2005 Urban Water Management Plan for the City and County of San Francisco

Prepared by the
San Francisco Public Utilities Commission

December 2005

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2005 Urban Water Management Plan
City and County of San Francisco

San Francisco Public Utilities Commission (SFPUC)

Date plan submitted to the Department of Water Resources: 12/23/05

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The Water supplier is: San Francisco Public Utilities Commission

The Water supplier is a: Wholesale and retail supplier

Utility services provided by the water supplier include: Surface Water, Groundwater, Recycled Water

Is This Agency a Bureau of Reclamation Contractor? No

Is This Agency a State Water Project Contractor? No

Abbreviations

ABAG	Association of Bay Area Governments
acre-feet	One acre of water one foot deep (volume of water, equivalent to 326,000 gallons)
afy	Acre-feet per year (flow or usage rate of water)
BAWSCA	Bay Area Water Supply and Conservation Agency
BMP	Best Management Practice
Ccf	One hundred cubic feet (volume of water, equivalent to 748 gallons)
CCWD	Contra Costa Water District
CII	Commercial, Industrial or Institutional
City	City and County of San Francisco
CUWCC	California Urban Water Conservation Council
EBMUD	East Bay Municipal Utility District
GED	Gallons per employee per day
gpcd	Gallons per capita per day
gpf	Gallons per flush
GWMP	Final Draft North Westside Basin Groundwater Management Plan (2005 GWMP)
HET	High Efficiency Toilet
HHWP	Hetch Hetchy Water and Power
IWSAP	Interim Water Shortage Allocation Plan
LWRS	Local Water Resources Study (2005 LWRS)
Master Contract	Settlement Agreement and Master Water Sales Contract
mgd	Million gallons per day (flow or usage rate of water)
MOU	Memorandum of Understanding
RWMP	Recycled Water Master Plan (2005 Draft RWMP)
RWS	Regional Water System
RWSAP	Retail Water Shortage Allocation Plan
SCVWD	Santa Clara Valley Water District
SFPUC	San Francisco Public Utilities Commission
UWMP	Urban Water Management Plan
WSIP	Water System Improvement Program
WSMP	Water Supply Master Plan

Preface

The San Francisco Public Utilities Commission (SFPUC) has prepared this 2005 Urban Water Management Plan for the City and County of San Francisco in accordance with the requirements of the 1983 California Urban Water Management Act (Act), California Water Code Division 6, Part 2.6, Sections 10610 through 10656. Appendix A contains a copy of the Act, which has undergone several amendments since it's adoption. The purpose of the Act is to ensure that water suppliers plan for long-term conservation and efficient use of California's water supplies.

The Act requires all urban water suppliers to prepare an Urban Water Management Plan every 5 years. The 2005 Urban Water Management Plans are due to the California Department of Water Resources by December 31, 2005. An urban water supplier, as defined by Section 10617, means a supplier, either publicly or privately owned, providing water for municipal purposes either directly or indirectly to more than 3,000 customers or supplying more than 3,000 acre-feet of water annually.

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Section 1: Plan Development and Adoption

This section summarizes actions taken by the San Francisco Public Utilities Commission (SFPUC) to ensure agency coordination and public participation during in the development of this 2005 Urban Water Management Plan update (2005 UWMP) for the City and County of San Francisco (City). Information on the adoption of the 2005 UWMP is also addressed.

1.1 Agency Coordination

The SFPUC has coordinated with other appropriate City and regional agencies in this 2005 UWMP update.

Coordination with City Agencies: The SFPUC coordinated with other City agencies in developing elements of this 2005 UWMP. For example, in the development of recycled water options and groundwater options, many departments were consulted, such as the City Recreation and Parks Department, Department of public works, Department of Public Health, Fire Department, and Department of Building Inspection.

Additionally, the City agencies listed above, among others, received mailings regarding the SFPUC's intent to review the 2000 UWMP and to prepare an updated 2005 UWMP. They also received a copy of the draft 2005 UWMP and notification of the date and time of the public hearing on the draft 2005 UWMP. Comments received from City agencies on the proposed 2005 UWMP were reviewed and addressed, as appropriate. Documentation relating to these efforts and communications is on file with the SFPUC.

Regional Interagency Coordination: The SFPUC also coordinated with the Bay Area Water Supply and Conservation Agency (BAWSCA) on this 2005 UWMP. BAWSCA is a public agency representing the wholesale agencies served by the SFPUC (i.e., wholesale customers of the SFPUC Regional Water System). Enabled by AB2058, BAWSCA was created on May 27, 2003 to represent the interests of 26 cities and water districts, and two private utilities, in Alameda, Santa Clara and San Mateo counties that purchase water on a wholesale basis from the San Francisco Regional Water System (RWS).

Regional coordination efforts with BAWSCA in the past have led to preparation of a Water Supply Master Plan (WSMP) in 2000, and adoption of an Interim Water Shortage Allocation Plan (IWSAP) in 2000, which describes an agreed-upon method for allocating water between the SFPUC and its wholesale customers collectively during shortages caused by drought.

In addition to coordination with BAWSCA, the SFPUC also contacted wholesale customers of the SFPUC RWS. Each of these wholesale customers received water supply reliability information from the SFPUC, which enabled them to complete their individual Urban Water Management Plans. Specifically, the customers received information regarding expected deliveries to them from the SFPUC RWS, including the following:

- their projected Single dry-year supply for 2005;
- their projected Multiple dry-year supply beginning 2005; and
- their projected supply reliability for years 2010, 2015, 2020, 2025 and 2030.

All current wholesale customers also received mailings regarding the SFPUC's intent to review the 2000 UWMP and to prepare a 2005 UWMP. They also received a copy of the draft 2005 UWMP and notification of the date and time of the public hearing on the draft document.

In addition to coordinating with BAWSCA and its member agencies, the SFPUC also communicated with other Bay Area water agencies, including: East Bay Municipal Utility District (EBMUD), Santa Clara Valley Water District (SCVWD), and Contra Costa Water District (CCWD). Each of these agencies received mailings regarding the SFPUC's intent to review the 2000 UWMP and to prepare an updated 2005 UWMP. They also received a copy of the draft 2005 UWMP and notification of the date and time of the public hearing on the draft document.

Comments received from BAWSCA, individual wholesale customers, and Bay Area water agencies were reviewed and addressed, as appropriate. Documentation of related communications and coordination efforts is on file with the SFPUC.

1.2 Public Participation

The SFPUC has always actively encouraged public participation in its urban water management planning efforts. For the 2005 UWMP update, the following measures were taken:

- A public hearing was held on November 8, 2005 during an SFPUC Commission Meeting. A notice of the hearing was advertised as specified in California Government Code 6066. Additional noticing was done in local community papers in order to reach a more diverse local population. Public comment on the draft 2005 UWMP was taken at the public hearing, as well as for a period prior to and after the hearing.
- The draft 2005 UWMP was made available for review prior to the public hearing at the San Francisco Main Public Library and the main offices of the SFPUC. A copy was also posted on the SFPUC website (www.sfwater.org).
- In addition to notification of the general public (i.e., general City retail water users), other measures were taken to inform large SFPUC retail water customers, such as the San Francisco Jail, Lawrence Livermore Labs, Treasure Island, Hunters Point Shipyard and Groveland Community Services. These large retail customers received mailings regarding the SFPUC's intent to review the 2000 UWMP and to prepare an updated 2005 UWMP. They also received a copy of the draft 2005 UWMP and notification of the date and time of the public hearing on the draft document.

Documentation of these above-stated notifications is on file with the SFPUC.

Public participation was encouraged through outreach on the draft 2005 UWMP, as wells as through public involvement in the development of the following water supply planning documents that provide the basis for much of the information included in this 2005 UWMP: the 2005 *Draft Recycled Water Master Plan for the City and County of San Francisco* (RWMP)*;* the 2005 *Final Draft North Westside Basin Groundwater Management Plan* (GWMP); and the 2005 *San Francisco Local Water Resources Study* (SF LWRS). Preparation of each document included a series of public workshops which were advertised through various avenues, such as e-mail, web postings and noticing in electronic SFPUC newsletters and in community newsletters.

An additional avenue for public involvement in SFPUC's water supply planning work has been through the development and ongoing implementation of the SFPUC Water System Improvement Program (WSIP). The WSIP includes multiple program elements including improvements to transmission and storage facilities within the SFPUC RWS for purposes of improving seismic and water delivery reliability, and meeting water supply reliability goals for 2030.

1.3 Plan Adoption and Implementation

2000 UWMP: Following adoption of the 2000 UWMP, the SFPUC has pursued water supply planning programs. The programs in the 2000 UWMP, such as recycled water and groundwater, were ultimately reflected in the SFPUC's 2002 Capital Improvement Program. Currently they are included in the WSIP, as adopted by the Commission in November 2005, which details project implementation schedules and budgets.

2005 UWMP: The SFPUC prepared this 2005 UWMP update and presented it to the San Francisco Public Utilities Commission for adoption on December 13, 2005. Refer to Appendix B for a copy of the SFPUC Resolution adopting this 2005 UWMP update.

The adopted 2005 UWMP will be submitted to the California Department of Water Resources within 30 days of SFPUC Commission approval. Also within 30 days of approval, the SFPUC will submit a copy to the California State Library and to any city or county within which it provides water. Also during this period, the SFPUC will make the adopted 2005 UWMP available for public review during normal business hours. The SFPUC will implement this adopted 2005 UWMP, in accordance with the California Urban Water Management Act.[1]

[1] California Water Code Division 6, Part 2.6, Sections 10610 through 10657. Refer to Appendix A for a copy.

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Section 2: Supplier Service Area

This section provides a description of the SFPUC's service area, climate and demographic features.

2.1 Service Area

The SFPUC provides water to both retail and wholesale water customers. A population of over 2.4 million people within the counties of San Francisco, San Mateo, Santa Clara, Alameda and Tuolumne rely entirely or in part on the water supplied by the SFPUC.

Retail Customers: The SFPUC's retail water customers include the residents, business and industries located within the corporate boundaries of the City and County of San Francisco (City). In addition to these customers, retail water service is also provided to other customers located outside of the City, such as Treasure Island, the Town of Sunol, San Francisco International Airport, Lawrence Livermore Laboratory, Castlewood and Groveland Community Services District.[2]

Wholesale Customers: The SFPUC sells water to wholesale customers under terms of the *Settlement Agreement and Master Water Sales Contract* (Master Contract) together with individual water supply contracts. Since 1970, the SFPUC has supplied approximately 65 percent of the total wholesale customer water demand. Some of the wholesale water customers are entirely reliant on the SFPUC for their water supply. Table 1 lists the SFPUC's 28 current wholesale water customers.

Table 1 - SFPUC Wholesale Water Customers

Alameda County	
- Alameda County Water District	- City of Hayward
Santa Clara County	
- City of Milpitas	- City of Santa Clara
- City of Mountain View	- City of Sunnyvale
- City of Palo Alto	- Purissima Hills Water District
- City of San Jose	- Stanford University
San Mateo County	
- City of Brisbane Water Department	- Coastside County Water District
- City of Burlingame	- City of East Palo Alto
- City of Daly City	- Estero Municipal Improvement District
- Town of Hillsborough	- Guadalupe Valley Municipal Improvement District
- City of Menlo Park	- North Coast County Water District
- City of Millbrae	- City of San Bruno
- City of Redwood City	- Skyline County Water District
- Mid-Peninsula Water District	- Westborough County Water District
- California Water Service[1]	- Cordilleras Mutual Water Association

Table Notes:

1 California Water Service Company includes the districts of Bear Gulch, Mid-Peninsula and South San Francisco.

[2] Although these customers are located outside of the corporate boundaries of the City and County of San Francisco, for the purposes of water billing and accounting they are considered as part of SFPUC retail, as shown on Table 8B.

2.2 Climate

San Francisco has a Mediterranean climate. Summers are cool and winters are mild with infrequent rainfall. Temperatures in the San Francisco area average 58 degrees Fahrenheit annually ranging from the mid-40s in winter to the mid-70s in late summer. Strong onshore flow of wind in summer keeps the air cool generating fog through September. The warmest temperatures generally occur in September and October. Rainfall in the San Francisco area averages about 20 inches[3] per year and is generally confined to the "wet" season from late October to early May. Except for occasional light drizzles from thick marine stratus clouds, summers are nearly completely dry.

The wholesale customers experience a climate similar to San Francisco, except for customers located in the southern and inland regions that tend to experience warmer temperatures in the summer months with less incidence of fog.

2.3 Retail Customer Demographic and Economic Trends

The retail water demand projections presented in this report are partially related to population and business trends forecast by the Association of Bay Area Governments (ABAG) and Citywide Planning (City Planning). ABAG's and City Planning's projections are used in combination with an analysis of the characteristics of water use in the San Francisco retail service area to develop water demands.

The ABAG report titled *Projections 2002, Forecasts for the San Francisco Bay Area to the Year 2025* summarizes demographic projections for the City at 5-year intervals. ABAG projections are then reviewed and refined by City Planning using up-to-date planning information for the City. City Planning accepted the industry data provided by ABAG in their 2002 projections but revised the population and household population projections based on projected future development.

The following provides demographic estimates and projections for the SFPUC's retail sector. This information is used as the basis for a detailed analysis of the SFPUC's retail water demand projections provided later in this document. A brief discussion of job growth and population estimates and projections for the SFPUC's wholesale customers is also included. Section 6 provides information on projected retail and wholesale customer water demands.

Population: The current population of San Francisco is estimated to be 798,000 (2005). The population of San Francisco is projected to increase to 871,000 by the year 2030. This increase amounts to an annual growth rate of approximately 0.35 percent for the next 25 years. A summary of population trends for the 1990 through 2030 historical and forecast period is shown in Table 2.

Households, Household Population, and Household Size: San Francisco projects water use within its residential sectors using factors such as household population[4], households

[3] Data from 1971-2000 from the two San Francisco monitoring stations (Mission Dolores/SF#047772 and Richmond/SF#047767). Source: www.wrcc.dri.edu.

[4] All persons living in individual housing units, not including persons who reside in places such as nursing homes, military facilities or rooming houses.

(occupied dwelling units) and household size (the household population divided by the number of households). These factors are important when projecting water use which is based on end-use of water within households.

A summary of household population and housing trends for the 1990 through 2030 historical and forecast period is shown in Table 2. The annual growth rate for households is about 0.4 percent for the next 25 years. The majority of new housing will be multi-family units.

Table 2
San Francisco County Demographic Trends

Demographics	1990	2000	2005	2010	2015	2020	2025	2030
Population	723,959	776,733	798,000	809,000[1]	824,000[1]	840,000[1]	855,000[1]	871,000[1]
Household Population	699,330[2]	756,976[3]	772,470[4]	787,965[4]	803,459[4]	818,954[4]	834,448[3]	849,942[5]
Households	305,584[2]	329,703[3]	337,005[4]	344,306[4]	351,608[4]	358,909[4]	366,211[3]	373,513[5]
Persons Per Household[2]	2.29	2.30	2.31	2.30	2.29	2.27	2.28	2.28
Single-family Units[6]	105,521	108,255	109,985	111,410	111,725	111,745	111,765	111,785
Multi-family Units[7]	200,063	221,448	227,020	232,896	239,883	247,164	254,446	261,728

Source*: City and County of San Francisco Retail Water Demands and Conservation Potential* Technical Memo (Hannaford, 2004).

***Notes**:*

1 *Estimated by SFPUC based on guidance provided by Citywide Policy Analysis and Planning, San Francisco Planning Department.*

2 *Association of Bay Area Governments. Projections 2002, Forecasts for the San Francisco Bay Area to the Year 2025, December 2001 (ABAG). Year 2030 based on Citywide Planning data.*

3 *Citywide Policy Analysis and Planning, San Francisco Planning Department, Land Use Allocation 2002.*

4 *Linearly interpolated from Citywide Planning estimates for 2000 and 2025.*

5 *Linearly extrapolated from Citywide Planning estimates for 2000 and 2025.*

6 *Historical value equals recorded number of single-family accounts. Projected values are estimated.*

7 *Estimated based on the difference between Total Household Units and Single-family units (i.e., water accounts).*

Industrial and Commercial Businesses: The current number employed in San Francisco is estimated to be 656,500 and projected to increase to 795,400 by the year 2030. This increase amounts to an annual growth rate of approximately 0.77 percent for the next 25 years. The historical and projected number of people employed in San Francisco has been developed by ABAG, and is shown in Table 3. The values have been delineated by job sectors as classified by Standard Industrial Classification (SIC) code.

The majority of the job growth between now and the year 2030 is anticipated in the services sector. The jobs in this sector include hotel services, health services and business services.

