impacted by power outages because it is gravity fed, the SFPUC has prepared for potential regional power outages as follows:

- The Tesla disinfection facility, the Sunol Valley Water Treatment Plant, and the San Antonio Pump Station have back-up power in place in the form of generators or diesel powered pumps. Additionally, both the Sunol Valley Water Treatment Plant and the San Antonio Pump Station would not be impacted by a failure of the regional power grid because it runs off of the SFPUC hydro-power generated by the RWS.
- Both the Harry Tracy Water Treatment Plant and the Baden Pump Station have back-up generators in place.
- Additionally, the WSIP includes projects which will expand the SFPUC's ability to remain in operation during power outages and other emergency situations.

5.2.3.2 SCVWD Water Utility Infrastructure Reliability Project

In 2003, SCVWD initiated the Water Utility Infrastructure Reliability Project (IRP) to determine the current reliability of its water supply infrastructure (pipes, pump stations, treatment plants) and to appropriately balance level of service with cost. The project measured the baseline performance of critical facilities in emergency events and identified system vulnerabilities. The study concluded that SCVWD's water supply system could suffer up to a 60-day outage if a major event, such as a 7.9 magnitude earthquake on the San Andreas Fault, were to occur. Less severe hazards, such as other earthquakes, flooding and regional power outages had less of an impact on SCVWD, with outage times ranging from one to 45 days.

The level of service goal identified for the IRP was "Potable water service at average winter flow rates available to a minimum of one turnout per retailer within seven days, with periodic one day interruptions for repairs." In order to meet this level of service goal, the project developed seven portfolios to mitigate the identified system risks, and identified a recommended portfolio for implementation. As a result, SCVWD has been implementing the recommended portfolio of reliability improvement projects (Portfolio 2). The cost to implement Portfolio 2 is estimated to be approximately $175 Million. Portfolio 2 is expected to reduce the post-earthquake outage period from 45-60 days to 7-14 days.

Additionally, SCVWD routinely monitors the conditions of all their ten dams used for both water supply and flood prevention. Seismic safety evaluations on eight dams are planned by 2013.

5.2.3.3 Sunnyvale Catastrophic Supply Interruption Planning

In 2004, G&E Engineering conducted a seismic vulnerability study of Sunnyvale's water system. According to their findings, a magnitude 7.9 earthquake on the San Andreas Fault would cause Sunnyvale's water system to fail. An earthquake of that magnitude would result in a prolonged loss of water service to over 131,000 people and the calculated loss of function of the water system for up to 60 days. To mitigate the failure of the water system, the City has seismically retrofitted its two (2) 5 million gallon storage tanks at Wright Avenue and is proposing to retrofit more key water infrastructure components that may be at risk. The City has prioritized seismic vulnerability mitigation projects and included them in its 20-year Capital Improvements Plan. Future projects will be completed according to this plan contingent upon available funding.

5.3 WATER SHORTAGE CONTINGENCY PLANNING

5.3.1. Stages of Action

In March 1989, in response to the third year of a continuing drought, SCVWD announced a supply reduction of 25% (of 1987 county wide water usage). All water retailers and cities in the county were asked to implement plans to achieve the 25% reduction for the remainder of 1989.

Sunnyvale staff, in anticipation of 25, 35, 45, and 50 percent or greater supply reductions developed a water shortage contingency plan that includes mandatory (and voluntary) water use restrictions, rate block adjustment, and approaches for enforcement associated with each stage of anticipated reduction.

As stated above, the following **Table 5-2** describes the four levels of supply reductions that were used for development of Sunnyvale's water shortage contingency plan.

Table 5-2: Water Shortage Contingency – Rationing Stages to Address Shortages

Stage No.	% Shortage	Water Supply Conditions
1	25%	25% shortage declared by wholesale water agency. Shortage conditions are worsening. Groundwater levels continue to decrease
2	35%	35% shortage declared by wholesale water agency. Signs of multiyear drought.
3	45%	45% shortage declared by wholesale water agency. Continued signs of multiyear drought.
4	50% or greater	Greater than 50% shortage declared by wholesale water agency. Typically meant for immediate crisis such as major infrastructure failure. Water supply reserved for health and safety needs.

5.3.2. Prohibitions, Penalties, and Consumption Reduction Methods

Table 5-3 details the use restrictions for each stage of reduction.

Table 5-3: Water Shortage Contingency – Mandatory Prohibitions

Stage No.	Prohibition
Stage 1 25%	• Flooding or runoff on sidewalks, streets or gutters • Cleaning sidewalks, driveways, buildings, patios, parking lots or other paved/hard surfaced areas • Using hose for washing cars, buses, boas, trailers without positive automatic shutoff value on hose • Use of decorative fountains • Water waste due to broken/defective plumbing, sprinkler, watering or irrigation systems • Restaurant water service unless requested • Landscape irrigation during daylight hours • Hydrant flushing (unless for public health or safety)
Stage 2 35%	• All of the above • New installations of plants, shrubs, trees, lawns other growing things • Landscape for mounds, hardscape okay but cannot include living plant materials • New swimming pool or pond construction • Filling or refilling swimming pools (can replace water loss due to evaporation) • Outdoor watering December through March.
Stage 3 45%	• All of the above • Watering turf, grass or dichondra lawns (can provide minimal water for sports playing fields) • Golf courses except for tees and greens
Stage 4 50% or greater	• All of the above • Landscape irrigation with potable water of any City-owned premises or businesses where recycled water is available for connection. • Utilization of potable water for any City operation where recycled water could be used.

In addition, Sunnyvale has adopted a series of water conservation action plans for City departments that correspond to the 25, 35, 45, and 50 percent or greater reduction scenarios. These plans apply mandatory prohibitions to potable water usage at City golf courses, City parks, City streetscape trees and landscaping, and public safety. The rates and charges for water services will be further increased for the 50% reduction case.

5.3.3. Water Rate Structure for Conservation

A major part of Sunnyvale's strategy for water conservation developed in 1989 is a block rate pricing structure involving a lifeline rate set at 15% above the existing rates, a conservation block rate set at a multiple of two times usage in applicable existing rate blocks, and a high impact/high use category at a multiple of 3.5 times the existing rate blocks. The lifeline category exists for all categories of users whereas the conservation and high use rates are applied to recognize the greatest opportunities and needs for reduction and to be sensitive to the importance of manufacturing production and commercial needs. The same approach would be used should the City move to a 35, 45, or 50 percent or greater reduction. However, the multipliers would escalate.

Separate metering systems have been set up for fire and landscape uses with potable water utilized for landscaping purposes at a different rate than domestic water.

Table 5-4: Water Shortage Contingency – Penalties and Charges

Stage No.	Description	Penalty/Charge
2	Fine for non-essential water uses as described in City ordinance	Not to exceed $1,000
2	Cost recovery for Installation and removal of flow restricting valves	$100

5.3.4. Enforcement Approach

The thrust of enforcement of Sunnyvale's conservation program is to solicit cooperation from water users who are unaware of the restrictions or have failed to comply with the provisions of the ordinance. Every effort is made to inform these users of the need for conserving water. If discussions with the user are unsuccessful in obtaining compliance, enforcement mechanisms are available.

The Departments of Public Works and Public safety cooperate on the responsibility for enforcement of the City's conservation plan. Computerized systems track complaints throughout the enforcement process. The process involves first establishing contact with the individual who may be in violation, giving the individual information about code requirements and verbally requesting that the user comply with these requirements. If a complaint has been registered with Neighborhood Preservation, the complainant is contacted and notified of the results of the preliminary investigation. The complainant is kept informed at each step of the process. Upon receipt of a notice of a second violation, the violator will receive a written notice to comply and a warning that the next violation may result in a citation and/or the installation of a flow restricting device at the water meter. This flow restricting device would reduce the flow of water to a trickle, thereby allowing the occupant only enough water for health and sanitation purposes. If there are further complaints and a citation is to be issued, the Department of Public Safety is called to issue the citation.

A "hot line" telephone number is established for drought information and to register complaints. Trained staff is available to provide information and to respond to complaints.

5.3.5. Analysis of Revenue Impacts of Reduced Sales During Shortages

In the event of a water shortage scenario, water fund revenues may decrease from the implementation of conservation measures and corresponding reduction in water sales. Conversely, expenses will increase as a result of the implementation and enforcement of water conservation measures. Expenditures will also rise on a per-unit basis, as wholesalers increase their per-unit price to compensate for the loss of revenue from wholesale sales.

The City has several options to address financial issues during a water shortage. First, the City retains two significant reserves, one for operating contingencies (Contingency Reserve) such as water shortages that is set at 25% of operations and purchased water costs, and a second for the purpose of stabilizing rates over time (Rate Stabilization Reserve). Each will help the City balance the water fund during supply shortages. The City is developing an emergency tiered rate structure that sends hard conservation pricing signals to customers during a period of supply shortage. Finally, the City has four sources of supply and the ability to move most of its supply from any one point to any other point (the exception being recycled water). In the event

of a water shortage, especially in the short term, the City has multiple supply options that should contribute to a more-stable revenue base than if the City were under very limited wholesale supplies.

5.3.6. Water Use Monitoring Procedure

For the purposes of implementing the water shortage contingency plan, the City relies on both staff observations regarding excessive water use as well as customer complaints. City staff is also studying the economic and operational feasibility of using metering technology to implement the plan, but no specific plans exist to make such a change.

5.4 DROUGHT PLANNING

5.4.1. Average/Normal Water Year

The "normal" year for the purposes of this Plan, is a year in the historical sequence that most closely represents median runoff levels and patterns. Carryover storage is that portion of SCVWD's local and outside of the county surface storage, local groundwater storage, and outside the county banked storage that is not required to meet this year's demands but could potentially be utilized in subsequent years. Note that groundwater is used in all year types (including years where the total supplies exceed total demands) for distribution, storage and treatment. The average/normal water year used by both wholesalers and the City is 2002.

The City selected 1985 as a representation of a "normal" or "average" water year based on an analysis of past water use. The year 1985 was determined to be representative of a year with both average precipitation and average water usage by the City.

5.4.2. Single-Dry Year Supply

The single dry year supply is defined as the year with the minimum usable supply. The hydrology of 1977 represents the minimum total supply that has been observed in the historical record according to SCVWD. SCVWD will be able to meet the water needs of the county during the single dry year even with increasing demands, based on the historical hydrologic sequence and carryover supplies that are projected to be available leading into a single dry year. If a similar dry year occurred when carryover storage was not available, implementation of actions associated with the water shortage contingency plan would be required.

In the single dry year analysis, supplies for SCVWD from carryover storage are needed to meet the annual demands under all demand years and make up almost half of the total supplies in the single dry year. SCVWD's ability to take water from the Semitropic Water Bank is proportional to SWP allocation percentages for the year. During drought years, this can significantly limit how much of its water bank balance SCVWD can withdraw.

SFPUC modeling and historic hydrological sequence identifies 1978 as the model single dry year. The City selected 1977 as the single dry year since groundwater managed by SCVWD will be relied upon to make up the deficit from water wholesalers.

5.4.3. Multiple-Dry Year Supply

Multiple dry year scenario analysis is useful particularly in the evaluation of carryover storage. Evaluating the availability of the county's water supplies requires an understanding of the driest periods that can reasonably be expected to occur. Over the more than 120 years of recorded rainfall, seven major drought events have occurred. SCVWD modeling results indicate that the county's water supply system is more vulnerable to successive dry years, such as those that occurred in 1928-1934 and 1987-1992. Multiple dry year periods deplete water storage reserves in local and imported supply reservoirs and in the groundwater subbasins. Multiple dry years (such as the 1987-1992 drought) pose the greatest challenge to SCVWD's water supply. Although the supply in each year may be greater than in a single very dry year, as drought lingers, storage reserves are relied on more and more. The multiple dry year period selected by the City for analysis is from 1987 through 1990.

The water supply available to individual retailers will ultimately be determined by SCVWD and SFPUC. The City will work closely with SCVWD, SFPUC, and other water retail agencies to implement any stages of action to reduce the demand for water during water shortages.

Table 5-5 summarizes the average, single dry, and multiple dry water years used to determine the minimum water supply available as compared to the average/normal water year.

Table 5-5: Basis of Water Year Data

Water Year Type	Base Year(s)
Average Water Year	1985
Single Dry Water Year	1977
Multiple Dry Water Years	1987-1990

As discussed earlier in this report, the City relies mostly on SFPUC and SCVWD for its water supply and is directly affected by the water supply conditions both wholesaler faces. This section discusses water supply conditions as it affects the wholesalers.

5.4.4. SFPUC

SFPUC historically has met demand in its service area in all year types from its Tuolumne River, Alameda Creek, and San Mateo County watersheds. In general, 85% of the supply comes from the Tuolumne River through Hetch Hetchy Reservoir and the remaining 15% comes from the local watersheds through the San Antonio, Calaveras, Crystal Springs, Pilarcitos and San Andreas Reservoirs. SFPUC's adopted WSIP retains this mix of water supply for all year types. In order to achieve its target of meeting at least 80% of its customer demand during droughts, the SFPUC must successfully implement the dry-year water supply projects included in the WSIP. SFPUC proposes to expand their water supply portfolio by increasing the types of water supply resources to meet future demands. This includes approximately 2,240 AFY of transfers and 8,100 AFY of groundwater from the Westside Basin.

The Tier One and Tier Two Plans, as earlier described, would be implemented as necessary in the event of a shortage of SFPUC supplies.

5.4.5. SCVWD

As a result of the 1987 to 1992 drought, local reservoirs were reduced and wholesalers received only partial entitlement from its imported sources. In response to these circumstances, SCVWD instituted an aggressive water conservation program and augmented imported sources of water with additional water supplies. Since the end of the drought, local reservoir levels have returned to normal, allowing greater flexibility to meet water demands during a short-term dry period.

In the event of a multiple dry year supply scenario occurring between now and 2020, supplies for SCVWD and groundwater are planned to be adequate to continue to meet the increased demands, while supplies from SFPUC will decrease. The City will compensate for temporarily decreased supply from SFPUC by using additional groundwater supply as available. SCVWD has accounted for additional groundwater pumping during a single-dry and multiple-dry years. Subsequent to 2020, implementation of water shortage contingency plan actions would be required to reduce demands by approximately 20-25% in the fifth year and beyond of a multi-year drought.

5.4.6. Supply Availability

In the event of a decrease of local supplies, the City would respond by pursuing demand reduction programs in accordance with the severity of the supply shortage. Any supply deficit would be compensated for by increased conservation levels and restrictions in consumption.

An analysis of the supplies historically available during times of shortage is reflected in **Table 5-6**. This analysis does not account for population and system growth, and reflects the amount of supply available to meet the system's demands during the designated years.

Table 5-6: Supply Reliability – Historic Conditions (AFY)

Water Source	Normal Water Year (1985)	Single Dry Water Year (1977)	Multiple Dry Water Years			
			Year 1 (1987)	Year 2 (1988)	Year 3 (1989)	Year 4 (1990)
SCVWD	9,199	6,636	10,335	12,073	11,503	10,499
SFPUC	13,209	10,956	10,956	9,522	9,522	10,870
Groundwater	8,369	5,104	4,019	4,116	2,509	1,973
Totals	**30,277**	**22,696**	**25,310**	**25,711**	**23,534**	**23,432**
Percent of Normal Year		**75.0%**	**83.6%**	**84.9%**	**77.7%**	**77.1%**

Table 5-7 is based on the projected demands during the indicated years, and analyses of the average/normal deliveries to the City from SFPUC and SCVWD in 1985. This analysis uses decreased supply availability in accordance with historic conditions as described in **Table 5-7**; however, an analysis of current supply and wholesale supplier systems indicates that supplies would be available to meet demands even in times of drought, with no reduction of supply necessary until the fifth year and beyond of a multi-year drought.

Table 5-7: Supply Reliability – Current Water Sources (AFY)

Source	Average/ Normal Water Year 2002	Multiple Dry Water Years		
		Year 2011	Year 2012	Year 2013
SFPUC	10,096	11,307	9,818	9,818
SCVWD	13,094	7,403	8,692	8,323
Groundwater	1,367	4,108	4,133	2,474
Recycled Water[1]	1,296	1,498	1,474	1,449
Totals	**25,853**	**24,316**	**24,116**	**22,065**
Percent of Average/Normal		**94%**	**93%**	**85%**

1. Decrease in recycled water supply is shown due to decrease in demand from 2010 to 2015.
2. Additional groundwater supply will be used to supplement decreases in purchased treated water supply.

Table 5-8 through **Table 5-14** provides a comparison between supply and demand for normal, single dry and multiple dry water years. As SFPUC supply decreases, groundwater supplies increase, leaving a zero percent difference between supply and demand.

Table 5-8: Supply and Demand Comparison – Normal Year (AFY)

Source	2015	2020	2025	2030	2035
SFPUC	10,003	10,003	10,003	10,003	10,003
SCVWD	9,570	9,999	11,023	12,728	12,728
Groundwater	1,000	1,000	1,000	1,000	1,000
Recycled Water	1,400	1,525	1,650	1,775	1,775
Supply Totals	**21,973**	**22,527**	**23,676**	**25,506**	**25,506**
Demand Totals	**21,973**	**22,527**	**23,676**	**25,506**	**25,506**
Difference	0	0	0	0	0
Difference as % Supply	0%	0%	0%	0%	0%
Difference as % Demand	0%	0%	0%	0%	0%

Table 5-9: Supply and Demand Comparison – Single Dry Year (AFY)

Source	2015	2020	2025	2030	2035
SFPUC	10,003	10,003	10,003	10,003	10,003
SCVWD	9,570	9,999	11,023	12,728	12,728
Groundwater	1,000	1,000	1,000	1,000	1,000
Recycled Water	1,400	1,525	1,650	1,775	1,775
Supply Totals	**21,973**	**22,527**	**23,676**	**25,506**	**25,506**
Demand Totals	**21,973**	**22,527**	**23,676**	**25,506**	**25,506**
Difference	0	0	0	0	0
Difference as % Supply	0%	0%	0%	0%	0%
Difference as % Demand	0%	0%	0%	0%	0%

Table 5-10: Supply and Demand Comparison – Multiple Dry Year for 2015 (AFY)

Source	Year 1 2015	Year 2 2016	Year 3 2017
SFPUC	10,003	9,818	9,818
SCVWD	9,570	9,656	9,742
Groundwater	1,000	1,185	1,185
Recycled Water	1,400	1,425	1,450
Supply Totals	**21,973**	22,084	22,195
Demand Totals	**21,973**	**22,084**	**22,195**
Difference	0	0	0
Difference as % Supply	0%	0%	0%
Difference as % Demand	0%	0%	0%

Table 5-11: Supply and Demand Comparison – Multiple Dry Year for 2020 (AFY)

Source	Year 1 2020	Year 2 2021	Year 3 2022
SFPUC	10,003	9,818	9,818
SCVWD	9,999	10,204	10,409
Groundwater	1,000	1,185	1,185
Recycled Water	1,525	1,550	1,575
Supply Totals	**22,527**	22,757	22,987
Demand Totals	**22,527**	**22,757**	**22,987**
Difference	0	0	0
Difference as % Supply	0%	0%	0%
Difference as % Demand	0%	0%	0%

Table 5-12: Supply and Demand Comparison – Multiple Dry Year for 2025 (AFY)

Source	Year 1 2025	Year 2 2026	Year 3 2027
SFPUC	10,003	9,818	9,818
SCVWD	11,023	11,364	11,705
Groundwater	1,000	1,185	1,185
Recycled Water	1,650	1,675	1,700
Supply Totals	**23,676**	24,042	24,408
Demand Totals	**23,676**	**24,042**	**24,408**
Difference	0	0	0
Difference as % Supply	0%	0%	0%
Difference as % Demand	0%	0%	0%

Table 5-13: Supply and Demand Comparison – Multiple Dry Year for 2030 (AFY)

Source	Year 1 2030	Year 2 2031	Year 3 2032
SFPUC	10,003	9,818	9,818
SCVWD	12,728	12,728	12,728
Groundwater	1,000	1,185	1,185
Recycled Water	1,775	1,775	1,775
Supply Totals	**25,506**	**25,506**	**25,506**
Demand Totals	**25,506**	**25,506**	**25,506**
Difference	0	0	0
Difference as % Supply	0%	0%	0%
Difference as % Demand	0%	0%	0%

Table 5-14: Supply and Demand Comparison – Multiple Dry Year for 2035 (AFY)

Source	Year 1 2035	Year 2 2036	Year 3 2037
SFPUC	10,003	9,818	9,818
SCVWD	12,728	12,728	12,728
Groundwater	1,000	1,185	1,185
Recycled Water	1,775	1,775	1,775
Supply Totals	**25,506**	**25,506**	**25,506**
Demand Totals	**25,506**	**25,506**	**25,506**
Difference	0	0	0
Difference as % Supply	0%	0%	0%
Difference as % Demand	0%	0%	0%

As shown in the tables above, Sunnyvale would be able to increase the amount of groundwater pumped to meet reasonably anticipated deficiencies from other sources, thus supply is projected to be sufficient to meet demand out to 2035. The Sunnyvale groundwater basin is not adjudicated, which means the right to pump groundwater from the basin has not been given by judgment of a court or board.

For each of the five-year increments presented above, the three-year dry period indicates that supplies will be able to meet demands through increased groundwater pumping and implementation of drought conservation programs. The City will be able to address the projected demands without rationing.

5.5 WATER QUALITY IMPACTS ON RELIABILITY

As described previously, the City has three sources that supply its potable water. These are the treated surface water from SCVWD and SFPUC and local groundwater. SCVWD provides

approximately 47% of Sunnyvale's annual potable water, SFPUC provides approximately 40%, Sunnyvale owned- and operated-wells provide 6% and the remaining 7% comes from recycled water.

5.5.1. SFPUC

SFPUC aggressively protects the natural water resources entrusted to its care. Its annual Hetch Hetchy Watershed survey evaluates the sanitary conditions, water quality, potential contamination sources, and the results of watershed management activities by the SFPUC and its partner agencies, including the National Park Service, to reduce or eliminate contamination sources. SFPUC also conducts sanitary surveys of the local Alameda and Peninsula watersheds every five years. These surveys identified wildlife and human activity as potential contamination sources. The regional system currently meets or exceeds existing water quality standards. However, system upgrades are needed to improve SFPUC's ability to maintain compliance with current water quality standards and to meet anticipated future water quality standards.

5.5.2. SCVWD

Treatment of surface water is necessary to ensure that the water SCVWD provides meets or exceeds all federal and state drinking water standards. Surface water quality programs include: treating local and imported surface water for sale to retailers; participating in regional and statewide coalitions to safeguard source water quality protection; and investigating opportunities for water quality improvements through partnership in regional facilities or exchanges.

SCVWD's source waters are susceptible to potential contamination from sea water intrusion and organic matter in the Delta and from a variety of land use practices, such as agricultural and urban runoff, recreational activities, livestock grazing, and residential and industrial development. Local sources are also vulnerable to potential contamination from commercial stables and historic mining practices. No contaminant associated with any of these activities has been detected in the treated water. The water treatment plants provide multiple barriers for physical removal and disinfection of contaminants. Additionally, SCVWD monitors surface water quality in local reservoirs and in the Sacramento-San Joaquin Delta.

5.5.3. Groundwater

SCVWD monitors groundwater quality to assess current conditions and identify trends or areas of special concern. Wells are monitored for major ions, such as calcium and sodium, nutrients such as nitrate, and trace elements such as iron. Wells are also monitored for man-made contaminants, such as organic solvents. The type and frequency of monitoring depends on the well location, historic and current land use, and the availability of groundwater data in the area. Overall groundwater quality in Santa Clara County is good. The most notable exceptions are nitrate and perchlorate, which have impacted groundwater quality in the Llagas Subbasin.

As the groundwater management agency in Santa Clara County, SCVWD has ongoing groundwater protection programs to ensure high water quality and more reliable water supplies. These programs include well permitting, well destruction, wellhead protection, land use and development review, nitrate management (targeted to areas of elevated nitrate in the Coyote

Subarea and the Llagas Subbasin), saltwater intrusion programs, and providing technical assistance to regulatory agencies to ensure local groundwater resources are protected.

5.5.3.1 Sunnyvale Groundwater Water Quality

Nitrate in the environment comes from both natural and anthropogenic sources. Small amounts of nitrate in groundwater (less than 10 mg/L) are normal, but higher concentrations suggest an anthropogenic origin. Common anthropogenic sources of nitrate in groundwater are fertilizers, septic systems, and animal waste. The drinking water maximum contaminant level (MCL) for nitrate is 45 mg/L as nitrate. Since the Santa Clara Valley has a long history of agricultural production and septic systems are still in use in the unincorporated areas of the county, monitoring for nitrate contamination is an essential groundwater management function in this valley.

Sunnyvale has observed nitrate in excess of 50% of the MCL and conducts monitoring for nitrate more often than is required by regulation.

SECTION 6 – DEMAND MANAGEMENT MEASURES

The City of Sunnyvale has a commitment to water conservation and to that end has instituted a tiered water fee schedule that penalizes excessive water consumption as well as a recycled water program. Many of the Demand Management Measures (DMMs) offered by the City are programs run by or coordinated through the SCVWD, one of the wholesalers from which the City buys water. The programs are either funded through the wholesale water rates paid by the City, or are directly reimbursed by the City. **Table 6-1** below lists each measure and indicates who administers the program. Each DMM is discussed in detail in the following section.

Table 6-1: Demand Management Measures (DMMs)

Demand Management Measure	City Program	District Program
Water survey programs for residential customers		X
Residential plumbing retrofit		X
System water audits, leak detection, and repair	X	
Metering with commodity rates for new and retrofit connections	X	
Large landscape conservation programs and incentives		X
High-efficiency washing machine rebate programs		X
Public information programs	X	X
School education programs	X	X
Conservation programs for CII accounts		X
Wholesale agency programs		X
Conservation pricing	X	
Water conservation coordinator	X	
Water waste prohibition	X	
Residential ultra-low-flush toilet replacement programs		X

The City, as a municipally-owned water utility, has the legal authority to implement demand management measures by ordinance or resolution of the City Council. This authority has been exercised through past implementation of demand management measure, fees, and penalties. This section describes the DMMs that are implemented within the City's service area in an effort to increase water conservation and meet the 2015 and 2020 water use targets.

Evaluation of Effectiveness

Evaluating the effectiveness of a single DMM is difficult and generally not cost-effective for the City, so each program is not necessarily monitored separately for effectiveness and water savings. Evaluating the effectiveness of all DMMs as a whole provides a better representation and can be translated into overall water conservation savings, which is discussed below. The City will use these countywide water savings tracked by SCVWD to evaluate the effectiveness of overall implementation efforts by both the City and SCVWD.

Water Conservation Savings

Water savings estimates are not available for each individual DMM. SCVWD has provided the projected savings as a result of DMM implementation as shown in **Table 6-2**. The City actively participates in SCVWD programs through cost-sharing and partnerships. Through SCVWD program participation and partnerships, the following projected savings can be achieved.

Table 6-2: SCVWD County-Wide Water Conservation Program Savings Goals

	2010	2015	2020	2025	2030	2035
Water Conservation Savings Goal (AFY)[1]	50,600	63,100	76,100	86,700	98,500	98,500

Source: SCVWD – Draft 2010 Urban Water Management Plan, Chapter 5.
1. Total conservation savings goal includes both urban and agricultural conservation using 1992 as the base year.

6.1 DEMAND MANAGEMENT MEASURES

A. Water Survey Programs for Single-Family Residential and Multi-Family Residential Customers

Implementation: This program was first implemented in July of 1998 as a pilot program. It is an active program administered by SCVWD. The City shares the cost to support this program. SCVWD plans to continue its program to meet the region's long-term water conservation goals.

Description: SCVWD markets water-use surveys to single-family and multi-family residential customers throughout the County. Since 1998, SCVWD has performed more than 29,600 residential audits, including more than 2,000 in FY 2009-2010, of which 676 were completed in the Sunnyvale City service area.