Table 3
San Francisco County
Number of Jobs in Industrial and Commercial Businesses

Job Sector Category	1990	2000	2005	2010	2015	2020	2025	2030[1]
Agriculture Services and Mining	700	700	700	700	700	700	700	700
Construction	16,350	22,420	23,290	24,080	25,140	26,150	26,900	27,650
Manufacturing	39,730	30,540	31,220	32,990	34,650	35,710	37,300	38,890
Transportation and Public Utilities	40,290	41,690	43,320	44,790	46,750	48,650	50,020	51,390
Wholesale Trade	30,560	23,450	23,970	25,340	26,610	27,430	28,640	29,850
Retail Trade	80,120	94,450	97,730	102,620	106,800	110,730	114,260	117,790
Finance, Insurance and Real Estate	75,400	74,480	77,380	80,010	83,520	86,900	89,360	91,820
Services	229,470	281,510	291,150	309,870	322,550	333,270	345,100	356,930
Government	64,900	65,190	67,720	70,020	73,090	76,060	78,220	80,380
Total	579,180	634,430	656,480	690,420	719,810	745,600	770,500	795,400

Source*: City and County of San Francisco Retail Water Demands and Conservation Potential* Technical Memo (Hannaford, 2004).

***Notes**:*
1 Linearly extrapolated from ABAG estimates for 2020 and 2025.

2.4 Wholesale Customer Population and Job Growth Estimates

The SFPUC, in coordination with the wholesale customers and BAWSCA, conducted a comprehensive water demand forecast of its wholesale service area which was similar in methodology to the retail demand projection model (described in Section 6 of this document). Table 4 provides estimates and projections of population for the wholesale customer service area. As the table indicates, the population for the wholesale customers is expected to increase over the next thirty years. During this same period, employment in the wholesale customer service area is projected to increase from 1,134,097 (2001) to 1,488,566 (2030).[5] New water demands were determined by applying the growth rate in population and employment to the applicable water accounts. Section 6.2 provides information on projected wholesale customer water demands.

Table 4
Wholesale Population Estimates and Projections

	2001	2005	2010	2015	2020	2025	2030
Wholesale Customer Service Area	1,623,560	1,688,216	1,741,087	1,792,558	1,840,995	1,887,342	1,933,829

Source: *SFPUC Wholesale Customer Water Demand Projections Study (URS, 2004).*

[5] Source: *SFPUC Wholesale Customer Water Demand Projections Study (URS, 2004), Table 4-1.*

Section 3: Water Supply Sources

This section summarizes current and projected future SFPUC retail water supplies and describes the various sources of water supply available to meet the retail water demands of San Francisco. Current and projected water supplies for SFPUC wholesale customers are also presented. This section also summarizes the options used, or being considered, by the SFPUC to maximize resources and minimize the need to import water.

3.1 Current and Projected Water Supply Overview

Retail Water Supplies: Approximately 96 percent of San Francisco's demand is provided by the SFPUC RWS, which is made up of a combination of runoff into local Bay Area reservoirs and diversions from the Tuolumne River through the Hetch Hetchy Water and Power Project (HHWP). The RWS supplies are distributed within San Francisco through SFPUC's in-City distribution system. A small portion of San Francisco's water demand is met through locally-produced groundwater and secondary-treated recycled water.

Table 5A provides a breakdown of current and projected water supply sources for meeting SFPUC retail water demand over the next 25 years. Figure 1 reflects SFPUC's retail water supply mix in 2005. The SFPUC is analyzing the potential to develop additional local groundwater, recycled water and conservation. It has not been determined how these resources will be used to benefit either retail customers or the SFPUC RWS, and therefore these sources are not quantitatively applied in this 2005 UWMP to meet retail customer demand.

Table 5A

Current and Projected Retail Supplies

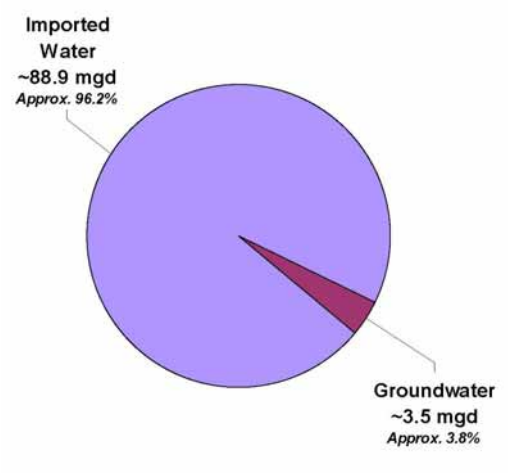
(Non-drought Periods)

Water Supply Source	**2000**	**2005**[1]	**2010**	**2015**	**2020**	**2025**	**2030**
Purchases from SFPUC Regional Water System	90.1 mgd	88.9 mgd	88.5 mgd	88.4 mgd	88.6 mgd	89.1 mgd	89.9 mgd
Recycled water[2]	< 1 mgd[2]	< 1 mgd[2]	< 1 mgd[2]	< 1 mgd[2]	< 1 mgd[2]	< 1 mgd[2]	< 1 mgd[2]
Groundwater[3]	3.5 mgd	3.5 mgd	3.5 mgd	3.5 mgd	3.5 mgd	3.5 mgd	3.5 mgd
Total	93.6 mgd	92.4 mgd	92.0 mgd	91.9 mgd	92.1 mgd	92.6 mgd	93.4 mgd

Table Notes:

1. 2005 figure is a projection because the City and County of San Francisco Retail Water Demands and Conservation Potential Technical Memo was conducted during fiscal year 2004-2005.
2. Less than 1 mgd of tertiary recycled water is currently produced at SFPUC's Southeast Water Pollution Control Plant. This recycled water is used for wash down operations. For estimated recycled water use in 2005 and projected future use, refer to Section 10 of this document.
3. Existing groundwater supplies from wells located in Golden Gate Park and in the San Francisco Zoo are used primarily for irrigation at Golden Gate Park, the Zoo and the Great Highway Median Irrigation (2.5 mgd). Approximately 1 mgd of groundwater is delivered to Castlewood from well fields in Pleasanton.

Figure 1: SFPUC's Retail Water Supply Mix (2005)



Wholesale Customer Water Supplies: SFPUC wholesale water customers rely on the SFPUC RWS and to some extent other sources of water supply to meet their water demands. These additional sources include groundwater, local surface water, the Santa Clara Valley Water District and the State Water Project, recycled water and conservation. Although two-thirds of the wholesale water customers are entirely dependent on the SFPUC for water, the other one-third of the customers are able to obtain some portion of their water from other sources.

Table 5B
Current and Projected Wholesale Customer Supplies
Non-drought Periods (mgd)

	2001	2005	2010	2015	2020	2025	2030
Wholesale Customer Purchase from the SFPUC RWS[1]	170.6	177.9	188.9	191.6	197.5	203.6	209.4
Other Supplies[2]	101.4	104.1	103.1	107.4	110.5	111.4	114.6
Total Wholesale Customer Demand[3, 4]	272	282	292	299	308	315	324

***Table Notes*:**

1. Purchases from SFPUC RWS: 2001 data is from Bay Area Water Users Association Annual Report, FY 2001-02. The 2005 data is estimated based on previous years' billing records. The 2010 - 2030 purchase estimates were collected from individual wholesale customers in April 2005.
2. "Other Supplies" were estimated as the difference between the Total Wholesale Customer Demand and the Wholesale Customer Purchases from the SFPUC RWS.
3. Source: SFPUC Wholesale Customer Water Demand Projections Study (URS, 2004), Table 3-1 and 5-1.
4. Demand figures reflect an approximately 7.8% reduction due to anticipated compliance with existing plumbing code standards (i.e., more efficient fixtures). Demand figures also include unaccounted for water losses of approximately 7.5% on average.

3.2 Description of Water Supply Sources

This section provides a description of the current water sources for SFPUC retail and wholesale customers.

3.2.1 SFPUC Regional Water System

The SFPUC RWS currently serves an average of approximately 265 million gallons per day (mgd) to 2.4 million users in Tuolumne, Alameda, Santa Clara, San Mateo and San Francisco counties. The SFPUC RWS is a complex system, shown in Figure 2, and supplies water from two primary sources:

- Tuolumne River through the Hetch Hetchy Reservoir; and
- Local runoff into reservoirs in Bay Area reservoirs in the Alameda and Peninsula watersheds.

Water developed by Hetch Hetchy Reservoir through the Hetch Hetchy Water and Power (HHWP) Project represents the majority of the water supply available to San Francisco. On average, the HHWP Project provides over 85 percent of the water delivered by the SFPUC. During drought, the water received from the HHWP Project can amount to over 93 percent of the total water delivered.

Bay Area reservoirs provide on average approximately 15 percent of the water delivered by the SFPUC RWS. The local watershed facilities are operated to conserve local runoff for delivery. The water demands that are not met with local supplies are met with supplies diverted from the Tuolumne River through the HHWP Project to the Bay Area.

The amount of 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 firm-up its water supplies. More importantly, reservoir storage provides the SFPUC RWS with year-to-year water supply carry-over capability. During dry years the SFPUC has a very small share of Tuolumne River runoff available and the local Bay Area watersheds produce very little water. Reservoir storage is critical to the SFPUC during drought cycles since it enables the SFPUC to carry-over water supply from wet years to dry years.

The SFPUC RWS is geographically delineated between the HHWP Project facilities and the Bay Area water system facilities. The HHWP Project is generally comprised of the reservoirs, hydroelectric generation and transmission facilities, and water transmission facilities from Hetch Hetchy Valley west to the Alameda East Portal at Sunol Valley. The local Bay Area water system is generally comprised of the facilities from Sunol Valley west and includes the Alameda and Peninsula watershed reservoirs and the distribution system that delivers water to the SPPUC retail and wholesale customers.

On the San Francisco Peninsula, the SFPUC utilizes Crystal Springs Reservoir, San Andreas Reservoir and Pilarcitos Reservoirs located in San Mateo County to capture local watershed runoff. In the Alameda Creek watershed (Alameda County), the SFPUC has constructed the Calaveras Reservoir and San Antonio Reservoir. In addition to using these facilities to capture runoff, San Andreas, San Antonio and Crystal Springs reservoirs also provide storage for HHWP Project diversions, and serve as an emergency water supply in the event of an interruption to HHWP Project diversions.

The SFPUC serves its retail and wholesale water demands with an integrated operation of local Bay Area water production and imported water from the HHWP Project. In practice, the local watershed facilities are operated to capture local runoff. The water demands that are not met with local runoff require the importation of water from the HHWP Project.

Local area water production is dependent on precipitation and the ability of the SFPUC to regulate watershed runoff. Based upon yearly runoff, the utilization of water from the Alameda and Peninsula watersheds has varied from negligible to approximately 104 mgd.

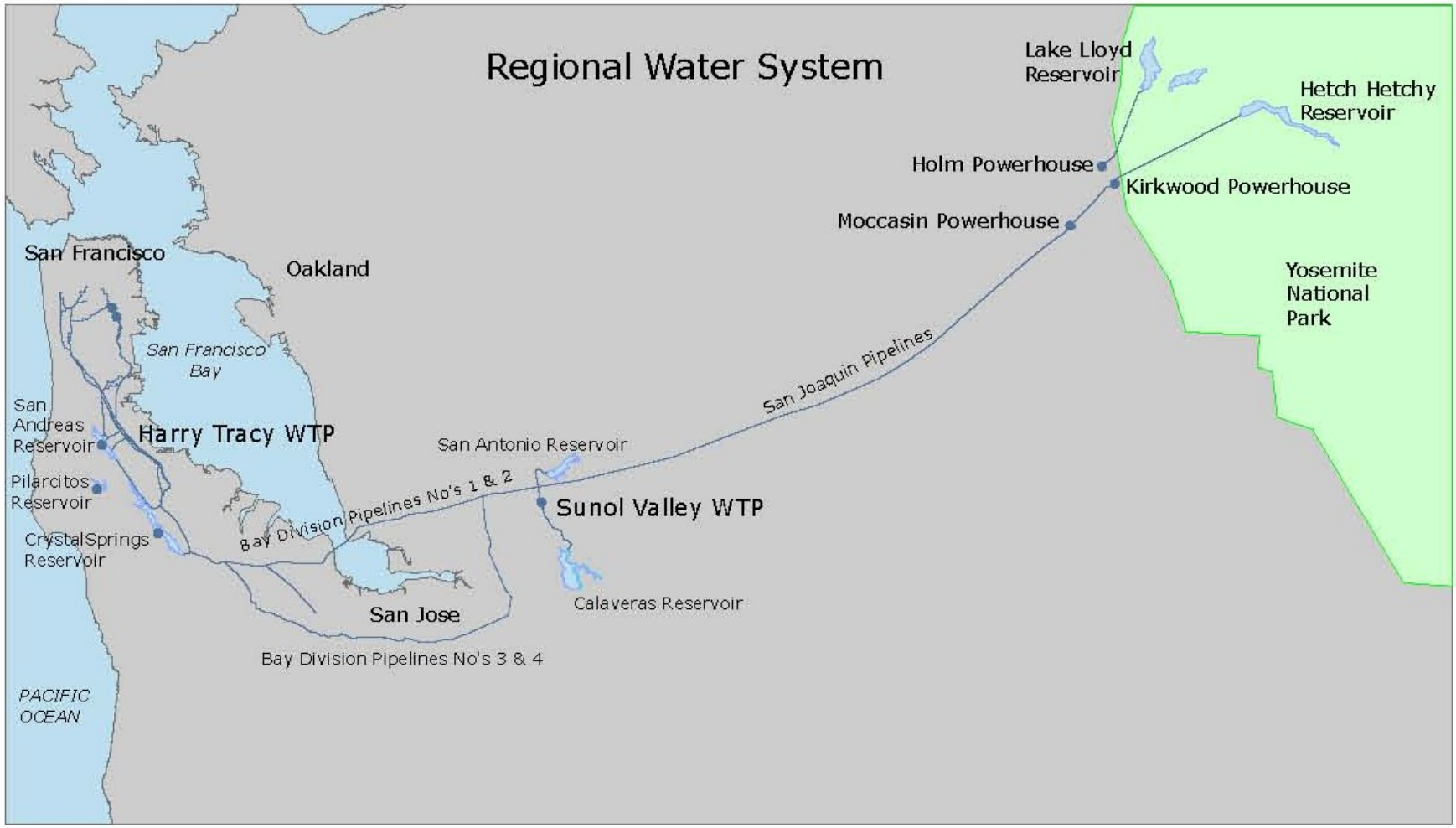
Historical Development of the HHWP Project: The SFPUC RWS evolved through the development of two separate water systems: the Spring Valley Water Company and HHWP Project. The Spring Valley Water Company was established in 1858, developing a spring and several creeks into a local water system. It expanded over the years with the construction of Pilarcitos, San Andreas and Upper and Lower Crystal Springs Dams on the Peninsula, and later with the development of the Pleasanton Well Field, the Sunol Filtration Galleries and the Calaveras Dam in Southern Alameda County.

Very early during San Francisco's development it was recognized that the local water resources would be inadequate to support a burgeoning metropolis and plans for importing water from the Sierra Nevada were born. In the late 1800s, the City decided to develop its own water supply system and culminated in the planning, financing and construction of the HHWP Project. Because many of the HHWP Project facilities were to be located within Yosemite National Park, Congressional approval of the project was required. That approval was granted by the Raker Act of 1913.

The construction of HHWP Project began in earnest in 1914, and after almost 20 years of construction, including building of the Hetch Hetchy Reservoir, and the acquisition of the Spring Valley Water Company by San Francisco, Sierra Nevada water began flowing into the local distribution system. Through the operation of the two systems, the SFPUC has been able to provide the residents of the City and its neighboring communities with an unfailing supply of high quality, potable water from protected sources.

Since the 1930s, the major additions to the SFPUC's water system have included the raising of O'Shaughnessy Dam and the development of Lake Lloyd; the construction of additional pipelines across the San Joaquin Valley; and the local construction of San Antonio Reservoir in Alameda County and the Bay Division Pipelines 2, 3 and 4. Other local projects included Crystal Springs Pipeline No. 3; Sunol Valley and San Andreas Filtration Plants; and the Crystal Springs Bypass Tunnel and Balancing Reservoir.

Figure 2: SFPUC Regional Water System



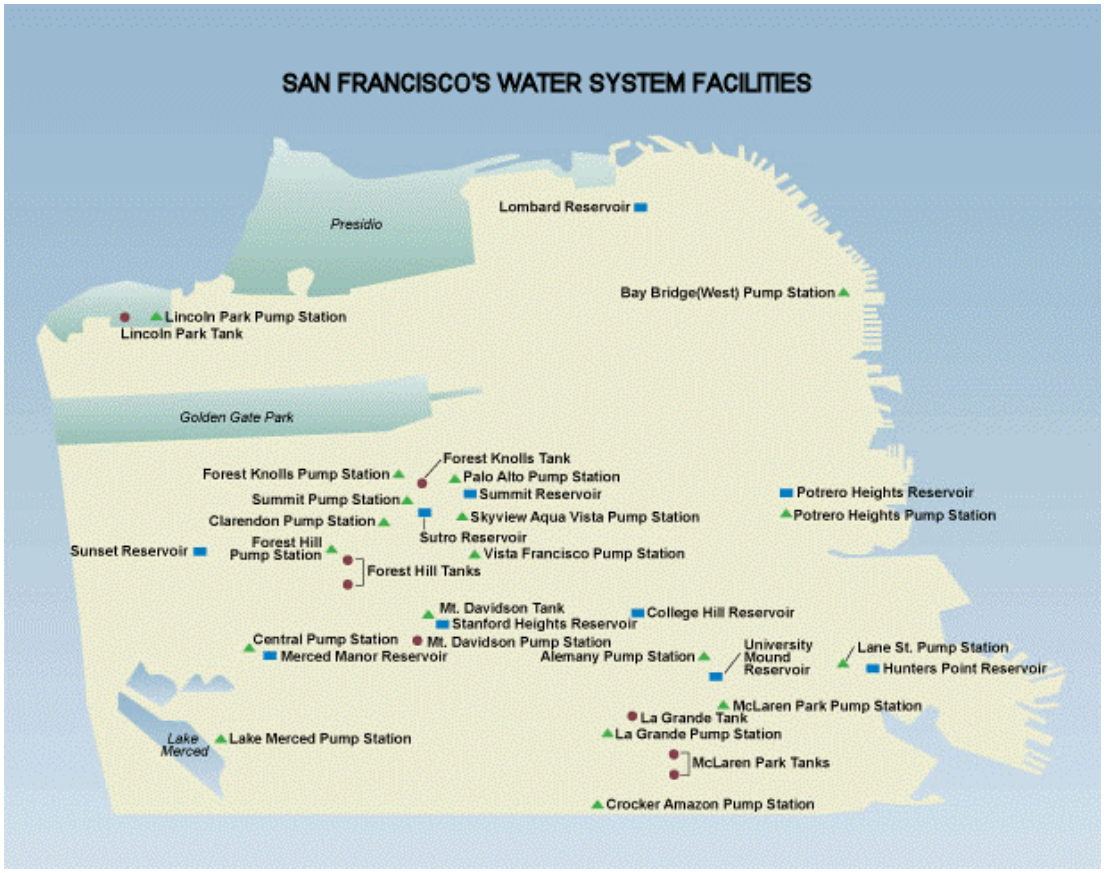
Improvements to the SFPUC RWS: The SFPUC is proceeding with the WSIP, which will deliver capital improvements to the existing system, enabling the SFPUC to meet level of service goals for seismic and delivery reliability, water supply and water quality. Further details on the WSIP are provided in the Reliability Planning section.

3.2.2 San Francisco Water System

San Francisco's Water System, the in-city distribution system, was developed during the one-hundred year period between 1860 and 1960, reflecting the patterns and rates of growth in the City. San Francisco's retail water supply is delivered to the City in several major pipelines. One pipeline provides water to the eastside of the in-city distribution system and three pipelines serve the westside of the in-city distribution system.

As shown in Figure 3, San Francisco's Water System includes 10 reservoirs and 8 water tanks that store the water delivered by the HHWP Project and the local Bay Area water system. The 18 pump stations and approximately 1,250 miles of pipelines move water throughout the system and deliver water to homes and businesses in the City. Several major pipelines convey water from the Peninsula System to San Francisco. Water to the Eastside of the City distribution system is fed by two pipelines that terminate at University Mound. Water to the Westside of the City distribution system is fed by two pipelines that terminate at Sunset Reservoir and one that terminates at Merced Manor Reservoir. Improvements to San Francisco's Water System are also included in the SFPUC's WSIP, such as seismic improvements to many of the pump stations and upgrades to reservoirs.

Figure 3: San Francisco Water System Facilities



3.3 Local Water Supply Sources

A small portion of SFPUC's retail water customer supply is provided by groundwater and recycled water, as described below.

3.3.1 Local Groundwater

San Francisco overlies all or part of seven groundwater basins. These groundwater basins include the Westside, Lobos, Marina, Downtown, Islais Valley, South and Visitation Valley basins. The Lobos, Marina, Downtown and South basins are located wholly within the City limits, while the remaining three extend south into San Mateo County. The portion of the Westside Basin aquifer located within San Francisco is referred to as the North Westside Basin. With the exception of the Westside and Lobos basins, all of the basins are generally inadequate to supply a significant amount of groundwater for municipal supply due to low yield.

Early in its history, San Francisco made use of local groundwater, springs, and spring-fed surface water. By 1913, it was estimated that San Francisco was using approximately 8.5 mgd of groundwater from private and City wells, springs, and Lobos Creek, which is fed by groundwater springs. Prior to the completion of the Calaveras Reservoir on Alameda Creek, part of the San Francisco's water supply was also from Lake Merced, which was significantly spring fed at the time. Lake Merced was substantially lowered by diversions in the 1920's and early 1930's, the latter as a result of diverting from the lake for emergency water supply during drought conditions from 1929 to 1932.

In the 1930's, a well field was installed on the westside of San Francisco and groundwater was extracted for a short period of time, from late 1930 through mid-1935. Pumping rates were reported to be up to a total of 6 mgd. After completion of the Hetch Hetchy Reservoir and aqueduct in the 1930's, the municipal water supply system began to rely almost exclusively on surface water from local runoff, from the Alameda Creek watershed (into Calaveras Reservoir), and from the HHWP Project.

Local groundwater use, however, has continued in the City. For several decades groundwater has been pumped from wells located in Golden Gate Park and the San Francisco Zoo. Based on well operator estimates, about 2.5 mgd is produced by these wells. The groundwater is mostly used in the Westside Groundwater Basin by the City's Recreation and Park Department for irrigation in Golden Gate Park and at the Zoo. These wells are located in the North Westside Groundwater Basin. The California Department of Water Resources (CA DWR) has not identified this basin as over drafted, nor as projected to be over drafted in the future.

About 1 mgd of groundwater is delivered to Castlewood from well fields operated by the SFPUC in Pleasanton. For the purposes of water accounting and billing, these deliveries to Castlewood are accounted for as part of the SFPUC retail customer base. This groundwater is drawn from the Central Groundwater Sub Basin in the Livermore/Amador Valley. The CA DWR has not identified this basin as over drafted, nor as projected to be over drafted in the future. These wells are metered and have been in operation for several decades.

3.3.2 Local Recycled Water

San Francisco's experience with recycled water dates back to the early 1900s when the Golden Gate Park Area was transformed from 1,070 acres of "great sand waste" to a garden spot through the application of raw sewage and groundwater. In 1932, the Recreation and Park Commission constructed the McQueen Treatment Plant to provide secondary treatment, using an activated sludge process. This plant produced recycled water that was used to irrigate Golden Gate Park, fill its lakes, brooks and spillways, and recharge groundwater. The McQueen Plant met State health requirements for the production of recycled water until new regulations were proposed in 1978. The advanced primary plant was shut down in 1981 when it could not meet new health standards for irrigation use.

Additional efforts to expand the use of available secondary-treated quality recycled water began in 1989, when San Francisco built a secondary effluent truck loading station at it's Southeast Water Pollution Control Plant to facilitate distribution of recycled water for soil compaction and dust control. In 1991, San Francisco passed *Ordinance 175-91*[6] which requires that water used for dust control, consolidation of backfill, or other nonessential construction purposes, must be either groundwater or recycled water.

Currently in San Francisco, tertiary-treated recycled water from SFPUC's Southeast Water Pollution Control Plant is used on a limited basis for wash-down operations. Current use of tertiary-treated recycled water for these purposes in San Francisco is less than 1 mgd. For estimated recycled water use in 2005 and projected future use, refer to Section 10 of this document.

3.3.3 Local Water Conservation

The SFPUC retail water supply strategy includes water conservation as a method for meeting water demands. A portion of future water demands in San Francisco is expected to be met by continued advancements in San Francisco's water conservation program. The Demand Management section of the 2005 UWMP provides information on San Francisco's past and current conservation program.

3.4 Resource Maximization/Import Minimization Plan

In order to maximize resources and minimize the need to import water, the SFPUC has initiated various local water supply planning efforts that, in combination, represent the available options to the SFPUC. Each of these efforts, briefly described below, has informed the content of this 2005 UWMP and will be discussed in greater detail throughout this document.

Water Conservation: The SFPUC has been implementing water conservation programs for its retails customers for over 20 years. These programs have historically focused on residential fixture replacement and more recent programs have offered low-flow spray valves and more efficient equipment to commercial customers. In 2004, the SFPUC completed the *City and County of San Francisco Retail Water Demands And Conservation Potential* Technical Memo. In this study, forty-eight conservation measures were identified, quantified for water savings and cost and feasibility of implementation. The most aggressive package of conservation measures

[6] San Francisco Public Works Code, Article 21, Sections 1100-1107

identified for implementation in San Francisco, given current technology and available information, was estimated to cumulatively save about 4.5 mgd[7] by 2030.

Recycled Water: The SFPUC has prepared a *2005 Draft Recycled Water Master Plan for the City and County of San Francisco* (2005 Draft RWMP) that explores the potential role that recycled water could play in San Francisco to reduce use of potable water for applications such as irrigation. The Draft RWMP, released for public review in October 2005, identifies potential Phase 1 recycled water projects for San Francisco that could produce approximately 4.1 - 4.5 mgd. The projects identified in the Draft RWMP will be implemented pursuant to the WSIP, following CEQA compliance.

Groundwater: Currently within the City, approximately 2.5 mgd of groundwater is pumped from the North Westside Groundwater Basin and used to irrigate in areas such as Golden Gate Park, the San Francisco Zoo and the Great Highway Median.[8] In May 2005, the SFPUC released the *Final Draft North Westside Basin Groundwater Management Plan* (GWMP). This 2005 GWMP identifies several new local groundwater projects that could be developed to produce an additional 2.0 mgd of groundwater for potable purposes. The GWMP projects will be implemented pursuant to the WSIP, following CEQA compliance.

San Francisco's Local Water Resources Study (SF LWRS)*:* In order to assess the potential of local water supply sources within the City in an integrated manner, the SFPUC initiated the San Francisco Local Water Resources Study (SF LWRS). This study brought together planning data from existing planning projects, such as the 2005 GWMP and the 2005 Draft RWMP, and summarizes the potential of local supplies and presents various implementation scenarios. The Draft RWMP and GWMP will be implemented pursuant to the WSIP, following CEQA compliance.

[7] Note that these savings would be *in addition to* passive water conservation savings of about 10.3 mgd that are expected to be generated by 2030 by the natural replacement of plumbing fixtures as required by the current plumbing code.

[8] An additional 1 mgd of groundwater is delivered by the SFPUC to Castlewood. This supply is metered.

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Section 4: Water Quality

As shown previously in Table 5, the SFPUC's retail demand is primarily met with water from the RWS, with a small portion (approximately 3 to 4 percent) from local groundwater supplies and recycled water. Each of these sources delivers high-quality water relative to its intended use; supplies from the RWS are extremely high-quality and are used for both potable and non-potable uses, and existing groundwater and recycled water supplies are currently used for non-potable uses.

It has been assumed in this 2005 UWMP that these existing supplies will be available in the future. The SFPUC does not anticipate that, in the future, water quality issues will alter the SFPUC's current water management strategies or supply reliability. This section provides information on the water quality of the SFPUC existing retail water supplies.

4.1 Quality of Regional Water System Supplies

The SFPUC RWS delivers high-quality water. The current supplies available to the RWS include the Tuolumne River and supplies from local Bay Area reservoirs. The majority of the water supply originates in the upper Tuolumne River Watershed high in the Sierra Nevada, remote from human development and pollution. This pristine water, referred to as Hetch Hetchy water, is protected in pipes and tunnels as it is conveyed to the Bay Area, requiring only primary disinfection and pH adjustment to control corrosion in the pipelines.

The U.S. Environmental Protection Agency and the California Department of Health Services have approved the use of this drinking water source without requiring filtration at a treatment plant. However, local water from the Alameda and Peninsula Watersheds requires filtration to meet drinking water quality requirements. The filtered and treated water from the local watersheds is blended with Hetch Hetchy water, and most customers receive water from a blended source. System water quality, including both raw water and treated water, is continuously monitored and tested to assure that water delivered to customers meets or exceeds federal and state drinking water/public health requirements.

As the purchases from the SFPUC RWS increase over time, the SFPUC will rely on the Tuolumne River and supplies from local reservoirs to meet the increased demand in most years, plus the additional water sources identified in the SFPUC WSIP during dry years. These dry-year supplies are summarized in Table 6 (refer to Section 5). The SFPUC will continue to rely on their high-quality water resources. It is anticipated that there will be no degradation of water quality in the future.

4.2 Quality of Groundwater Supplies

Based on semi-annual monitoring, the groundwater currently used for irrigation and other non-potable uses in San Francisco meets, or exceeds, the quality needs for these end uses.

Plans for development of additional groundwater in San Francisco include plans for potable supply in the North Westside Groundwater Basin. As part of this effort, the groundwater quality at new proposed well sites is being sampled for all drinking water parameters. Based on preliminary information collected to date, water quality appears to meet drinking water standards at the new proposed well sites. However, two existing irrigation wells have detected nitrate and iron at levels

above drinking water standards. These elevated levels may be the result of a shallow sanitary seal or other historic land uses at these specific sites.

4.3 Quality of Recycled Water Supplies

Recycled water in San Francisco is currently being used on a limited basis for in-plant wash-down purposes. This recycled water undergoes tertiary-treatment at SFPUC's Southeast Water Pollution Control Plant and meets the CA Title 22 Code of Regulation requirements for recycled water use for non-potable uses.

Development of additional recycled water supplies in San Francisco is being addressed in the 2005 Draft RWMP, which has identified four proposed Phase 1 projects. Three of the four proposed Phase 1 projects call for disinfected tertiary-level recycled water. The remaining project calls for "advanced" tertiary treatment, including microfiltration and reverse osmosis in order to remove nutrients, for use in or around Lake Merced in order to prevent eutrophication of the lake.

Section 5: Reliability Planning

This section addresses the reliability of both the SFPUC RWS and the reliability of deliveries to San Francisco's retail customers. As previously described, the retail customer's water supply comes from the SFPUC RWS and local water supply sources (groundwater and recycled water). Retail customers receive about 96 percent of their water supply from the SFPUC RWS. The SFPUC RWS also meets the water needs of the SFPUC wholesale customers who collectively in 2001 received about 67% of their water supply from the SFPUC RWS.[9] Future projections indicate that between 2010 and 2030 this figure will be in the range of 64-65% (as reflected previously in Table 5B).

5.1 SFPUC RWS Reliability

The SFPUC's water supply system reliability is expressed in terms of the system's ability to deliver water during droughts. Reliability is defined by the amount and frequency of water delivery reductions (deficiencies) required to balance customer demands with available supplies in droughts. The SFPUC plans its water deliveries anticipating that a drought worse than the worst drought yet experienced may occur. This section discusses both system-wide deficiencies and anticipated retail deficiencies that the City may experience.

The SFPUC's RWS supply has experienced periodic, short-term outages as a result of water quality events. Due to the fact that Hetch Hetchy water is not filtered, it is subject to strict water quality standards set by the state Department of Health Services. As a result of weather events, turbidity levels can exceed standards requiring the Hetch Hetchy supply to be diverted to local storage, in the case of short-term events, or shut off, in the case of longer-term events, until levels drop to within standards. During these periods, the SFPUC's entire supply comes from the Sunol Valley Water Treatment Plant and the Harry Tracy Water Treatment Plant, both of which are supplied by local Bay Area reservoirs.

Estimating Frequency and Magnitude of SFPUC RWS Supply Deficiencies

The total amount of water the SFPUC has available to deliver to retail and wholesale customers during a defined period of time is dependent on several factors. These include the amount of water that is available to SFPUC from natural runoff, the amount of water in reservoir storage, and the amount of that water that must be released from the SFPUC's system for commitments to purposes other than customer deliveries (e.g., releases below Hetch Hetchy reservoirs to meet Raker Act and fishery purposes).

The 1987-92 drought profoundly highlighted the shortfall between the SFPUC's water supplies and its demands. Other than during the drought of 1976-77, drought sequences in the past did not seriously affect the ability of SFPUC RWS to sustain full deliveries to its retail and wholesale customers. Based on the 1987-92-drought experience, the SFPUC assumes its "firm" capability to be the amount the system can be expected to deliver during historically experienced drought periods. In estimating this firm capability, the SFPUC assumes the potential recurrence of a drought such as occurred during 1987-92, plus an additional period of limited water availability. This drought sequence is referred to as the "design drought" and serves as the basis for planning and modeling of future drought scenarios.

[9] 2001 data from Bay Area Water Users Association Annual Report, FY 2001-2002.

SFPUC Design Drought

The SFPUC Design Drought, used for planning and modeling of future drought scenarios, is based on historic droughts and hydrology. As detailed below, it is a drought sequence that is more severe than what the SFPUC RWS has historically experienced.

The 1987-92 drought defines the most extreme recorded drought for SFPUC water deliveries, and this establishes the basis for the Design Drought sequence. The drought covered a 6½ year period, July 1986 (point in time SFPUC reservoirs were full) to about November/December 1992 (point in time SFPUC reservoirs reached minimum storage). Though the SFPUC reservoir system began to recover with precipitation during the last 6 months of the drought, July 1992 through December 1992, SFPUC customer purchases exceeded SFPUC inflow and the SFPUC system storage continued to decline through November/December 1992. Because the last 6 months of the 1987-92 drought includes the beginning of this recovery period, it has been removed from the SFPUC's Design Drought.

In summary, the SFPUC's Design Drought sequence totals an 8½ year period and is based on the following factors:

- Historical Hydrology: The 6 years of hydrology from the historical drought (July 1986 - June 1992);
- Prospective Drought: A 2½ year period which includes the 1976-1977 drought (to represent a drought sequence worse than historical); and
- The last 6 months of the Prospective Drought is the beginning of the system recovery period. The precipitation begins in the fall, and by about the month of December the SFPUC reservoir inflow exceeds customer demands and SFPUC system storage begins to recover.