The program includes educating the customer on how to read a water meter; checking flow rates of showerheads, faucet aerators and toilets; checking for leaks; installing low-flow showerheads, aerators and/or toilet flappers if necessary; checking the irrigation system for efficiency (including leaks); measuring landscaped area; developing an efficient irrigation schedule for the different seasons; and providing the customer with evaluation results, water savings recommendations, and other educational materials. In 2004, SCVWD began programming the irrigation controllers for the homeowners as well (i.e., if allowed by the homeowner, the surveyors will input the recommended schedules into the controller).

Each year these programs are promoted countywide through a summer media campaign, which typically includes television, radio, and print advertisements.

B. Residential Plumbing Retrofit

Implementation: This program was first implemented in 1992. It is an active program administered by SCVWD. The City also implements the program and shares the cost to support this program. The City plans to continue offering free showerheads and aerators both directly and through the District's Water-Wise House Call Program.

Description: The City and SCVWD distribute high-quality, low-flow showerheads and faucet aerators to single-family and multi-family residents as the implementation of the residential plumbing retrofits program. The City makes low-flow showerheads and aerators available to residents free of charge and to date has directly distributed thousands of units to interested parties. Since program inception, more than 296,000 low-flow showerheads and aerators have been distributed throughout the County, including more than 22,000 in FY 2009-2010. The cost for these devices is not tracked by the City.

C. System Water Audits, Leak Detection, and Repair

Implementation: The City continuously implements water audits and leak detection and repair for the water distribution system. In addition to City staff continuously monitoring the water distribution system through SCADA technology and field inspections, the City also implements a leak detection program. The City expects this to be an ongoing program.

Description: In order to fulfill this measure, all accounts within the City service area are metered. The City also offers help to its residential customers in determining if a leak exists at the property. Water Meter Readers report leaky meters or water meters running when a residence does not appear to be occupied so that a technician can be dispatched to investigate and make repairs as needed.

Additionally, a leak detection company conducts annual inspections of distribution pipeline. The length of pipe inspected annually is a determined by the City. The leak detection contractor generates a condition assessment report for the inspected pipeline, and reported leaks are promptly remediated by City staff or a hired contractor. These programs have helped the City attain lower-than-average system losses.

D. Metering with Commodity Rates for All New Connections and Retrofit of Existing Connections

Implementation: The City implements metering requirements within the service area and will continue to do so. Additionally, the City implements a program to retrofit and replace meters as they age.

Description: The City requires that all service connections within the service area are metered. All new service connections are metered and are billed by volume of water used. There are no known connections operating without a meter. Connections to the City are governed by Chapter 12.24 of the Sunnyvale Municipal Code, which is provided as **Appendix G**.

Sunnyvale encourages all new commercial, industrial, and multi-family developments to have dedicated water meters and separate accounts and meters for landscape irrigation. As older developments are replaced with newer ones, any customers without a dedicated landscape irrigation meter will be encouraged to acquire one.

E. Large Landscape Conservation Programs and Incentives

Implementation: Large landscape conservation programs are administered by SCVWD. There are currently two programs implemented, including the Landscape Survey Program (LSP),

formerly known as the Irrigation Technical Assistance Program (ITAP), and the Landscape Rebate Program. The landscape survey program was first implemented in 1995.

The landscape rebate program is a combination of programs including the weather-based irrigation controllers (WBICs) program, the Irrigation System Hardware Rebate Program (ISHRP), the Residential Irrigation System Hardware Rebate Program (RISHRP), and the Water Efficient Landscape Rebate Program (WELRP). The WELRP was first implemented in 2005 and the other three programs were first implemented in 2006. The four programs were then combined into the Landscape Rebate Program in 2009. Both survey and rebate programs are currently active and both programs will continue to be implemented in the future.

The City also issued Ordinance No. 19.37 regulating conservation in landscaping. This ordinance applies to all new and rehabilitated landscaping for public agency projects and private development projects that require a permit, as well as developer-installed landscaping in single-family and multi-family projects. A copy of this ordinance is included in **Appendix G**.

Description of Landscape Survey Program (LSP): Since 1995, SCVWD has offered and provided large landscape water audits to sites in the County with one acre or more of landscaping. Landscape managers have been provided water-use analyses, scheduling information, in-depth irrigation evaluation, and recommendations for affordable irrigation upgrades. Each site receives a detailed report upon completion of the audit. An annual report is generated to recap the previous year's efforts. To generate several reporting and monitoring options, water use history, meter numbers, account numbers, and site contacts and addresses are captured for each site in a specialized database. In 2009, in an effort to expedite program participation and water savings, the program was expanded to include any commercial, industrial, and institutional sites with 5,000 square feet or more of irrigated landscape.

The LSP reaches the community through advertising in Tri-County Apartment Association's monthly Apartment Management magazine, colorful flyers at the biannual Home & Garden Show, NCTLC Turf & Landscape Expo, and retailer outreach through direct mailing of personalized letters to high water use customers and also through City newsletters and business newsletters. There have been 14 audits conducted in the City's service area through this program in FY 2009-2010.

Description of Landscape Rebate Program: In 2006, SCVWD partnered with five Bay Area water supply agencies and received a DWR Proposition 13 grant that provided funding for the installation of WBICs. This new generation of irrigation controller utilizes the principals of evapo-transpiration (ET) to automatically calculate a site-specific irrigation schedule based on several factors, including plants and soil type. The controller then adjusts the irrigation schedule as local weather changes to regulate unnecessary irrigation.

SCVWD first implemented a direct install program which installed two types of WBICs (real-time and historic) in both residential and commercial sites throughout SCVWD's service area. In order to expedite program participation and include emerging WBIC manufacturers, SCVWD shifted the WBIC program to a rebate style program that offered rebates of $300-$1,100 per approved controller installed.

SCVWD expanded its irrigation equipment incentives beyond the WBIC program, when two grants were received in 2006 for the implementation of two types of water efficient irrigation hardware installation rebate programs.

The first grant, received from DWR, kicked off implementation of the ISHRP. This program aimed to install a variety of water efficient irrigation hardware at commercial, industrial, and institutional sites throughout the County. Through ISHRP, SCVWD provided rebates ranging from $200 to a maximum of $2,000 per site (not to exceed 50% of the hardware cost). Qualifying hardware included rain sensors, high distribution uniformity nozzles, dedicated landscape meters, replacement sprinkler heads, converting overhead irrigation to drip irrigation, pressure reducing valves, and spray heads or rotors with pressure compensating heads and/or check valves.

The second water efficient irrigation equipment grant was received from the United States Bureau of Reclamation and was to launch the RISHRP. The program was designed to retrofit inefficient irrigation equipment at residential sites with new water conserving equipment. This residential version of the ISHRP offered rebates for the same efficient irrigation equipment but was unique as RISRHP offered flat rebate amounts per equipment items. Through the RISHRP program, residents could receive rebates ranging from $50 up to $1,000 per site.

In addition to efficient irrigation equipment retrofits, SCVWD began to focus on water efficient landscapes by launching the WELRP in early 2005. The WELRP offered rebates to residential and commercial sites for the replacement of approved high water using landscape with low water use plants, mulch, and permeable hardscape. WELRP participants could receive up to $0.75 per square foot of irrigated turf grass with a maximum of rebate of $1,000 and $10,000 for residential and commercial sites respectively. In an effort to expedite program participation, SCVWD Board of Directors moved to double the maximum rebate from $1,000 up to $2,000 for residents and from $10,000 up to $20,000 for commercial sites in March 2009.

A summary of the surveys and rebates issued within the City's service area during FY 2009-2010 is provided in **Table 6-3**.

Table 6-3: Large Landscape Surveys Conducted during FY 2009-2010

Program	Landscape Surveys Completed	Equipment Retrofit Rebates	Landscape Conversion Rebates	WBIC Rebates
No. of Rebates/Surveys	14	15	16	11

Source: SCVWD – Water Conservation Program Monthly Report Totals through June 2010, dated August 3, 2010.

Description of Recycled Water Program: The City evaluated large-area landscapes for conversion to recycled water. The location of the recycled water pipeline system was selected based on the concentration of potential customers since that would make the most economic sense. To date, recycled water is used in Sunnyvale only for landscaping purposes in the northern portion of the City. Parks, golf courses, business and industrial parks, and play fields use recycled water purchased at a discounted rate. To serve this variety of customers, the City has constructed a separate distribution network of water lines in the north half of the City solely for the delivery of recycled water. Eventually, recycled water may be available city-wide and to neighboring jurisdictions with a need for a reliable, cost-effective source of water for landscaping and other non-potable purposes.

F. High-Efficiency Washing Machine Rebate Programs

Implementation: In October 2001, SCVWD began participating in the regional Bay Area Water Utility Clothes Washer Rebate Program. Since January 2008, the regional program has partnered with Pacific Gas & Electric (PG&E). This is an active program administered by SCVWD and the City shares the cost to support this program. The program is expected to continue in the future, though in the year 2019, it is expected that higher clothes washer standards will be in effect and cost-sharing may be re-evaluated at that time.

Description: Residents of the County are eligible for a rebate of up to $175 for qualifying clothes washers. Qualifying clothes washers are rated by the Consortium for Energy Efficiency (CEE) as Tier 3. The total rebate is a combined rebate from both SCVWD and PG&E. In FY 2009-2010, 1,040 residential clothes washer rebates were issued in the Sunnyvale service area. The number of rebates distributed over the last five years within the City's service area is provided in **Table 6-4**.

Table 6-4: High-Efficiency Clothes Washer Machines Rebate

	2006	2007	2008	2009	2010
No. of Rebates	327	806	845	924	545

Source: SCVWD – Water Conservation Program Monthly Report Totals through June 2010, dated August 3, 2010.

G. Public Information Programs

Implementation: The City and SCVWD participate in developing and implementing public information programs. The City also implements outreach programs in the service area. The City and SCVWD will continue to implement public information programs in the future.

Description: The City and SCVWD have carried out various public information campaigns in the past and continue to do so. Multi-media advertising has covered topics such as water conservation, urban runoff pollution prevention, water quality, groundwater recharge, water supply, water recycling, watershed and flood protection, and stream stewardship. Efforts included paid advertising, public service announcements, bill inserts/brochures, website development, and special events. Campaigns have been carried out in various languages including English, Spanish, Vietnamese, and Chinese.

The City also participates by including inserts and information flyers in customer utility bills, and by distributing articles and information in newsletters and reports sent to City residents. All utility bills include a water usage chart comparing current year to previous year usage to help customers who have unknowingly increased their water consumption to check on the cause of the increase.

Sunnyvale also participates in public activities such as the Columbia Health and Safety Fair and Earth Day Celebration. Partnerships with the Public Safety and Community Services departments in activities sponsored by those departments (Pancake Breakfast, Summer Camp) provide more opportunities to reach youth and the general public with a message extolling the virtue of water conservation.

H. School Education Programs

Implementation: In 1995, SCVWD's Public Information Office hired a full-time, fully credentialed educator who holds lifetime teaching and Administrative Services credentials to coordinate their school education programs. From 2001-2007, a second, bilingual educator joined SCVWD's full-time staff to assist with the program. The City has also been implementing school education programs in the WPCP service area for over 10 years. The City and SCVWD will continue to implement school education programs in the future.

Description: SCVWD's educators develop school programs, contract with the Youth Science Institute for additional instructors, and supervise university student interns as classroom assistants. SCVWD has been continuously active in this area by providing free classroom presentations, puppet plays, and tours of SCVWD facilities to schools within the County. The objective is to teach students about water conservation, water supply, watershed stewardship, and flood protection. SCVWD also provides school curricula to area educators, including workbooks and videos, as well as hands-on training for teachers. Materials distributed to students include topical lessons. All meet state education framework requirements and are grade-level appropriate.

The City also has a water pollution and conservation outreach program spearheaded by Sunnyvale's Water Pollution Control Plant staff. This program offers tours of the plant, classroom presentations and a creek water education program. Plant tours teach youth about the function of wastewater treatment, water pollution prevention, and water conservation. Oftentimes, the tour is a supplement to a water study module in the classroom, and approximately 50% are repeat tours scheduled year after year by teachers.

The Creek Education program provides watershed, urban runoff, water pollution prevention, storm water, creek education, water conservation and wastewater information to Sunnyvale students at schools in the Cupertino & Sunnyvale school districts. Students take a yearly field trip to Stevens Creek at McClellan Ranch Park after studying water and structures of life courses in class.

Classroom presentations involve a watershed pollution demonstration designed to correlate with the State of California curriculum standards for earth sciences. Subjects covered include water cycle, groundwater, aquifers, water pollution and water conservation.

I. Conservation Programs for Commercial, Industrial, and Institutional (CII) accounts

Implementation: Since 1992, SCVWD has implemented various programs targeting commercial, industrial, and institutional (CII) customers for water efficiency outreach and education. Both the City and SCVWD expect to continue the programs in the future, with the potential for minor changes based on technological advancements.

Description: Many initiatives and programs are implemented to increase water efficiency in the CII sectors. Following is a description of the programs offered:

SCVWD's Commercial Toilet Program: SCVWD has a free high-efficiency toilet replacement program specifically for businesses in Santa Clara County. The program is for CII users as well as multi-family residential customers. The existing toilet must flush at 3.5 gallons per flush or

higher. The toilets to be installed are high-efficiency toilets (HETs) utilizing state-of-the-art technology. The toilet and the installation are provided free of charge.

SCVWD's Commercial Washer Program: In July 1999, SCVWD partnered with Silicon Valley Power and the City to offer rebates for the replacement of laundromat clothes washers with high-efficiency washers. In 2000, the program was expanded to commercial machines in multi-family complexes. The program offers rebates of $400 per unit on approved purchased and leased high-efficiency washing machines within the County.

SCVWD's Pre-Rinse Spray Valve Program: SCVWD purchased a quantity of high-efficiency pre-rinse spray valves with a flow rate of 1.15 gallons per minute for distribution to commercial sites, especially those identified through the CII Water Survey Program.

SCVWD's Submeter Rebate Program: This program, which began as a pilot program in FY 2000-2001, gives a rebate of $100 for every water submeter installed at multi-family housing complexes, such as mobile home parks and condominium complexes. Water use records from participating mobile home parks showed an average water savings of 23% per mobile home.

Table 6-5, below, provides a summary of the rebates and installations implemented by SCVWD in the City service area during FY 2009-2010.

Table 6-5: Rebate Programs Implemented by SCVWD for the City (FY 2009-2010)

Program	WET Program	Commercial HETs	Commercial Washers	Pre-Rinse Spray Valves	Submeters
No. of Rebates/Installs	1	872	21	3	1,154

Source: SCVWD – Water Conservation Program Monthly Report Totals through June 2010, dated August 3, 2010.

J. Wholesale Agency Programs

Sunnyvale is not a wholesale agency and does not provide water to other retailers.

K. Conservation Pricing

Implementation: Conservation pricing is implemented by the City and will continue to be implemented by the City in the future.

Description: In March 1989, in response to drought conditions, the City adopted a water conservation plan that required implementation of demand management measures such as an inverted rate structure, deterrents to water waste, landscaping restrictions and the institution of a recycled water program.

Prior to the 1976-1978 drought, the City had a traditional declining-rate block structure, which meant that the more water that was used by a customer, the lower the cost per unit. In 1977, a flat-rate block structure was established with costs fixed regardless of the quantity used. In the year following the drought, an inverted rate structure was adopted and is regularly modified to ensure water conservation and to adequately reflect the high cost of developing new water resources projects.

With the inverted rate structure, each user category has between one and seven rate blocks. The first rate block, providing up to 600 cubic feet of water, represents the lifeline rate, which is a minimum rate for basic water requirements of customers. For the other rate blocks, rates increase with increased water usage to encourage water conservation.

Sunnyvale's Fiscal Year 2010/2011 Utility Fee Schedule is attached as **Appendix H**.

L. Water Conservation Coordinator

Implementation and Description: The City established the position of Water Conservation Coordinator in 1999. The current Water Conservation Coordinator information is provided below:

Name:	Dustin Clark
Title:	Environmental Sustainability Coordinator
	Department of Public Works
Address:	City of Sunnyvale
	Water Pollution Control Plant
	1444 Borregas Avenue
	Sunnyvale, CA 94089
Phone:	(408) 730-7260
Fax:	(408) 747-1139
Email:	dclark@ci.sunnyvale.ca.us

It is expected that there will continue to be a staff member dedicated to water conservation programs.

M. Water Waste Prohibition

Implementation: The Water Conservation Plan adopted by the City of Sunnyvale in 1989 established a listing of non-essential water practices that were prohibited in Sunnyvale. Municipal Code Chapter 12.34 details the water conservation restrictions. The ordinance will continue to be in effect unless it is superseded or amended with a new ordinance.

Description: Some of the prohibitions were lifted after the drought was over, but the following is a listing of current non-essential water practices prohibited by the City (Municipal Code Chapter 12.34.020):

- Allowing or maintaining broken or defective plumbing, sprinklers, watering or irrigation systems which permit the escape or leakage of potable water.
- Using potable water in any manner which causes, allows or permits the flooding of any premises, or any portion thereof, or which causes, allows or permits water to escape from any premises or any portion thereof and flow into gutters, streets, or any surface water drainage system.

- Using any hose or similar device using potable water for washing automobiles, trucks, buses, boats, trailers, equipment, recreational vehicles, mobile homes or other vehicles or machinery, unless the hose or device is equipped with a positive automatic shutoff valve.
- Using potable water to wash sidewalks, driveways, filling station aprons, patios, parking lots, porches or other paved or hard surfaced areas, unless there is a positive automatic shutoff valve on the outlet end of the hose.
- The service of water by any restaurant or other eating or refreshment establishment to any patron, except upon the specific request by a patron for such services.
- Installation of any single pass cooling process in new construction.
- Any use of non-potable water not in compliance with all federal, state and local laws, rules and regulations. Use of reclaimed water from the city's water pollution control plant shall be subject to the discretion of the Director of Public Works.

Violation of these provisions may escalate to installation of a flow restricting device upon the water service lines and cumulative fines. The Water Resources Sub-element of the General Plan and Municipal Code is included as **Appendix F** and **Appendix G**, respectively.

N. Residential Ultra-Low-Flush Toilet Replacement Programs

Implementation: This program was first implemented by SCVWD in 1992 as a ULFT program and was active through 2003. Beginning in 2004, SCVWD began implementing a High Efficiency Toilet (HET) program as described below. This program is an active program that the City also shares the cost to implement. The program is expected to continue in the future, though in the year 2014, it is expected that higher toilet water efficiency standards will be in effect and cost-sharing may be re-evaluated at that time.

Description: The current program consists of a rebate program for single-family and multi-family accounts and a full-installation program for multi-family accounts. County residents can receive up to $125 per toilet for replacing old, high water-use toilets that use 3.5 gallons per flush (gpf) or more, with a new HET or Dual Flush Toilet from an approved toilet list. In FY 2009-2010, 286 HET or Dual Flush Toilet rebates were issued in the City's service area.

Appendix A

City of Sunnyvale
2010 Urban Water Management Plan
Postings and Notifications for UWMP Preparation

January 21, 2011

Subject: Notice of Preparation of Urban Water Management Plan

Dear: Stakeholder

The Urban Water Management Plan Act requires the City of Sunnyvale to update its Urban Water Management Plan by June 30, 2011. We are reviewing our current Plan, which was last updated in 2005, and will be considering revisions to it. We invite your agency's participation in this process.

We will make proposed revisions to our Plan available for public review and will hold a public hearing later this year. In the meantime, if you have any questions about our Plan, or the process for updating it, please contact:

Brendan McCarthy
Administrative Aide
P.O. Box 3707
Sunnyvale, CA 94088-3707
TEL: 408-730-7565
Fax: 408-736-1611
E-mail: bmccarthy@ci.sunnyvale.ca.us

Sincerely,

Val Conzet
Water Operations Manager

PUBLIC NOTICE

URBAN WATER MANAGEMENT PLAN

The City of Sunnyvale is in the process of updating the 2005 Urban Water Management Plan (UWMP) for 2010. City Council will consider adoption of the 2010 UWMP at their regularly scheduled meeting on:

Tuesday, June 28, 2011, at 7p.m.
City Council Chambers − Sunnyvale City Hall
456 W. Olive Ave.

Beginning on Friday, June 10, 2011, copies of the draft 2010 UWMP will be available for review at the Sunnyvale Public Library, 665 W. Olive Ave., and at the One-Stop Permit Center in City Hall, 456 W. Olive Ave.. A public outreach meeting will be held with members of City staff on Wednesday, May 18, 2011, from 6 p.m. to 7 p.m. in the Heritage Building at the City's Community Center. 550 E. Remington Drive, to answer questions and gather ideas from residents and interested stakeholders regarding the contents of the final plan.

An electronic copy of the 2005 UWMP can be downloaded from the City's web site at *www.sunnyvale.ca.gov*.

To request a copy of the 2010 plan upon its completion, or if you have any questions or comments, please contact:

Brendan McCarthy
P.O. Box 3707
Sunnyvale, CA 94088-3707
(408) 730-7565, TDD (408) 730-7501
(408) 736-1611 (FAX)
bmccarthy@ci.sunnyvale.ca.us

Please note that parties requesting paper copies of the plan, above and beyond those copies already publicly available (see above), may incur associated printing costs.

Val Conzet
Public Works Supervisor

cc: City Council
Department Directors

Appendix B

City of Sunnyvale
2010 Urban Water Management Plan
Resolution for Adoption of the UWMP

Resolution for the Adoption of the UWMP will be attached subsequent to Council approval.

Appendix C

City of Sunnyvale
2010 Urban Water Management Plan
City of Sunnyvale Detailed Demographic Data

BUSINESS ECONOMIC PROFILE
FOR

SUNNYVALE

SANTA CLARA COUNTY, CALIFORNIA

JUNE 2010

Sunnyvale's history is based largely on its economy. When Martin Murphy, Sr. arrived in Sunnyvale in 1845, its vast open space and fertile soil were seen as assets to farming, particularly fruit orchards. With the arrival of the railroad in 1864, the industrial base of the community was able to expand. Canneries to process the fruit from surrounding orchards were built near the rail lines. In 1906, Hendy Iron Works relocated from San Francisco to Sunnyvale, thus diversifying the industrial base.

Sunnyvale was incorporated as a city in 1912, with a population of approximately 1,800. By 1940, the population had grown to about 4,400. During World War II, Sunnyvale supplied food and equipment to the troops; the Hendy Iron Works was taken over by Westinghouse to support the war effort. After the war, defense-related industries arrived, capitalizing on the pleasant climate and the Naval Air Station. Lockheed became the city's largest employer. By 1950 the population had grown to 9,900. The 1950s and 1960s were the biggest periods of growth for the community, resulting in a 1960 population of 52,900 and a 1970 population of 96,000.

The defense era gave way to the high-tech era when the microprocessor was introduced in 1971. The population in 1980 was 106,700; 1990 was 117,200, and 2000 was 131,760, respectively. The next and most recent era was related to the internet, with technology companies in Sunnyvale undertaking research and development for this newest industry. The world is now primed for the next great wave of innovation—nanotechnology---and Silicon Valley is well positioned to lead the world in the realms of research and commercialization of this enabling technology.

COMMUNITY

The story has it that Sunnyvale got its name from a local builder looking out over yet another sunny day, shading his eyes, and saying, "Let's call it Sunnyvale." Sunnyvale boasts a very mild climate, with temperatures varying from an average of 52 degrees in January to an average of 70 degrees in July. The rainfall of the winter months usually amounts to around 7 inches. This gorgeous climate naturally leads to an ideal environment for many outdoor activities such as golf and tennis. Sunnyvale is home to two golf courses, 20 neighborhood parks and 51 tennis courts, 16 of which are at our very own world class Municipal Center. Within close proximity are beautiful beaches, spectacular state and national parks, as well as San Francisco and San Jose. Sunnyvale has a solid economic base, and the business revenue generated each year gives us a superb quality of life. The median household income for a Sunnyvale resident is $88,297. Poverty levels in Sunnyvale have remained consistently lower than those of Santa Clara County or the state. The City offers affordable housing programs and first-time homebuyer programs. Please contact our Housing Division at *housing@ci.sunnyvale.ca.us* or (408) 730-7250 if you would like information on different housing programs.

HOUSING CHARACTERISTICS (2010 AVERAGE)	
Average Household Size	2.56
Average Housing Price (single family homes)	$901,000
Average Rental Price (3 bedrooms)	$2,093

ECONOMIC BASE (2009)	
Total City Revenue	114,000,000
Issuer Credit Rating	AAA
Sales Tax Collected (in millions)	$25.0

BUSINESS AND ECONOMICS

Sunnyvale, with its Silicon Valley location, has a solid high-tech presence. Transitioning from agricultural to defense to the current high tech economy, Sunnyvale has remained on the cutting edge of Silicon Valley innovation.

BUSINESS (2010)	
Total Number of Businesses (inside City limits)	7,883
Employment Generated by Sunnyvale Businesses (inside City limits) – 2008	85,400
Total Number of Jobs in the City (includes schools, military, etc.) - 2008	91,000
Business Tax – Minimum*	$31.32
Business Tax – Maximum*	$9,919.90

* Business Tax is renewed every 2 years. All business licenses are subject to a $61.00 processing fee.

EMPLOYMENT BY INDUSTRY	PERCENTAGE	EMPLOYMENT BY INDUSTRY	PERCENTAGE
Information Services	25	Services	8.2
Retail Trade	10	Recreation/Hospitality	3.5
Wholesale Trade	.9	Public Administration	1
Manufacturing	24	Misc./Undefined	13.2
Construction	2.2		

Note: Figures based on December **2005** Employment Development Data (www.labormarketinfo.edd.ca.gov)

LABOR MARKET		
	Sunnyvale	**Santa Clara County**
Labor Force		
April 2010	74,700	876,400
April 2009	76,100	891,700
June 2007	73,200	849,600
March 2006	69,900	817,300
March 2005	69,900	818,800
April 2004	73,830	867,300
2003 Average	75,940	895,100
Employment		
April 2010	67,400	776,100
April 2009	69,000	795,200
June 2007	70,300	809,500
March 2006	66,900	776,100
March 2005	66,600	772,600
April 2004	69,920	812,500
2003 Average	70,610	821,600
Unemployment		
April 2010	7,400	100,300
April 2009	7,100	96,500
June 2007	2,900	40,100
March 2006	3,000	41,200
March 2005	3,300	46,200
April 2004	3,910	54,700
2003 Average	5,330	73,500
Unemployment Rate		
April 2010	9.9%	11.4%
April 2009	9.3%	10.8%
March 2008	4.3%	4.7%
March 2006	4.3%	5.0%
March 2005	4.8%	5.6%
April 2004	5.3%	6.3%
2003 Average	7.0%	8.2%

RENTAL LOCATIONS/ TYPES	**HISTORICAL ASKING RATES ($/SF/MONTH)**
R&D	$1.20
Industrial	$0.96
Warehouse	$0.64
Office	$3.05
Sunnyvale Vacancy Rate	**16.7%**

*Rental rates information updated 4nd Quarter 2009. Information collected by average from: Cornish & Carey – www.ccarey.com: NAI BT Commercial – www.btcommercial.com; & Colliers International – www.colliers.com. Please contact Economic Development via e-mail at econdev@ci.sunnyvale.ca.us or (408) 730-7607 for updated information

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PEOPLE

Sunnyvale is a diverse community, with a highly educated population. The population in 2010 for Sunnyvale is 140,450 and 1,880,876 in Santa Clara County. Leading research facilities and national labs in and near the city attract residents from around the world. These prestigious institutions include Stanford University, UC Berkeley, NASA Ames Research Center, Onizuka Air Force Base & Satellite tracking facility, Santa Clara University, and San Jose State University.

HOUSEHOLD	
2010 Total Population	140,450
2005-2007 (Average) Single Parent	4,900

RACE 2008 Census Update – Community Survey		
	Sunnyvale	**Santa Clara County**
Race		
White	60,394 (43.0%)	916,186
Black/African American	2,388 (1.7%)	45,356
American Indian/Alaska Native	281 (.2%)	8,681
Asian	54,635 (38.9%)	545,045
Native Hawaiian/other Pacific Islander	421 (.3%)	5,945
Other Race	18,539 (13.2%)	181,903
Two or more races	3,792 (2.7%)	61,383

SOCIAL CHARACTERISTICS 2008 Census Data		
	Sunnyvale	**Santa Clara County**
Foreign Born Population	58,492	649,753
Naturalized Citizen	22,143	321,883
Not a Citizen	36,349	327,870

LANGUAGE SPOKEN IN HOUSEHOLD 2008 Census Data	
English*	59,414
Spanish*	16,972
Other Indo-European language*	14,789
Asian/Pacific Islander language*	29,518
Other language*	2,342

EDUCATIONAL ATTAINMENT (FOR POPULATION 25 YEARS AND OLDER) 2008 Updated Census Data –Community Survey		
	Sunnyvale*	**Santa Clara County**
Population 25 years and older	97,260	1,175,219
Less than High School Diploma	9,329	168,836
High School Graduate	13,174	192,073
Some College	14,134	210,905
Associate Degree	7,014	85,701
Bachelor Degree	28,004	287,886
Graduate or Professional Degree	25,605	229,818
% High School Graduate or higher	90.4%	85.6%
% Bachelor Degree or higher	55.1%	44.1%
% Graduate/Professional Degree	26.3%	19.6%

* Data was obtained by calculating percentages of County estimate

DISABLED POPULATION 2008 Census Update		
	Sunnyvale	**Santa Clara County**
Total Population 16 – 64 years	9,279	141,149

Prepared by the
CITY OF SUNNYVALE
www.sunnyvale.ca.gov

The information contained in this profile was obtained from a variety of sources including the 2010 Census Update, the 2008 American Community Survey (Average), the California Employment Development Department, and the City of Sunnyvale. For more detailed information about sources, please contact:

Economic Development: (408) 730-7607
email: econdev@ci.sunnyvale.ca.us
www.sunnyvale-econdev.com

Planning Division: (408) 730-7440
email: planning@ci.sunnyvale.ca.us

Appendix D

City of Sunnyvale
2010 Urban Water Management Plan
Projected Demands Provided to Wholesale Agencies

Twenty Year Water Supply Forecast
Summary
FY 2012 - 2031

Fiscal Year	Actual 2009	Actual 2010	Plan 2011	Plan 2012	Plan 2013	Plan 2014	Plan 2015	Plan 2016	Plan 2017	Plan 2018	Plan 2019	Plan 2020	Plan 2021
Citywide Projection													
Total Demand (AF/YR)	24,076	21,475	21,475	21,690	21,907	21,929	21,973	22,038	22,127	22,237	22,371	22,527	22,708
Growth		-10.8%	0.0%	1.0%	1.0%	0.1%	0.2%	0.3%	0.4%	0.5%	0.6%	0.7%	0.8%
San Francisco Water Supply (SFPUC)													
Quantity (Acre Feet)	11,894	10,954	10,003	10,003	10,003	10,003	10,003	10,003	10,003	10,003	10,003	10,003	10,003
Cost (per Acre Foot)	$ 623	$ 719	$ 836	$ 1,185	$ 1,263	$ 1,363	$ 1,464	$ 1,668	$ 1,773	$ 1,891	$ 1,891	$ 1,921	$ 1,943
Meter Charge	$ 271,368	$ 252,329	$ 275,268	$ 275,268	$ 275,268	$ 275,268	$ 275,268	$ 330,322	$ 330,322	$ 330,322	$ 330,322	$ 330,322	$ 396,386
Total Cost	$ 7,361,313	$ 8,152,989	$ 8,641,297	$ 12,648,268	$ 13,058,435	$ 14,093,872	$ 15,074,993	$ 17,073,296	$ 18,011,326	$ 19,016,248	$ 18,861,285	$ 19,021,307	$ 19,157,358
Percent Change in Cost		10.8%	6.0%	46.4%	3.2%	7.9%	7.0%	13.3%	5.5%	5.6%	-0.8%	0.8%	0.7%
Santa Clara Valley Water District Supply (SCVWD)													
Quantity (Acre Feet)	9,330	7,430	10,409	9,889	9,889	9,889	9,570	9,610	9,674	9,759	9,868	9,999	10,155
Cost (per Acre Foot)	$ 520	$ 520	$ 520	$ 569	$ 625	$ 685	$ 750	$ 820	$ 895	$ 970	$ 1,030	$ 1,085	$ 1,130
Treated Water Charge (per Acre Foot)	$ 100	$ 100	$ 100	$ 100	$ 100	$ 100	$ 100	$ 100	$ 100	$ 100	$ 105	$ 105	$ 105
Total Cost	$ 5,784,805	$ 4,609,607	$ 6,453,828	$ 6,615,741	$ 7,169,525	$ 7,762,635	$ 8,134,130	$ 8,841,644	$ 9,625,268	$ 10,442,418	$ 11,199,832	$ 11,899,153	$ 12,540,815
Percent Change in Cost		-20.3%	40.0%	2.5%	8.4%	8.3%	4.8%	8.7%	8.9%	8.5%	7.3%	6.2%	5.4%
City Wells													
Quantity (Acre Feet)	937	1,762	1,200	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000
Cost (per Acre Foot)	$ 520	$ 520	$ 520	$ 569	$ 625	$ 685	$ 750	$ 820	$ 895	$ 970	$ 1,030	$ 1,085	$ 1,130
Power Cost (per Acre Foot)	$ 82	$ 203	$ 190	$ 194	$ 198	$ 202	$ 206	$ 210	$ 214	$ 218	$ 223	$ 227	$ 234
Total Cost	$ 554,348	$ 916,100	$ 852,000	$ 762,725	$ 822,512	$ 886,630	$ 955,662	$ 1,029,775	$ 1,108,971	$ 1,188,250	$ 1,252,615	$ 1,312,068	$ 1,363,880
Percent Change in Cost		65.3%	-7.0%	-10.5%	7.8%	7.8%	7.8%	7.8%	7.7%	7.1%	5.4%	4.7%	3.9%
Total Potable Water Demand (Acre Feet)	22,161	20,146	21,612	20,892	20,892	20,892	20,573	20,613	20,677	20,762	20,871	21,002	21,158
Total Potable Water Cost	$ 13,700,466	$ 13,678,696	$15,947,125	$ 20,026,734	$ 21,050,472	$ 22,743,137	$ 24,164,785	$ 26,944,716	$ 28,745,565	$ 30,646,917	$ 31,313,732	$ 32,232,527	$ 33,062,053
Percent Change in Total Cost		-0.2%	16.6%	25.6%	5.1%	8.0%	6.3%	11.5%	6.7%	6.6%	2.2%	2.9%	2.6%
City Produced Recycled Water													
Quantity (Acre Feet)	1,915	1,329	1,100	798	1,015	1,037	1,400	1,425	1,450	1,475	1,500	1,525	1,550
Cost (estimated per Acre Foot)[1]	$ 450	$ 459	$ 468	$ 478	$ 487	$ 497	$ 507	$ 517	$ 527	$ 538	$ 549	$ 560	$ 571
Total Cost	$ 861,750	$ 610,011	$ 514,998	$ 381,080	$ 494,401	$ 515,219	$ 709,482	$ 736,595	$ 764,508	$ 793,243	$ 822,821	$ 853,266	$ 884,599

1. Recycled water cost is estimated based on FY 2010 production. Cost is estimated based on the incremental cost of producing recycled water plus distribution and doesn't factor in additional overhead or other costs.

Twenty Year Water Supply Forecast
Summary
FY 2012 - 2031

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Fiscal Year	Plan 2022	Plan 2023	Plan 2024	Plan 2025	Plan 2026	Plan 2027	Plan 2028	Plan 2029	Plan 2030	Plan 2031
Citywide Projection										
Total Demand (AF/YR)	22,912	23,141	23,396	23,676	23,984	24,320	24,685	25,080	25,506	25,968
Growth	0.9%	1.0%	1.1%	1.2%	1.3%	1.4%	1.5%	1.6%	1.7%	1.8%
San Francisco Water Supply (SFPUC)										
Quantity (Acre Feet)	10,003	10,003	10,003	10,003	10,003	10,003	10,003	10,003	10,003	10,003
Cost (per Acre Foot)	$ 1,959	$ 1,975	$ 1,992	$ 2,008	$ 2,025	$ 2,042	$ 2,059	$ 2,076	$ 2,093	$ 2,110
Meter Charge	$ 396,386	$ 396,386	$ 396,386	$ 396,386	$ 475,663	$ 475,663	$ 475,663	$ 475,663	$ 475,663	$ 475,663
Total Cost	$ 19,147,362	$ 19,151,337	$ 19,156,919	$ 19,162,503	$ 19,247,365	$ 19,252,952	$ 19,258,540	$ 19,264,130	$ 19,269,722	$ 19,275,316
Percent Change in Cost	-0.1%	0.0%	0.0%	0.0%	0.4%	0.0%	0.0%	0.0%	0.0%	0.0%
Santa Clara Valley Water District Supply (SCVWD)										
Quantity (Acre Feet)	10,334	10,538	10,768	11,023	11,306	11,617	11,957	12,327	12,728	13,165
Cost (per Acre Foot)	$ 1,164	$ 1,199	$ 1,235	$ 1,272	$ 1,310	$ 1,349	$ 1,390	$ 1,431	$ 1,474	$ 1,519
Treated Water Charge (per Acre Foot)	$ 120	$ 120	$ 120	$ 125	$ 125	$ 125	$ 130	$ 130	$ 130	$ 130
Total Cost	$ 13,267,661	$ 13,897,684	$ 14,587,669	$ 15,397,607	$ 16,223,998	$ 17,126,492	$ 18,171,219	$ 19,247,390	$ 20,420,666	$ 21,703,533
Percent Change in Cost	5.8%	4.7%	5.0%	5.6%	5.4%	5.6%	6.1%	5.9%	6.1%	6.3%
City Wells										
Quantity (Acre Feet)	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000
Cost (per Acre Foot)	$ 1,164	$ 1,199	$ 1,235	$ 1,272	$ 1,310	$ 1,349	$ 1,390	$ 1,431	$ 1,474	$ 1,519
Power Cost (per Acre Foot)	$ 241	$ 248	$ 256	$ 263	$ 271	$ 279	$ 288	$ 296	$ 305	$ 314
Total Cost	$ 1,404,796	$ 1,446,940	$ 1,490,348	$ 1,535,059	$ 1,581,110	$ 1,628,544	$ 1,677,400	$ 1,727,722	$ 1,779,554	$ 1,832,940
Percent Change in Cost	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%
Total Potable Water Demand (Acre Feet)	21,337	21,541	21,771	22,026	22,309	22,620	22,960	23,330	23,731	24,168
Total Potable Water Cost	$ 33,819,818	$ 34,495,961	$ 35,234,936	$ 36,095,168	$ 37,052,473	$ 38,007,988	$ 39,107,159	$ 40,239,242	$ 41,469,942	$ 42,811,789
Percent Change in Total Cost	2.3%	2.0%	2.1%	2.4%	2.7%	2.6%	2.9%	2.9%	3.1%	3.2%
City Produced Recycled Water										
Quantity (Acre Feet)	1,575	1,600	1,625	1,650	1,675	1,700	1,725	1,750	1,775	1,800
Cost (estimated per Acre Foot)[1]	$ 588	$ 605	$ 624	$ 642	$ 662	$ 681	$ 702	$ 723	$ 745	$ 767
Total Cost	$ 925,832	$ 968,744	$ 1,013,397	$ 1,059,857	$ 1,108,193	$ 1,158,475	$ 1,210,777	$ 1,265,174	$ 1,321,746	$ 1,380,573

1. Recycled water cost is estimated based on FY 2010 production. Cost is estimated based on the incremental cost of producing recycled water plus distribution and doesn't factor in additional overhead or other costs.

Twenty Year Water Supply Forecast
Summary
FY 2012 - 2031

Fiscal Year	Plan 2022	Plan 2023	Plan 2024	Plan 2025	Plan 2026	Plan 2027	Plan 2028	Plan 2029	Plan 2030	Plan 2031
Citywide Projection										
Total Demand (AF/YR)	22,912	23,141	23,396	23,676	23,984	24,320	24,685	25,080	25,506	25,968
Growth	0.9%	1.0%	1.1%	1.2%	1.3%	1.4%	1.5%	1.6%	1.7%	1.8%
San Francisco Water Supply (SFPUC)										
Quantity (Acre Feet)	10,003	10,003	10,003	10,003	10,003	10,003	10,003	10,003	10,003	10,003
Cost (per Acre Foot)	$ 1,959	$ 1,975	$ 1,992	$ 2,008	$ 2,025	$ 2,042	$ 2,059	$ 2,076	$ 2,093	$ 2,110
Meter Charge	$ 396,386	$ 396,386	$ 396,386	$ 396,386	$ 475,663	$ 475,663	$ 475,663	$ 475,663	$ 475,663	$ 475,663
Total Cost	$ 19,147,362	$ 19,151,337	$ 19,156,919	$ 19,162,503	$ 19,247,365	$ 19,252,952	$ 19,258,540	$ 19,264,130	$ 19,269,722	$ 19,275,316
Percent Change in Cost	-0.1%	0.0%	0.0%	0.0%	0.4%	0.0%	0.0%	0.0%	0.0%	0.0%
Santa Clara Valley Water District Supply (SCVWD)										
Quantity (Acre Feet)	10,334	10,538	10,768	11,023	11,306	11,617	11,957	12,327	12,728	13,165
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Treated Water Charge (per Acre Foot)	$ 120	$ 120	$ 120	$ 125	$ 125	$ 125	$ 130	$ 130	$ 130	$ 130
Total Cost	$ 13,267,661	$ 13,897,684	$ 14,587,669	$ 15,397,607	$ 16,223,998	$ 17,126,492	$ 18,171,219	$ 19,247,390	$ 20,420,666	$ 21,703,533
Percent Change in Cost	5.8%	4.7%	5.0%	5.6%	5.4%	5.6%	6.1%	5.9%	6.1%	6.3%
City Wells										
Quantity (Acre Feet)	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000
Cost (per Acre Foot)	$ 1,164	$ 1,199	$ 1,235	$ 1,272	$ 1,310	$ 1,349	$ 1,390	$ 1,431	$ 1,474	$ 1,519
Power Cost (per Acre Foot)	$ 241	$ 248	$ 256	$ 263	$ 271	$ 279	$ 288	$ 296	$ 305	$ 314
Total Cost	$ 1,404,796	$ 1,446,940	$ 1,490,348	$ 1,535,059	$ 1,581,110	$ 1,628,544	$ 1,677,400	$ 1,727,722	$ 1,779,554	$ 1,832,940
Percent Change in Cost	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%
Total Potable Water Demand (Acre Feet)	21,337	21,541	21,771	22,026	22,309	22,620	22,960	23,330	23,731	24,168
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Percent Change in Total Cost	2.3%	2.0%	2.1%	2.4%	2.7%	2.6%	2.9%	2.9%	3.1%	3.2%
City Produced Recycled Water										
Quantity (Acre Feet)	1,575	1,600	1,625	1,650	1,675	1,700	1,725	1,750	1,775	1,800
Cost (estimated per Acre Foot)[1]	$ 588	$ 605	$ 624	$ 642	$ 662	$ 681	$ 702	$ 723	$ 745	$ 767
Total Cost	$ 925,832	$ 968,744	$ 1,013,397	$ 1,059,857	$ 1,108,193	$ 1,158,475	$ 1,210,777	$ 1,265,174	$ 1,321,746	$ 1,380,573

1. Recycled water cost is estimated based on FY 2010 production. Cost is estimated based on the incremental cost of producing recycled water plus distribution and doesn't factor in additional overhead or other costs.

Santa Clara Valley Water District

ANTICIPATED MONTHLY WATER DELIVERY SCHEDULE (In Acre-Feet)

FCE 264 (1-29-10)

Contractor's Name:	CITY OF SUNNYVALE					
Month	Anticipated Monthly Schedules					
	2010-2011	2011-2012	2012-2013	2013-2014	2014-2015	2015-2016
July	1290	1139	1139	1139	1080	1080
August	1290	1139	1139	1139	1080	1080
September	1290	1139	1139	1139	1080	1080
October	816	804	804	804	780	780
November	792	804	804	804	756	756
December	792	804	804	804	756	756
January	792	804	804	804	756	756
February	792	804	804	804	756	756
March	792	804	804	804	756	756
April	815	804	804	804	779	779
May	815	804	804	804	779	779
June	1290	1139	1139	1139	1080	1080
Total	**11,566**	**10,988**	**10,988**	**10,988**	**10,438**	**10,438**
Peak day deliver (Million Gallons)	18.59	17.66	*17.61	17.66	16.77	16.77

Submitted by (contractor's Representative):	Val Conzet	Date:	03/29/10

*Leap year = 366 days

NOTE: The estimate monthly quantities shall include the total deliveries to all turnouts of each contractor.

The District will provide executed copies to: Water Retailers' Agency
Financial Planning and Management Division
Financing and Revenue Collection Unit
Treated Water Operations and Maintenance Division
Water Quality Unit
Water Supply Operations Division

From: Nicole Sandkulla [mailto:NSandkulla@bawsca.org]
Sent: Thursday, February 24, 2011 3:04 PM
To: Levin, Ellen
Cc: Art Jensen; Allison C. Schutte; Anona Dutton; Petrick, Molly; Alan Kurotori (akurotori@santaclaraca.gov); Alex Ameri (alex.ameri@hayward-ca.gov); Art Morimoto (amorimoto@burlingame.org); Cari Lemke; Carrasco, Anthony; cathya@midpeninsulawater.org; David Dickson (ddickson@coastsidewater.org); dbarrow@westboroughwater.com; eric.cartwright@acwd.com; Flegel, Elizabeth; Gregg Hosfeldt (gregg.hosfeldt@mountainview.gov); Henry Young (henryy@midpeninsulawater.org); James Craig; Jerry Flanagan; Justin Ezell (jezell@redwoodcity.org); smtp:kphalen@ci.milpitas.ca.gov; Klara Fabry (kfabry@sanbruno.ca.gov); koconnell@nccwd.com; ksteffens@menlopark.org; M. L. Gordon (acmoffice2415@yahoo.com); Nasser, Mansour; Marty Laporte (martyl@bonair.stanford.edu); Marvin Rose (mrose@ci.sunnyvale.ca.us); mdebry@hillsca.org; Patrick Sweetland (psweetland@dalycity.org); Patrick Walter (pwalter@purissimawater.org); paulr@midpeninsulawater.org; Procos, Nicolas; Randy Breault; Rebecca Fotu (rlfotu@menlopark.org); rpopp@ci.millbrae.ca.us; rtowne@fostercity.org; Thomas.Niesar@acwd.com; Tim McAuliffe (tmcauliffe@burlingame.org); (mbolzowski@calwater.com); Alicia Sargiotto; Allison turner (alison.turner@mountainview.gov); Aparna Chatterjee; Brendan McCarthy; Brent Chester; Cathleen Brennan (cbrennan@coastsidewater.org); Cindy Bertsch; croyer@dalycity.org; Dana Jacobson; ECooney@HILLSBOROUGH.NET; Elvert, Catherine; gnathan@amwater.com; Howard Salamanca (hsalamanca@ci.milpitas.ca.gov); Jade Williams (jawilliams@calwater.com); Jeanette Kalabolas (jeanettek@midpeninsulawater.org); Krista Kuehnnackl; Leah Edwards; marilyn.mosher@hayward-ca.gov; Quesada, Nicole; Nina Hawk (nhawk@santaclaraca.gov); Norm Dorais (NDORAIS@fostercity.org); Shelly Reider (sreider@ci.millbrae.ca.us); Stephanie Nevins (stephanie.nevins@acwd.com); Toni Harris; Tracy Ingebrigtsen (tracyi@bonair.stanford.edu); Val Conzet (vconzet@ci.sunnyvale.ca.us); Virginia Parks; William Lai; Zach Goldberg
Subject: FW: Projected SFPUC Purchases for UWMP Preparation Needed by February 17, 2011

Dear Ms. Levine,

In response to the e-mail below and the SFPUC's request for purchase projections from its Wholesale Customers for use in the SFPUC's Urban Water Management Plan 2011 Update, attached is the requested information that I have received from the BAWSCA agencies. The table below provides a summary display of the responses received from the BAWSCA member agencies as transmitted in this e-mail.

If you have any further questions, please contact me at the BAWSCA office. I will forward to the SFPUC any additional responses that are received at a later date.

Sincerely,
Nicole Sandkulla

Updated Purchase Projections for SFPUC	
Agency Name	**Projections Included in 2/24/11 E-Mail**
ACWD	x
Brisbane	x
Burlingame	x
Cal Water	x
Coastside	x
Daly City	x
East Palo Alto	
Estero	x
Guadalupe Valley	x
Hayward	x
Hillsborough	E-Mail Response Included, Projections Not Yet Available
Menlo Park	
Mid-Peninsula	x
Millbrae	x
Milpitas	x
Mountain View	E-Mail Response Included, Projections Not Yet Available
North Coast	
Palo Alto	
Purissima Hills	
Redwood City	x
San Bruno	x
San Jose	x
Santa Clara	x
Stanford	E-Mail Response Included, Projections Not Yet Available
Sunnyvale	x
Westborough	x

Nicole M. Sandkulla, P. E.
Water Resources Planning Manager
Bay Area Water Supply and Conservation Agency
155 Bovet Road, Suite 302

San Mateo, CA 94402
Ph: (650) 349-3000 Fax: (650) 349-8395
EMail: NSandkulla@BAWSCA.org
Website: WWW.BAWSCA.org

From: Nicole Sandkulla [mailto:NSandkulla@bawsca.org]
Sent: Friday, February 04, 2011 12:03 PM
Subject: Projected SFPUC Purchases for UWMP Preparation Needed by February 17, 2011
Importance: High

Dear BAWSCA Water Management Representatives,

The San Francisco Public Utilities Commission (SFPUC) has requested projections from each of its wholesale customers of purchases from the San Francisco Regional Water System (System) in five year increments from 2015 to 2030 (or 2035). The SFPUC will use this information to prepare its Wholesale Urban Water Management Plan for the System.

SFPUC's request is consistent with the requirements of Section 10631 of the California Water Code which states:

> *(k) Urban water suppliers that rely upon a wholesale agency for a source of water shall provide the wholesale agency with water use projections from that agency for that source of water in five-year increments to 20 years or as far as data is available. The wholesale agency shall provide information to the urban water supplier for inclusion in the urban water supplier's plan that identifies and quantifies, to the extent practicable, the existing and planned sources of water as required by subdivision (b), available from the wholesale agency to the urban water supplier over the same five-year increments, and during various water-year types in accordance with subdivision (c). An urban water supplier may rely upon water supply information provided by the wholesale agency in fulfilling the plan informational requirements of subdivisions (b) and (c).*

Historically, the SFPUC has relied on each agency's water purchase projections reported in the BAWSCA Annual Report. However, past purchase projections may not be appropriate for a variety of reasons:

- Changes in the economy and overall water use characteristics in the region
- Agencies are updating their projected needs and use of sources as they prepare their UWMP's
- Projections in the FY 2008-2009 Annual Report do not include the results of the Water Conservation Implementation Plan and the status of each agency's conservation programs

The SFPUC will need to document estimated water sales, including amounts for Wholesale Customers that are exempt from filing UWMP's. We recommend that those agencies that

are not required to prepare UWMP's provide BAWSCA with the five-year projected purchases you wish the SFPUC to use in preparing its report.

As in the past, BAWSCA will support providing this information to the SFPUC in a coordinated fashion. To meet the SFPUC's deadline, please provide BAWSCA your projected SFPUC purchases in 5-year increments by close-of-business on Thursday, February 17, 2011. In addition to the numbers themselves, BAWSCA will forward to the SFPUC any qualifications that you wish to have associated with the data you provide at this time (e.g. that the data is draft and subject to modification as part of finalizing your agency UWMP). BAWSCA will forward information received to SFPUC on Friday, February 18th.

BAWSCA will only send to the SFPUC data that it receives from each of your agencies specifically for this purpose. No data will be provided to the SFPUC for agencies that do not provide data to BAWSCA.

Lastly, please note that BAWSCA will also utilize these purchase projections provided by each BAWSCA agency to prepare and submit the water purchase projections through 2018 due to the SFPUC by June 30, 2011 in compliance with Section 4.05 of the 2009 Water Supply Agreement unless otherwise notified of a change in the numbers by individual member agencies.

If you have any questions, please call me or Anona Dutton.

Sincerely,
Nicole Sandkulla

_____
Nicole M. Sandkulla, P. E.
Water Resources Planning Manager
Bay Area Water Supply and Conservation Agency
155 Bovet Road, Suite 302
San Mateo, CA 94402
Ph: (650) 349-3000 Fax: (650) 349-8395
EMail: NSandkulla@BAWSCA.org
Website: WWW.BAWSCA.org

Sunnyvale
p. 121

Nicole Sandkulla

From:	Jim Craig [JCraig@ci.sunnyvale.ca.us]
Sent:	Monday, February 07, 2011 3:25 PM
To:	Nicole Sandkulla
Cc:	Brendan McCarthy; Christina Uribe; Marvin Rose; Tim Kirby; Val Conzet
Subject:	Re: Projected SFPUC Purchases for UWMP Preparation Needed by February 17, 2011

Nicole,

On behalf of the City of Sunnyvale, and Director Marvin Rose, appointed Water Management Representative for the City, I am informing you of the projection of water purchases by the City of Sunnyvale from the SFPUC from 2015 through 2035.

The projected Sunnyvale purchases from SFPUC for the requested period, at 5 year increments, are as follows:

2015	8.930 MGD
2020	8.930 MGD
2025	8.930 MGD
2030	8.930 MGD
2035	8.930 MGD

If you have any questions about this projection, please call at your convenience.