Current Estimates of SFPUC RWS Supply Deficiencies

At current delivery levels, the SFPUC RWS can be expected to experience up to a 25 percent shortage 15 to 20 percent of the time, during multiple-year drought sequences. Therefore, the SFPUC is faced with the necessity to develop a long-term strategy to accommodate or rectify the potential of future water shortages throughout its wholesale and retail operations.

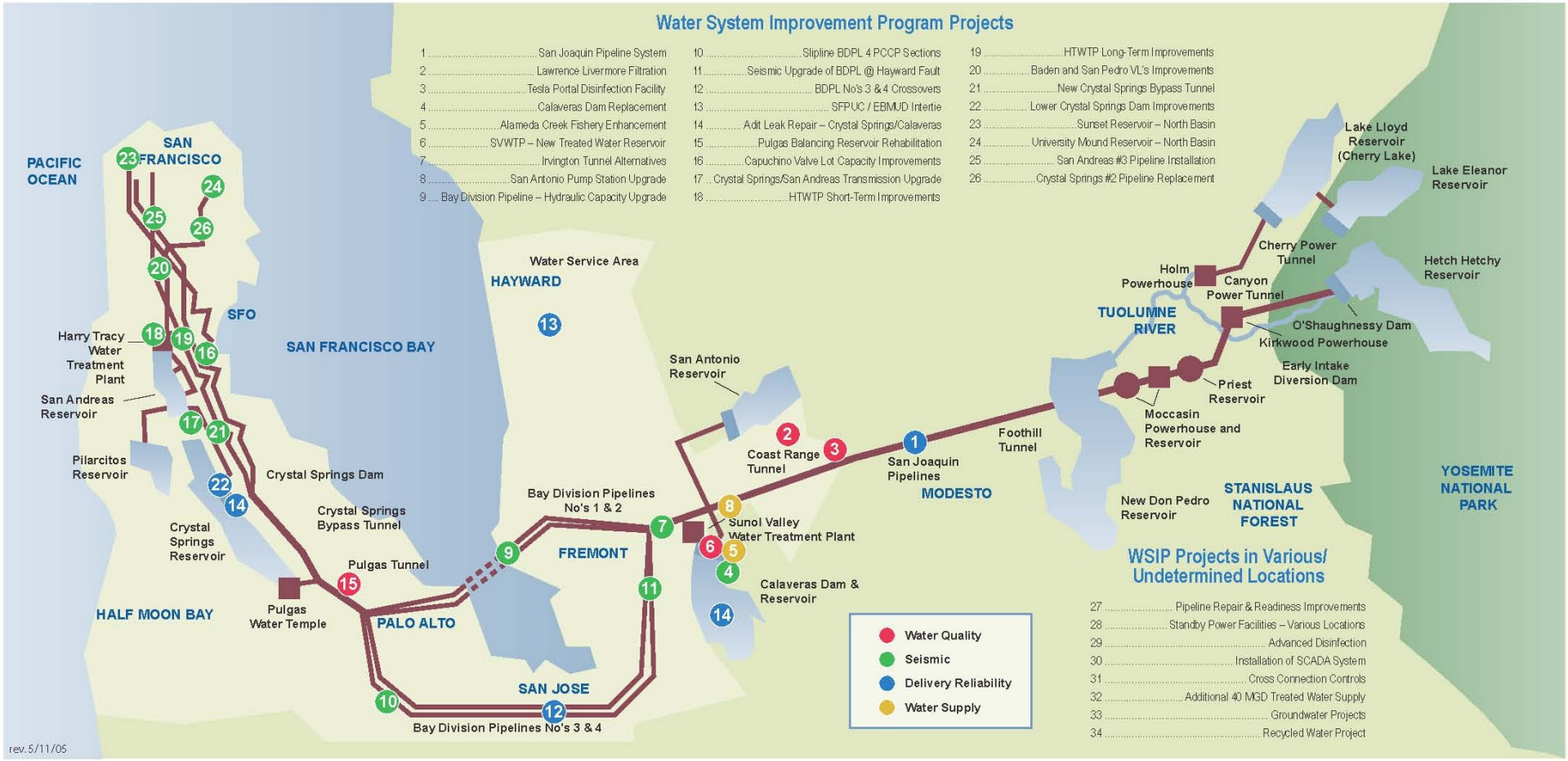
5.2 SFPUC RWS Plans to Assure a Reliable Water Supply

As an established major water supplier for the Bay Area region, the SFPUC has a responsibility to secure and manage its existing system supplies and plan for future needs, as well as securing its own retail supply. Given the existing circumstance that the SFPUC's water supplies are less than current system demands during dry-years and that demand growth is anticipated, the SFPUC and its customers must accept the challenge of an increasing gap between supplies and demands.

5.2.1 SFPUC 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 is undertaking the WSIP. The WSIP will implement capital improvements aimed at enhancing the SFPUC's ability to meet its water service mission of providing high quality water to its customers in a reliable, affordable and environmentally sustainable manner. Figure 4 on the following page lists the WSIP projects and their location.

Figure 4: SFPUC Water System Improvement Projects



Aspects of the WSIP are rooted in the 2000 "Water Supply Master Plan" (WSMP) and various water system vulnerability assessments. Planning efforts for the WSIP gained momentum in 2002 with the passage of San Francisco ballot measures Propositions A and E, which approved the financing for the water system improvements. Also in 2002, Governor Davis approved Assembly Bill No. 1823, the Wholesale Regional Water System Security and Reliability Act. Division 20.5, Section 73502 of the State Water Code (Assembly Bill No. 1823) specifically requires the following:

- By February 1, 2003, San Francisco must submit to the State a plan for capital improvements to the regional water system.
- The plan (i.e., the WSIP) submitted by February 1, 2003 must include a schedule.
- The schedule submitted with the February 1, 2003 plan must show completion of projects equivalent to one-half the total program cost by 2010 and completion of the balance by 2015.
- San Francisco may later revise the projects and the project schedules in the program, and may delete or defer projects.

A Program Environmental Impact Report (PEIR) is being prepared under the California Environmental Quality Act (CEQA). Projects included in the WSIP will undergo individual project specific environmental review as required. Under CEQA, project specific environmental review would result in preparation of a Categorical Exemption, Negative Declaration or Environmental Impact Report. Each project will also be reviewed for compliance with the National Environmental Policy Act and local, state and federal permitting requirements as necessary.

The water supply source options being investigated as part of the WSIP and assumed to be available to the SFPUC RWS in this 2005 UWMP are:

1. SFPUC RWS Conjunctive Use Program: South Westside Groundwater Basin
2. SFPUC RWS Water Transfers: Tuolumne River
3. SFPUC RWS Recovery of Storage: Restoration of Calaveras and Crystal Springs reservoirs

The following subsections describe these three SFPUC RWS source options.

The WSIP is also investigating the potential of developing local water resources such as water recycling, groundwater, desalination and conservation to produce water to meet SFPUC customer's purchase requests. These options are still under development and are not discussed below in this section. However, in Section 5.3, as part of the Local Water System Reliability description, these resources as discussed as potential opportunities in San Francisco to meet retail customer demands.

5.2.2 SFPUC RWS Conjunctive Use Program

To the south of San Francisco, the South Westside Groundwater Basin in San Mateo County also has the potential to be utilized as part of a regional conjunctive use program. Under the program, SFPUC surface water would be used "in-lieu," or instead of pumping groundwater, in normal and wet years. Reducing such pumping would allow normal surface water recharge to increase the volume of groundwater in storage. This would effectively increase the amount of groundwater in storage available during dry years or an extended drought. Historic groundwater use within the basin has lowered the groundwater levels in the basin by up to 200 feet below sea level, one goal is to improve overall storage in the basin such that the net draw down during droughts would not

cause water levels to decline below these historic low levels. Also, it should be noted that Tuolumne River water will not be used to "recharge" the aquifer but rather will be substituted in place of pumped groundwater, which will rise slowly over time as a result of not being pumped.

Since the late 1990's the cities of Daly City, San Bruno and the California Water Service Company (CWSC), which serves the City of South San Francisco, have worked cooperatively on several groundwater management activities with the long-term goal of preserving groundwater quality and improving water supply reliability. Projects have included ongoing semi-annual groundwater monitoring, installation of coastal saltwater intrusion monitoring wells, installation of an interior multi-level monitoring well, regional geologic analysis, and implementation of a pilot conjunctive use program.

Conjunctive Use Pilot Project: A pilot supplemental water program was initiated in late 2002 with the CWSC and the Cities of San Bruno and Daly City. The supplemental delivery allowed the parties to study the effects of a conjunctive use pilot program whereby CWSC, San Bruno and Daly City reduced groundwater pumping and purchased supplemental surface water from the SFPUC. Results from the study allowed the SFPUC and its groundwater consultants to investigate the effects of groundwater pumping on groundwater basin water levels. The findings of the study indicate that conjunctive use is feasible in the study area and that for planning purposes approximately 75,000 AF of potential storage is available.

Full Scale Conjunctive Use Agreements: In December 2004, the SFPUC and City of Daly City approved the terms of a conjunctive use program term sheet for a portion of the Westside Groundwater Basin. Under this proposed program, the SFPUC will bank groundwater for later use when surface water supplies are reduced due to a drought or emergency. The SFPUC is currently working to establish similar term sheets with CWSC and San Bruno that can be used to negotiate the detailed agreements needed to implement the program following CEQA review.

Full Scale Program Concept: The program is being designed to provide about 8,100 acre-feet per dry-year (up to 61,800 acre-feet over about 7.5 years). In normal and wet years SFPUC surface water would be used "in-lieu," or instead, of pumping groundwater. Reducing such pumping would increase the volume of groundwater in storage available during dry years or an extended drought. For example it is assumed that customers such as Daly City, CWSC and San Bruno will receive an additional combined 7 mgd (an additional 7 mgd delivery above their purchase request) during non-dry years to offset their groundwater pumping. This "banked" water will be provided to these same customers during dry years (pumped from the groundwater), reducing their purchase request from the SFPUC by about 7 mgd in dry years. This decreased demand on the RWS will increase the system's reliability for all RWS customers (as reflected in Tables 11 and 12 of this document).

Implementation Plan: Funds for construction of facilities to support the South Westside Groundwater Basin Conjunctive Use Program are allocated in the SFPUC's WSIP. Construction includes up to ten new groundwater production wells to allow for increased groundwater production during a drought or an emergency. Well pump stations, disinfection units, and piping are assumed. This project also supports the development of a groundwater basin computer model.

This conjunctive use groundwater project is scheduled to begin construction in the 1st Quarter of 2010 and be fully completed (all wells in) by 3rd Quarter of 2013. Note that this 2005 UWMP

reflects an initial dry-year supply of 4,500 AFY from this project beginning in 2010. The results of a 2002-2005 pilot project indicate that this yield can be achieved by using new wells (funded by the SFPUC's WSIP budget), provided that the SFPUC establishes conjunctive use term sheets with San Bruno and CWSC in 2006. Although the project schedule in the WSIP (as adopted by the Commission on 11/29/05) lists construction of these new dry-year supply wells beginning in October 2010 (and thus not being completed until 3rd Quarter 2011), the SFPUC plans to accelerate this schedule so that the 4,500 AFY demand can be supplied by March 2010, as assumed in this 2005 UWMP. Implementation of the remainder of the project wells may also be accelerated, and therefore the completion of construction of all wells (to achieve the full yield of 8,100 AFY) may be achieved earlier than the current schedule of 3rd Quarter of 2013.

In this Plan, it has been assumed that this resource will be available to the SFPUC RWS as follows:

- Year 2005: 0 AFY during dry years
- Year 2010: 4,500 AFY during dry years
  (Maximum draw-down over a 7.5 year period is assumed to be about 33,800 acre-feet)
- Year 2015: 7,000 AFY during dry years
  (Maximum draw-down over a 7.5 year period is assumed to be about 52,500 acre-feet)
- Years 2020-2030: 8,100 AFY[10] during dry years
  (Maximum draw-down over a 7.5 year period is assumed to be about 61,800 acre-feet)

For the 2005 UWMP, excess local and Tuolumne River resources may be provided to the existing groundwater users (i.e., Daly City, San Bruno, and CWSC) to replace what they might otherwise pump from the groundwater basin. This reduction in pumping during wet/normal years would thereby assist the recharge of the groundwater basin for use during drought periods.

5.2.3 SFPUC RWS Water Transfer or Exchange Possibilities

The WSMP provides a discussion of the opportunities for the SFPUC to purchase water to benefit its wholesale and retail customer's water supply reliability. The discussion includes purchasing additional Tuolumne River water as well as water from willing sellers located geographically south of the Delta who possess water rights or contractual entitlements to water diverted from the Delta. In addition, the WSMP identifies potential opportunities of water purchases from willing sellers upstream of the Delta along the Sacramento, Feather, Yuba, American, San Joaquin Rivers and their tributaries.

In November 2001, the SFPUC issued a request-for-proposal to provide the SFPUC with up to 50,000 acre-feet of water per year for use as dry-year supplies. Under the RFP, the purchases/exchanges would need to be secured for a minimum of 5 years to meet water supply shortfalls out to year 2030. The RFP was sent out to water districts throughout the state of California, including irrigation districts, state agencies, federal agencies, wholesale urban water providers, and third party water marketers. In April 2002, the SFPUC received a sole response from Semitropic Water Storage District (Semitropic), located near Bakersfield, California.

The storage proposal requires the SFPUC to supply water to Semitropic for storage in Semitropic's groundwater basin. Under the proposal the SFPUC could use non-dry year supply

[10] While the construction phase of this project is expected to be completed in 2013, the yield is expected to increase after

from the Tuolumne River or find another source of non-dry-year supply that could be transported to the Semitropic groundwater basin. Semitropic would store the delivered water in the Semitropic groundwater basin by in-lieu means. Semitropic would credit the SFPUC account with the stored water, less the actual losses currently estimated to be ten percent. When called on by the SFPUC, Semitropic would exchange State Water Project (SWP) water for the stored SFPUC water. Semitropic would return the stored water to the California Aqueduct via a proposed New Unit of the Semitropic Groundwater bank. The SFPUC would take delivery from the SWP South bay Aqueduct turnout at San Antonio Reservoir or other locations. Other SWP contractors located south of Semitropic would actually use the water delivered by Semitropic.

After thorough evaluation and consideration, the SFPUC declined the proposal due to institutional issues related to water rights. The SFPUC also investigated the potential to participate in Semitropic through some of its wholesale customers that are current Semitropic banking partners. These options were also determined to be operationally infeasible.

Though an agreement is not in place today, the SFPUC has assumed in the 2005 UWMP that transfer agreements with other water right holder(s) on the Tuolumne River would provide a dry-year supply to the SFPUC RWS. These options may or may not require new or modified facilities to implement. The purchase will be utilized during dry years and will be available to the SFPUC RWS as follows:

- Year 2005: 0 AFY
- Years 2010-2015: 23,200 AFY
- Years 2020-2030: 29,000 AFY

5.2.4 Recovery of Storage in the SFPUC RWS

Crystal Springs Reservoir System: The SFPUC plans to restore capacity lost at the Crystal Springs Reservoir System (Upper and Lower Crystal Springs Reservoirs) due to an order imposed by the California Division of Safety of Dams (DSOD), which prohibits use of stop logs in the reservoir spillway due to seismic concerns. The recovered capacity at the Crystal Springs Reservoir System would restore storage capacity from 58,300 to 69,400 acre-feet, the historical maximum capacity. Construction on this project is expected to being in the 1st Quarter of 2010. In the 2005 UWMP, it has been assumed that the recovered storage will be available to the SFPUC RWS in 2011.[11]

Calaveras Dam: Due to seismic stability concerns regarding the Calaveras Dam, the DSOD has restricted the amount of water stored in Calaveras Reservoir to a target maximum of 38,000 acre-feet, a reduction in storage capacity of approximately 60 percent. Under DSOD direction, the SFPUC has committed to an aggressive schedule to alleviate the seismic safety concerns. Construction is expected to begin in the 2nd Quarter of 2009 and is expected to be completed in the 4th Quarter of 2011, following completion of CEQA review. The replacement dam and reservoir will store 96,700 acre-feet of water, the historical maximum capacity. In this 2005 UWMP, it has been assumed that the recovered storage will be available to the SFPUC RWS by

construction is completed due to basin recharge.

[11] SFPUC Water System Improvement Program, as adopted by the Commission on 11/29/05. This UWMP reflects that this supply will be available during the 2010-2015 time increment because information in this document is presented in 5-year increments and this supply will be available during the majority of this time period.

year 2015.

5.2.5 Bay Area Regional Efforts to Improve Water Supply Reliability

The following describes projects and efforts underway or completed that help the SFPUC RWS meet its water supply reliability needs. Some of these projects are reflected in the SFPUC's current strategy for meeting water supply needs. As the remainder of these projects move through the planning stages they will continue to inform the SFPUC water supply strategy.