Jim Craig
Superintendent of Field Services
P.O. Box 3707
Sunnyvale, CA 94088-3707

(408) 730-7558
jcraig@ci.sunnyvale.ca.us

>>> Nicole Sandkulla <NSandkulla@bawsca.org> 2/4/11 12:02 PM >>>

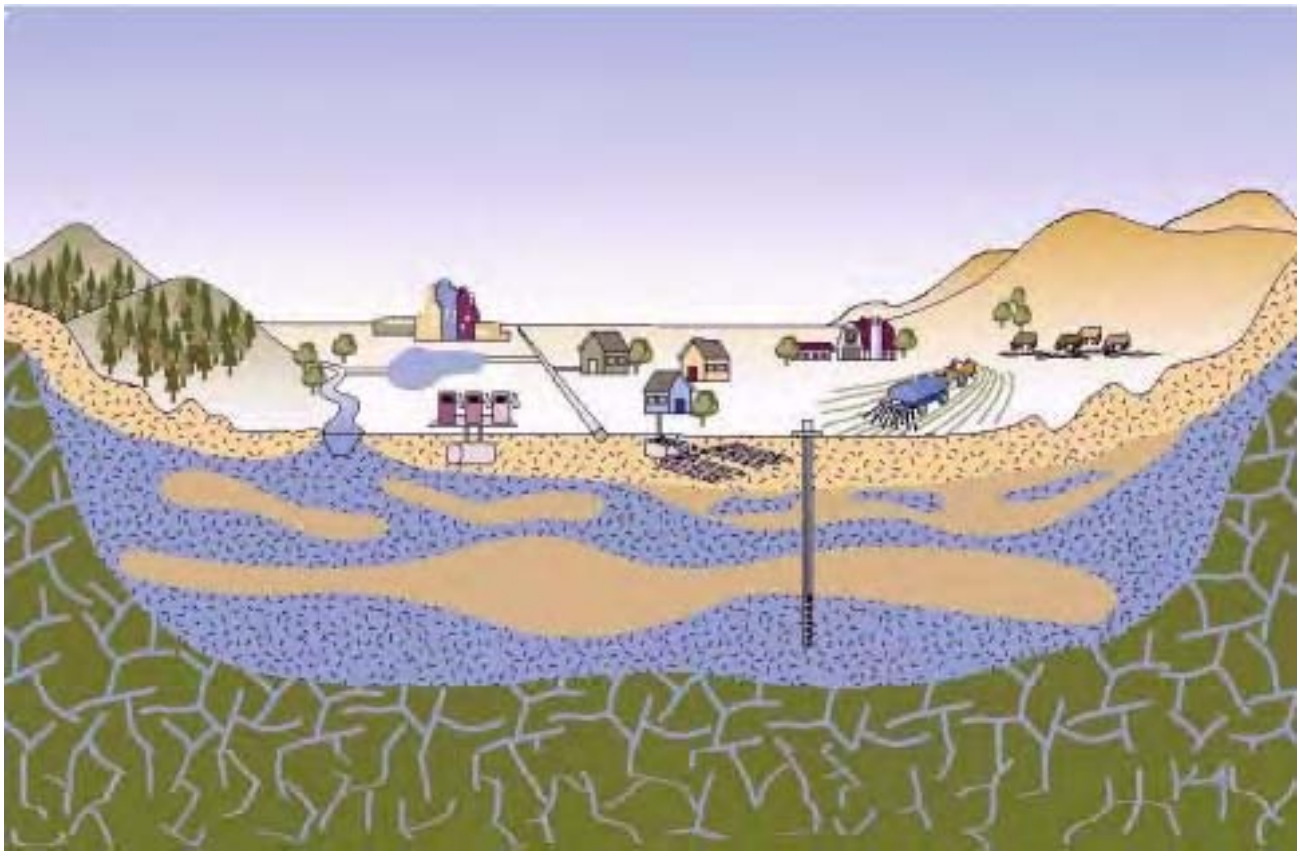
Dear BAWSCA Water Management Representatives,

The San Francisco Public Utilities Commission (SFPUC) has requested projections from each of its wholesale customers of purchases from the San Francisco Regional Water System (System) in five year increments from 2015 to 2030 (or 2035). The SFPUC will use this information to prepare its Wholesale Urban Water Management Plan for the System.

Appendix E

City of Sunnyvale
2010 Urban Water Management Plan
SCVWD Groundwater Management Plan

Santa Clara Valley Water District
Groundwater Management Plan



July 2001

Santa Clara Valley Water District

SANTA CLARA VALLEY WATER DISTRICT

Santa Clara Valley Water District Groundwater Management Plan

Prepared by

Vanessa Reymers	Assistant Engineer II
Tracy Hemmeter	Program Administrator

Under the direction of

Behzad Ahmadi
Unit Manager
Groundwater Management Unit

Keith Whitman
Deputy Operating Officer
Water Supply Management Division

Walter L. Wadlow
Chief Operating Officer
Assistant General Manager

DISTRICT BOARD OF DIRECTORS

Rosemary Kamei, Vice Chair	District 1	Tony Estremera, Chair	At Large
Joe Judge	District 2	Sig Sanchez	At Large
Richard P. Santos	District 3		
Larry Wilson	District 4		
Greg Zlotnick	District 5		

ACKNOWLEDGMENTS

OVERSIGHT MANAGER	Keith Whitman Deputy Operating Officer Water Supply Management Division
PROJECT SPONSOR	William G. Molnar
PROJECT MANAGER	Behzad Ahmadi
REPORT CONTRIBUTORS	
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Introduction	Behzad Ahmadi Tracy Hemmeter Vanessa Reymers
Background	Behzad Ahmadi Tracy Hemmeter
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Groundwater Monitoring	Behzad Ahmadi Randy Behrens Tracy Hemmeter Luis Jaimes Mark Merritt Lauren Moll Joseph Montenero Vanessa Reymers

Groundwater Quality Management	Behzad Ahmadi Randy Behrens Frances Brewster Ellen Fostersmith Tracy Hemmeter Seena Hoose Luis Jaimes Roger Pierno
Summary	Vanessa Reymers

The authors would like to extend a special thanks to William G. Molnar for his support, assistance, and guidance on this project.

Special acknowledgment is also given to the following people for their technical contributions, support, and feedback: James Crowley, Michael Duffy, Nai Hsueh, Tom Iwamura, Karen Kianpour, Carol Nigh, Sandy Oblonsky, and Sue Tippets.

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ACRONYMS USED

af – acre-feet
BMP – Best Management Practices
CEQA – California Environmental Quality Act
CIMIS – California Irrigation Management Information System
CVP – Central Valley Project
DEIR – Draft Environmental Impact Report
DRASTIC – Depth to water table, net Recharge, Aquifer media, Soil media, Topography, Impact of the vadose zone, and hydraulic Conductivity
DWR – Department of Water Resources
DWSAP – Drinking Water Source Assessment and Protection
EIR – Environmental Impact Report
EPA – Environmental Protection Agency
GIS – Geographic Information Systems
InSAR – Interferometric Synthetic Aperture Radar
IWRP – Integrated Water Resources Plan
LUSTOP – Leaking Underground Storage Tank Oversight Program
MCL – Maximum Contaminant Level
MOU – Memorandum of Understanding
MTBE – Methyl Tert Butyl Ether
NPDES – National Pollution Discharge Elimination System
NTU – Nephelometric Turbidity Unit
PCB - Polychlorinated biphenyl
RWQCB – Regional Water Quality Control Board
SBA – South Bay Aqueduct
SBWRP – South Bay Water Recycling Program
SCRWA – South County Regional Wastewater Authority
SCVWCD – Santa Clara Valley Water Conservation District
SCVWD – Santa Clara Valley Water District
SWRCB – State Water Resources Control Board
USGS – United States Geological Survey
UST – Underground Storage Tank
VOC – Volatile Organic Compound
WHP – Wellhead Protection Program
WMI – Watershed Management Initiative
WTP – Water Treatment Plant

EXECUTIVE SUMMARY

The Santa Clara Valley Water District (District) has managed the groundwater basin in Santa Clara County (County) since the early 1930s and is nationally recognized as a leader in groundwater management. The District works in conjunction with local retailers, the Regional Water Quality Control Board, and other agencies to ensure a safe and healthy supply of groundwater. In 2000, the groundwater basin supplied nearly half of the 390,000 acre-feet used in the County.

The District is the groundwater management agency in Santa Clara County as authorized by the California legislature under the Santa Clara Valley Water District Act (District Act), California Water Code Appendix, Chapter 60. Since its creation, the District has worked to minimize subsidence and protect the groundwater resources of the County under the direction of the District Act. As stated in the District Act, the District's objectives related to groundwater management are to recharge the groundwater basin, conserve water, increase water supply, and to prevent waste or diminution of the District's water supply.

The mission of the District is a healthy, safe, and enhanced quality of living in Santa Clara County through the comprehensive management of water resources in a practical, cost-effective, and environmentally-sensitive manner. In the Global Governance Commitment adopted by the District Board of Directors, it is stated that the conjunctive management of the groundwater basins is an integral part of the District's comprehensive water supply management program.

The District has always effectively managed the groundwater basin to fulfill the objectives of the District Act and its mission. The goal of these groundwater management efforts has been, and continues to be, ***to ensure that groundwater resources are sustained and protected***.

The Groundwater Management Plan formally documents the District's groundwater management goal and describes programs in place that are designed to meet that goal. The following programs are documented in the plan:

- Groundwater supply management programs that replenish the groundwater basin, sustain the basin's water supplies, help to mitigate groundwater overdraft, and sustain storage reserves for use during dry periods.

- Groundwater monitoring programs that provide data to assist the District in evaluating and managing the groundwater basin.

- Groundwater quality management programs that identify and evaluate threats to groundwater quality and prevent or mitigate contamination associated with those threats.

This plan serves as the first step toward a more formal and integrated approach to the management of groundwater programs, and to the management of the basin overall. The

various groundwater management programs and activities described in this document demonstrate that the District is proactive and effective in protecting the County's groundwater resources.

Recommendations

The groundwater management programs described in the Groundwater Management Plan were developed and implemented before the Board of Directors adopted the Ends Policies in 1999, and were therefore not driven by these formally documented ends. As the District is now guided by these policies, we need to ensure that the outcomes of our groundwater management programs match those of the Ends Policies. In addition, we need to ensure that existing programs are integrated and effective in terms of achieving the District's groundwater management goal.

Although the District manages the basin effectively, there is room for improvement of the groundwater management programs in terms of meeting these outcomes. Specific areas where further analysis is recommended include:

1. **Coordination between the Groundwater Management Plan and the Integrated Water Resources Plan (IWRP) –** As the District's water supply planning document through year 2040, the IWRP has identified the operation of the groundwater basin as a critical component to help the District respond to changing water supply and demand conditions. Planning and analysis efforts for future updates of the Groundwater Management Plan and the IWRP need to be integrated in order to provide a coordinated and comprehensive water supply plan for Santa Clara County.

2. **Integration of groundwater management programs and activities** – Individual groundwater management programs tend to be implemented almost independently of other programs. A more integrated approach to the management of these programs, and to the management of the basin overall needs to be developed. Integration of these programs and improved conjunctive use strategies will result in more effective basin management.

3. **Optimization of recharge operations** – As artificial recharge is critical to sustaining groundwater resources, an analysis of the most effective amount, location, and timing of recharge should be conducted.

4. **Improved understanding of the groundwater basin** – In general, the existing groundwater management programs seem to focus on managing the basin to meet demands and protecting the basin from contamination and the threat of contamination. However, improving the District's understanding of the complexity of the groundwater basin is critical to improved groundwater management. The more we know about the basin, the better we can analyze the impact of different groundwater scenarios and management alternatives.

5. **Effective coordination and communication with internal and external agencies** – Improved communication and coordination will lead to improved groundwater

management programs. Increased sharing of ideas, knowledge, and technical expertise among people involved with groundwater at the District will result in increased knowledge, well-coordinated and efficient work, and well-informed analyses and conclusions. Improved coordination with external agencies, such as retailers and state and federal organizations, will result in improved knowledge of customer needs and increased awareness of District activities.

A detailed analysis of these areas and of all groundwater programs as they relate to the Ends Policies and the groundwater management goal is recommended. District staff have already begun to address some of these issues, which will be fully discussed in the first update to the Groundwater Management Plan. The update, which is scheduled for 2002, will fully address the issues above and the overall management of the basin by presenting a formal groundwater management strategy. The update will evaluate each groundwater program's contribution and effectiveness in terms of the groundwater management goal and outcomes directed by the Ends Policies. If there is no direct connection between the Ends Policies and a specific program, that program's contribution to other linked programs will be analyzed. The update will include recommendations for changes to existing programs or for the development of new programs, standards, or ordinances. The update will also develop an integrated approach for the management of groundwater programs, and for the management of the groundwater basin in general.

Groundwater is critical to the water supply needs of Santa Clara County. Therefore, it is of the utmost importance that the District continues the progress begun with this Groundwater Management Plan. Increased demands and the possibility of reduced imported water in the future make effective and efficient management of the groundwater basin essential. The Groundwater Management Plan and future updates will identify how the management of the groundwater basin can be improved, thereby ensuring that groundwater resources will continue to be sustained and protected.

Chapter 1
INTRODUCTION

The Santa Clara Valley Water District (District) has managed the groundwater basin in Santa Clara County (County) since the early 1930s and is nationally recognized as a leader in groundwater management. Effective management of the groundwater basin is essential, as the groundwater basin provides nearly half of the County's overall water supply. Since its creation, the District has implemented numerous groundwater management programs and activities to manage the basin and to ensure a safe and healthy supply of groundwater.

Purpose

The purpose of this Groundwater Management Plan is to describe existing groundwater management programs and to formally document the District's groundwater management goal of ensuring that groundwater resources are sustained and protected. The following groundwater management programs are documented in this plan:

- Groundwater supply management programs that replenish the groundwater basin, sustain the basin's water supplies, help to mitigate groundwater overdraft, and sustain storage reserves for use during dry periods.

- Groundwater monitoring programs that provide data to assist the District in evaluating and managing the groundwater basin.

- Groundwater quality management programs that identify and evaluate threats to groundwater quality and prevent or mitigate contamination associated with those threats.

Background

The District is the groundwater management agency in Santa Clara County as authorized by the California legislature under the Santa Clara Valley Water District Act (District Act), California Water Code Appendix, Chapter 60. Since its creation, the District has worked to minimize subsidence and protect the groundwater resources of the County under the direction of the District Act. As stated in the District Act, the District's objectives related to groundwater management are to recharge the groundwater basin, conserve water, increase water supply, and to prevent waste or diminution of the District's water supply. The District Act also provides the District with the authority to levy groundwater user fees and to use those revenues to manage the County's groundwater resources.

The mission of the District is a healthy, safe, and enhanced quality of living in Santa Clara County through the comprehensive management of water resources in a practical, cost-effective, and environmentally-sensitive manner. As part of the District's Global Governance Commitment adopted by the Board of Directors, "the District will provide a healthy, clean, reliable, and affordable water supply that meets or exceeds all applicable water quality regulatory standards in a cost-effective manner. Utilizing a variety of water supply sources and strategies, the District will pursue a comprehensive water

management program both within the county and statewide that reflects its commitment to public health and environmental stewardship." The policy also states that the conjunctive management of the groundwater basins to be an integral part of the District's comprehensive water supply management program.

The District has always effectively managed the groundwater basin to fulfill the objectives of the District Act and its mission. The goal of these efforts has been, and continues to be, to sustain and protect groundwater resources.

This Groundwater Management Plan is the District's first step toward a more formal and integrated approach to groundwater management. This Groundwater Management Plan describes existing groundwater management programs and formally documents the District's groundwater management goal, which is ***to ensure that groundwater resources are sustained and protected***.

Report Contents

The structure of the Groundwater Management Plan is outlined below. Chapters 3 through 5, which pertain to specific groundwater management programs, are organized to provide program objectives, related background information, the current status of the program, and information on the future direction of each program.

- Chapter 1 (this Introduction)

- Chapter 2 describes the geography and geology of the County as well as the history of local groundwater use. The chapter also describes the development of District facilities, and explains the various components of the existing water conservation and distribution system. A brief discussion on current groundwater conditions is also presented.

- Chapter 3 describes District groundwater supply management programs that replenish the groundwater basin, sustain the basin's supplies, and/or help in mitigating groundwater overdraft. In addition, the chapter summarizes the role of groundwater in the District's overall water supply outlook, and describes water use efficiency programs for groundwater users.

- Chapter 4 describes groundwater monitoring programs that provide data to assist the District in evaluating groundwater basin management.

- Chapter 5 describes groundwater quality management programs that evaluate groundwater quality and protect the groundwater from contamination and the threat of contamination.

- Chapter 6 summarizes existing groundwater management programs and activities designed to sustain and protect groundwater resources and provides recommendations for future work.

Chapter 2
BACKGROUND

This chapter describes the study area as well as the history of local groundwater use and the development of District facilities. Various components of the District's existing water conservation and distribution system are also described. A brief discussion on current groundwater conditions is also presented.

Geography

Santa Clara County is located at the southern tip of the San Francisco Bay. It encompasses approximately 1,300 square miles, making it the largest of the nine Bay Area counties. The County contributes about one fourth of the Bay Area's total population and more than a quarter of all Bay Area jobs.

Figure 2-1
Location of Santa Clara County

The County boasts a combination of physical attractiveness, economic diversity, and numerous natural amenities. Major topographical features include the Santa Clara Valley, the Diablo Range to the east, and Santa Cruz Mountains to the west. The Baylands lie in the northwestern part of the County, adjacent to the waters of the southern San Francisco Bay.

History of the County's Groundwater

Water has played an important part in the development of Santa Clara County since the arrival of the Spaniards in 1776. Unlike the indigenous peoples, who for thousands of years depended upon the availability of wild food, the Spaniards cultivated food crops and irrigated with surface water. Population growth and the United States' conquest of the area in 1846 increased the demand for these crops, which forced the use of the groundwater basin. Groundwater was drawn to the surface by windmill pumps or flowed up under artesian conditions. The first well was drilled in the early 1850s in San Jose.

By 1865, there were close to 500 artesian wells in the valley and already signs of potential misuse of groundwater supplies. In the valley's newspapers a series of editorials and letters appeared which complained of farmers and others who left their wells uncapped, and blamed them for a water shortage and erosion damage to the lowlands.

As a result of several dry years in the late 1890s, more and more wells were sunk. Dry winters in the early 1900s were accompanied by a growing demand for the County's fruits and vegetables, which were irrigated with groundwater. This trend of increased irrigation and well drilling continued until 1915. During this period, less water replenished the groundwater basin than was taken out, causing groundwater levels to drop rapidly.

In 1913 a group of farmers asked the federal government for relief from the increased cost of pumping that resulted from a lower groundwater table. The farmers formed an irrigation district to investigate possible reservoir sites; however, the following year was wet and no action was taken. It was not until 1919 that the Farm Owners and Operators Association presented a resolution to the County Board of Supervisors expressing their strong opposition to the waste resulting from the use of artesian wells, and again raised the issue of building dams to supplement existing water supplies. By that year subsidence of 0.4 ft had occurred in San Jose. Between 1912 and 1932 subsidence ranged from 0.35 ft in Palo Alto to 3.66 ft in San Jose.

In 1921, a report was presented to the Santa Clara Valley Water Conservation Committee showing that far more water was being pumped from the ground than nature could replace. The committee planned to form a water district that differed from others in the state by having a provision for groundwater recharge. Their effort to form the water district failed, but they were able to implement several water recharge and conservation programs. It was not until 1929 that the County's voters approved the Santa Clara Valley Water Conservation District (SCVWCD), with the initial mission of stopping groundwater overdraft and ground surface subsidence.

District History

The SCVWCD was the forerunner of today's District, which was formed through the consolidation and annexation of other flood control and water districts within Santa Clara County. By 1935, the District had completed the construction of Almaden, Calero, Guadalupe, Stevens Creek, and Vasona dams to impound winter waters for recharge into percolation facilities during the summer. Later dams completed include Coyote in 1936, Anderson in 1950 and Lexington in 1952. The Gavilan Water District in the southern

portion of the County constructed Chesbro Dam in 1955 and Uvas Dam in 1957. These dams enabled the District to capture surface water runoff and release it for groundwater recharge.

The late 1930s to 1947 marked a period of recovery in groundwater levels that reduced subsidence. In 1947 conditions became dry, groundwater levels declined rapidly and subsidence resumed. In 1950 almost all of the County's water requirements were met by water extracted from the groundwater basin. This resulted in an all-time low water level in the northern subbasin.

In 1952, the first imported water was delivered by the water retailers in northern Santa Clara County through the Hetch-Hetchy southern aqueduct. By 1960, the population of the County had doubled from that of 1950. To supply this growth, groundwater pumping increased and groundwater levels continued to decline. By the early 1960s, it was evident that the combination of Hetch-Hetchy and local water supplies could not meet the area's water demands, so the District contracted with the state to receive an entitlement of 100,000 acre-feet (af) per year through the South Bay Aqueduct (SBA).

The SBA supply could not be fully utilized for recharge in the groundwater basin. Hence, to supplement the basin, the District constructed its first water treatment plant (WTP), Rinconada. In 1967, the District started delivering treated surface water to North County residents (North County refers to the Santa Clara Valley Subbasin), thus reducing the need for pumping. This led to a recovery of groundwater levels and reduced the rate of subsidence as well.

From 1960 to 1970 the County's population nearly doubled yet again. The semiconductor and computer manufacturing industries contributed to almost 34 percent of the job growth between 1960 and 1970. Population growth and economic diversity seemed especially important to Santa Clara County, which had been predominantly agricultural. This transformation was not without its problems. In the early 1980s a major underground tank storing a solvent for a manufacturing process in south San Jose was discovered to be leaking and the District's attention focused on water quality of the groundwater basin.

The growth and prosperity of the County continued, and jobs grew 39 percent between 1970 and 1980. In 1974, Penitencia (the District's second WTP) started delivering treated water. Groundwater pumping accounted for about half of the total water use by the mid-1980s. The rate of subsidence was reduced to about 0.01 ft/year compared to 1 ft/year in 1961. To provide a reliable source of supply the District contracted with the federal government for the delivery of an entitlement of 152,500 af per year of imported water from the Central Valley Project (CVP) through the San Felipe Project. The first delivery of San Felipe water took place in 1987, but it was not until 1989 that the District's Santa Teresa WTP was began operating to fully utilize this additional source of imported supply. Since the 1980s, the population of Santa Clara County has continued to increase, and the change in land use toward urbanization has continued.

District Board of Directors

The District is governed by a seven-member Board of Directors. Five of the members are elected, one from each of the five County supervisorial districts, and the remaining two directors are appointed by the Santa Clara County Board of Supervisors to represent the County at large. The directors serve overlapping four-year terms.

The Board establishes policy on the District's mission, goals, and operations and represents the general public in deciding issues related to water supply and flood control. The Board also has the authority to adopt ordinances that have the force of law within the District. The Board reviews staff recommendations and decides which policies should be implemented in light of the District's mission and goals. The Board also monitors the implementation of its policies, and supervises management to see that work is accomplished on time and efficiently.

The Board of Directors holds biweekly public meetings, at which the public is given the opportunity to express opinions or voice concerns. In addition, the public can participate in the annual process of groundwater rate setting through public hearings.

The Board of Directors identifies the conjunctive management of the groundwater basins to maximize water supply reliability as an integral part of the District's commitment to a comprehensive water management program.

District System

As a water resource management agency for the entire County, the District provides a reliable supply of high-quality water to 13 private and public water retailers serving more than 1.7 million residents, and to private well owners who rely on groundwater.

The District operates and maintains a Countywide conservation and distribution system to convey raw water for groundwater recharge and treated water for wholesale to private and public retailers. The components of this distribution system are described in detail below.

Reservoirs

Local runoff is captured in reservoirs within the County with a combined capacity of about 169,000 af. The stored water is released for beneficial use at a later time. The District's reservoirs are described in Table 2-1 and are shown in Figure 2-2.

Treatment Plants

The District also operates three water treatment plants (WTPs): Rinconada, Penitencia, and Santa Teresa. These facilities are all connected by five major raw water conduits, which also connect the two imported raw water sources from the State Water Project (SWP) and the CVP. Two pumping plants (Coyote and Vasona) provide the lifts required for conveyance during peak usage.

Table 2-1
District Reservoirs

Reservoir	*Capacity(af)*	*Year Completed*	*Surface Area (ac)*	*Dam Height (ft)*
Almaden	*1,586*	*1935*	*59*	*108*
Anderson	*89,073*	*1950*	*1,245*	*240*
Calero	*10,050*	*1935*	*347*	*98*
Chesbro	*8,952*	*1955*	*265*	*95*
Coyote	*22,925*	*1936*	*648*	*138*
Guadalupe	*3,228*	*1935*	*79*	*129*
Lexington	*19,834*	*1952*	*475*	*195*
Stevens Creek	*3,465*	*1935*	*91*	*129*
Uvas	*9,935*	*1957*	*286*	*105*
Vasona	*400*	*1935*	*57*	*30*

Figure 2-2
District Reservoir Locations

Recharge Facilities

The Districts operates and maintains 18 major recharge systems, which consist of a combination of off-stream and in-stream facilities. These systems have a combined pond surface recharge area of more than 390 acres, and contain over 30 local creeks for artificial in-stream recharge to replenish the groundwater basin. The total annual average recharge capacity of these systems is 157,200 af.

Groundwater Basins

The groundwater basin is divided into three interconnected subbasins that transmit, filter, and store water. These subbasins are portrayed in Figure 2-3. The Santa Clara Valley Subbasin in the northern part of the County extends from Coyote Narrows at Metcalf road to the County's northern boundary. The Diablo Range bounds it on the east and the Santa Cruz Mountains on the west. These two ranges converge at the Coyote Narrows to form the southern limits of the subbasin. The Santa Clara Valley Subbasin is approximately 22 miles long and 15 miles wide, with a surface area of 225 square miles. A confined zone within the northern areas of the subbasin is overlaid with a series of clay layers resulting in a low permeability zone. The southern area is the unconfined zone, or forebay, where the clay layer does not restrict recharge.

The Coyote Subbasin extends from Metcalf Road south to Cochran Road, where it joins the Llagas Subbasin at a groundwater divide. The Coyote Subbasin is approximately 7 miles long and 2 miles wide and has a surface area of approximately 15 square miles. The subbasin is generally unconfined and has no thick clay layers. This subbasin generally drains into the Santa Clara Valley Subbasin.

The Llagas Subbasin extends from Cochran Road, near Morgan Hill, south to the County's southern boundary. It is connected to the Bolsa Subbasin of the Hollister Basin and bounded on the south by the Pajaro River (the Santa Clara - San Benito County line). The Llagas Subbasin is approximately 15 miles long, 3 miles wide along its northern boundary, and 6 miles wide along the Pajaro River. A series of interbedded clay layers, which extends north from the Pajaro River, divides this subbasin into confined and forebay zones.

The three subbasins serve multiple functions. They transmit water through the gravelly alluvial fans of streams into the deeper confined aquifer of the central part of the valley. They filter water, making it suitable for drinking and for municipal, industrial, and agricultural uses. They also have vast storage capacity, together supplying as much as half of the annual water needs of the County. In 2000, the groundwater basin supplied 165,000 acre-feet of the total water use of 390,000 acre-feet.

Figure 2-3
Santa Clara County Groundwater Subbasins

Current Groundwater Conditions

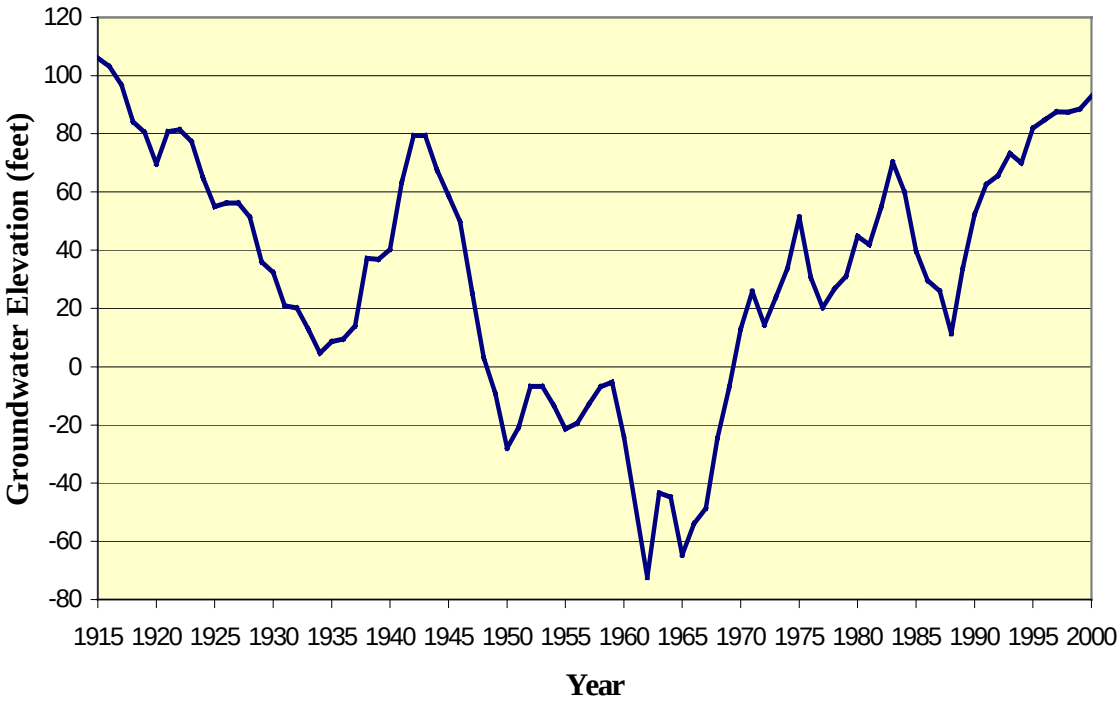
Groundwater conditions throughout the County are generally very good, as District efforts to prevent groundwater basin overdraft, curb land subsidence, and protect water quality have been largely successful. Groundwater elevations are generally recovered from overdraft conditions throughout the basin, inelastic land subsidence has been curtailed, and groundwater quality supports beneficial uses. The District evaluates current groundwater conditions based on the results of its groundwater monitoring programs, which are described in Chapter 4 of this plan.

Groundwater Elevations

Groundwater elevations are affected by natural and artificial recharge and groundwater extraction, and are an indicator of how much groundwater is in storage at a particular time. Both low and high elevations can cause severe, adverse conditions. Low groundwater levels can lead to land subsidence and high water levels can lead to nuisance conditions for below ground structures.

Figure 2-4 shows groundwater elevations in the San Jose Index Well in the Santa Clara Valley Subbasin. While groundwater elevations in the well are not indicative of actual groundwater elevations throughout the County, they demonstrate relative changes in groundwater levels.

Figure 2-4
Groundwater Elevations in San Jose Index Well



Land Subsidence

Land subsidence occurs in the Santa Clara Valley when the fluid pressure in the pores of aquifer systems is reduced significantly by overpumping, resulting in the compression of clay materials and the sinking of the land surface. Historically, the Santa Clara Valley Subbasin has experienced as much as 13 feet of inelastic, or nonrecoverable, land subsidence that necessitated the construction of additional dikes, levees, and flood control facilities to protect properties from flooding. The costs associated with inelastic land subsidence are high, as it can lead to saltwater intrusion that degrades groundwater quality and flooding that damages buildings and infrastructure. However, imported water from the State Water Project and Central Valley Project has increased District water supplies, reducing the demand on the groundwater basin, and providing water for the recharge of the basin. As a result, the rate of inelastic land subsidence has been curtailed to less than 0.01 feet per year.

Groundwater Quality

Natural interactions between water, the atmosphere, rock minerals, and surface water control groundwater quality. Anthropogenic (man-made) compounds released into the environment, such as nitrogen-based fertilizer, solvents, and fuel products, can also affect groundwater quality. Groundwater quality in the Santa Clara Valley Subbasin is generally high. Drinking water standards are met at public water supply wells without the use of treatment methods.

A few water quality problems have been detected. High mineral salt concentrations have been identified in the upper aquifer zone along San Francisco Bay, the lower aquifer zone underlying Palo Alto, and the southeastern portion of the forebay area of the Santa Clara Valley Subbasin. Nitrate concentrations in the South County (Coyote and Llagas Subbasins) are elevated and high nitrate concentrations are sporadically observed in the Santa Clara Valley Subbasin. Lastly, even though Santa Clara County is home to a large number of Superfund sites, there are few groundwater supply impacts from the chemicals from these sites; volatile organic compounds VOCs) are intermittently detected at trace concentrations in public water supply wells. In four wells, such contamination has been severe enough to cause the wells to be destroyed. Overall, the District's groundwater protection programs, including its well permitting, well destruction, and leaking underground storage tank programs, have been effective in protecting the groundwater basin from contamination.

Water quality data for common inorganic compounds during the period from 1997 through 2000 are summarized in Table 2-2. The typical concentration ranges were computed using standard statistical methods. Organic compounds were nondetectable in almost all wells and below drinking water standards in all wells. Data for organic compounds, including MTBE, solvents, and pesticides is not shown in Table 2-2 due to the large number of compounds.

Table 2-2
Summary of Santa Clara County Groundwater Data (1997-2000)
and Water Quality Objectives[a]

Constituents	Santa Clara Valley Subbasin		Coyote Subbasin	Llagas Subbasin	Drinking Water Standard	Ag. Objective[f]
	Principal Aquifer Zone[d]	Upper Aquifer Zone[d]				
Chloride (mg/l)	40 – 45	92 – 117	16 – 27	24 -52	500[c,e]	355
Sulfate (mg/l)	37 – 41	106 – 237	32 - 65	32 -65	500[c,e]	-
Nitrate (mg/l)	15 – 18	0.002 – 4	12 -38	44 -47	45[b]	30
Total Dissolved Solids (mg/l)	366 – 396	733 – 1210	250 - 490	320 -540	1000[c,e]	10,000
Sodium Adsorption Ratio	0.89 - 1.26	1.23 - 3.84	NA	NA	-	9
Electrical Conductance (uS/cm at 25 C)	596 - 650	1090 – 1590	375 - 391	500 - 715	1600[c,e]	3000
Aluminum (ug/l)	6 - 18	23 – 97	<5 - 86	5 -51	1000[b]	20,000
Arsenic (ug/l)	0.7- 1.2	1.2 – 3.7	<2	<2	50[b]	500
Barium (ug/l)	141 - 161	60 – 220	71 - 130	99 - 180	1000[b]	-
Boron (ug/l)	115 - 150	200 – 523	81 - 119	82 -159	-	500
Cadmium (ug/l)	<1	<0.5	< 0.5	<0.5	5[b]	500
Chromium (ug/l)	6 – 8	0.5 – 1.8	0.5 - 10	2 - 10	50[b]	1000
Copper (ug/l)	1.9 – 4.4	0.3 – 1	<1 - 50	0.75 – 3.90	1000[c]	-
Fluoride (mg/l)	0.13 – 0.16	0.15 – 0.3	0.12 – 0.21	0.12 – 0.17	1.8[b]	15
Iron (ug/l)	10 – 38	40 – 160	19 - 100	14 - 170	300[c]	20,000
Lead (ug/l)	0.2 – 1.1	<0.5	<2	<2	50[b]	10,000
Manganese (ug/l)	.15 – 1.5	120 – 769	<0.5 - 29	0.86 - 21	50[c]	10,000
Mercury (ug/l)	<1	<0.2	<0.2	<0.2	2[b]	-
Nickel (ug/l)	1.8 – 3.4	4 – 10	<2- 10	<2 - 10	100[b]	2000
Selenium (ug/l)	2.5 – 3.8	0.4 – 2	<2	<2	50[b]	20
Silver (ug/l)	<5	<0.5	<0.5	<0.5	100[b]	-
Zinc (ug/l)	3 – 8	3 - 13	<50	10 - 32	500[c]	10,000

[a] For common inorganic water quality constituents
[b] Maximum Contaminant Level as specified in Table 64431-A of Section 64431, Title 22 of the California Code of Regulations
[c] Secondary Maximum Contaminant Level as specified in Table 64449-B of Section 64449, Title 22 of the California Code of Regulations
[d] Typical range = approximate 95% Confidence Interval estimate of the true population median
[e] Upper limit of secondary drinking water standard
[f] Taken from the Water Quality Control Plan for the San Francisco Bay Basin, 1995 Regional Water Quality Control Boards

Chapter 3
GROUNDWATER SUPPLY MANAGEMENT

This chapter covers the District programs that relate to groundwater supply management. It describes the District's groundwater recharge, treated groundwater recharge/reinjection, and water use efficiency programs. It also summarizes the role of the groundwater basin in terms of the District's overall water supply plan, the Integrated Water Resources Plan (IWRP). Groundwater supply management programs support the District's groundwater management goal by sustaining the basin's groundwater supplies, mitigating groundwater overdraft, minimizing land subsidence, protecting recharge and pumping capabilities, and sustaining storage reserves for use during dry periods.

Future efforts in groundwater supply management will include strengthening the District's groundwater recharge program so that the District makes the most effective use of its resources with regard to the amount, location, and timing of groundwater recharge.

GROUNDWATER RECHARGE

Program Objective
The objective of the Groundwater Recharge Program is to sustain groundwater supplies through the effective operation and maintenance of District recharge facilities.

Background
Groundwater recharge is categorized as either natural recharge or facility recharge. The District defines "natural" groundwater recharge to be any type of recharge not controlled by the District. Sources may include rainfall, net leakage from pipelines, seepage from surrounding hills, seepage into and out of the groundwater basin, and net irrigation return flows to the basin. Facility recharge consists of controlled and uncontrolled recharge through District facilities, which include about 90 miles of stream channel and 71 off-stream recharge ponds. Controlled recharge refers to the active and intentional recharge of the basin by releases from reservoirs or the distribution system. Uncontrolled recharge occurs through District facilities, such as creeks, but refers to recharge that would occur without any action on the part of the District. This includes natural recharge through streams as a result of rainfall and runoff. This section focuses exclusively on controlled and uncontrolled facility recharge.

Current Status
The District's current recharge program is accomplished by releasing locally conserved water and imported water to District in-stream and off-stream recharge facilities.

In-stream Recharge

The controlled in-stream recharge accounts for approximately 45 percent of groundwater recharge through District facilities. In-stream recharge occurs along stream channels in the alluvial plain, upstream of the confined zone that eventually reaches the drinking water aquifer. The District can release flow for

recharge into 80 of the 90 miles of streams. Uncontrolled in-stream recharge accounts for approximately 20 percent of groundwater recharge.

Spreader dams have been a key component of the in-stream recharge program. These temporary or permanent dams are constructed within streambeds to impound water in the channels and increase recharge rates via percolation through stream banks. The use of spreader dams increases in-stream recharge capacity by about 15,000 af, or approximately ten percent. Spreader dams have been constructed at 60 or more sites since they were first employed in the 1920s.

Off-stream Recharge

The off-stream recharge accounts for approximately 35 percent of groundwater recharge through District facilities. The off-stream facilities include abandoned gravel pits and areas excavated specifically as recharge ponds. Ponds range in size from less than 1 acre to more than 20 acres. The District operates 71 off-stream ponds in 18 major recharge systems with a cumulative area of about 393 acres. Locally conserved and imported water is delivered to these ponds by the raw water distribution system.

Off-stream recharge facilities are generally operated in one of two modes: constant head mode or wet/dry cycle mode. The District most often uses the constant head mode, which involves filling the pond and maintaining inflow at a rate equal to the recharge rate of the pond. This operation is continued until the recharge rate of the pond has decreased to an unacceptable rate. In order to maintain high recharge rates, ponds are cleaned periodically. Pond cleaning is generally considered when the recharge rate has decreased by about 75 percent. The pond is then emptied and any sediment cleaned out. In some cases, the pond is emptied and allowed to dry out and the recharge operation is restarted without cleaning. However, this typically results in a slightly reduced recharge rate. The recharge rates of the District's ponds generally range from 1 af/acre/day to about 2 af/acre/day, although some ponds have rates up to 5 af/acre/day.

In the constant head mode, algae and weed growth generally occurs. The algae growth varies according to sunlight, water temperature, nutrients and other factors. As the algae dies, it falls to the pond bottom, also contributing to a reduced recharge rate. The algae are generally controlled using chemical additives. Using deeper ponds can also reduce algae growth, as ponds in the range of 13 to 15 feet deep do not support algae growth as rapidly as shallower ponds.

Water Quality

High turbidity of incoming water results in a rapid decrease of recharge rates. In order to increase recharge pond efficiency, the District works to reduce turbidity levels with coagulants, simple mixing procedures, settling basins and skimming weirs. At most facilities, water with turbidity levels up to about 100 Nephelometric Turbidity Unit (NTU) can be treated effectively. Water with turbidity levels of less than 10 NTU is usually not treated. Each NTU represents

several pounds of fine-grained material per acre-foot of water. Allowable influent turbidity levels may depend on the availability of water.

Monitoring
Recharge facilities are monitored around the clock by operations center personnel using a computerized control system, and in the field by technicians. The raw water control system provides for remote operation of water distribution facilities and real-time system performance data. Operations technicians perform daily inspection of recharge facilities and record flows and water levels.

A periodic water balance is performed to reconcile all measured imported water, inflows, releases and changes in surface water storage. The results of this balance become the final accounting for distribution and facility processing. The data is used for water rights reporting, accounting for usage of federal water, for facility performance measurement purposes, and for the groundwater basin water budget.

Future Direction
Although spreader dams have traditionally been a key component of the in-stream recharge program, their use has been limited significantly because of more stringent permitting due to fish and wildlife concerns.

The District has completed the feasibility testing of a direct injection facility to increase recharge and has completed construction of a full-scale well. The injection well has a capacity of 750 af/year and will be supplied with water treated at the Rinconada WTP. The potential for additional direct injection facilities may be evaluated in the future.

TREATED GROUNDWATER RECHARGE/REINJECTION PROGRAM

Program Objective
The objective of the Treated Groundwater Recharge/Reinjection Program is to encourage the reuse or recharge of treated groundwater from contamination cleanup sites in order to enhance cleanup activities and protect the County's groundwater resources.

Background
District Resolution 94-84 encourages the reuse or recharge of treated groundwater from groundwater contamination cleanup projects and provides a financial incentive program to qualifying cleanup project sponsors. Sponsors must document that all non-potable demands are satisfied to the maximum extent possible prior to injecting any water into the aquifer. All injected water must be recovered by the pump-and-treat cleanup activities at the site.

Each application is processed within 45 working days. Once an applicant has met the qualifying conditions and is accepted, a legal contract is prepared and signed by the District and the clean-up project sponsor. This contract details how the sponsor will

receive a financial incentive from the District. The sponsor is responsible for providing periodic updates on the amount and quality of water reinjected/recharged.

Current Status
The amount of this financial incentive is equivalent to the basic groundwater user rate. IBM (San Jose) is currently recharging between 900 and 1,000 af per year, and is the only approved sponsor currently injecting/recharging groundwater and receiving this financial incentive.

Future Direction
Any future applications will be evaluated rigorously with respect to overall groundwater basin management to ensure that the groundwater basin will not be adversely impacted.

WATER USE EFFICIENCY PROGRAMS

The District's Water Use Efficiency Programs are designed to promote more effective use of the County's water supplies. The District's demand management measures are described in the Water Conservation and Agricultural Water Efficiency sections that follow the discussion of Recycled Water. The District's commitment to increasing the use of recycled water within the County will also help the District to more effectively use the County's water.

Recycled Water

Program Objective
The objective of the Recycled Water Program is to increase the use of recycled water, thereby promoting more effective use of the County's water supplies. To meet this objective, the District is forming partnerships with the four sewage treatment plant operators in the County and is taking every opportunity to expand the distribution and use of tertiary treated recycled water for non-potable uses. Present efforts focus on planning for future uses in agriculture, industry, commercial irrigation, and indirect potable reuse. To meet the objective of increasing the use of recycled water, the District is:

- Partnering with and providing rebates to the South Bay Water Recycling Program (SBWRP) which includes the cities of San Jose, Santa Clara and Milpitas.

- Operating and expanding the South County Recycled Water System as the recycled water wholesaler in the area. Formal agreements with the recycled water producer, the South County Regional Wastewater Authority (SCRWA), and the recycled water retailer, the City of Gilroy, are in place.

- Providing the City of Sunnyvale a rebate on the recycled water delivered each year.

- Meeting with the City of Palo Alto and their stakeholder group to help plan for expanded future use of recycled water in the North County.

- Contracting a consultant to perform a feasibility study on Advanced Treated Recycled Water.

Background

The District has been involved in water recycling since the 1970s when it supported research in Palo Alto and partnered in the establishment of the South County distribution system in Gilroy. Since the early 1990s, the District has become involved in an ever-increasing role. Recycled water use in the County has grown from about 1,000 af in 1990 to over 6,000 af in the year 2000. To encourage the use of recycled water, in 1993 the District started providing rebates to agencies delivering recycled water.

The largest system for recycled water distribution is the South Bay Water Recycling Program, which has over 60 miles of distribution pipelines and serves over 300 customers. The District continues a partnership with the SBWRP in its planning effort for expansion. In 1999, the District formalized its partnership with the South County Regional Wastewater Authority and the cities of Gilroy and Morgan Hill to plan and operate the recycled water distribution system in South County. Since then, the District has begun construction on major pumping and reservoir facilities to modernize the system.

Current Status

The District is expanding its planning efforts and is continuing discussions with the SBWRP for expanding the use of recycled water. This will involve transporting recycled water south from the existing pipeline in south San Jose in order to supply agricultural and industrial customers that now use groundwater or untreated surface water. The City of San Jose, who administers the SBWRP, has installed several groundwater monitoring wells at the District's request in order to monitor potential changes in groundwater quality as a result of the application of recycled water for irrigation.

The District continues to modernize and expand the South County Recycled Water System. Besides serving golf courses and parks, expansion of this system will involve delivering water to industrial and agricultural users. District staff has inventoried the volume of use and location of the largest groundwater and surface water users in the area and is beginning a marketing study for expansion of the system. The District is also working with the City of Gilroy to plan for the connection of new large water use developments to the system.

A project has been initiated to study the feasibility of installing a pilot plant for the advanced treatment of recycled water for use in agriculture, commercial irrigation, industry, and possibly for future streamflow augmentation and groundwater replenishment.

Future Direction

The future direction of the recycled water program is driven by District Board policy, which directs staff to increase recycled water use to 5% of total water use in the County by the year 2010 and to 10% of total use by the year 2020. To meet this goal, it is assumed that a countywide network of recycled water distribution systems will be

developed. The initial stage will provide for a major transmission main from the area of south San Jose in the SBWRP service area to the major commercial and agricultural customers in South County. Developing advanced treatment methods and facilities to provide recycled water of a higher quality standard than the present tertiary treatment will be required in order to meet the needs of some potential customers. Methods and facilities to blend recycled water with untreated surface water and with groundwater will also need to be developed in order to provide for peaking factors and the quality requirements of some customers. Additional research on the most effective method of advanced treatment and ways to develop more industrial use and onsite treatment of recycled water will be performed.

District efforts to expand recycled water use within Santa Clara County will be coordinated with the District's Integrated Water Resources Plan which will evaluate the various options for obtaining the additional water the County will require in future years. This effort will evaluate the comparative costs and benefits of recycled water, water conservation, water banking, and water transfers. District staff will work with partnering agencies to ensure that any potential uses of recycled water will not adversely impact the groundwater basin or recharge and extraction capabilities.

Water Conservation Programs

Program Objective

The objective of the Water Conservation Program is to promote more efficient use of the County's water resources and to reduce the demands placed on the District's water supplies. To meet this objective, the District has implemented a variety of programs designed to increase water use efficiency in the residential, commercial, industrial, and agricultural sectors, which all rely, in part, on extraction from the groundwater basin.

Background

The District's Water Conservation Program has been developed in large part to comply with the Best Management Practices (BMPs) commitments, defined in the 1991 Memorandum of Understanding (MOU) Regarding Urban Water Conservation in California. The program targets residential, commercial/industrial/institutional, and agricultural water use.

The District has promoted conservation of the County's water supplies since its creation. However, a series of drought years between 1987 and 1992 prompted the District and local water retailers to significantly increase conservation efforts. The District enjoys a special cooperative partnership with the water retailers in regional implementation of the BMPs; several program elements were developed in partnership with the local water retailers. Water retailers have partnered with the District in marketing efforts for cooperative programs and in the distribution of water-saving devices such as showerheads and aerators.

Current Status

The Water Conservation Program has designed programs aimed specifically at residential, commercial, and agricultural users. Residential programs include:

- Water-Wise House Call Program designed to measure residential water use and provide recommendations for improved efficiency.
- Showerhead/Aerator Retrofit Distribution Program, which provides free showerheads and aerators to replace less efficient devices.
- Clothes Washer Rebate Program for the installation of high-efficiency washing machines.
- Landscape workshops focused on water efficient landscape and irrigation design.
- Ultra-Low-Flush Toilet (ULFT) Program (free or low-cost).
- Multi-Family Submeter Pilot Program aimed at reducing water use in multi-family dwellings.
- Education programs in English and Spanish, including the distribution of literature, promotion of water conservation at organized events, and the survey program.

District programs targeting water conservation in the commercial sector include:

- Irrigation Technical Assistance Program (ITAP) designed to help large landscape managers improve irrigation efficiency through free site evaluations.
- Commercial Clothes Washer Rebate Program, in conjunction with PG&E, San Jose/Santa Clara Water Pollution Control Plant, and the City of Santa Clara.
- Project WET (Water Efficient Technologies), which offers rebates to commercial and industrial customers for the reduction of water use and wastewater discharges (in conjunction with the City of San Jose).
- Ultra-Low-Flush Toilet Retrofit Program in conjunction with the San Jose/Santa Clara Water Pollution Control Plant.
- Irrigation Submeter Program to encourage better water management at large commercial sites.

The District has also implemented several programs to promote water use efficiency in the agricultural sector, which relies mainly on the groundwater basin for its water needs. These programs are discussed in the following section of this report.

In fiscal year 1999/2000, the District's water conservation programs achieved an estimated water savings of over 24,000 af, which includes 10,000 af through water retailer participation.

Future Direction
Water conservation efforts are anticipated to reduce County water demands by approximately 30,000 af in 2001, and by almost 32,000 af in 2002. Future programs and projects being developed include:

- Water Use Efficiency Baseline Survey to provide specific information needed to tailor the District's water use efficiency program to result in effective long-term water use efficiency, to evaluate the impacts of water efficiency measures, and further promote and implement Best Management Practices (BMPs).

- Expansion of the Water Efficient Technologies (WET) Program to the entire county.

- Landscape and Agricultural Area Measurement and Water Use Budgets.

Agricultural Water Efficiency

Program Objective
The objective of the Agricultural Water Efficiency Program is to promote, demonstrate and achieve water use efficiency in the agricultural sector, which relies on groundwater supplies for most of its water needs. To meet this objective the District has implemented the following program elements:

- Mobile Lab Program

- California Irrigation Management Information System (CIMIS) Program

- Outreach Program

Background
As required by the Central Valley Project Improvement Act, in 1994 the District adopted a Water Conservation Plan to comply with U.S. Bureau of Reclamation criteria. This plan commits the District to support various agricultural water management activities and to implement the urban BMPs discussed in the Water Conservation Programs section.

Among the agricultural water management activities outlined in the plan is a Mobile Irrigation Lab program. This program provides local farmers with on-site irrigation system evaluations and recommendations for efficiency improvement. The mobile lab is designed to help increase water distribution uniformity and on-farm irrigation and energy efficiencies for all types of irrigation systems. Proper distribution uniformity can result in lower water and energy bills and decreased fertilizer application. Managing nitrogen and irrigation input to more closely match actual crop needs can also reduce water and

energy bills; this approach reduces the potential for nitrate to leach into groundwater while maintaining or improving agricultural productivity.

California Irrigation Management Information System (CIMIS) is a related program that helps large-scale water users to develop water budgets for determining when to irrigate and how much water to apply. Created in 1982 through a joint effort of UC Davis and the Department of Water Resources (DWR), CIMIS is a network of more than 100 computerized weather stations across the state that collects, measures and analyzes all the climatological factors that influence irrigation. This information provides major irrigators daily data on the amount of water that evaporates from the soil and the amount used by grasses.

The District owns and supervises two CIMIS weather stations, one at the UC field station in downtown San Jose, and the other at Live Oak High School in Morgan Hill. Both of these stations, as well as others around the state, are connected to a central computer run by the DWR in Sacramento. The updated information from the District's two stations is automatically downloaded and then provided to the public via a telephone hotline recording or the Internet.

An Outreach Program is an essential component of the agricultural efficiency programs. Outreach to the agricultural community includes public information dissemination, seminars or workshops, public presentations, newsletter articles and specific program materials.

Current Status

The District continues to implement the Mobile Lab Program, which provides on-farm irrigation evaluations, pump efficiency tests, nitrate field test demonstrations, and recommendations for efficient irrigation improvements. Approximately 30 sites participate in the program each year.

The District is currently assessing the potential need for an additional CIMIS station in the North County.

As part of the Outreach Program, significant work has been channeled into developing educational materials on the use of CIMIS in efficient irrigation scheduling. Presentations on the various program elements have been made to the District's Agriculture Advisory Committee, Farm Bureau and grower associations. Articles and brochures have been developed for CIMIS and the mobile lab program. In addition, the staff from the District's Water Use Efficiency and Groundwater Management Units have worked together to hold various workshops and seminars in the South County on irrigation and nutrient and pesticide management. All seminars have been well attended.

Future Direction

The future direction of the agricultural water efficiency programs includes the continuation and further development of the Mobile Lab Program. District staff will recommend continuation of the program as long as it demonstrates its cost-effectiveness.

The District is currently evaluating the feasibility of implementing a financial incentives program to complement the mobile lab.

A Monitoring and Evaluation Program is necessary to determine and assess the effectiveness of the various programs. The focus of the current monitoring effort has been the tracking of activity levels and program costs. To ensure that future water saving goals are achieved and urban and agricultural programs are successful, the District will need to enhance its existing monitoring program to more rigorously quantify actual water savings.

INTEGRATED WATER RESOURCES PLAN

Program Objective
The objective of the Integrated Water Resources Plan (IWRP) is to develop a long-term, flexible, comprehensive water supply plan for the County through year 2040 that incorporates community input and can respond to changing water supply and demand conditions.

Background
The District's 1975 water supply master plan identified the Federal San Felipe Project as the best solution to meet future water demands. However, recent severe droughts, changing state and federal environmental and water quality regulations, and the variability and reliability of both local and imported supplies underscored the need for an updated, more flexible water supply planning process. In the early 1990s, District staff developed a water supply overview study and began to outline a process to update the 1975 master plan.

The overview study described the District's water system and identified drinking water quality issues, the County's water needs, existing water supplies, projected water supplies, potential water shortages, and other components for managing water supplies. The overview study also evaluated water supply alternatives and recommended a stakeholder process to help the District select the preferred alternative.

As a result of the recommendations from the water supply overview process and several workshops involving the Board and overview study project team, the District Board of Directors authorized staff to undertake the IWRP.

In March of 1996, the project team introduced the Board's planning objectives for the IWRP evaluation of water supply strategies. These objectives were refined by stakeholders, including: the general public, representatives of business, community, environmental and agricultural groups, District technical staff, and officials of local municipalities and other water agencies. Stakeholders used these objectives to evaluate various water supply strategies and agree upon an IWRP Preferred Strategy.

The IWRP Preferred Strategy aims to maximize the District's flexibility to meet actual water demands, whether they exceed or fall short of projections. It relies on water

banking, recycled water, demand management, and water transfers, plus "core elements" designed to ensure the validity of baseline planning assumptions, monitor or evaluate resource options, and help meet planning objectives. The Board approved the preferred strategy in December of 1996**.**

The groundwater basin is a critical component in the management of the County's water supply. The basin treats, transmits, and stores water for the County. The management objective of the 1996 IWRP is to maintain the highest storage possible in the three interconnected subbasins (or to bank groundwater) without creating high groundwater problems. During dry periods when local and imported water supplies do not meet the County's water needs, stored groundwater is used to make up the difference. However, the use of this storage has to be balanced with the potential occurrence of land subsidence.

Land subsidence has been a great concern in the valley. As much as thirteen feet of subsidence occurred in parts of the basin before subsidence was minimized through recharge activities and imported water deliveries. If subsidence were to recommence, the damage to infrastructure would be significant, as many levees, pipelines, and wells would need to be rebuilt. Therefore, the IWRP must balance the use of the groundwater basin with the avoidance of adverse impacts.

Current Status

The preferred strategy from the 1996 IWRP is being implemented. Action on several elements of the plan that has already taken place includes the following:

Water Banking

The District reached an agreement with Semitropic Storage District to bank up to 350,000 af in their storage facilities. The District currently has stored about 140,000 af in the water banking program.

Recycled Water

The District is working closely with the city of San Jose and Sunnyvale to develop and market recycled water in lieu of groundwater pumping for irrigation. Planning with South County Regional Wastewater Agency is also occurring (see section on Water Use Efficiency).

Demand Management

The Water Use Efficiency Unit has developed an aggressive program to minimize water use and provide assistance to irrigators to improve the efficiencies in their irrigation systems (see section on Water Use Efficiency).

Water Transfers

In 1999, the District entered into a multi-party water transfer agreement for an agricultural supply from a Central Valley Project (CVP) contractor. This transfer will make a small amount of dry year water available to the District during the next 20 years.