5.2.5a Regional Interties

Regional interties help increase the reliability of the SFPUC RWS by allowing for water exchanges during emergencies, water shortages or maintenance.

Existing Interties:

- **Milpitas Intertie:** The SFPUC and Santa Clara Valley Water District (SCVWD) constructed a 40 mgd intertie between their two systems to exchange water during emergencies and planned maintenance. The intertie was recently used during maintenance of one of SCVWD's water treatment plants.
- **South Bay Aqueduct Interties:** The SFPUC also has one permanent and one temporary intertie to the South Bay Aqueduct (SBA), which would enable the SFPUC to receive State Water Project water.

Future Interties:

- **EBMUD-Hayward- SFPUC Intertie**: The SFPUC and East Bay Municipal Utility District (EBMUD) are constructing a 30 mgd intertie between the two systems in the City of Hayward. The intertie will be used to transfer water between EBMUD and SFPUC during emergencies and maintenance, when water may be available. This project is part of the WSIP and the expected completion date for this intertie is August 2006.

5.2.5b Regional Desalination

The SFPUC is currently participating in the Bay Area Regional Desalination Project with SCVWD, EBMUD, and the Contra Costa Water District (CCWD), to jointly explore the development of regional desalination facilities that could benefit the 5.4 million Bay Area residents served by these agencies. The partnership has received state and federal funds for the investigation.

The Bay Area Regional Desalination Project 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 facilities would provide the following:

- A supplemental supply during drought periods;
- A supplemental long-term supply;
- Additional source(s) of water during emergencies; and
- An alternative water supply that would allow major facilities to be taken out of service for an extended time for inspection, maintenance, or repairs.

In October 2003, a preliminary Pre-Feasibility Study of the Bay Area Regional Desalination Project identified three venues where a regional desalination facility of ocean water could be located. These sites include East Contra Costa County Pittsburg-Antioch area, Oakland near the foot of the Bay Bridge, and San Francisco near the Oceanside Water Pollution Control Plant. The likely water treatment process would be reverse osmosis, which removes salt using thin membranes. Salts are concentrated in a brine solution that must be treated or diluted and then returned to the ocean or Bay in compliance with regulations.

A more detailed Feasibility Study is being conducted and will be completed in 2006. This level of study is needed to provide more information on potential benefits, institutional arrangements, location and type of facilities, appropriate technologies, environmental impacts, and to estimate costs of the various options. Public outreach will also occur during this phase of the project. If the project continues forward, the pilot plant, environmental review process, design and construction will occur during the ensuing years. Implementation of the Bay Area Regional Desalination Project will require a lengthy public review process because of the number of agencies that would be involved with discretionary permit review and the as-yet unidentified concerns of the affected public. Desalination is not reasonably expected to occur before 2010.

5.2.5c Bay Area Water Quality and Supply Reliability Program

The SFPUC has also been an active participant in a CALFED funded program to identify potential Bay Area projects that can improve water supply reliability and water quality through Bay Area partnerships. The other participating agencies included Alameda County Water District (ACWD), BAWSCA, CCWD, EBMUD, SCVWD, and Zone 7 Water Agency. The program has just completed its second phase and it will be up to the individual partners to determine if they would like to proceed to a feasibility stage with any of the projects identified through the process. The program identified an enlarged Calaveras Reservoir as a potential surface storage project that could provide water supply reliability benefits to the SFPUC retail and wholesale customers, SCVWD and ACWD. Another project involving brackish water desalination in the East Bay near Newark was also identified as providing potential water supply reliability benefits to the SFPUC retail and wholesale customers and ACWD. None of these projects have advanced beyond the CALFED study.

5.2.5d Bay Area Integrated Regional Water Management Plan

The SFPUC is currently participating in a nine county Bay Area effort to develop an integrated regional water management plan that will cover water supply and water quality, wastewater and water recycling, storm water and flood protection, and habitat protection and ecosystem restoration objectives and efforts in the Bay Area. The Integrated Plan will also identify integrated and collaborative projects among Bay Area agencies.

5.3 Local Water System Reliability (SFPUC Retail Customers)

There are three ways to improve water reliability to the SFPUC retail customer:

- Improve the reliability of the SFPUC RWS – as discussed above in Section 5.2;
- Increase local water supply projects within San Francisco; and
- Improve the reliability of San Francisco's local water distribution system.

Although SFPUC retail customers receive approximately 96 percent of their water supply from the SFPUC RWS, efforts to improve the reliability of the local water system are also a key component of the SFPUC's planning work. This section summarizes the most current information on the SFPUC's efforts to increase local water supply within San Francisco and to improve the reliability of the SFPUC's local water distribution system.

5.3.1 San Francisco Local Water Resources Study

In order to assess the potential of local water supply sources within the City in an integrated manner, the SFPUC initiated the San Francisco Local Water Resources Study (SF LWRS) in 2005. The study brought together planning data from existing planning projects, such as the *Final Draft North Westside Basin Groundwater Management Plan* and the *Draft Recycled Water Master Plan,* and summarizes the potential of local supplies and presents different implementation scenarios.

The SF LWRS report, entitled *Local Water Resources Study: Diversifying San Francisco's Water Supply Mix*, will be released by the end of 2005 and will summarize the potential local water supply options for San Francisco (including recycled water, groundwater, conservation and desalination). The study also presents the implications of implementing different combinations of these local supply options, in terms of costs, ratepayer impacts and drought impact. The local water resources information in the remainder of this section is consistent with the summary information which will be provided in the final SF LWRS study report.

5.3.2 Local Groundwater Program

In April 2005 the SFPUC completed the Final Draft North Westside Basin Groundwater Management Plan (2005 Groundwater Plan). Following environmental review, this plan will be presented to the Commission for formal adoption. The 2005 Groundwater Plan, as summarized in the section below, was developed as part of the SFPUC's commitment to integrated water resources management for the following primary reasons:

- Provides a roadmap for managing and developing groundwater resources as an emergency, drought, and regular drinking water supply;
- Allows for community involvement related to new well locations and interrelated concerns about Lake Merced and Pine Lake;
- Forms the basis for supplemental environmental review of several new groundwater production wells not contained in a 1997 Environmental Impact Report; and
- Fulfills California Department of Water Resources (DWR) recommendations that encourage development of local groundwater management plans and as a requirement for most DWR grant funding.

North Westside Groundwater Basin Overview: The North Westside Groundwater Basin underlies that portion of the Sunset District in San Francisco from Golden Gate Park to the San Francisco/San Mateo County line, and from the Pacific Ocean to inland bedrock exposures generally associated with Mount Sutro and Mount Davidson. The principal aquifers for water supply in the basin are the Colma and Merced Formations. Several thousand feet in total thickness, the Merced Formation has been developed for water supply in its upper and middle units which are on the order of 500 and 600 feet thick, respectively. The shallower Colma Formation is near the surface, and is not clearly distinguishable from the upper Merced Formation. Almost all groundwater development in the overall Westside Basin has been south of the North Westside Basin, in the northern part of San Mateo County, although there was some groundwater development in the Sunset District in the 1930s. In recent years, the substantial use of groundwater from the basin south of San Francisco has been for municipal supply in Daly City, South San Francisco and San Bruno [about 7,000 acre feet per year (afy)], and for golf course and cemetery irrigation (about 3,500 afy). Some of the latter irrigation pumping was reduced, beginning in 2004, when recycled water from the North San Mateo County Sanitation District was made available as a substitute irrigation supply at three private golf courses near Lake Merced. DWR has not identified the North Westside Groundwater Basin as over drafted, nor as projected to be over drafted in the future.

The most notable feature of the North Westside Groundwater Basin is the Lake Merced complex, a surface expression of the shallow aquifer system. Lake Merced is composed of four lakes: North Lake, East Lake, South Lake, and Impound Lake. Over the last century, Lake Merced has experienced notably significant fluctuations in its level as a result of diversions from the lake for water supply, use of the lake as a regulating reservoir as part of San Francisco's surface water system, and a combination of increased groundwater pumping and increased urbanization effects on the Lake's watershed and local groundwater recharge areas. To a substantial degree, depressed levels of Lake Merced in the last 20 years have been a driving force toward development of this Groundwater Management Plan for the North Westside Groundwater Basin, particularly as related to the objective of the Plan to preserve surface water resources such as Lake Merced.

The 2005 Groundwater Plan includes the installation of production wells in the Sunset District, coupled with a monitoring program to ensure that the installation and operation of those wells will not cause seawater intrusion, further declines in water levels at Lake Merced and Pine Lake, or other negative environmental effects.

2005 Groundwater Plan Summary: To accomplish the management objectives established for the basin, the 2005 Groundwater Plan incorporates 13 elements which can be generally grouped into four types: monitoring of surface and groundwater conditions; groundwater exploration and development activities for local water supply; analysis and reporting on groundwater conditions; and other related management actions. The elements of the 2005 Groundwater Plan include:

Plan Element 1: Monitoring of Groundwater Levels, Quality, Production, and Subsidence – expansion of the existing monitoring of groundwater levels, quality and production to provide the basic data on which to assess the condition of the groundwater basin and to assess the impacts of groundwater production on groundwater levels, groundwater quality, subsidence and on surface waters.

Plan Element 2: Monitoring and Management of Surface Water Resources – continued

and possibly expanded monitoring of surface water levels and quality, most notably at Lake Merced, to further the understanding of their interaction with groundwater.

Plan Element 3: Determination of Basin Yield and Avoidance of Overdraft – determination of the yield of the basin on both a regular (average annual) and an intermittent (dry year or emergency) basis in order to accomplish one of the primary objectives for the basin: that it be operated within its yield and thus not be overdrafted, and that it be effectively sustained as an ongoing reliable water supply without depletion of groundwater storage or degradation of quality.

Plan Element 4: Development of Groundwater to Augment SFPUC Municipal Water Supplies – exploration and development of groundwater for regular and dry period/emergency water supply, including possible development of water supply well sites in Golden Gate Park, in the Sunset District, near Stern Grove (Pine Lake), and in the vicinity of Lake Merced; currently identified potential well sites are listed.

Plan Element 5: Initiation of Conjunctive Use Operations – future pursuit of a conjunctive use program in the basin as a complement or extension of the conjunctive use activities that have been initiated on a demonstration basis since late 2002 in the southern part of the basin, in Daly City, South San Francisco and San Bruno, subject to agreement with these entities. In non-drought years under this project, the SFPUC would provide water from the RWS to these customers to substitute groundwater currently used for municipal purposes, thereby allowing the groundwater basin to recharge naturally; in drought years, the groundwater would be available for use to supplement the regional system water. In this Plan, this program is identified under the SFPUC RWS water sources -- refer to the section on, "SFPUC RWS Conjunctive Use Program."

Plan Element 6: Integration of Recycled Water – incorporation of recycled water as a component of non-potable water supply in the basin, initially for recently implemented golf course irrigation and subsequently for other non-potable uses, in order to reduce groundwater pumping for non-potable uses and thus provide increased groundwater availability for regular as well as dry-period/emergency water supply.

Plan Element 7: Development and Continuation of Local, State and Federal Agency Relationships – development and continuation of relationships with local, state and federal agencies, primarily to continue cooperative efforts in the overall basin toward integrated data collection, initiation of conjunctive use, and development of supplemental water for augmentation of Lake Merced.

Plan Element 8: Continuation of Public Education and Water Conservation Program – continuation of public education and water conservation programs, primarily to inform interested groups on technical and related details about surface and groundwater details, to solicit public input to lake management and conjunctive use planning, and to obtain community support for basin management actions.

Plan Element 9: Identification and Management of Recharge Areas and Wellhead Protection Areas Delineation of groundwater protection zones and identification and investigation of potential contaminating activities.

Plan Element 10: Identification of Well Construction, Abandonment and Destruction Policies – continued implementation of well construction, abandonment, and destruction policies, pursuant to the newly revised 2005 San Francisco Well Ordinance.

Plan Element 11: Identification and Mitigation of Soil and Groundwater Contamination – coordination with the San Francisco Department of Public Health and Regional Water Quality Control Board to address soil and groundwater contamination in groundwater protection

zones.

Plan Element 12: Groundwater Management Reports – preparation of regular and ad-hoc reports to complement a number of technical reports that have been prepared over the last decade on groundwater in the Westside Basin and its interrelationship with Lake Merced.

Plan Element 13: Provisions to Update the Groundwater Management Plan – provisions to update the 2005 Groundwater Plan, a recognition that the currently drafted plan reflects the most updated understanding of the occurrence of groundwater in the basin, but that the plan's elements could result in knowledge that suggests a change in currently planned management actions. The updated plan is intended to be a flexible document which can be updated to modify its existing elements and/or incorporate new elements as appropriate in order to recognize and respond to future groundwater and surface water conditions.

Development of the 2005 Groundwater Plan included significant public outreach and involvement efforts and included staff presentations, public workshops, email noticing, newspaper advertisements, web posting, and noticing in SFPUC newsletters. In addition to these organizations, the SFPUC contacted numerous individual residents.

Additional Groundwater Management Activities: Of the potential groundwater management activities listed in Water Code Section 10753, those already being cooperatively investigated and implemented as part of less formal groundwater management by the various pumpers in the basin include:

- Implementation of a conjunctive use pilot program.[12]
- Design and construction of a recycled water facility in Daly City to provide water to replace groundwater pumping for non-potable, irrigation uses at three golf courses around Lake Merced.
- Monitoring of groundwater levels and quality, including detailed monitoring of aquifer conditions around Lake Merced.
- Analysis of basin yield to avoid overdraft while maintaining municipal water supply and potentially increasing emergency and dry year water supply.
- Analysis and reporting on basin conditions.
- Continuing technical investigation to assess potential seawater intrusion and potential pumping impacts on surface water resources.
- Installation of a network of dedicated coastal monitoring wells between Thornton Beach and Golden Gate Park.
- Construction of test wells in the Sunset District to assess the potential yield of that portion of the North Westside Basin and to provide a design basis for new Sunset production wells described in the 2005 Groundwater Plan.
- Development of a conceptual model of the surface water and groundwater system.
- Continued development of lake augmentation programs.
- Continuing work on the development of a numerical groundwater flow model of the Westside Basin.

[12] This program is identified under the SFPUC RWS water sources. Refer to the section on, "SFPUC RWS Conjunctive Use Program."

Potential for Increased Local Groundwater Production: The 2005 Groundwater Plan identifies opportunities for increasing groundwater production within San Francisco. For planning purposes, it is estimated that within the City approximately 2.5 mgd[13] of groundwater is being pumped for non-potable uses, and that about 2 mgd of additional groundwater can be developed for potable supply. Additionally, of the existing groundwater being used in the City, primarily for irrigation at Golden Gate Park, the Zoo and the Great Highway Median, it is expected that about 2 mgd of this pumping can ultimately be redirected towards potable uses if recycled water is developed to take the place of groundwater in meeting these irrigation needs.

The potential for new groundwater is currently estimated at approximately 2 mgd. If project planning and development were to begin in the near future, this groundwater source could be available by year 2010. At this point in time, however, because it has not yet been determined how these resources will be used to benefit either SFPUC retail customers or the SFPUC RWS, this source has not been quantitatively applied in this 2005 UWMP to meet retail customer demand.

5.3.3 Local Conservation

Conservation through demand management measures is being treated as a local resource to improve the reliability of the retail customers. In November 2004, the SFPUC released a study which examined the potential for water savings in the City through implementation of a variety of conservation measures.[14] The study evaluated the costs and benefits of implementing 48 different conservation measures using an end-use model. The end-use model analyzed the effects of a specific conservation measure for a particular use, such as toilets, on overall water demand.

The results of this study indicated that local conservations programs implemented through 2030 could cumulatively reduce retail purchases from the SFPUC RWS by 4.5 mgd in year 2030. A description of the program which would achieve these savings is included in Section 8 (Water Demand Management Measures). At this point in time, however, because it has not yet been determined how these resources will be used to benefit either retail customers or the SFPUC RWS, this source has not been quantitatively applied in this 2005 UWMP to meet retail customer demand.

5.3.4 Local Recycled Water

The SFPUC is in the process of updating the *Recycled Water Master Plan for the City and County of San Francisco (RWMP, July 1996*). The 2005 Draft RWMP forms the basis for developing new recycled water project alternatives and updates the plan for implementation of recycled water projects in the City. These projects will save imported surface water and local groundwater for appropriate beneficial use and will provide increased reliability and sustainability.

Many factors prompted the need to update the existing 1996 RWMP (the Commission did not approve the 1996 RWMP due to the cost). These factors include: 1) new potential major customers; 2) new recycled water demand estimates; 3) new treatment technology; and, 4) new methods being implemented such as installation of built-in dual-plumbing facilities at locations

[13] An additional 1 mgd of groundwater is delivered by the SPFUC to Castlewood. This supply is metered. Refer to Section 3.3.1 (Local Groundwater) for additional details.
[14] *City and County of San Francisco: Retail Water Demands and Conservation Potential* Technical Memo, prepared for the SFPUC by Hannaford. M; November 2004.

throughout the City, in compliance with San Francisco's Recycled Water Use Ordinances 390-91 and 391-91.

In 2002, San Francisco voters approved a $1.6 billion revenue bond to fund renovations to SFPUC's water delivery system. Development of the WSIP began in 2003 to implement capital projects authorized under the bond measure. The WSIP adopted by the Commission in November 2005 includes approximately $205 million for recycled water projects.