Core Elements

- In 1997, the District entered into a Reallocation Agreement that provides a reliability "floor" of 75 percent of contract quantity for the District's Municipal and Industrial CVP supply, except for extreme years when CVP allocations are made on the basis of public health and safety.

- A study was recently conducted to determine the frequency of critical dry periods using a statistical approach that showed the preferred strategies are very robust although not perfect.

- The Operational Storage Capacity of the Santa Clara Valley Subbasin was evaluated and refined in 1999 (SCVWD, 1999) – see section on operational storage capacity.

Future Direction

An ongoing process of monitoring the baseline conditions and contingency action levels is being developed. Updates to the IWRP are scheduled for every 3 to 5 years. The District is currently developing the 2002 IWRP Update.

As the District's water supply planning document through year 2040, the IWRP has identified the operation of the groundwater basin as a critical component to help the District respond to changing water supply and demand conditions. Planning and analysis efforts for future updates of the Groundwater Management Plan and the IWRP need to be integrated in order to provide a coordinated and comprehensive water supply plan for Santa Clara County.

Additional Groundwater Supply Management Activities

Groundwater Modeling

The District uses a three-dimensional groundwater flow model to estimate the short-and long-term yield of the Santa Clara Valley Subbasin and to evaluate groundwater management alternatives. Six layers are used to represent the subbasin, and changes in rainfall, recharge, and pumping are simulated. The model is used to simulate and predict groundwater levels under various scenarios, such as drought conditions, reduced imported water availability, or increased demand. The groundwater model also allows the District to evaluate the operational storage capacity (discussed below) in the Santa Clara Valley Subbasin.

In the future, a three-dimensional flow model similar to the one used in the Santa Clara Valley Subbasin will be developed for the Coyote and Llagas Subbasins, enabling the District to simulate groundwater conditions throughout the County.

Operational Storage Capacity Analysis

The operational storage capacity is an estimate of the storage capacity of the groundwater basin as a result of District operation. Operational storage capacity is generally less than the total storage capacity of the basin, as it accounts for operational constraints such as

available pumping capacity and the avoidance of land subsidence or high groundwater levels. Identifying a reasonable range for the amount of groundwater that can be safely stored in wet years and withdrawn in drier years is critical to proper management of the groundwater basin.

The operational storage capacity of the Santa Clara Valley Subbasin was evaluated (SCVWD, 1999) using the groundwater flow model and historical hydrology, which included two periods of severe drought. The key findings of the analysis were that:

- The operational storage capacity of the Santa Clara Valley Subbasin is estimated to be 350,000 af.

- The rate of withdrawal from the basin is a controlling function and pumping should not exceed 200,000 af in any one year.

- The western portion of the subbasin is operationally sensitive which requires the Rinconada Water Treatment Plant to receive the highest priority when supplies become limited.

In 2001, an analysis of the operational storage capacity for the Coyote and Llagas Subbasins was conducted (SCVWD, 2001). As the District does not currently have a groundwater model for these two subbasins, a static analysis was used. Unlike a groundwater model, a static analysis cannot simulate changes in recharge, pumping, or demand. Instead, the operational storage capacity was estimated as the volume between high and low groundwater surfaces, chosen to maximize storage while accounting for operational constraints such as high groundwater conditions. The draft estimate for the combined operational storage capacity of the Coyote and Llagas Subbasins ranges from 175,000 to 198,000 af. The District is working to narrow the range of estimates for operational storage capacity through further analysis.

Having an estimate of the amount of water that can be stored within the basin during wet years and withdrawn during drier times will continue to be critical in terms of long-term water supply planning. As hydrology, water demands, recharge, and pumping patterns change, the estimate of operational storage capacity will need to be updated.

Subsidence Modeling

Due to substantial land subsidence that has occurred within the Santa Clara Valley Subbasin, the District uses numerical modeling to simulate current conditions and predict future subsidence under various groundwater conditions. PRESS (Predictions Relating Effective Stress and Subsidence) is a two-dimensional model that relates the stress associated with groundwater extraction to the resulting strain in fine-grained materials such as clays. The District has calibrated the model at ten index wells within the subbasin, and has established subsidence thresholds equal to the current acceptable rate of 0.01 feet per year.

Chapter 4
GROUNDWATER MONITORING PROGRAMS

This chapter describes District programs that monitor the water quality, water levels and extraction from the groundwater basin. It also describes the District's land subsidence monitoring program. These programs provide data to assist the District in evaluating and managing the groundwater basin. Specifically, the groundwater and subsidence monitoring programs provide the data necessary for evaluating whether the program outcomes result in achievement of the groundwater management goal.

Future efforts in groundwater monitoring will include the annual development of a groundwater conditions report, which will contain information regarding groundwater quality, groundwater elevation, and land subsidence.

GROUNDWATER QUALITY MONITORING

Program Objective

The objective of the General Groundwater Quality Monitoring Program is to determine the water quality conditions of the County's groundwater resources. By monitoring the quality of the groundwater basin, the District can discover adverse water quality trends before conditions become severe and intractable, so that timely remedial action to prevent or correct costly damage can be implemented. In general, the District monitors groundwater quality to ensure that it meets water quality objectives for all designated beneficial uses, including municipal and domestic, agricultural, industrial service, and industrial process water supply uses.

Background

Groundwater quality samples have been collected in the County since the 1940s by the District and by others. In 1980, District staff reviewed the existing general groundwater quality monitoring program and recommended changes and enhancements. The recommended changes and enhancements included revising the monitoring well network, revising the list of water quality parameters to be measured, and collecting groundwater samples biennially (every other year). Groundwater samples were analyzed for general mineral and physical water quality parameters.

Current Status

The general groundwater quality monitoring program is designed to provide specific water quality data for each of the three subbasins (Figure 2-3). The monitoring well network includes one or more wells in each hydrographic unit yielding significant amounts of water. Groundwater samples collected from the monitoring network are intended to reflect the general areal and vertical groundwater quality conditions. Currently, the following program activities occur biennially:

- Water quality samples are collected from a monitoring network of approximately 60 wells (Figure 4-1).

- Samples are analyzed for general minerals, trace metals, and physical characteristics.
- Analytical results are evaluated, the database is updated, and routine water quality computations are performed.
- A summary report describing the water quality of the groundwater resources in the County is prepared.

Figure 4-1
Water Quality Monitoring Wells

In addition to the 60 wells monitored by the District for general groundwater quality analysis, the District monitors additional wells for special studies. There are currently approximately 100 wells monitored for MTBE, 60 wells monitored for nitrate, and 30 wells monitored for saltwater intrusion. The District also receives groundwater quality data for approximately 300 water retailer wells from the California Department of Health Services.

Monitoring results suggest that water quality is excellent to good for all major zones of the groundwater basin. This is based on comparing groundwater quality monitoring results to water quality objectives. Regional Water Quality Control Boards designed water quality objectives based on beneficial uses. Water quality objectives for municipal and domestic, industrial service, and industrial process water supply beneficial uses are equivalent to the drinking water standards established by the California Department of

Health Services. Water quality objectives for agricultural beneficial uses are defined specifically in the Regional Water Quality Control Boards' Water Quality Control Plans. Drinking water standards, agricultural water quality objectives, and monitoring results for common groundwater constituents are summarized in Table 2-2.

The more common trace constituents, which are considered unwanted impurities when present in high concentrations, are generally not observed in concentrations that adversely affect beneficial uses. Areas with somewhat degraded waters in terms of total mineral salt content have been identified in the Santa Clara Valley Subbasin and elevated nitrate concentrations have been observed in the Coyote and Llagas Subbasins. In addition, volatile organic compounds and other anthropogenic compounds have affected shallow aquifers in localized areas. Special groundwater monitoring programs have been developed to define the extent and severity of these problems and are discussed in Chapter 5.

Radon analysis was performed as a one-time special survey of current conditions and provided data for analyzing the potential impacts of upcoming drinking water standards for radon. The results of the 1999 sampling are presented in the 2000 General Groundwater Quality Monitoring report.

Future Direction

The General Groundwater Quality Monitoring Program utilizes relatively few, widely spaced monitoring points to assess large areas. Certain hydrographic units of the basin are only sparsely monitored at present. Staff is continuing to review the monitoring network to ensure that groundwater samples collected from the monitoring well network reflect areal and vertical groundwater quality conditions within each hydrographic unit. If it is determined that additional monitoring points are needed in some areas where there are no existing wells, District staff will recommend the installation of additional monitoring wells.

The District is also planning to increase the frequency of monitoring and the number of water quality parameters that are measured. Historically, the most frequent sampling frequency has been biennially. However, in order to parallel District efforts to better monitor performance in achieving desired results, the sampling frequency for the General Groundwater Quality Monitoring Program will be increased to annually. The number of water quality parameters that are measured will also be increased, so that samples are analyzed for volatile organic compounds, a significant concern in Santa Clara County. Samples will continue to be analyzed for general minerals, trace constituents, and physical characteristics.

The District will continue to assess and provide recommendations to address any adverse water quality trends that are observed through the General Groundwater Quality Monitoring Program. In addition, the District will continue to conduct special studies for specific contaminants as the need arises. As part of groundwater management planning, action levels and triggers will be developed for the constituents monitored.

The District will also begin developing annual groundwater conditions reports, which will summarize information regarding groundwater quality, groundwater elevation, and land subsidence.

GROUNDWATER ELEVATION MONITORING

Program Objective
The objective of the Groundwater Elevation Monitoring Program is to provide accurate and dependable depth-to-water field measurements for the County's major groundwater subbasins. By monitoring the groundwater elevations, the District can evaluate the groundwater supply conditions and formulate strategies to ensure adequate water supplies, prioritize recharge activities, and minimize any adverse impacts.

Background
Collecting depth-to-water information has been one of the District's functions since it was first formed as a water conservation district in 1929. Depth-to-water information is used to create groundwater elevation contour maps, which depict the conditions of the groundwater basin in the fall and spring of each year. Depth-to-water data are also used for subsidence modeling, to generate hydrographs needed to analyze groundwater model simulations, and to provide information to District customers on current and historical groundwater elevations.

Current Status
The District continues to collect depth-to-water field measurements, obtain depth-to-water measurements from other agencies and record that information for approximately 275 wells. Most wells in the current program are privately owned and their locations are fairly evenly distributed among the three subbasins (Figure 4-2). Current groundwater elevation monitoring includes the following:

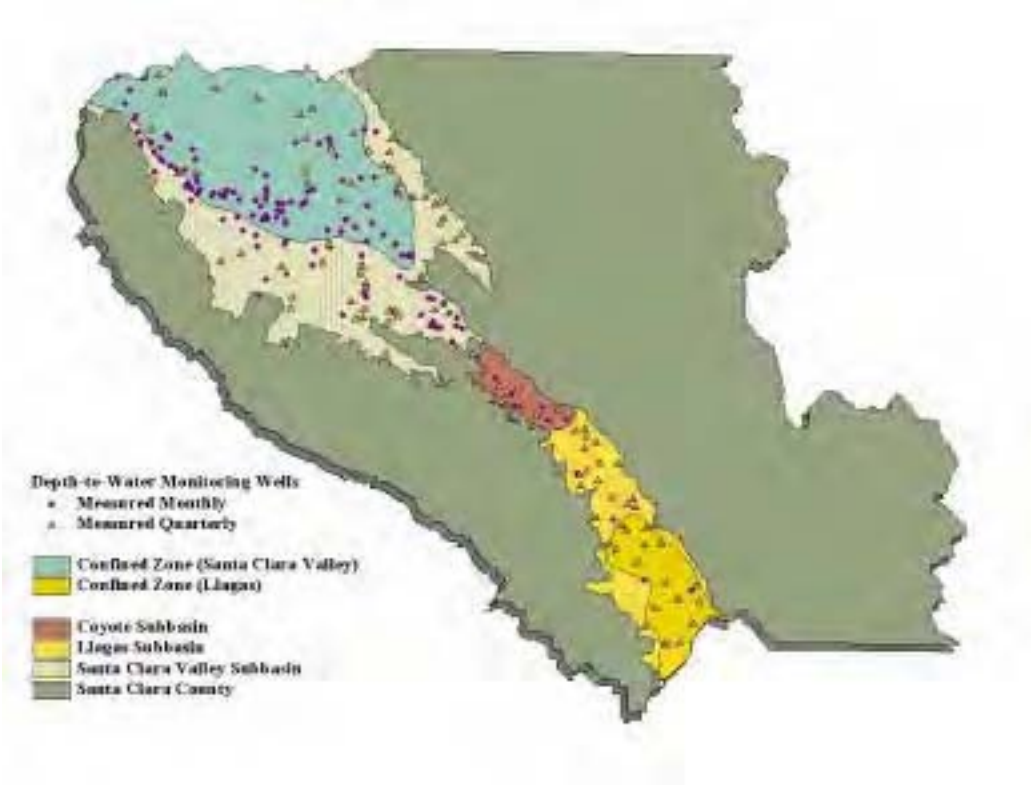
- Collection of monthly depth-to-water field measurements from approximately 168 wells, including approximately 150 wells owned by other agencies (Figure 4-2).
- Collection of quarterly depth-to-water field measurements from approximately 108 wells (Figure 4-2).
- Maintenance of a groundwater elevation database.
- Preparation of semi-annual groundwater level elevation contour maps.

The information in the District depth-to-water database is used regularly by District staff. Each year the District answers several hundred requests for depth-to-water information from other public agencies, consultants, and the public.

Future Direction
Although the District collects depth-to-water data from many wells throughout the County, most wells were designed as production wells, with perforations at multiple

intervals to increase groundwater extraction. There are relatively few wells that measure groundwater elevations in a single depth zone. The existing Groundwater Elevation Monitoring Program is currently being updated to target monitoring wells where discrete, depth-specific groundwater elevations can be obtained, which will enable better characterization of the three-dimensional groundwater system. A new groundwater elevation monitoring network has already been designed for the Santa Clara Valley Subbasin, and another project will be undertaken to develop a monitoring network for the Coyote and Llagas Subbasins by 2003.

Figure 4-2
Groundwater Elevation Monitoring Wells



The proposed network for the Santa Clara Valley Subbasin will include monitoring the individual piezometric pressures at the following 79 wells, which are geographically distributed among the hydrographic units in the subbasin. Specific recommendations include the:

- Continued monitoring of 31 depth-specific wells monitored in the existing depth-to-water program.
- Acquisition of 16 aquifer-specific wells from other organizations.
- Addition of 25 wells that are not part of the existing depth-to-water program.
- Installation of 7 new multiple-well monitoring sites to be constructed by 2003.

Monitoring these 79 wells will provide invaluable information to aid in characterizing depth-specific groundwater conditions. However, in addition to these 79 wells, monitoring of the wells in the current groundwater elevation network will continue indefinitely, as the water level data can be useful even though it cannot be attributed to specific depth zones. Monitoring is recommended on a quarterly basis during the months of January, April, July, and October, although some wells will be monitored monthly. A quarterly monitoring frequency is consistent with the historical groundwater level data in the basin, and is currently adequate in terms of current groundwater elevation monitoring needs. A change in monitoring frequency will be assessed if necessary.

The proposed monitoring network for the Santa Clara Valley Subbasin will be re-evaluated in 2003 to ensure that monitoring needs can be met with the wells proposed. A monitoring network for the Coyote and Llagas Subbasins will be developed by 2003.

Since groundwater information is continually utilized both within and outside the District, an online database that is easily accessible through the District's web site is being evaluated as it would significantly reduce District staff time spent in database maintenance and fulfilling depth- to-water data requests.

GROUNDWATER EXTRACTION MONITORING

Program Objective
The amount of groundwater extracted from the groundwater basin is recorded through the Water Revenue Program. Data produced by this program are used primarily to: 1) determine the amount of water used by each water-producing facility and collect the revenue for this usage, and 2) fulfill the provisions of Section 26.5 of the District Act which requires the District to annually investigate and report on groundwater conditions.

Background
The Water Revenue Program tracks groundwater, surface water, treated water and recycled water production within the District. The first collection of groundwater extraction data began shortly after the State Legislature authorized amendments to the Santa Clara County Flood Control and Water District Act in June 1965. As part of implementation of the District Act, wells within the District were registered. The District has been collecting groundwater extraction data from wells in the Santa Clara Valley Subbasin (also known as the North Zone or Zone W-2) since the early 1960s. After the merger with Gavilan Water Conservation District in 1987, this program expanded to the Coyote and Llagas Subbasins (the South Zone, or Zone W-5).

Current Status
To determine the amount of all water produced in the District, including groundwater, the Water Revenue Program:

- Develops and distributes water extraction statements to well owners within the two water extraction zones on a monthly, semi-annual, and annual basis.

- Audits incoming water extraction statements and completes field surveillance to ensure that water extraction information is accurate.
- Audits and invoices surface, treated and recycled water accounts.
- Assists the public in completing and filing water extraction statements.
- Maintains files for surface, ground, treated and recycled water accounts.
- Administers and maintains a database containing all water extraction information.
- Initiates and approves the installation of water measurement devices (meters) on water-producing wells.
- Registers (assigns state well numbers) and maps all water extraction wells.

Water extraction data is stored in an electronic database (Water Revenue Information System) and on paper. Program staff maintain accounts and records for more than 6,000 water extraction wells and approximately 27,000 monitoring wells. Staff provide information on these accounts to other District programs and outside customers, and provide other customer support as necessary.

Although approximately half of the wells within the County are not metered, metered wells extract the vast majority of groundwater used within the County. Where meters are not feasible, crop factors are used to determine agricultural water usage and average values adjusted for residences. Water meter testing and maintenance are performed on a regular basis. Maintenance is done to ensure meters are performing properly and accurately. When problems are discovered, meters are repaired or replaced. Meters are also replaced on a regular basis for testing and rebuilding.

The following table shows type of usage for wells in Zone W-2 (Santa Clara Valley Subbasin) and Zone W-5 (Coyote and Llagas Subbasins) and the number of meters recording usage.

Table 4-1
1998 Statistics on Extraction Wells

	North Zone (W-2)	**South Zone (W-5)**
Agricultural Wells	81	570
Municipal & Industrial Wells	1,875	350
Domestic Wells	567	2,569
Ag & M&I Wells	77	511
Total Number of Wells	2,600	4,000
Number of Metered Wells	1,017	395
Percentage of Metered Wells	40%	10%

In accordance with Section 26.5 of the District Act, the District prepares an annual Water Utility Enterprise Report, which contains the following information: present and future water requirements of the County; available water supply; future capital improvement, maintenance and operating requirements; financing methods; and the water charges by zone for agricultural and nonagricultural water. Recommended water rates are based on multi-year projections of capital and operating costs. Water charges can be used as a groundwater supply management tool, as the surcharge for treated water can be adjusted to encourage or discourage extraction from the groundwater basin.

Future Direction
Groundwater extraction monitoring data will continue to be important as a basis of groundwater management decisions and for groundwater revenue receipts. Program staff are currently evaluating the existing database and hope to convert the database into a relational database and link it to the newly developed Geographic Information System (GIS) based well mapping system. This will enable staff to evaluate groundwater use data geographically and to provide this data to groundwater management decision-makers in a meaningful and easy to use format.

LAND SUBSIDENCE MONITORING

Program Objective
The objective of the Land Subsidence Monitoring Program is to maintain a comprehensive system to measure existing land subsidence and to predict the potential for further subsidence.

Background
Land subsidence was first noticed in 1919 after an initial level survey conducted in 1912 by the National Geodetic Survey. At that time, 0.4 feet of subsidence was measured in downtown San Jose. Between 1912 and 1932, over 3 feet of subsidence were measured at the same location. As a result of this drastic increase in subsidence, an intensive leveling network was installed for periodic re-leveling to evaluate the magnitude and geographical extent of subsidence. From 1912 to 1970, cumulative subsidence measured at the same San Jose location totaled approximately 13 feet.

A cross-valley differential leveling survey circuit was run in the 1960s and continues to be conducted. The level circuit was conducted almost annually from 1960 through 1976, once in 1983, and annually from 1988 to the present.

In 1960, the United States Geologic Survey (USGS) installed extensometers, or compaction recorders, in the two 1,000-foot boreholes drilled in the centers of recorded subsidence sites in Sunnyvale and San Jose. The purpose for installing these wells was to measure the rate and magnitude of compaction that occurs between the land surface and the bottom of the well.

In the mid-1960s, imported water from San Francisco's Hetch-Hetchy reservoir and the State Water Project's South Bay Aqueduct played a major role in restoring groundwater

levels and curbing land subsidence. A combination of factors including imported water, natural recharge, decreased pumping and increased artificial recharge has reduced land subsidence to an average 0.01 feet per year.

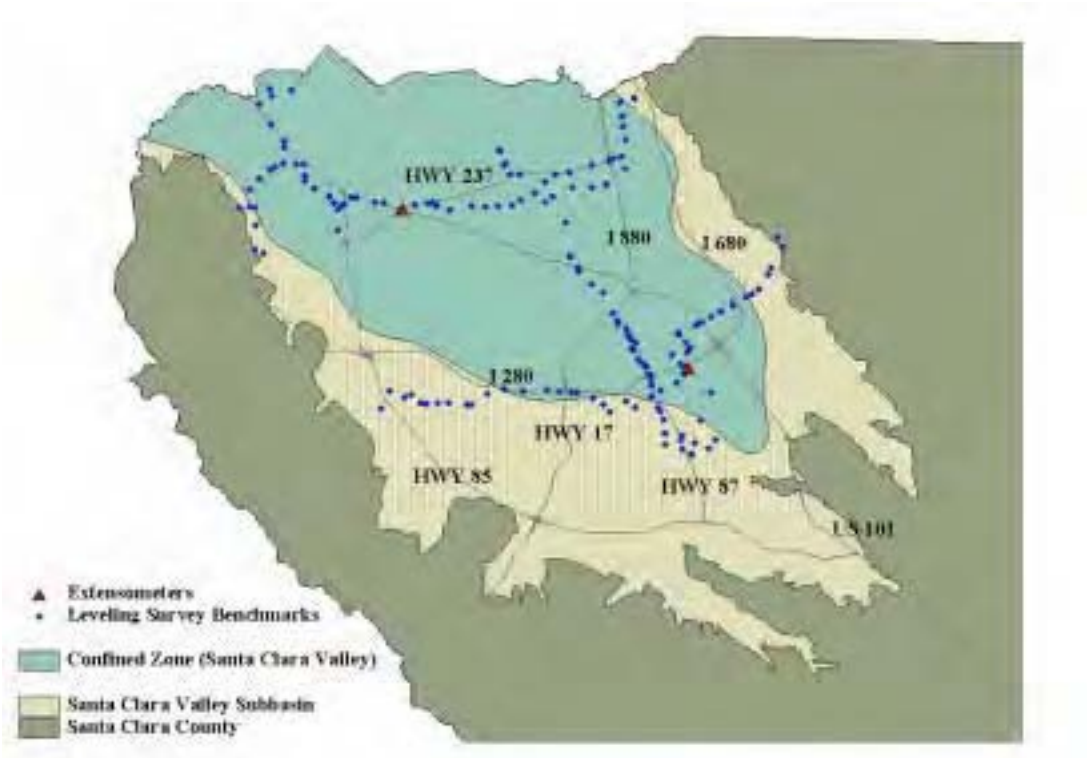
The District developed subsidence thresholds that relate the expected rate of land subsidence from various groundwater elevations. The Predictions Relating Effective Stress and Subsidence (PRESS) computer code was utilized for this model, and 10 index wells located throughout the Santa Clara Valley Subbasin were used as control points for the subsidence calibration and prediction.

Current Status

The existing land subsidence monitoring program includes the following:

- Monitoring land subsidence at two extensometer sites in San Jose and Sunnyvale (Figure 4-3).
- Conducting an annual leveling survey across three different directions in the valley to measure any land subsidence that may be occurring away from the extensometers (Figure 4-3).
- Analyzing data to evaluate the potential of re-initiating land subsidence.

Figure 4-3
Location of Extensometers and Leveling Survey Benchmarks



The extensometer in the San Jose site has recently been upgraded and equipped with monitoring and storage instrumentation to execute the data acquisition process electronically. Data collected from this site continues to be analyzed to determine any changes in the rate of land subsidence.

In 1998, the District entered into a cooperative agreement with the USGS to use Interferometric Synthetic Aperture Radar (InSAR) technology to measure any subsidence that may have not been captured in the existing monitoring program. This new technology compares satellite images taken at different times and reveals any changes in ground surface elevations with an accuracy of a few millimeters. INSAR covers the entire County, unlike traditional monitoring which is site-specific. Under the cooperative agreement, InSAR images were analyzed both seasonally and over a five-year period. Data from this study reasonably replicated and supported the data obtained from the District's extensometers.

The leveling survey continues to be conducted annually. A new leveling line was added to the leveling survey in 1998 as InSAR images indicated that additional information was needed along the Silver Creek Fault in San Jose.

Future Direction

Monitoring and data storage equipment have been installed at the San Jose extensometer site. Plans to enhance the land subsidence monitoring network program include the installation of new equipment to facilitate the monitoring and storage of data from the extensometer site in Sunnyvale, and the evaluation of datum stability at this site.

Through the 1998 study with the USGS, InSAR technology was proven able to reasonably replicate historical subsidence data from extensometers and the cross-valley leveling surveys. District staff will investigate the benefits of incorporating InSAR technology into the current land subsidence monitoring program.

The District will continue to utilize groundwater flow and subsidence models to simulate land subsidence as a result of different groundwater scenarios and groundwater management alternatives.

Chapter 5
GROUNDWATER QUALITY MANAGEMENT PROGRAMS

This chapter describes District programs that address nitrate management, saltwater intrusion, well construction and destruction, wellhead protection, leaking underground storage tanks, toxic cleanup, land use and land development review, and other groundwater protection issues. These programs help protect groundwater quality by identifying existing and potential groundwater quality problems, assessing the extent and severity of such problems, and preventing and mitigating groundwater contamination.

NITRATE MANAGEMENT

Program Objective

The objective of the Nitrate Management Program is to delineate, track and manage nitrate contamination in the groundwater basin in order to ensure the basin's viability as a long-term potable water supply. More specifically, the objectives are as follows:

- Reduce the public's exposure to high nitrate concentrations.
- Reduce further loading of nitrate.
- Monitor the occurrence of nitrate.

Background

The conversion of nitrogen to nitrate is a natural progression in the nitrogen cycle. In the form of nitrate, nitrogen is highly soluble and mobile. Due to its solubility and mobility, nitrate is one of the most widespread contaminants in groundwater. Unlike other compounds, nitrate is not filtered out by soil particles. It travels readily with rain and irrigation water into surface and groundwater supplies.

The amount of nitrate reaching the groundwater depends on the amount of water infiltrating the soil, the concentration of nitrate in the infiltrating water and soil, the soil type, the depth to groundwater, plant uptake rates, and other processes. Nitrate concentrations now observed in the groundwater basin might be a result of land use practices from several decades ago.

High concentrations of nitrate in drinking water supplies are a particular concern for infants. Nitrate concentrations above the federal and state maximum contaminant level (MCL) of 45 milligrams per liter (45 mg/L NO_3) have been linked to cases of methemoglobinemia ("Blue Baby Syndrome") in infants less than 6 months of age. In addition, public health agencies, including the California Department of Health Services, are conducting research to determine whether excess nitrate in food and drinking water might also have long term carcinogenic (tendency to cause cancer) or teratogenic (tendency to cause fetal malformations) effects on exposed populations.

Communities in the South County rely solely on groundwater for their drinking water supply. The District created the Nitrate Management Program in October 1991 to manage increasing nitrate concentrations in the Llagas Subbasin.

In June of 1992, an extensive study was initiated to review historical nitrate concentrations, identify potential sources, collect and analyze groundwater samples for nitrate, and develop a set of recommendations for the prevention and control of nitrate loading in South County. The results of the study, completed in February 1996, indicated that nitrate concentrations in the Llagas Subbasin are generally increasing over time and that elevated concentrations still exist throughout the subbasin.

In addition, the study found that there are many sources of nitrate loading in Llagas Subbasin. The major sources of nitrate are fertilizer applications, and animal and human waste generation. The southern portion of Santa Clara County has historically been an agricultural area. Only in recent years has agricultural acreage declined due to residential growth. However, due to the slow movement of surface water to the water table, residual nitrate concentrations in the soil from past practices may continue to contribute to increasing nitrate concentrations in the groundwater for several years or decades to come.

The specific recommendations of the study were the following: increase public education to reduce loading and exposure; blend water to reduce exposure; review and possibly revise the well standards; increase the level of regional wastewater treatment in order to reduce reliance on septic systems; increase point source regulation; conduct recharge feasibility studies; increase monitoring of the groundwater basin; and to consider alternative water supplies, treated surface water, water recycling and enhanced sewage treatment technologies for on-site systems.

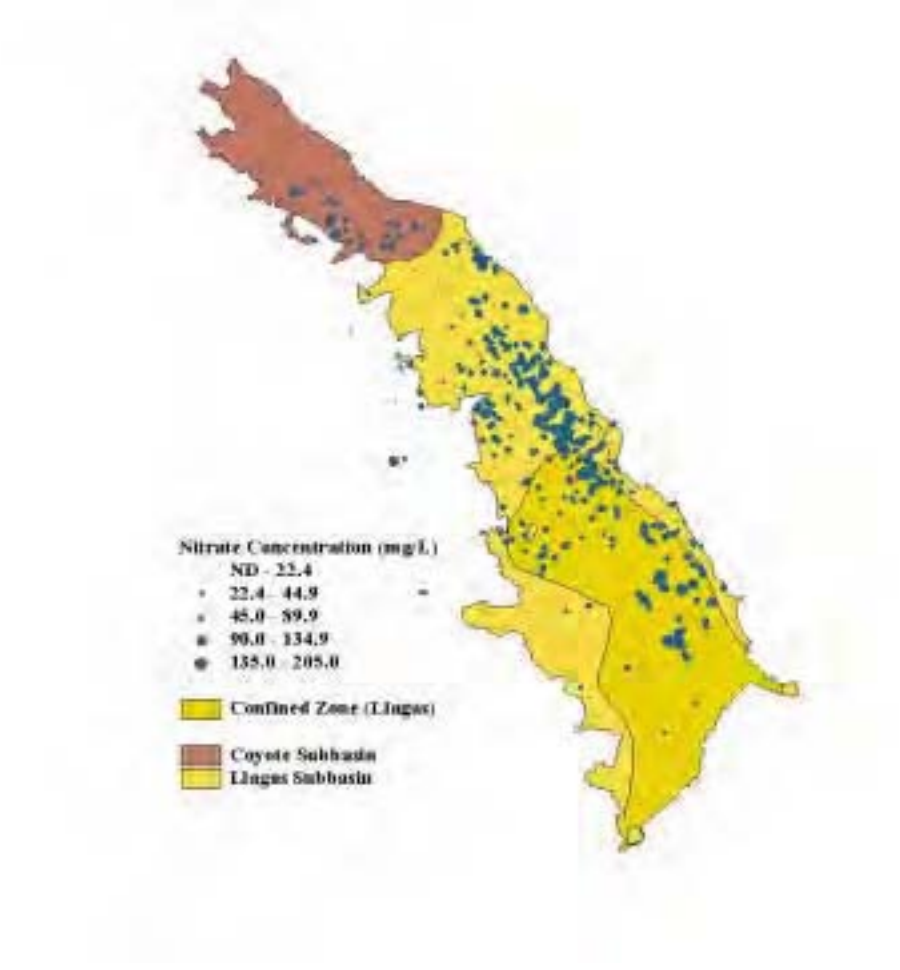
In 1997, the District began implementing the public education portion of the study recommendations. A large agricultural outreach effort was initiated. As part of that outreach, the District entered into a contract with a Mobile Irrigation Lab to offer free irrigation evaluations to farmers in order to improve the efficiency of their irrigation systems and scheduling. By improving the irrigation efficiency and distribution uniformity, the irrigators can reduce the amount of water and nitrate leached beyond the active root zone of the crop and into the groundwater. Over 250 people have attended seminars to increase their awareness of the mobile lab and to learn nitrate-sampling and nitrogen management techniques. Approximately 150 free soil nitrate test kits have been prepared and distributed. A series of 5 fact sheets on Nitrogen and Water Management in Agriculture was produced in cooperation with Monterey County Water Resources Agency and the Pajaro Valley Water Management Agency. English and Spanish versions have been distributed to the agricultural community through a series of seminars, mobile lab operators, other agricultural agencies and the on the District's new Agricultural web page.

To reduce exposure, reduce loading and monitor occurrence, a large-scale public outreach effort was launched offering a free nitrate analysis to all well water users in the Llagas and Coyote Subbasins. Approximately 2,500 residents were notified through

direct mailings about the program and the issues surrounding nitrate in drinking water. An unknown number were notified through newspaper, radio and television coverage. More than 600 private wells shown in Figure 5-1 have been tested for nitrate. Along with the results of the testing, residents were mailed a fact sheet describing what nitrate is, where it comes from, what the health effects are, how to prevent further loading and where to find more information.

Of the 600 private wells tested, more than half exceed the federal safe drinking water standard for nitrate. Of those that exceed the standard, half of the residents use an alternate water source or point-of-use treatment for their drinking water. The data also indicated that nitrate concentrations in the Llagas Subbasin continue to increase, that nitrate concentrations in the Coyote Subbasin have remained steady, and that high concentrations of nitrate are sporadically located throughout both subbasins. A report on the findings was produced in December 1998 and was distributed to several local and state agencies. These elevated nitrate levels were detected only in private wells; it should be noted again that public water supply wells within the County meet drinking water standards.

Figure 5-1
South County Nitrate Concentration



Current Status

To reduce nitrate loading, the District continues to schedule mobile lab evaluations and agricultural seminars. These seminars focus on how to apply irrigation water more efficiently and how to conduct soil testing for nitrate. In addition, the District is a cooperator on a grant with a soil scientist to establish field trials demonstrating and evaluating the effectiveness of in-field nitrate testing in drip and sprinkler irrigated vegetables.

To monitor nitrate occurrence, the District is conducting a comprehensive monitoring effort to track seasonal, areal, vertical and long-term trends in nitrate concentrations. The current monitoring program shown in Figure 5-2 consists of 42 deep groundwater wells (greater than 100 feet deep) and 15 shallow monitoring wells (less than 100 feet deep).The shallow monitoring wells will allow us to track what we might expect to see in the deeper wells in the future. Network wells are being monitored on a quarterly basis to track seasonal variations.

Figure 5-2
Current South County Nitrate Monitoring Network

To reduce nitrate exposure, the District is working with the Santa Clara County Department of Environmental Health to produce a well owner's guide. Among other things, the guide will contain information on recommended sampling, testing and disinfecting practices, as well as measures to protect against contamination.

Future Direction
Continued public education and outreach will remain the focus of the nitrate management program to reduce further loading and prevent possible exposure. If nitrate concentrations continue to increase at all depths, more extensive action may be required. The District may need to investigate alternate water supplies for the many private well water users in the area. Alternate water supplies could include a water treatment plant to remove the nitrate from the existing groundwater supply or the treatment of water from the San Felipe pipeline.

More research is needed to determine how much nitrate is contributed through the various manure management practices currently used. Best Management Practices (BMPs) for manure management need to be determined, and they need to be communicated to the public in a manner that will encourage adoption. More research is also needed regarding reduction of nitrate loading from septic systems; specifically, regarding whether the benefit of removing or reducing septic system loading justifies the economic and political cost of increasing sewer line connections.

To achieve the objective of monitoring nitrate occurrence, the District will continue to sample the existing monitoring network in the Llagas and Coyote Subbasins on a quarterly basis. Two years of quarterly data has been collected so far and staff are in the process of analyzing the data for seasonal, areal, and long-term trends. Staff is beginning a thorough evaluation of the extent and severity of nitrate contamination in the Santa Clara Subbasin, based on water quality data from the District's groundwater monitoring program and the water retailers.

The District may also investigate the feasibility of remediating nitrate contamination. There is some indication that nitrate concentrations around recharge facilities are lower than elsewhere. This finding would need to be confirmed as part of an investigation into reducing nitrate concentrations by additional recharge. Similarly, the District may be able to remediate nitrate contamination by setting up several pump and treat operations. High nitrate water would be pumped out of the basin, treated and injected back into the basin. Phytoremediation, which uses deep-rooted plants to draw the nitrate out of the vadose zone before it can reach groundwater, may be employed in some areas. A fourth possibility is reactive zone remediation where a reagent is injected into the system to intercept and immobilize or degrade the nitrate into a harmless end product. A thorough investigation of any remediation technology would need to occur before prior to its adoption.

SALTWATER INTRUSION PREVENTION

Program Objective
The objective of the Saltwater Intrusion Prevention Program is to monitor and to protect the groundwater basin from seawater intrusion.

Background

The movement of saline water into a freshwater aquifer constitutes saltwater intrusion. This potential exists in groundwater basins adjacent to the sea or other bodies of saline water. Intrusion of saltwater into a freshwater aquifer degrades the water for most beneficial uses and, when severe, can render it virtually unusable. Salty water can corrode holes in well casings and travel vertically to other aquifers not previously impacted. Once freshwater aquifers are rendered useless by a severe case of saltwater contamination or intrusion, it is extremely difficult and costly to reclaim them.

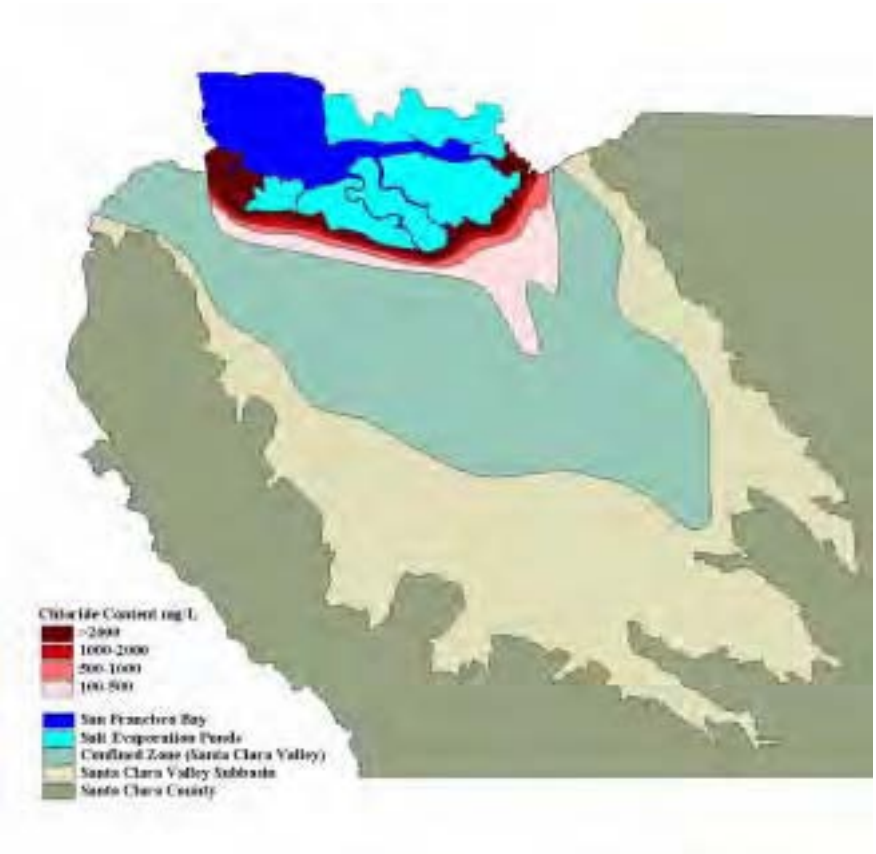
Comparison of older mineral analyses of groundwater from wells in the San Francisco bayfront area in Santa Clara and Alameda counties, some dating back to 1907, with more recent data shows that saltwater intrusion has occurred in the upper aquifer. With much higher water demands after World War II and the occurrence of land subsidence, saltwater intrusion conditions became aggravated and encompassed a portion of the baylands (the area adjacent to the southern San Francisco Bay). Bayshore Freeway (U.S. Route 101) and the Nimitz Freeway (Interstate 880) delineate the southern limits of this area.

The alluvial fill deposits of the Santa Clara Valley Subbasin in the flat baylands area consist of thin aquifers amongst abundant clays. The aquifers are broadly grouped into two water-bearing zones referred to as the "upper aquifer zone," which usually occurs at depths less than 100 feet, and the "lower aquifer zone," which usually occurs at depths greater than 150 to 250 feet, and which constitutes the potable aquifer system. Previous studies indicate the upper aquifer zone fringing San Francisco Bay is widely intruded by saltwater. The lower aquifer zone has pockets of small areas of elevated salinity associated with migration through abandoned wells.

Within the upper aquifer zone, the "classical case" of intrusion which occurs by displacement of freshwater by seawater and is indicated by total dissolved salt content over 5,000 mg/L, has progressed only a short distance inland from the bayfront, estuaries or salt evaporator ponds as shown in Figure 5-3. This intrusion had been induced when pumping of the upper aquifer and land subsidence reversed the hydraulic gradients, which had originally been toward the Bay. A large mixed transition zone precedes this intruding front with its outer limit arbitrarily defined by the 100 mg/L chloride line.

The greatest inland intrusion of the mixed transition water occurs along Guadalupe River and Coyote Creek. The large mixed transition zone is caused by saltwater moving upstream during the high tides and leaking through the clay cap into the upper aquifer zone when this zone is pumped. Land surface subsidence has aggravated the condition of intrusion by allowing farther inland incursion of saltwater up the stream channels from the Bay and by changing the gradient directions.

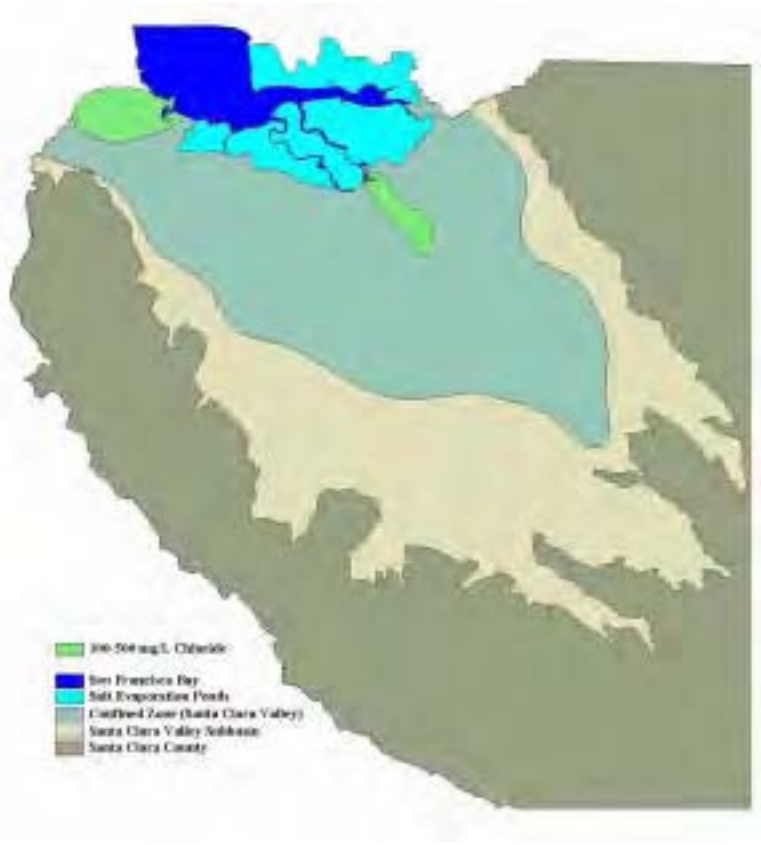
Figure 5-3
Upper Zone Saltwater Intrusion



Data has revealed a local area of high salt concentration in the upper aquifer zone in the Palo Alto bayfront area. This locally concentrated groundwater has moved inland historically and has the potential to continue farther inland. It is in this area that the District constructed a 2-mile-long hydraulic barrier in order to prevent further intrusion and to reclaim portions of the intruded aquifers.

The lower aquifer zone is only mildly affected; the area of elevated salinity encompasses a much smaller area than that of the upper aquifer zone (Figure 5-4). The contaminated lower aquifers lie beneath the intruded portion of the upper aquifer zone. The areal distribution and the variable concentration of the saltwater contamination with time imply that the intrusion into the lower aquifer occurred as seasonal slugs of contaminated water were induced from either the surface or the upper aquifer. As the clay aquitard between the upper and lower aquifer zones is essentially impermeable, the salinity in the lower aquifer zone is thought to have occurred through improperly constructed, maintained or abandoned wells. As a result of this finding, the operation of the hydraulic barrier was discontinued.

Figure 5-4
Lower Zone Saltwater Intrusion



The resumption of land surface subsidence is the greatest potential threat to aggravating the intrusion condition, as it would further depress the land surface fronting South San Francisco Bay. This would increase the inland hydraulic gradient relative to the classical intrusion front and expose a larger area of the upper aquifer zone to intrusion as a consequence of the greater inland incursion of tidal waters. A lowering of the piezometric level in the lower aquifers, which is related to the cause of subsidence, will also increase the potential for intrusion into the lower zone.

Current Status

As part of the Saltwater Intrusion Prevention Program, the defective wells in the northern Santa Clara Valley Subbasin along San Francisco Bay were to be located and destroyed. The District conducted an extensive program of locating and properly destroying these contaminant conduit wells. After these defective wells were located, the owners were required to properly destroy them under District ordinance, or by litigation if necessary. From District records, a list of 45 defective wells to be destroyed was generated.

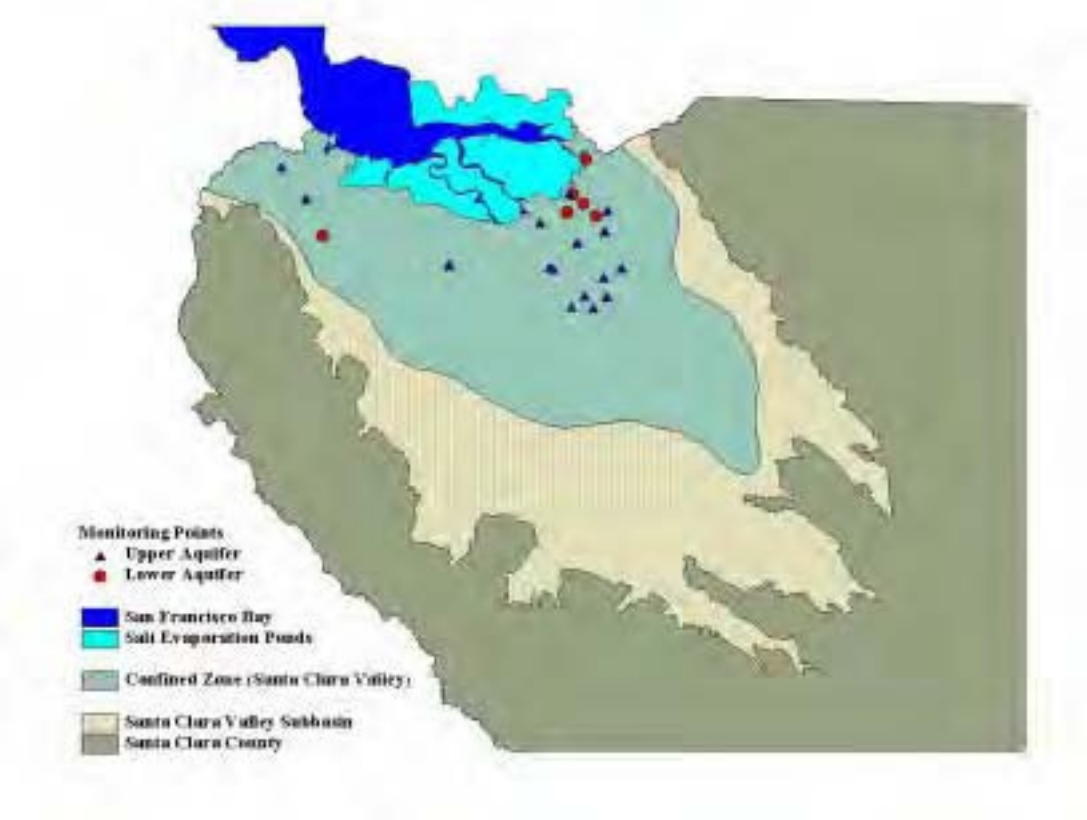
Since the inception of this program, the Board has authorized a more comprehensive well destruction program, through which abandoned wells near areas of known chemical contamination can be destroyed with District funds. This program began in October 1984, and was in part a result of general concerns about contamination of useable aquifers by saltwater as well as by industrial chemicals throughout the County. Several

wells in the area were included in this parallel program, many of which were not identified as defective or potential conduit wells.

Of the 45 potential conduit wells, six were removed from the list as they do not appear to be acting as conduits. In 1985, the District's Groundwater Protection Section pursued destroying the remaining 39 wells through District Ordinance No. 85-1. This ordinance gives the District authority to require owners of wells determined to be "public nuisances" to destroy the wells or to upgrade them to active or inactive status. Of the 39 potential conduit wells identified, 10 were not located and were presumed destroyed without a permit. The remaining wells were all properly destroyed.

The District continues to monitor the extent and severity of saltwater intrusion. The current Saltwater Intrusion Monitoring Program consists of 21 monitoring wells that are sampled quarterly as shown in Figure 5-5. Five of these wells monitor the status of saltwater intrusion in the lower aquifer zone, while the remaining 16 wells monitor the upper aquifer zone. Originally, the program consisted of 25 wells. Eight of these wells could not be located during recent field investigations and presumably were destroyed by the owners. However, work is commencing to replace the lost wells with District-owned wells and restore the monitoring program to its original form.

Figure 5-5
Saltwater Intrusion Monitoring Locations



Future Direction

The present status of the Saltwater Intrusion Prevention Program is subject to change, depending upon the future basin operation and groundwater demand in the area. The two economically practical ways to prevent or minimize any further intrusion are through management of the groundwater basin and strict enforcement of ordinances on well construction and destruction standards. These approaches have been adopted by the District and should continue to be implemented.

Saltwater intrusion continues to be monitored. Monitoring data are stored by electronic and conventional means. Electronic storage consists of a geographically referenced database of monitoring wells and a related database of water quality information. Conventional storage consists of filing hard copies of laboratory analytical reports in the appropriate well folders and providing data to DWR. Biennial evaluations of the data are documented in the General Groundwater Quality Monitoring Program reports. The monitoring program, including well location and sampling frequency, will be evaluated with respect to long-term groundwater quality protection strategies and overall basin management.

WELL CONSTRUCTION/DESTRUCTION PROGRAMS

Well Ordinance

Program Objective

The objective of the Well Ordinance Program is to protect the County's groundwater resources by ensuring that wells and other deep excavations are constructed, maintained and destroyed such that they will not cause groundwater contamination. To meet this goal, the Well Ordinance Program:

- Develops standards for the proper construction, maintenance, and destruction of wells and other deep excavations.
- Educates the public, including contractors, consultants and other government agencies about the Well Ordinance and the Well Standards.
- Verifies that wells are properly constructed, maintained and destroyed using a permitting and inspection mechanism.
- Takes enforcement action against violators of the well ordinance.
- Maintains a database and well mapping system to document information about well construction and destruction details, a well's location, and well permit and well violation status.

The scope of the Well Ordinance Program includes all activities relating to the construction, modification, maintenance, or destruction of wells and other deep excavations in the County.

Background

In the late 1960s, following post-war industrialization and development of Santa Clara County, it became apparent that abandoned or improperly constructed wells and other deep excavations (e.g. elevator shaft pits) are potential conduits through which contaminants can travel from shallow, potentially contaminated aquifers, to deeper drinking water aquifers. Recognizing this, in 1971, a District advisory committee consisting of representatives from local agencies, the District, and the Association of Drilling Contractors, was established.

The committee was charged with the development of well construction standards and standards for the proper destruction of abandoned wells. The Board adopted standards for well destruction and construction in October 1972 and January 1975, respectively. In 1975, the District Board of Directors passed the first District Well Ordinance.

Both the Standards and the Well Ordinance have undergone numerous revisions. The most recent version of the well standards, the *Standards for the Construction and Destruction of Wells and Other Deep Excavations in Santa Clara County*, was adopted by the Board in July 1989. The Board passed district Well Ordinance 90-1 in April 1990. These documents address the permitting and proper construction and destruction of wells and other deep excavations, including water supply wells, monitoring wells, remedial extraction wells, vadose wells, cathodic protection wells, injection wells, storm water infiltration wells and elevator shaft pits.

Beginning in 1975, well construction and destruction permits were required by the District and the District began inspecting every well that was constructed. Well destruction activities were first inspected by the District in 1984.

Since the inception of well permitting, the annual number of permits issued has greatly increased. The District issued approximately 400 well permits in 1976, the first full year of permitting, to a maximum of approximately 2,544 permits in 1994.

The District is in compliance with Sections 13803 and 13804 of the State Water Code and thereby has the authority to assume the lead role in the enforcement of the State Well Standards, the assignment of State Well Numbers, and the collection of State Drillers Reports for all wells constructed or destroyed in Santa Clara County.

Current Status

To date, the District has permitted and inspected the construction of approximately 3,000 water supply wells, 22,000 monitoring wells, 4,000 exploratory borings, and the destruction of 9,500 wells under the Well Ordinance Program.

The District has recently completed converting the paper-based well maps to a GIS based well mapping system.

Future Direction

In order to continue protecting the District's groundwater resource, the District will continue implementation of the program and will continue to regulate the construction and destruction of wells in the County. District staff will re-write District's well standards and ordinance to address recent changes in well construction and destruction techniques. District staff is also currently evaluating District's existing well information database and would like to convert the database into a relational database format and link it to the newly developed GIS based Well Mapping System.

Dry Well Program

Program Objective

The objective of the Dry Well Program is to minimize the impacts of dry wells on groundwater quality. The main objectives of this program are to:

- Control installation of new dry wells.
- Destroy existing dry wells that have contaminated or may contaminate groundwater.
- Educate planning agencies and the public about the threat that dry wells pose to groundwater quality.

Background

Dry wells, also known as storm water infiltration devices, are designed to direct storm water runoff into the ground. Storm water runoff can carry pollution from surface activities. Because dry wells introduce runoff directly into the ground, they circumvent the natural processes of pollution breakdown and thereby increase the chance of groundwater contamination. Additionally, dry wells have been sites of illegal dumping of pollutants.

In Santa Clara County, at least 8 serious contamination sites were caused or aggravated by the presence of dry wells introducing contamination into the groundwater. One dry well site has a solvent plume more than 2,000 feet long and more than 200 feet deep in a recharge area of South County where the only source of drinking water is groundwater.

In 1974, the Environmental Protection Agency (EPA) developed the Underground Injection Control Program under the Safe Drinking Water Act. The program requires the owners and operators of all shallow drainage wells to submit information regarding the status of each well to the EPA. The Regional Board adopted the "Shallow Drainage Wells" amendment to the Basin Plan in 1992. The Basin Plan amendment requires the local agency to develop a shallow drainage well control program that would locate existing shallow wells and establish a permitting program for existing and new wells.

In 1991, the District and municipal agencies began development of a Storm Water Infiltration Policy to satisfy Regional Board requirements. In August 1993, the District adopted Resolution 93-59 regarding Storm Water Infiltration Devices.

Current Status
Since 1993, owners of dry wells deeper than 10 feet have been required to register their wells by filing a "Notice to Continue Use" with the District. Dry well owners can continue using their wells as long as the well is not an immediate threat to groundwater quality. Local cities, businesses, contractors and private citizens regularly call for District guidance on dry wells.