Recycled water is currently being used within San Francisco on a limited basis. San Francisco uses tertiary-treated recycled water for in-plant wash-down operations. In addition, the SFPUC partnered with the North San Mateo County Sanitation District (a subsidiary of Daly City) to modify their wastewater plant to produce tertiary-treated recycled water. A portion of the recycled water produced at the facility is used to irrigate three golf courses - one located in Daly City, and two in the City and County of San Francisco.

The SFPUC is currently working with the North Coast County Water District, one of its wholesale customers, and the City of Pacifica, to implement recycled water in the City of Pacifica. A significant customer to this project would be the Sharp Park Golf Course, owned and operated by the City and County of San Francisco's Recreation and Parks Department. This project would reduce SFPUC retail demand as well as some wholesale water demand. The SFPUC has recently applied for Proposition 50 grants to construct the project.

The 2005 Draft RWMP for San Francisco proposes a Phase 1 project for recycled water which would produce approximately 4.1 – 4.5 mgd by year 2015. At this point in time, because it has not yet been determined how these resources will be used to benefit either SFPUC retail customers or the SFPUC RWS, this source has not been quantitatively applied in this 2005 UWMP to meet retail customer demand. Recycled water is discussed in further detail in Section 10 (Water Recycling).

5.3.5 Local Desalination

The SFPUC's investigations of desalination as a water supply source have focused primarily on the potential for regional facilities. As discussed previously, the SFPUC's is participating in the Bay Area Regional Desalination Project with the SCVWD, EBMUD, and CCWD to investigate the feasibility of constructing a regional desalination plant to serve the needs of the 5.4 million Bay Area residents served by these participating agencies.

However, in the SF LWRS, which will be completed in 2005, a local desalination facility is included as an option in one of the alternative implementation scenarios presented. At this point in time, however, consideration of desalination as a local supply option is still in the early stages of evaluation and will not be used as a source option in this 2005 UWMP to meet retail demand.

5.3.6 Local Projects of the WSIP

Improvements to San Francisco's water system are also included in the SFPUC's WSIP, such as seismic improvements to many of the pump stations and upgrades to reservoirs. These improvements will also contribute to improving water reliability to SFPUC's retail customers.

5.4 Water Availability Comparison

The current supplies available to the SFPUC RWS include the Tuolumne River (through the HHWP Project) and supplies from local reservoirs. In addition, supplies for retail deliveries include groundwater and recycled water. This 2005 UWMP assumes that these existing supplies will continue to be available in the future.

As the purchases from the SFPUC RWS increase over time, the SFPUC will rely on the Tuolumne River and supplies from local reservoirs to meet the increased demand in most years, plus the additional water sources identified in the WSIP in dry years, in order to meet the reliability goal of 80 percent set by the Commission in January 2005.[15] These dry-year supplies are summarized below in Table 6. ***This 2005 UWMP assumes that these resources will be available to the RWS in the volumes and timeframes indicated in Table 6.***

Table 6
Water Supply Reliability
Water Supply Options for Years 2010 through 2030[1]

Water Supply Option	2005	2010	2015	2020	2025	2030
Crystal Springs Reservoir Storage Recovered to 22 bg[2]	No	Yes	Yes	Yes	Yes	Yes
Conjunctive Use/Westside Basin Groundwater (afa)[3]	0	4,500	7,000	8,100[4]	8,100	8,100
Calaveras Reservoir Storage Recovered to 31.5 bg[5]	No	No	Yes	Yes	Yes	Yes
Water Transfers (afa)	0	23,200	23,200	29,000	29,000	29,000

bg = Billion gallons; afa = Acre-feet annually

Table Notes:

1. Water supply option schedule information from SFPUC Water System Improvement Program, as adopted by the Commission on 11/29/05.
2. Construction of this project is expected to begin in the 1st Quarter of 2010 and is expected to be completed in 2011. This table indicates that this supply will be available during the 2010-2015 time increment because information in this document is presented in 5-year increments and this supply is will be available during the majority of this time period.
3. This conjunctive use groundwater project is scheduled to begin construction in the 1st Quarter of 2010 and be fully completed (all wells in) by 3rd Quarter of 2013. Note that this 2005 UWMP reflects an initial dry-year supply of 4,500 AFY from this project beginning in the 1st Quarter of 2010. The results of a 2002-2005 pilot project indicate that this yield can be achieved by using new wells (funded by the SFPUC's WSIP budget), provided that formal conjunctive use agreements are completed with Daly City, San Bruno and CWSC in 2006. Although the project schedule in the WSIP (as adopted by the Commission on 11/29/05) lists construction of these new dry-year supply wells beginning in October 2010 (and thus not being completed until 3rd Quarter 2011), the SFPUC plans to accelerate this schedule so that the 4,500 AFY demand can be supplied by March 2010, as assumed in this 2005 UWMP. Implementation of the remainder of the project wells may also be accelerated, and therefore the completion of construction of all wells (to achieve the full yield of 8,100 AFY) may be achieved earlier than the current schedule of 3rd Quarter of 2013.
4. While the construction phase of this project is expected to be completed in 2013, the yield is expected to increase after construction is completed due to basin recharge.
5. The construction phase of this project is expected to begin in the 2nd Quarter of 2009 and is expected to be completed in the 4th Quarter of 2011.

[15] This reliability goal is discussed in more detail in Section 8.2 of this document.

5.4.1 Normal, Single Dry-year and Three-year Minimum Water Supply

Assuming a normal water condition occurs for the ensuing year, no deficiency in water deliveries would be anticipated. The SFPUC system water deliveries are anticipated to be approximately 267 mgd (approximately 299,000 acre-feet), all of which could be met through existing resources.

The SFPUC plans its water deliveries anticipating that a drought worse than the 1987 through 1992 drought may occur. As a result, the SFPUC system operations are designed for providing sufficient carry-over water in SFPUC reservoirs after six years of drought. This design would enable the SFPUC to continue delivering water, although at significantly reduced levels, during and after such a drought.

The SFPUC currently operates under a plan that anticipates three stages of response to water supply shortages, ranging from voluntary customer actions to enforced rationing; the third stage envisioned to occur only during a drought period worse than previously experienced. At current demand levels the SFPUC system can expect shortages of at least 10 to 20 percent in the first 3 multiple dry water years[16] (as shown in Table 7).

The 1987-92 drought period includes one-year and three-year sequences that are among the worst hydrologic periods projected for the SFPUC system. If within the next year a single dry (critical) year occurs, the SFPUC system deliveries could be reduced by 10 percent as a precaution to continued drought. If within the next three years a critical thee-year sequence recurred, the SFPUC system deliveries could be reduced by 10 to 20 percent.

Table 7 illustrates the SFPUC system water availability for the next three years under differing assumptions of hydrologic conditions. The impact of drought on the retail customers is described in Section 7 (Supply and Demand Comparison Provisions), Table 13.

Table 7
SFPUC System Water Availability - Year 2005
[Unit of Measure: Acre-feet/Year]

		Multiple Dry Water Years[1]		
Average/Normal Water Year	**Single Dry Water Year**	**Year 1 2006**	**Year 2 2007**	**Year 3 2008**
299,000 100% of Normal	269,000 90% of Normal	269,000 90% of Normal	239,000 80% of Normal	239,000 80% of Normal

Table Notes:
1. The multiple dry-years shown in this table reflect years 2-4 of the SFPUC 8.5 year design drought. It is assumed that in year 1 of the design drought there are no delivery reductions and full deliveries are made.

[16] Note that if the drought were to continue for 7 years, there would be shortages of 25 percent in dry years.

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Section 6: Water Use Provisions

This section primarily focuses on the projection of the SFPUC's retail water demands. These demands are based on the recent demographic information and a detailed analysis of the SFPUC's retail water use characteristics. A brief discussion is also included concerning the projection of the wholesale water demand that affects SFPUC's water system operation.

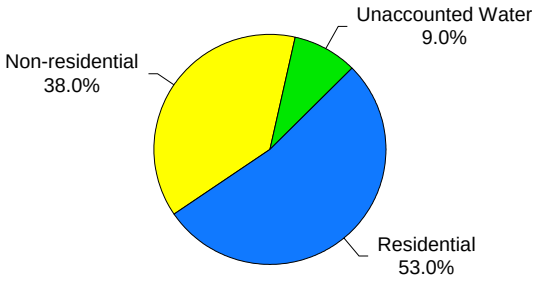
6.1 Retail Water Demands

Water use within San Francisco is currently less than the level of water use experienced in the 1960s and 1970s. Many factors have contributed to this reduction in water use, including significant changes to the mix of industrial and commercial businesses and their associated water demand, and the general characteristics of water use by San Francisco water customers. In particular, the droughts of 1976-77 and 1987-92, changes in plumbing codes, and conservation programs (either voluntarily embraced by residents and businesses or mandated by San Francisco), have apparently affected water demands.

All of SFPUC's retail water customers have been metered since 1916. Currently, total water use by SFPUC retail customers is approximately 90 million gallons per day (mgd)[17]. Approximately 53 percent of this total is delivered to San Francisco residential customers. Non-residential water use accounts for approximately 38 percent of the demand with unaccounted water amounting to approximately 9 percent (Figure 5).

Both the total consumption and the per capita use of water have been on a general decline in San Francisco since the mid-1970s. Figure 6 shows the historical record of retail water deliveries by San Francisco for the 1965 through 2004 period in terms of both total deliveries and gross per capita consumption (gallons per capita-day, gpcd).

Figure 5
San Francisco Retail Water Demands



While the gross per capita consumption is not a true measure of the water used by an individual (since it includes water use by all categories of customers, e.g., industrial, commercial and losses), it does provide insight when comparing water use among regions. The current gross per capita consumption rate of water by San Francisco retail water customers is 112 gpcd, one of the lowest in the state.[18]

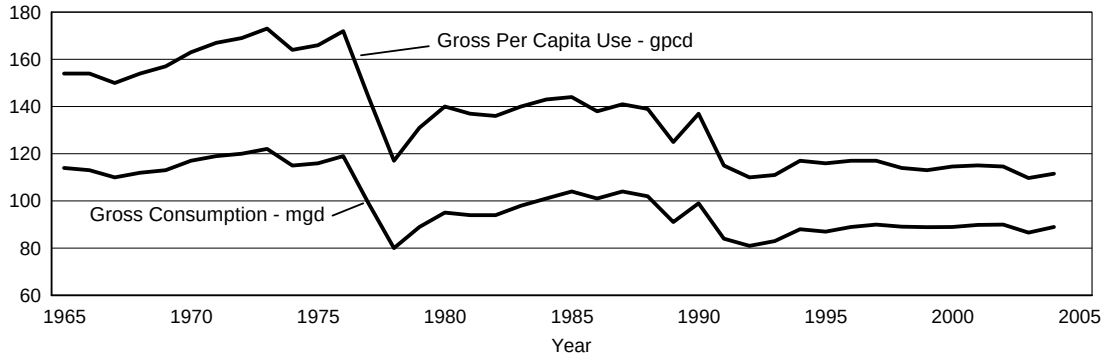
[17] Total water use of 90 mgd excludes 3.5 mgd of groundwater use.
[18] Excludes current groundwater use and use at Groveland Community Services District.

6.1.1 Retail Residential Water Use

Single-family units comprise approximately 33 percent of the total households in San Francisco, and use approximately 40 percent of the total water delivered to the residential sector. The remainder of residential water use (60 percent) occurs from multi-family units such as apartments.

Combined, the single-family and multi-family residential sectors have a current per capita consumption rate of 62 gpcd. Due to the moderate climate and the high density housing in San Francisco, water use within the residential sector is used almost entirely indoors. For multi-family units, the average outdoor water use is considered negligible. For single-family residential units, the average, outdoor water use is less than ten percent of their total use.

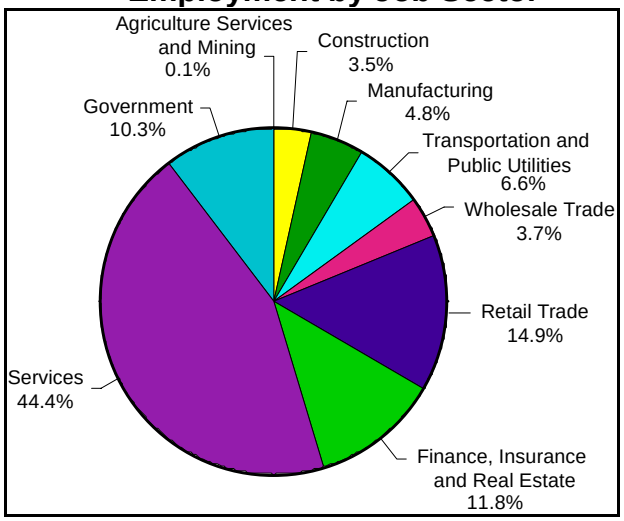
Figure 6
Historical San Francisco Water Consumption



6.1.2 Retail Non-residential Water Use

Non-residential water use accounts for approximately 38 percent of San Francisco's retail water demands. This category of water use includes all sectors of water users not designated as residential, such as manufacturing, transportation, trade, finance, and government employment sectors, and the large services sector. Figure 7 illustrates the current distribution of jobs among the various employment categories within San Francisco.

Figure 7
Employment by Job Sector



Average employee-use rates, gallons per employee-day (GED), have been estimated for the various employment categories in the development of the end-use study. These values range from approximately 19 GED for the very small construction employment category to approximately 80 GED for the manufacturing employment category.

Table 8A provides a breakdown by industry type of SFPUC's projected water demands for the retail non-residential sector for 2000 through 2030 in 5-year increments. The total demands for each 5-year increment, with anticipated reductions due to the plumbing code applied, are presented again in Table 8B as the "In-City Customers/Non-residential" data.

Table 8A

SFPUC Projected Retail Water Demands:
Non-Residential Sector Breakdown (mgd)

Non-Residential Category/Industry	Year 2000	Year 2005	Year 2010	Year 2015	Year 2020	Year 2025	Year 2030
Agriculture, Mining	0.07	0.07	0.07	0.07	0.07	0.07	0.07
Construction	0.43	0.44	0.46	0.48	0.50	0.51	0.53
Manufacturing	2.45	2.50	2.64	2.77	2.86	2.99	3.11
Transportation	0.95	0.99	1.02	1.07	1.11	1.14	1.17
Wholesale Trade	1.38	1.41	1.49	1.56	1.61	1.68	1.75
Retail Trade	5.09	5.27	5.53	5.76	5.97	6.16	6.35
F.I.R.E. (Finance, Insurance and Real Estate)	1.36	1.41	1.46	1.53	1.59	1.63	1.68
Services	15.71	16.25	17.29	18.00	18.60	19.26	19.92
Government	1.19	1.24	1.28	1.33	1.39	1.43	1.47
Total	28.62	29.57	31.24	32.57	33.69	34.87	36.04
Total with plumbing code savings applied	27.9	29.2	30.2	31.0	31.7	32.6	33.5

6.1.3 Methodology Used to Project Retail Water Demands

The SFPUC uses disaggregated end-use models to project its retail water demands. San Francisco's water demand is segregated into three distinct categories of water use: non-residential (industrial, commercial and municipal uses); multi-family residential (multiple family dwellings such as townhouses and apartments); and single-family residential. The remainder of San Francisco's water demands such as unaccounted water and minor uses such as docks and shipping are forecast through trend analysis.

Non-residential water use is estimated using relationships between employment within San Francisco and employee-use of water. These coefficients are segregated by type of business or service enterprise, which is based on SIC code. The determination of appropriate employee-use rates within San Francisco's model came from extensive review of industry literature.

Two separate use models estimate multi-family and single-family residential water use. These models rely on a desegregation of household end-use of water, such as the number and volume of toilet flushes, duration of showering, and the size and frequency of use of washing machines and dishwashers. These data came from available residential end-use monitoring studies.

The models have been verified with water delivery records for historical periods, including periods of time when water demands were affected by drought induced rationing programs. Water use projections through the year 2030 were developed using these models. The water use projections incorporate the effects of water-saving plumbing code requirements, among other factors.

6.1.4 Projected Retail Demands

Projected water use for SFPUC's retail customers has been estimated using San Francisco's water use models. These models have incorporated economic and demographic forecast data, including projections of population, housing stock and employment. This forecast data was based on the Association of Bay Area Government report titled *Projections 2002: Forecasts for the San Francisco Bay Area to the Year 2025*, which summarizes demographic projections for the City at 5-year intervals. ABAG projections were then reviewed and refined by San Francisco City Planning using up-to-date planning information for the City. City Planning accepted the industry data provided by ABAG in their 2002 projections but revised the population and household population projections based on projected future development.

Results of the water demand forecasts show that SFPUC's retail water demand will only slightly increase by the year 2030 (Table 8B), even though the population in San Francisco is expected to increase by 15 percent for the same period (year 2005 through year 2030). The projected increase in retail water demands is due to estimated growth in business and industry activity, which will translate into a commensurate increase in water use. However, the expected increase in water use within these sectors is forecast to be partially counter balanced by decreases in water use within the residential sector.