The District continues to issue permits for dry wells greater than 10 feet deep and for the destruction of dry wells. District staff advise the public and planning agencies about the appropriate use of dry wells to mediate storm water problems generally and on a case-by-case basis. District staff continue to work with local programs to clarify the District dry well policy. Local inspecting agencies continue to work with the District to locate and register dry wells.

Future Direction
The Dry Well Program is being incorporated into the Well Ordinance Program. Specific standards for dry wells will be incorporated into the next revision to the Well Standards. These standards include prohibiting the construction of dry wells greater than 10 feet deep and defining dry wells to include all shallow drainage wells, not just shallow drainage wells receiving storm water. The purpose of revising the program to incorporate it into the Well Ordinance Program is to clarify permitting and construction standards for dry wells, to expand the definition of devices covered by the Well Standards so that all wells that bypass natural protection processes are subject to standards for protecting groundwater, and to simplify the process by which dry wells are permitted.

Abandoned Water Well Destruction Assistance

Program Objective
The objective of the Abandoned Well Destruction Assistance Program is to protect the County's groundwater resources by helping property owners properly destroy old, abandoned water supply wells that they have discovered.

To meet the program's objective, the District:

- Passed a Board Resolution (94-87) allowing District assistance to property owners who discover abandoned wells.

- Enters into annual contracts with well drillers to complete work associated with the project.

- Destroys abandoned wells for property owners.

Background
Due to the agricultural history of the County and to subsequent post-World War II development, many former water supply wells were abandoned and buried and remain

potential vertical conduits that may transport contaminants into the District's deep, water supply aquifers.

Some estimates indicate that there may be as many as 10,000 abandoned water supply wells within the boundaries of the Santa Clara Subbasin. Since there are no official records for these wells, the District has no knowledge of their existence or their locations.

In the mid-1980s, the District took a proactive stance on active and abandoned water supply wells found within known contamination plumes. At that time, with assistance from the Regional Board, the District actively searched for and destroyed known active wells and abandoned wells.

However, when abandoned water wells were discovered in areas not threatened by known groundwater contamination, they were not included in the District's well destruction efforts, but instead were treated as well violations under the Well Ordinance Program. As well violations, the District proceeded with enforcement action to force the property owner to properly destroy the well.

Unfortunately, this enforcement action often took months to complete. Property owners often didn't have the $3,000 to $15,000 dollars needed to destroy the well and had to secure loans to complete the destruction. Many property owners had negative feelings about the District after the enforcement action, especially considering that most property owners had no previous knowledge of the well and when they had discovered the well, they had been the first to inform the District of its existence.

District staff believed that while a well was found on an owner's property (and according to the Well Ordinance, that the property owner is responsible for destroying it), the owner wasn't actually responsible for the well's current status (abandoned and buried) and because the destruction of the well was in the best interest of the District, that the District should destroy it.

Therefore, in 1994, the District initiated the Abandoned Well Destruction Assistance Program to aid property owners who happen to discover an abandoned water supply well on their property. Under the Abandoned Well Destruction Program, the District destroys abandoned water wells if: 1) the property owner had no previous knowledge of the well, 2) the well was not registered with the District, 3) the well has no surface features that would have obviously indicated its presence, and, 4) the property owner enters into a Right of Entry Agreement with the District.

Current Status

Since the program's inception in 1994, the District has destroyed 108 abandoned wells under the Abandoned Well Destruction Program. Most of these wells were first discovered and reported to the District because they were flowing under artesian pressure.

Future Direction
Staff will continue to implement the program. Annually, staff receives reports of approximately 20 wells that meet program criteria and staff expect that this trend to continue.

WELLHEAD PROTECTION

Program Objective
The Wellhead Protection Program (WHP) represents the groundwater portion of the District's Source Water Assessment Program. The objective of the Wellhead Protection Program is to identify areas of the groundwater basin that are particularly vulnerable to contamination. The District uses this knowledge to focus groundwater protection, monitoring, and cleanup efforts.

Background
Groundwater vulnerability is based on groundwater sensitivity to contamination and the presence of potentially contaminating activities. Groundwater sensitivity is evaluated based on hydrogeology and groundwater use patterns. Areas with shallow groundwater, high recharge, high conductivity aquifers, permeable soils and subsurface materials, mild slopes, and high groundwater pumping rates are most sensitive to contamination. The District compiles data on hydrogeologic conditions, pumping patterns, and contamination sources, and uses GIS technology to identify areas of the groundwater basin that are particularly vulnerable to contamination.

The District first began compiling groundwater protection data in the late 1980's. In 1989, the District, in collaboration with the U.S. Environmental Protection Agency (EPA), conducted a pilot project in the Campbell area to evaluate the usefulness of GIS for groundwater protection. Data on roads, city boundaries, hazardous material storage sites, groundwater recharge facilities, wells and hydrogeology were collected and used to create GIS coverages for the Campbell study area. The project team used GIS to evaluate groundwater sensitivity and draw areas to be protected around production wells. The study concluded that GIS is a feasible tool to use for WHP programs.

After the Campbell pilot study, the District expanded its groundwater protection data collection effort to encompass the entire County. Staff developed Countywide GIS coverages of active wells, abandoned and destroyed wells, geology, soil types, depth to groundwater, leaking underground storage tank sites, and petroleum storage facilities. This data, along with water quality data, is used to identify and evaluate threats to groundwater quality.

Current Status
The District created a groundwater sensitivity map to evaluate land use development proposals and make recommendations for appropriate groundwater protection strategies. In 1996, the District built upon the pilot GIS project to assess groundwater sensitivity throughout the groundwater basin using EPA's DRASTIC method. DRASTIC stands for

depth to water table, net recharge, aquifer media, soil media, topography, impact of the vadose zone, and hydraulic conductivity of the aquifer. The DRASTIC method is a quantitative evaluation of these hydrogeologic factors to assess relative groundwater sensitivity. The results of this effort were several GIS coverages and a groundwater sensitivity map (Figure 5-6), which the District uses to review land development proposals. In sensitive groundwater areas, the District requests that planning agencies require, and that property owners implement, best management practices and other protection activities beyond those required by minimum standards.

Figure 5-6
Groundwater Sensitivity Map

Staff uses information on land use and the location of contaminated sites to help identify and evaluate the sources of contamination that are detected in wells. Although groundwater quality is generally good throughout the basin, contamination is occasionally detected in individual wells. By quickly locating contamination sources, we can work with the regulatory agencies to ensure prompt and adequate cleanup.

The District also uses information on well construction, well location, well pumping, leaking Underground Storage Tank (UST) site locations and conditions, land use, and hydrogeology to prioritize leaking UST sites and identify vulnerable water supply wells. Sites that pose the greatest threat to groundwater supplies are the first to receive detailed regulatory oversight. Staff also uses this information to select wells for groundwater monitoring and special studies.

District staff is working with local water retailers on the state's Drinking Water Source Assessment and Protection (DWSAP) Program. The state's DWSAP Program is required by the 1996 reauthorization of the federal Safe Drinking Water Act. California has until May 2003 to assess all of its drinking water sources for vulnerability to contamination. The District developed a GIS-based wellhead assessment and protection area delineation tool, which delineates protection areas according to state guidelines. Once the vulnerability assessments are completed in Santa Clara County, the District will work with the water retailers to ensure that the greatest threats to their drinking water supply wells are being addressed.

Future Direction
District staff continues to create GIS coverages that help assess groundwater vulnerability. Some coverages that are in development include solvent contamination sites and plumes, dry cleaners, hazardous materials storage facilities, septic system locations, and sewer lines. The District has found great utility in these GIS coverages, and is beginning to work with other agencies and organizations to determine how we can share GIS information and increase its use for groundwater protection. We will continue to use this information to identify areas vulnerable to groundwater contamination, and focus our monitoring, protection, and cleanup efforts.

LEAKING UNDERGROUND STORAGE TANK OVERSIGHT

Program Objective
The objective of the Leaking Underground Storage Tank Oversight Program (LUSTOP) is to protect the groundwater basin from water quality degradation as a result of releases of contaminants from underground storage tanks. The District provides regulatory oversight of the investigation and cleanup of fuel releases from USTs for most of Santa Clara County.

Background
In 1983, the State Legislature enacted the UST Law [Chapter 6.7 of the Health and Safety Code] authorizing local agencies to regulate the design, construction, monitoring, repair, leak reporting and response, and closure of USTs. In the early 1980s, several drinking water wells in the County were shut down as a result of contamination by chlorinated solvents. In 1986, the Board decided to implement a leaking UST oversight program for petroleum fuels in coordination with the San Francisco Bay Regional Water Quality Control Board (RWQCB). The District Board recognized that releases from USTs affect groundwater quality and that effective protection of the County's groundwater basin demanded a proactive approach. They committed financial and technical resources in-house to quickly initiate the program.

In 1987, the District entered into an informal agreement with the San Francisco RWQCB to create a pilot oversight program. At that time more than 1,000 fuel leaks had been reported within the County. The District developed an in-house technical group of employees capable of providing regulatory oversight of the investigation and cleanup of

releases from USTs. In 1988, the District and the County of Santa Clara entered into a contract with the State Water Resources Control Board to implement one of the State's first Local Oversight Programs. This allowed the District to get reimbursed by state and federal funds for costs associated with operation of the program.

The State Water Resources Control Board (SWRCB) amends its Local Oversight Program contract with the District and the County annually. Over the years, many changes have occurred in the UST regulatory process as new laws were passed, scientific knowledge improved, and new investigation and cleanup strategies became available. The District's program actively participates in ensuring that new laws and regulations continue to protect groundwater quality into the future. The District has been at the forefront of several initiatives for improving the effectiveness and efficiency of our regulatory oversight efforts and the cost-effectiveness of corrective action while protecting human health, safety, the environment and water resources.

Every leaking petroleum UST case is currently assigned to a District caseworker who provides technical and regulatory guidance to responsible parties and their consultants (Figure 5-7).

Figure 5-7
Fuel Leak Cases in Santa Clara County

The District only provides regulatory oversight on investigation and cleanup at UST sites where a release has occurred. Tank removals, leak prevention, and UST release detection activities are overseen by one of 10 other agencies, usually the local fire department. Each agency has jurisdiction over a designated geographical area in the County. If there is evidence of a leak or if contamination is detected, an agency inspector or UST owner/operator notifies the District and/or the Regional Board. The District reviews the data to confirm the release, lists the site on the Leaking Underground Storage Tank Oversight Program database, and notifies the responsible party and the SWRCB. The District then determines if the unauthorized release poses a threat to human health and safety, the environment, or water resources and, if necessary, a caseworker requests additional investigation and cleanup.

To get case closure for the release, the responsible party must provide evidence that the release does not pose a significant threat to human health and safety, the environment or water resources; or, that the release has been adequately investigated and cleaned up. Fuel leak investigation and cleanup is closely monitored by a caseworker, and the case is promptly closed when the unauthorized release no longer poses a threat to human health, safety, the environment or water resources.

Current Status

As of January 2000, a total of 2,315 fuel leak cases have been reported in the County, the majority of which have affected groundwater. Approximately 1,650 (71 percent) of reported leak cases have been closed. About 575 cases are currently within the District's UST program, while about 75 cases receive Regional Board oversight. As a local oversight program, the District has made significant progress in closing low-risk sites and sites that have performed appropriate corrective action to reduce contamination to below levels of regulatory concern.

The presence of Methyl tert-Butyl Ether (MTBE) in gasoline has precipitated additional changes in the UST regulatory process and the manner in which sites are investigated and cleaned up. Since 1995, MTBE and other oxygenates have emerged as significant contaminants at fuel leak sites within the County, causing increased concern for the protection of groundwater resources. MTBE has been blended into gasoline in high percentages (up to 15 percent by volume) beginning in the winter of 1992 with the intent to significantly improve air quality. However, MTBE is a recalcitrant chemical in groundwater, as it does not undergo significant breakdown (bio-degradation) in groundwater. As a result, MTBE contamination can migrate considerable distances in groundwater and may impact wells miles downgradient. MTBE has been detected at more than 375 current fuel leak cases in the County, with concentrations at these sites ranging from 5 parts per billion to more than 1 million parts per billion. The District has taken a progressive and vigilant approach to protecting groundwater resources from MTBE contamination through the use of GIS to manage and analyze both UST site and regional information and in demanding a more intense and detailed level of work be performed at MTBE release sites.

The District is also very concerned regarding the increasing occurrence of MTBE at operating gasoline stations, which poses a significant threat to municipal drinking water wells within the County. In response to this threat, the District completed two studies of operating gasoline stations that were in compliance with the 1998 UST upgrade requirements. The first study, completed by Levine-Fricke in 1999, involved soil and groundwater sampling at 28 facilities to determine if releases were occurring from upgraded UST systems. MTBE was detected in groundwater at 13 of the 27 sites where groundwater was encountered. The second study, completed in 2000 (SCVWD, 2000), was a case study of 16 sites with operating USTs and high levels of MTBE in groundwater to evaluate whether undetected releases are occurring and to assess weaknesses in fuel storage, management, and delivery operation. Of the 16 sites studied, undetected releases were suspected at 13 sites.

Despite the fact that gasoline stations have been upgraded to meet stringent requirements, it is clear that faulty installations, poor maintenance and poor facility operation practices are resulting in leaks, and that improvements in the management of USTs are needed to prevent widespread contamination of groundwater.

Future Direction

The District continues to provide technical guidance and regulatory oversight to cases using improved scientific knowledge and latest investigation and cleanup strategies. The District will continue to work closely with local universities, research organizations, the water community, major oil companies, local, state and federal agencies, and the state and federal legislature to ensure that problems in the UST program are identified and that prompt effective solutions are implemented to protect groundwater quality.

An effective UST leak prevention and monitoring program is essential. There are several studies underway regarding the effectiveness of leak prevention and monitoring systems at sites. The District will continue to monitor all developments in this area and propose ongoing studies and/or regulatory changes. To ensure water resources are protected, the District actively participates in the legislative process to ensure that recalcitrant chemicals like MTBE that can cause significant groundwater degradation are not used in fuels.

One of the biggest concerns for the District regarding MTBE is the significance of both short-term and long-term threats to groundwater quality. The District is committing additional resources to gain a more extensive understanding of the groundwater basin, groundwater flow patterns, and groundwater pumping trends. This improved understanding allows for better decisions regarding: the level of oversight necessary at sites; how much investigation is required to properly understand the nature and extent of contamination at sites; the level of cleanup necessary to protect groundwater resources; and the effectiveness of the program in preventing significant short-term and long-term water quality degradation.

The District will continue responding to the public regarding USTs and groundwater contamination and will ensure that files and information are available for public review.

District staff plan to have all fuel leak files scanned and electronically accessible over the Internet in the near future. Program guidance, site information, and news of the latest developments in the program are available on the District's web site.

TOXICS CLEANUP

Program Objective

The objective of the Toxics Cleanup Program is to ensure the protection of the groundwater basins from water quality degradation as a result of toxics and solvent contamination and spills of other non-fuel chemicals. The District performs peer review of these cases and makes water use and geologic information available to the public and environmental consultants. District staff also provide expert technical assistance to the regulatory agencies (County of Santa Clara, San Francisco and Central Coast Regional Boards, Department of Toxics Substances Control, and the Federal Environmental Protection Agency) responsible for the oversight of investigation and cleanup at non-fuel contaminated sites within Santa Clara County.

Background

Since the late 1970s, the District has provided expert technical and hydrogeologic assistance to agencies having the legal responsibility for the protection of the water resources serving the needs of Santa Clara County. The discovery of groundwater contamination at Fairchild Semiconductor in 1981 resulted in heightening the awareness for the protection of groundwater quality and the need for the District to be actively involved in ensuring that appropriate investigation and cleanup of sites was undertaken in a timely manner. District staff were actively involved with the review and analysis of early laws governing the regulation of underground storage tanks and hazardous materials and in laws, regulations, and policies to ensure groundwater resource protection. District staff have documented the migration of contamination down abandoned wells and conduits and fashioned a well installation and destruction ordinance to ensure that wells were properly installed and potential conduits properly destroyed.

Current Status

The District has records of over 700 releases of non-fuel related cases involving the release of solvents, metals, pesticides, Polychlorinated Biphenyls (PCBs), and a variety of other chemicals in Santa Clara County. The San Francisco Bay RWQCB provides regulatory oversight on over 600 cases in the Santa Clara Valley and Coyote Subbasins. The Central Coast RWQCB provides oversight on an estimated 35 cases in the Llagas Subbasin. The California Department of Toxics Substances Control provides oversight of 17 cases and the Federal EPA provides oversight of 11 sites.

The District maintains an elaborate filing system for these cases that is heavily used by the environmental consultants and the public researching contaminated sites. District staff actively track and peer review the most serious of these cases (primarily the Superfund sites). Staff provide review and comment on Site Cleanup Requirements and Cleanup and Abatement Orders prepared by the Regional Boards and investigation and cleanup reports prepared for these sites. The District provides geologic and technical

expertise to responsible parties (site owners and operators) and their consultants and staff, and regularly participate in various committees and public meetings to ensure groundwater protection issues are properly addressed.

Future Direction
The District plans to continue these efforts in addition to conducting a review of all the recorded cases to ensure that all have been properly addressed by the various regulatory agencies. Many cases have remained "inactive" and may not have performed appropriate investigation and cleanup. The District plans to inform the regional boards and other agencies of these reviews and assist them to ensure appropriate work is performed. The District also plans to make more information available regarding geologic conditions and the status of solvent and toxics cases in GIS and over the Internet.

LAND USE AND DEVELOPMENT REVIEW

Program Objective
The objective of the Land Use and Development Review Program is to evaluate the land use and developments occurring within the County for adverse impacts to watercourses under District jurisdiction and to other District facilities, including the pollution of groundwater.

Background
Land development decisions made by the cities and the County influence a variety of issues related to water quality and quantity. The District reviews land development proposals, identifies any potential adverse impacts to District facilities and provides comments to the lead agency charged with making the final decision for the proposals. The District also reviews Draft Environmental Impact Reports (DEIRs) and/or EIRs and provides comments to the lead agency.

Current Status
The District reviews and comments on proposed land development, environmental documents and city and County General plans. Review of land development proposals includes a determination of direct and indirect impacts to District facilities. Indirect impacts could result from increased runoff and flooding due to new impervious surface or introduction of pollutants to a watercourse from construction activities or urban runoff. Direct impacts to watercourses under District jurisdiction are addressed through the District's permitting program as defined by Ordinance 83-2.

This ordinance allows the District to investigate whether a proposed project or activity will:

a. Impede, restrict, retard, pollute or change the direction of the flow of water.

b. Catch or collect debris carried by such water.

c. Be located where natural flow of the storm and flood waters will damage or carry any structure or any part thereof downstream.

d. Damage, weaken, erode, or reduce the effectiveness of the banks to withhold storm and flood waters.

e. Resist erosion and siltation and prevent entry of pollutants and contaminants into water supply.

f. Interfere with maintenance responsibility or with structures placed or erected for flood protection, water conservation, or distribution.

If a project appears likely to do any of the above, the District may deny or conditionally approve the permit application for the proposed project.

Future Direction

The California Environmental Quality Act (CEQA) provides the District an opportunity to comment in areas relevant to the issues listed above; however, cities need to make certain these issues are adequately addressed and treated. The use of Ordinance 83-2 and CEQA have generally not effected adequate attention to these issues.

In years past the District has relied on local agencies to place conditions on development projects and to include provisions that address District water supply and flood protection measures. The recent increase in development and land use coupled with more stringent environmental concerns and requirements imposed by other regulatory agencies has made it necessary for the District to shift to a more proactive approach and to undertake greater participation in development planning activities. District land use and development review staff plan to participate on interagency project teams, conduct general plan review and revision, and development of relevant policies (such as riparian corridor and building setback policies). The program will also seek revisions to Ordinance 83-2, and greater education of land development planning staff and officials.

Additional Groundwater Quality Management Activities

Groundwater Guardian Affiliate

The District was designated as Groundwater Guardian Affiliate for the year 2000. Groundwater Guardian is an annually earned designation for communities and affiliates that take voluntary, proactive steps toward groundwater protection. The district earned the designation in 2000 based on activities such as conducting irrigation, nutrient, and pesticides management seminars, sponsoring a mobile irrigation management laboratory, and creating a prototype zone of contribution delineation tool for delineating wellhead protection areas. The Groundwater Guardian Program is sponsored by The Groundwater Foundation, a private, international, not-for-profit education organization that educates and motivates people to care about and for groundwater. The District will continue to participate in the program by submitting annual work plans and reports documenting our groundwater protection efforts.

Comprehensive Reservoir Watershed Management

The District has initiated a Comprehensive Reservoir Watershed Management Project to protect the water quality and supply reliability of the District's reservoirs. The District seeks to balance watershed uses, such as the rights of private property owners and public recreational activities, with the protection and management of natural resources. The District recognizes that preserving beneficial watershed uses can benefit reservoir water quality, which in turn benefits drinking water quality delivered to the District treatment plants and recharged into the groundwater basins.

Watershed Management Initiative

The District is an active participant in the San Francisco Bay Regional Water Quality Control Board's Santa Clara Basin Watershed Management Initiative (WMI). The purpose of the WMI is to develop and implement a comprehensive watershed management program. The goals of the WMI include balancing the objectives of water supply management, habitat protection, flood management, and land use to protect and enhance water quality, including the quality of water used for groundwater recharge and water in the groundwater basins. The WMI will develop a watershed management plan that will set out agreed upon actions to meet stakeholder goals, including water quality protection and enhancement.

Non-Point Source Pollution Control

The District along with other agencies is the co-permittee for National Pollution Discharge Elimination System (NPDES) permit number CAS029718. The co-permittees formed the Santa Clara Valley Urban Runoff Management Program in 1990 to develop and implement efficient and uniform approaches to control non-point source pollution in storm water runoff that flows to the South San Francisco Bay, in compliance with NPDES permit responsibilities.

Chapter 6
SUMMARY

The many groundwater management programs and activities described in this document demonstrate that the District is proactive and effective in terms of ensuring that groundwater resources are sustained and protected. A summary of existing District groundwater programs is presented here, organized by report section.

Groundwater Supply Management

The objective of the District's groundwater supply management programs is to sustain groundwater resources by replenishing the groundwater basin, increasing basin supplies, and mitigating groundwater overdraft. This is currently achieved through:

- In-stream recharge, including controlled and uncontrolled recharge through District facilities.
- Off-stream recharge through District percolation ponds and abandoned gravel pits, including activities to reduce turbidity of incoming water.
- Periodic water balance to reconcile water imports, inflows, releases, and changes in surface water storage.
- Direct injection recharge facilities.
- Water use efficiency programs.
- Estimation of operational storage capacity.
- Subsidence and groundwater flow modeling to evaluate potential impacts to the groundwater basin.
- Public outreach and education for water use efficiency programs.

Groundwater Monitoring

The District's groundwater monitoring programs provide basic data to assist in the evaluation of groundwater conditions. Programs include:

- Groundwater quality monitoring, including sampling for general minerals, trace metals, and physical characteristics.
- Groundwater elevation monitoring, including depth-to-water measurements and the development of groundwater contour maps.
- Groundwater extraction monitoring, which tracks groundwater use throughout the County.

- Land subsidence monitoring, which measures existing subsidence.

Groundwater Quality Management
Existing programs designed to protect the groundwater from contamination and the threat of contamination include the following:

- Nitrate management program designed to delineate, track, and manage nitrate contamination by monitoring nitrate occurrence, and by reducing further loading and the public's exposure to nitrate.

- Saltwater intrusion prevention program to prevent freshwater aquifers from degradation through monitoring and the sealing of contaminant conduit wells.

- Well construction and destruction programs to protect groundwater resources by ensuring that wells will not allow the vertical transport of contaminants.

- Wellhead protection program to identify areas of the basin that are particularly vulnerable to contamination to focus groundwater protection, monitoring, and cleanup efforts.

- Leaking underground storage tank oversight program to protect the groundwater from water quality degradation and provide regulatory oversight of investigation and cleanup of fuel releases from underground tanks.

- Toxics cleanup program to protect the basin from contamination by non-fuel chemicals.

- Land use and development review to evaluate land use proposals in terms of potential adverse impacts to District facilities.

- Public outreach and education for groundwater quality management programs.

Recommendations
In 1999, the District Board of Directors established Ends Policies that direct the Chief Executive Officer/General Manager to achieve specific results or benefits. The following Ends Policies are related to groundwater:

E.1.1.2. The water supply is reliable to meet current demands.
E.1.1.3. The water supply is reliable to meet future demands as identified in the District's Integrated Water Resource Plan (IWRP) process.
E.1.1.4. There are a variety of water supply sources.
E.1.1.5. The groundwater basins are aggressively protected from contamination and the threat of contamination.
E.1.1.6. Water recycling is expanded consistent with the District's Integrated Water Resource Plan (IWRP) within Santa Clara County.
E.1.2.2.3. Groundwater supplies are sustained.

Two of the Ends Policies directly relate to the management of groundwater resources: 1.1.5 - The groundwater basins are aggressively protected from contamination and the threat of contamination, and 1.2.2.3 - Groundwater supplies are sustained. As the District is now formally guided by these policies, we need to ensure that program outcomes match these ends.

Although the District manages the basin effectively, there is room for improvement of the groundwater programs in terms of meeting the Ends Policies and in the coordination and integration of the programs. Specific areas where further analysis is recommended include:

1. **Coordination between the Groundwater Management Plan and the Integrated Water Resources Plan (IWRP) –** As the District's water supply planning document through 2040, the IWRP has identified the operation of the groundwater basin as a critical component to help the District respond to changing water supply and demand conditions. Planning and analysis efforts for future updates of the Groundwater Management Plan and the IWRP need to be integrated in order to provide a coordinated and comprehensive water supply plan for Santa Clara County.

2. **Integration of groundwater management programs and activities** – Individual groundwater management programs tend to be implemented almost independently of other programs. A more integrated approach to the management of these programs, and to the management of the basin overall needs to be developed. Integration of these programs and improved conjunctive use strategies will result in more effective basin management.

3. **Optimization of recharge operations** – As artificial recharge is critical to sustaining groundwater resources, an analysis of the most effective amount, location, and timing of recharge should be conducted.

4. **Improved understanding of the groundwater basin** – In general, the existing groundwater management programs seem to focus on managing the basin to meet demands and protecting the basin from contamination and the threat of contamination. However, improving the District's understanding of the complexity of the groundwater basin is critical to improved groundwater management. The more we know about the basin, the better we can analyze the impact of different groundwater scenarios and management alternatives.

5. **Effective coordination and communication with internal and external agencies** – Improved communication and coordination will lead to improved groundwater management programs. Increased sharing of ideas, knowledge, and technical expertise among people involved with groundwater at the District will result in increased knowledge, well-coordinated and efficient work, and well-informed analyses and conclusions. Improved coordination with external agencies, such as retailers and state and federal organizations, will result in improved knowledge of customer needs and increased awareness of District activities.

A detailed analysis of the areas above and of all groundwater programs as they relate to Ends Policies and the groundwater management goal is recommended.

The next update of the Groundwater Management Plan, scheduled for 2002, will address the issues above and the overall management of the basin by presenting a formal groundwater management strategy for achieving the groundwater management goal in a practical, cost-effective, and environmentally-sensitive manner. The update will evaluate each groundwater program's contribution and effectiveness in terms of the groundwater management goal and Ends Policies. Measurement criteria will be developed, and if there is no direct connection between the Ends Policies and a specific program, that program's contribution to other linked programs will be analyzed. The update will include recommendations for changes to existing programs or for the development of new programs, standards, or ordinances. The update will also develop an integrated approach for the management of groundwater programs, and for the management of the groundwater basin in general.

Groundwater is critical to the water supply needs of Santa Clara County. Therefore, it is of the utmost importance that the District continues the progress begun with this Groundwater Management Plan. Increased demands and the possibility of reduced imported water in the future make effective and efficient management of the groundwater basin essential. The Groundwater Management Plan and future updates will identify how the management of the groundwater basin can be improved, thereby ensuring that groundwater resources will continue to be sustained and protected.

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