The decreased water use forecast for both single-family and multi-family residential sectors is attributed primarily to the following factors:

- Population density within housing units will decline in the future, and
- Market penetration of current plumbing codes within the residential sectors will increase as time progresses, resulting in an increase in current water savings due to the installation of more water-efficient fixtures.

In tandem, these two factors[19] will lead to a lower water use by a slowly increasing population.

[19] A decrease in water use can also be expected, in both the residential and non-residential sectors, as a result of water conservation programs (such as those discussed in Section 8). Estimated water savings from such programs, however, were not included in projected water demand modeling, and therefore are not accounted for in Table 8B).

Table 8B
SFPUC Projected Retail Water Demands (mgd)

Entity	Year 2000	Year 2005	Year 2010	Year 2015	Year 2020	Year 2025	Year 2030
In-City Customers							
Single-family Residential [1]	18.8[2]	18.4	17.8	17.3	16.8	16.4	16.2
Multi-family Residential [1]	28.8[2]	27.7	26.9	26.5	26.4	26.5	26.7
Non-residential [1, 5]	27.9[2]	29.2	30.2	31.0	31.7	32.6	33.5
Other (B&C, D&S) [4]	0.24[3]	0.24	0.24	0.24	0.24	0.24	0.24
Sub-total	75.7	75.5	75.1	75.0	75.2	75.7	76.5
Unaccounted-for Water (losses)	8.3	7.3	7.3	7.3	7.3	7.3	7.3
Total	84.0	82.8	82.4	82.3	82.5	83.0	83.8
Other Retail Customers							
Other Retail Customers	4.9[3]	4.9	4.9	4.9	4.9	4.9	4.9
Groveland Community Services District	0.4[3]	0.4	0.4	0.4	0.4	0.4	0.4
Lawrence Livermore Laboratory	0.8[3]	0.8	0.8	0.8	0.8	0.8	0.8
Sub-total	6.1	6.1	6.1	6.1	6.1	6.1	6.1
Retail Demand Met by SFPUC RWS	**90.1**	**88.9**	**88.5**	**88.4**	**88.6**	**89.1**	**89.9**
Existing Groundwater							
Golden Gate Park, San Francisco Zoo and Great Highway Median Irrigation	2.5	2.5	2.5	2.5	2.5	2.5	2.5
Castlewood	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Sub-total	3.5	3.5	3.5	3.5	3.5	3.5	3.5
Total SFPUC Water System Retail Demand	**93.6**	**92.4**	**92.0**	**91.9**	**92.1**	**92.6**	**93.4**

***Table Notes*:**

[1] Includes the impact of water savings due to plumbing code changes.

[2] Current water use based on FY 1999-00 billing records.

[3] Current water use based on FY 1996-97- FY 2000-01 billing records.

[4] Builders & Contractors and Docks & Shipping.

[5] Refer to Table 8A for a breakdown of the non-residential category by sector.

6.2 Wholesale Water Demands

The SFPUC provides water to 28 entities that comprise the wholesale water customers. These entities receive almost two-thirds of the total water delivered by the SFPUC.

6.2.1 Methodology Used to Project Wholesale Water Demands

The SFPUC in coordination with the wholesale customers and BAWSCA conducted a comprehensive water demand forecast of its wholesale service area. Similar in methodology to the retail demand projection model, the Least Cost Decision Support System (DSS) model, an end-use model that disaggregates water account data to end-uses, was employed. End-use models allow one to portray the effects of the plumbing code on each account type over time as high water use fixtures are replaced with low water use fixtures. The DSS model disaggregates water use in an account by each water using fixture and incorporates the effects of plumbing and appliance codes on fixtures and appliances including toilets (1.6 gallons per flush), showerheads (2.5 gallons per minute) and washing machines (lower water use) on existing accounts. In projecting water demands for current users using the DSS model, the effects of the plumbing code are applied to the future water use of existing accounts. New water demands are determined by applying the growth rate in population and employment to the applicable water accounts.

6.2.2 Wholesale Water Demands

Water supplied by the SFPUC to its wholesale customers is metered. The total water demands of the wholesale water customers are shown in Table 9. Wholesale customers collectively in 2001 received about 67% of their water supply from the SFPUC RWS. Future projections indicate that between 2010 and 2030 this figure will be in the range of 64-65%. The data shows that for the year 2030, water demands of the wholesale water customers (regardless of water source) will increase to approximately 324 mgd. Other water supplies available and developed by the wholesale customers, which include increased water conservation and recycling, show a net increase of about 10 mgd. As shown in Table 9 the purchase of SFPUC water by the wholesale customers is projected to increase from approximately 178 mgd to 209 mgd by the year 2030.

Table 9
SFPUC Wholesale Customer Water Demands and Supplies (mgd)

	2001	2005	2010	2015	2020	2025	2030
Wholesale Customer Purchase from the SFPUC RWS[1]	170.6	177.9	188.9	191.6	197.5	203.6	209.4
Other Supplies[2]	101.4	104.1	103.1	107.4	110.5	111.4	114.6
Total Wholesale Customer Demand[3, 4]	272	282	292	299	308	315	324

Table Notes:

1. Purchases from SFPUC RWS: 2001 data is from Bay Area Water Users Association Annual Report, FY 2001-02. The 2005 data is estimated based on previous years' billing records. The 2010 - 2030 purchase estimates were collected from individual wholesale customers in April 2005.
2. "Other Supplies" were estimated as the difference between the Total Wholesale Customer Demand and the Wholesale Customer Purchases from the SFPUC RWS.
3. Source: SFPUC Wholesale Customer Water Demand Projections Study (URS, 2004), Table 3-1 and 5-1.
4. Demand figures reflect an approximately 7.8% reduction due to anticipated compliance with existing plumbing code standards (i.e., more efficient fixtures). Demand figures also include unaccounted for water losses of approximately 7.5% on average.

6.2.3 Water Supplies Available to Wholesale Customers

The wholesale water customers rely on SFPUC and to some extent other supplemental sources of water supply to meet water demands. These additional sources include groundwater, local surface water, the Santa Clara Valley Water District and the State Water Project, recycled water and conservation. Several wholesale agencies utilize recycled water as a source of supply today. Looking to 2030, additional wholesale agencies will be investing in the development and use of recycled water as a source of supply. The wholesale customers are also committed to water conservation and have included an additional 13 mgd of conservation as a source of supply in 2030. When added to the 25 mgd of conservation savings resulting from implementation of existing plumbing codes, water conservation in the wholesale service area represents 38 mgd or 11 percent of the total projected water needs of the wholesale service area in 2030. Although two-thirds of the wholesale water customers are entirely dependent on the SFPUC for water, the other one-third of the customers are able to obtain some portion of their water from other sources. Several entities are projecting an increased reliance on supplies other than the SFPUC to hold their SFPUC demands constant, or in some instances reduce their demands of SFPUC supplies.

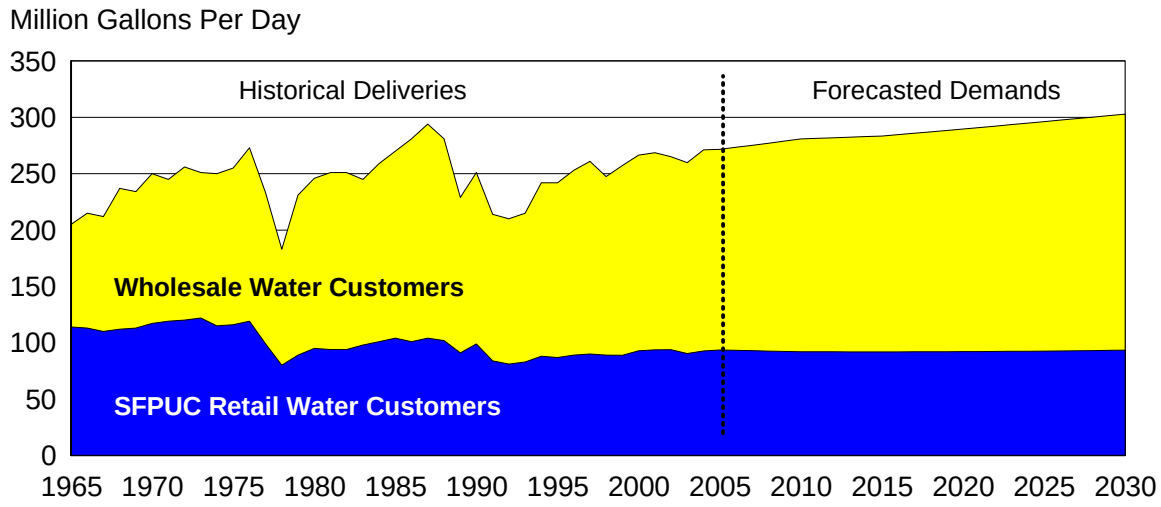
6.2.4 Variability of Total Purchases from the SFPUC RWS

The water demands and supplemental sources of supply projected for the wholesale water customers are continually adjusting due to changing economic and demographic conditions within the retail and wholesale service areas.

The supply projections made by the wholesale water customers may not always account for the variability in water supply hydrology associated with each source. They also may not incorporate all the potential impacts of recent or pending regulatory decisions such as the triennial review of the State Water Resources Control Board 1995 Water Quality Control Plan for the Bay-Delta estuary, which may significantly impact the availability of water from the State Water Project and the federal Central Valley Project. Additionally, supply projections do not take into account the effect of listings of endangered species in local watersheds that could potentially impact the ability to use local water supplies. In addition to these factors, plans for increasing groundwater production, local surface water use, and reclaimed water use are at various stages of development and evaluation. Therefore, their projected supply benefits may be realized at different times and different yields than currently planned and/or projected. In the event any of these circumstances occur the wholesale customer water demands on the SFPUC could be higher than projected.

The historical delivery of water and the projected demand of water to the wholesale water customers from the SFPUC are shown in Figure 8. Figure 8 also depicts the demand for water by the wholesale water customers in combination with demands from all other SFPUC retail customers.

Figure 8:
Total San Francisco Water Demands



6.3 Impact of Past Drought on Water Demand and Conservation

The SFPUC and its wholesale customers experienced a prolonged drought from 1987 through 1992. During this time, the SFPUC met its retail customer needs through water purchases, aggressive conservation and voluntary rationing, and finally by mandatory rationing. Wholesale customers also reduced their demand through aggressive conservation and rationing. As a result of the drought-induced conservation programs, the SFPUC's retail and wholesale water use has remained below pre-drought use, as reflected in Figure 8.

Section 7: Supply and Demand Comparison Provisions

This section provides an assessment of the reliability of the SFPUC water supply during normal, dry and multiple dry years. The first section address supply and demand for the entire SFPUC RWS and the second section addresses supply and demand for SFPUC retail demand only.

7.1 Supply and Demand Comparison -- Regional Water System

Normal Years: Table 10 compares current and projected SFPUC RWS supply and demand. It indicates that during normal precipitation years, the SFPUC has adequate supplies to meet its projected retail and wholesale water demands.

Table 10
Projected Normal Year Water Supply and Demand Comparison (mgd/Yr)
SFPUC RWS

Supply/Demand	Year				
	2010	**2015**	**2020**	**2025**	**2030**
Supplies					
SFPUC System Supply[20]	277	280	286	293	300
Additional Supplies from Restored Crystal Springs Reservoir	0	0	0	0	0
Westside Basin Groundwater	0	0	0	0	0
Additional Supplies from Restored Calaveras Reservoir	0	0	0	0	0
Water Transfer	0	0	0	0	0
Demand					
Regional Water System Demand	277	280	286	293	300
Supply and Demand Comparison					
Supply Totals	277	280	286	293	300
Demand Totals	277	280	286	293	300
Difference	0	0	0	0	0

As previously stated, projects as described in the WSIP will be required to meet demands during multiple dry years. The new water sources assumed to be available in this 2005 UWMP, with implementation dates, were previously summarized in Table 6.

Single Dry-Year: Given the additional supplies assumed to be available, Table 11 illustrates the level of first dry-year water delivery shortage that could occur with the projected 5-year increments of water demands.

[20] Current retail groundwater use does not offset potable supply and the water demand supplied by groundwater is not considered in the retail demand. Thus, the approximately 2.5 mgd of groundwater currently used for Golden Gate Park, San Francisco Zoo, irrigation on the Great Highway Median and 1 mgd used in Castlewood is not included in this table.

Table 11
Projected Single Dry-year Supply and Demand Comparison
SFPUC RWS (Integrated Supplies)

	2005	2010	2015	2020	2025	2030
SFPUC Demand Totals	267 mgd	277 mgd	280 mgd	286 mgd	293 mgd	300 mgd
SFPUC RWS Supply Totals	240 mgd 90% of Demand	277 mgd 100% of Demand	280 mgd 100% of Demand	286 mgd 100% of Demand	293 mgd 100% of Demand	270 mgd 90% of Demand[1]
Difference	27	0	0	0	0	30[1]

Table Notes:

1. The SFPUC is currently identifying 10 mgd of groundwater, recycled water and conservation programs to reduce the need for rationing during a single-dry year when projected demand levels reach 300 mgd. These potential supplies are not accounted for in Table 11.

Table 11A attempts to illustrate a theoretical application of how the different water supplies may be used in a single dry-year per DWR's requirements. However, it should be noted that the SFPUC utilizes its water supplies in an integrated, conjunctive operation in which all water supplies are part of the SFPUC's regional water system supply, functioning together not independent of one another. Therefore Table 11 is a more accurate illustration of the affect of additional water supplies on the SFPUC regional water system supply.

Table 11A
Projected Single Dry Year Water Supply and Demand Comparison (mgd/Yr)
SFPUC RWS

Supply/Demand	Year				
	2010	**2015**	**2020**	**2025**	**2030**
Supplies					
Existing SFPUC System Supply	253	249	249	256	233
Restored Crystal Springs Reservoir	1	1	1	1	1
Westside Basin Groundwater	3	5	6	6	6
Restored Calaveras Reservoir	0	5	5	5	5
Water Transfer	20	20	25	25	25
Total	277	280	286	293	270
Demand					
Regional Water System Demand	277	280	286	293	300
Supply and Demand Comparison[1, 2]					
Supply Totals	277	280	286	293	270
Demand Totals	277	280	286	293	300
Difference	0	0	0	0	-30
Difference as % of Supply	0%	0%	0%	0%	-11%
Difference as % of Demand	0%	0%	0%	0%	-10%

See table notes on next page →

Table 11A Notes:

1. Note the reduction of existing SFPUC supplies in year 2030. This does not represent a reduction in water supply from the existing system. The existing supplies not delivered following one dry year will be delivered over subsequent dry years.
2. The SFPUC is currently identify 10 mgd of groundwater, recycled water and conservation programs to reduce the need for rationing during a single-dry year when projected demand levels reach 300 mgd. These potential supplies are not accounted for in Table 11A.

Multiple Dry-Years: Multiple-year drought sequences could subject the SFPUC customers to greater levels of shortage. Table 12 provides a summary in three-year increments of how water supply reliability will improve as the package of water supply options are applied to the SFPUC regional water system.

The Table 12A–E series illustrates the level of water delivery shortages that would be anticipated if a five-year dry hydrologic condition occurred, for each year of the 5-year intervals shown. Tables 12A-E attempt to illustrate a theoretical application of how the different water supplies may be used in multiple dry-years per DWR's requirements. However, it should be noted that the SFPUC utilizes its water supplies in an integrated, conjunctive operation in which all water supplies are part of the SFPUC's regional water system supply, functioning together not independent of one another. Therefore Table 12 is a more accurate illustration of the affect of additional water supplies on the SFPUC regional water system supply.

Potential New Sources of Supply: The SFPUC is currently in the process to identifying 10 mgd of groundwater, recycled water and conservation programs to reduce the need for rationing when projected demand levels reach 300 mgd. Assuming 10 mgd of supplies (SPPUC demand of 290 mgd), the level of rationing during a multiple-dry period would be:

- Year 1, full deliveries, 290 mgd or 100% of demand
- Year 2, full deliveries, 261 mgd or 90% of demand
- Year 3, full deliveries, 261 mgd or 90% of demand

The 10 mgd provides an additional resource for use during a drought and thus improves the water supply reliability of the SFPUC RWS. During the design drought it provides about 90,000 acre-feet to be used over the 8.5 year period. For the WSIP, the SFPUC used this 90,000 acre-feet to reduce the level of rationing in 3 specific years of the design drought. In Year 2, instead of 10% rationing there is no rationing. In Year 3, instead of 20% rationing there is only 10% rationing, and in Year 6, instead of 20% rationing there is only 10%. If one were to apply this change to the three years shown in Table 12 as being consistent with the first three years of the design drought, there would be no rationing in the first two years and 10% rationing in year 3.

Table 12

Projected Multiple Dry-Years Supply and Demand Comparison
SFPUC RWS

	Multiple Dry Water Years[1]		
	Year 1	**Year 2**	**Year 3**
2005 SFPUC Demand	267 mgd	267 mgd	267 mgd
SFPUC RWS Supply Total	240 mgd 90% of Demand	214 mgd 80% of Demand	214 mgd 80% of Demand
Year 2010 SFPUC Demand	277 mgd	277 mgd	277 mgd
SFPUC RWS Supply Total	277 mgd 100% of Demand	249 mgd 90% of Demand	249 mgd 90% of Demand
Year 2015 SFPUC Demand	280 mgd	280 mgd	280 mgd
SFPUC RWS Supply Total	280 mgd 100% of Demand	252 mgd 90% of Demand	252 mgd 90% of Demand
Year 2020 SFPUC Demand	286 mgd	286 mgd	286 mgd
SFPUC RWS Supply Total	286 mgd 100% of Demand	257 mgd 90% of Demand	257 mgd 90% of Demand
Year 2025 SFPUC Demand	293 mgd	293 mgd	293 mgd
SFPUC RWS Supply Total	293 mgd 100% of Demand	264 mgd 90% of Demand	264 mgd 90% of Demand
Year 2030 SFPUC Demand	300 mgd	300 mgd	300 mgd
SFPUC RWS Supply Total	270 mgd 90% of Demand	240 mgd 80% of Demand	270 mgd 90% of Demand

Table Notes:

1. The multiple dry-years shown in this table reflect years 2-4 of the SFPUC's 8.5 year design drought. It is assumed that in year 1 of the design drought there are no delivery reductions and full deliveries are made.

Table 12A
Projected Multiple Dry Year Water Supply and Demand Comparison, 2006-2010 (mgd/Yr)
SFPUC RWS

Supply/Demand	Year[1]				
	2006	**2007**	**2008**	**2009**	**2010**
Supplies					
Existing SFPUC System Supply	220	194	194	194	194
Restored Crystal Springs Reservoir	0	0	0	0	0
Westside Basin Groundwater	0	0	0	0	0
Restored Calaveras Reservoir	0	0	0	0	0
Water Transfer	20	20	20	20	20
Total	240	214	214	214	214
Demand					
Regional Water System Demand	267	267	267	267	267
Supply and Demand Comparison					
Supply Totals	240	214	214	214	214
Demand Totals	267	267	267	267	267
Difference	-27	-53	-53	-53	-53
Difference as % of Supply	-11%	-25%	-25%	-25%	-25%
Difference as % of Demand	-10%	-20%	-20%	-20%	-20%

Table Notes:

1. The multiple dry-years shown in this table reflect years 2-6 of the SFPUC's 8.5 year design drought. It is assumed that in year 1 of the design drought there are no delivery reductions and full deliveries are made.

Table 12B
Projected Multiple Dry Year Water Supply and Demand Comparison, 2011-2015 (mgd/Yr)
SFPUC RWS

Supply/Demand	Year[1]				
	2011	**2012**	**2013**	**2014**	**2015**
Supplies					
Existing SFPUC System Supply	248	220	220	192	192
Restored Crystal Springs Reservoir	1	1	1	1	1
Westside Basin Groundwater	3	3	3	3	3
Restored Calaveras Reservoir	5	5	5	5	5
Water Transfer	20	20	20	20	20
Total	277	249	249	222	222
Demand					
Regional Water System Demand	277	277	277	277	277
Supply and Demand Comparison					
Supply Totals	277	249	249	222	222
Demand Totals	277	277	277	277	277
Difference	0	-28	-28	-55	-55
Difference as % of Supply	0%	-11%	-11%	-25%	-25%
Difference as % of Demand	0%	-10%	-10%	-20%	-20%

Table Notes:

1. The multiple dry-years shown in this table reflect years 2-6 of the SFPUC's 8.5 year design drought. It is assumed that in year 1 of the design drought there are no delivery reductions and full deliveries are made.

Table 12C
Projected Multiple Dry Year Water Supply and Demand Comparison, 2016-2020 (mgd/Yr)
SFPUC RWS

Supply/Demand	Year[1] 2016	2017	2018	2019	2020
Supplies					
Existing SFPUC System Supply	244	216	216	216	216
Restored Crystal Springs Reservoir	1	1	1	1	1
Westside Basin Groundwater	5	5	5	5	5
Restored Calaveras Reservoir	5	5	5	5	5
Water Transfer	25	25	25	25	25
Total	280	252	252	252	252
Demand					
Regional Water System Demand	280	280	280	280	280
Supply and Demand Comparison					
Supply Totals	280	252	252	252	252
Demand Totals	280	280	280	280	280
Difference	0	-28	-28	-28	-28
Difference as % of Supply	0%	-11%	-11%	-11%	-11%
Difference as % of Demand	0%	-10%	-10%	-10%	-10%

Table Notes:

1. The multiple dry-years shown in this table reflect years 2-6 of the SFPUC's 8.5 year design drought. It is assumed that in year 1 of the design drought there are no delivery reductions and full deliveries are made.

Table 12D
Projected Multiple Dry Year Water Supply and Demand Comparison, 2021-2025 (mgd/Yr)
SFPUC RWS

Supply/Demand	Year[1] 2021	2022	2023	2024	2025
Supplies					
Existing SFPUC System Supply	249	220	220	192	220
Restored Crystal Springs Reservoir	1	1	1	1	1
Westside Basin Groundwater	6	6	6	6	6
Restored Calaveras Reservoir	5	5	5	5	5
Water Transfer	25	25	25	25	25
Total	286	257	257	229	257
Demand					
Regional Water System Demand	286	286	286	286	286
Supply and Demand Comparison					
Supply Totals	286	257	257	229	257
Demand Totals	286	286	286	286	286
Difference	0	-29	-29	-57	-29
Difference as % of Supply	0%	-11%	-11%	-25%	-11%
Difference as % of Demand	0%	-10%	-10%	-20%	-10%

Table Notes:

1. The multiple dry-years shown in this table reflect years 2-6 of the SFPUC's 8.5 year design drought. It is assumed that in year 1 of the design drought there are no delivery reductions and full deliveries are made.

Table 12E

Projected Multiple Dry Year Water Supply and Demand Comparison, 2026-2030 (mgd/Yr)

SFPUC RWS

Supply/Demand	Year[1]				
	2026	**2027**	**2028**	**2029**	**2030**
Supplies					
Existing SFPUC System Supply	256	227	227	197	197
Restored Crystal Springs Reservoir	1	1	1	1	1
Westside Basin Groundwater	6	6	6	6	6
Restored Calaveras Reservoir	5	5	5	5	5
Water Transfer	25	25	25	25	25
Total	293	264	264	234	234
Demand					
Regional Water System Demand	293	293	293	293	293
Supply and Demand Comparison					
Supply Totals	293	264	264	234	234
Demand Totals	293	293	293	293	293
Difference	0	-29	-29	-59	-59
Difference as % of Supply	0%	-11%	-11%	-25%	-25%
Difference as % of Demand	0%	-10%	-10%	-20%	-20%

Table Notes:

1. The multiple dry-years shown in this table reflect years 2-6 of the SFPUC's 8.5 year design drought. It is assumed that in year 1 of the design drought there are no delivery reductions and full deliveries are made.

7.2 Supply and Demand Comparison – SFPUC Retail

As described in Table 7 previously, and illustrated in Table 10, during non-critical years neither the SFPUC retail nor wholesale customers are anticipated to be curtailed in their SFPUC deliveries within the reporting period. However, as illustrated in Table 11 and in the Table 12A - 12E series, during single dry-year or multiple dry-year events the SFPUC system supply available to the SFPUC retail customers, as well as wholesale customers, may be limited.

The illustrations shown above depict anticipated SFPUC shortages on a system-wide basis. Historically, system-wide shortages have been applied to SFPUC wholesale and retail customers based on the circumstances occurring at the time. During the 1987-92 drought, procedures included considerations of anticipated impacts upon the system's end-user use of water. These considerations lead to a differing amount of delivery reduction to each SFPUC wholesale customer and to the individual retail customers.

The SFPUC and its wholesale customers negotiated an Interim Water Shortage Allocation Plan (IWSAP) in year 2000, that provides a fair and reasonable method for allocating water between the SFPUC and its wholesale customers during times of system-wide shortages up to 20 percent due to drought. Under the IWSAP, the SFPUC retail customers can translate a 10 percent system-shortage into a 6.9 percent shortage to retail deliveries, collectively. A 20 percent system-shortage can be translated into a 13.8 percent shortage to retail deliveries.[21] A copy of the IWSAP is provided in Appendix C.

Single-Dry Year Event: For a single dry-year event, Table 13 illustrates the comparison between SFPUC retail demands and supplies for the reporting period.

[21] The allocation of the IWSAP is based on the average demand for the previous three year period. For simplification, it has been assumed that the IWSAP for the specific five-year increment is based on the demand for that specific year (i.e., in year 2020, the SFPUC RWS is 286.1 mgd and the San Francisco Retail demand met by the SFPUC is 88.6 mgd, the percentage allocation to the customers will be based on an average San Francisco Retail demand of 88.6 mgd and a Wholesale customer average demand of 197.5 for a total demand of 286.1 mgd, applying these shortages for the period 2021-2025).

Table 13
Projected Single Dry Year Water Supply and Demand Comparison (mgd/Yr)
SFPUC Retail

Supply/Demand	Year				
	2010	**2015**	**2020**	**2025**	**2030**
Supplies					
SFPUC System Supply[1]	88.5	88.4	88.6	89.1	84.3
Existing Groundwater	3.5	3.5	3.5	3.5	3.5
Total	92.0	91.9	92.1	92.6	87.8
Potential New Sources Not Utilized[2]					
Potential Groundwater[3]	*2.0*	*2.0*	*2.0*	*2.0*	*2.0*
Potential Recycled Water[4]	*0.0*	*4.1*	*4.1*	*4.1*	*4.1*
Potential Conservation[5]	*3.1*	*3.7* [6]	*4.2*	*4.4* [6]	*4.5*
Demand					
San Francisco Retail	92.0	91.9	92.1	92.6	93.4
Supply and Demand Comparison					
Supply Totals	92.0	91.9	92.1	92.6	87.8
Demand Totals	92.0	91.9	92.1	92.6	93.4
Difference	0.0	0.0	0.0	0.0	-5.6
Difference as % of Supply	0%	0%	0%	0%	-6%
Difference as % of Demand	0%	0%	0%	0%	-6%

Table Notes*:*

1. This 2005 UWMP assumes that the resources identified in Section 5.4 will be available to the SFPUC RWS.
2. The SFPUC is currently in the process of identifying 10 mgd of groundwater, recycled water and conservation programs to reduce the need for rationing when projected demand levels reach 300 mgd. It is believed that these projects could be within the retail service area. This would reduce the SFPUC demand in year 2030 by 10 mgd (a reduction in the SPPUC demand from 300 mgd to 290 mgd).
3. San Francisco is currently evaluating the potential for groundwater use in the Draft San Francisco Local Water Resources Study (SF LWRS). At this point in time, however, it has not been determined how these resources will be used to benefit either SFPUC retail customers or the SFPUC Regional Water System. Therefore, this source has not been quantitatively applied in this 2005 UWMP to meet retail customer demand.
4. Current recycled water use is less than 1 mgd and the water demand supplied by recycled water is not considered in the retail demand. San Francisco is currently evaluating the potential for recycled water use in the SF LWRS. At this point in time, however, it has not been determined how these resources will be used to benefit either SFPUC retail customers or the SFPUC Regional Water System. Therefore, this source has not been quantitatively applied in this 2005 UWMP to meet retail customer demand.
5. The 2004, the SFPUC commissioned a report which evaluated the conservation potential within the City and County of San Francisco *(City and County of San Francisco Retail Water Demands and Conservation Potential* Technical Memo, Hannaford, November 2004). At this point in time, however, it has not been determined how these resources will be used to benefit either retail customers or the SFPUC Regional Water System. Therefore, this source has not been quantitatively applied in this 2005 UWMP to meet retail customer demand.
6. Conservation savings presented are cumulative over time. For year 2015 and 2025, conservation savings has been estimated by linearly interpolating between conservation savings estimates for years 2010, 2020 and 2030.

Multiple Dry-Year Sequences: Table 14 provides a summary of the impact of multiple dry years on SFPUC's retail supplies. For 5-year multiple dry-year sequences, Tables 14A-E illustrate the comparison between SFPUC retail demands and supplies for each of the 5-year intervals shown. Note that the conservation savings presented in this series of tables are cumulative over time. For year 2015 and 2025, conservation savings have been estimated by linearly interpolating between conservation savings estimates for years 2010, 2020 and 2030.

As previously stated, this 2005 UWMP assumes that:

1. the resources identified in Section 5.4 will be available to the SFPUC RWS; and
2. the supplies identified as "potential" new sources are not quantitatively applied to meet retail customer demand because, at this point in time, it has not been determined how these resources will be used to benefit either SFPUC retail customers or the SFPUC Regional Water System. Accordingly, these potential sources have not been applied in this 2005 UWMP to reduce the "deficit" (difference) as computed in Table 13. Therefore, Tables 14A-E do not apply these resources as a source of supply for the retail system.

Potential New Sources of Supply: The SFPUC is currently in the process of identifying 10 mgd of groundwater, recycled water and conservation programs to reduce the need for rationing when projected demand levels reach 300 mgd. Assuming 10 mgd of supplies (SPPUC demand of 290 mgd), the level of rationing during a multiple-dry period would be:

- Year 1, full deliveries, 290 mgd or 100% of demand
- Year 2, full deliveries, 261 mgd or 90% of demand
- Year 3, full deliveries, 261 mgd or 90% of demand

Table 14
Projected Multiple Dry-Years Supply and Demand Comparison
SFPUC Retail

	Multiple Dry Water Years[1]		
	Year 1	**Year 2**	**Year 3**
Year 2005 Retail Demand	92.4 mgd	92.4 mgd	92.4 mgd
SFPUC RWS Supply	82.8 mgd	76.6 mgd	76.6 mgd
Existing Groundwater	3.5 mgd	3.5 mgd	3.5 mgd
Deficit	6.1 mgd	12.3 mgd	12.3 mgd
Potential Groundwater	*0 mgd*	*0 mgd*	*0 mgd*
Potential Recycled Water	*0 mgd*	*0 mgd*	*0 mgd*
Potential Conservation	*0 mgd*	*0 mgd*	*0 mgd*
Year 2010 Retail Demand	92.0 mgd	92.0 mgd	92.0 mgd
SFPUC RWS Supply	88.5 mgd	82.4 mgd	82.4 mgd
Existing Groundwater	3.5 mgd	3.5 mgd	3.5 mgd
Deficit	0 mgd	6.1 mgd	6.1 mgd
Potential Groundwater	*2.0 mgd*	*2.0 mgd*	*2.0 mgd*
Potential Recycled Water	*0 mgd*	*0 mgd*	*0 mgd*
Potential Conservation	*3.1 mgd*	*3.1 mgd*	*3.1 mgd*
Year 2015 Retail Demand	91.9 mgd	91.9 mgd	91.9 mgd
SFPUC RWS Supply	88.4 mgd	82.3 mgd	82.3 mgd
Existing Groundwater	3.5 mgd	3.5 mgd	3.5 mgd
Deficit	0 mgd	6.1 mgd	6.1 mgd
Potential Groundwater	*2.0 mgd*	*2.0 mgd*	*2.0 mgd*
Potential Recycled Water	*4.1 mgd*	*4.1 mgd*	*4.1 mgd*
Potential Conservation	*3.7 mgd*	*3.7 mgd*	*3.7 mgd*
Year 2020 Retail Demand	92.1 mgd	92.1 mgd	92.1 mgd
SFPUC RWS Supply	88.6 mgd	82.5 mgd	82.5 mgd
Existing Groundwater	3.5 mgd	3.5 mgd	3.5 mgd
Deficit	0 mgd	6.1 mgd	6.1 mgd
Potential Groundwater	*2.0 mgd*	*2.0 mgd*	*2.0 mgd*
Potential Recycled Water	*4.1 mgd*	*4.1 mgd*	*4.1 mgd*
Potential Conservation	*4.2 mgd*	*4.2 mgd*	*4.2 mgd*
Year 2025 Retail Demand	92.6 mgd	92.6 mgd	92.6 mgd
SFPUC RWS Supply	89.1 mgd	82.9 mgd	82.9 mgd
Existing Groundwater	3.5 mgd	3.5 mgd	3.5 mgd
Deficit	0 mgd	6.2 mgd	6.2 mgd
Potential Groundwater	*2.0 mgd*	*2.0 mgd*	*2.0 mgd*
Potential Recycled Water	*4.1 mgd*	*4.1 mgd*	*4.1 mgd*
Potential Conservation	*4.4 mgd*	*4.4 mgd*	*4.4 mgd*
Year 2030 Retail Demand	93.4 mgd	93.4 mgd	93.4 mgd
SFPUC RWS Supply	84.3 mgd	78.1 mgd	84.3 mgd
Existing Groundwater	3.5 mgd	3.5 mgd	3.5 mgd
Deficit	6.3 mgd	12.5 mgd	6.3 mgd
Potential Groundwater	*2.0 mgd*	*2.0 mgd*	*2.0 mgd*
Potential Recycled Water	*4.1 mgd*	*4.1 mgd*	*4.1 mgd*
Potential Conservation	*4.5 mgd*	*4.5 mgd*	*4.5 mgd*

Table Notes:

1. The multiple dry-years shown in this table reflect years 2-4 of the SFPUC's 8.5 year design drought. It is assumed that in year 1 of the design drought there are no delivery reductions and full deliveries are made.

Table 14A
Projected Multiple Dry Year Water Supply and Demand Comparison 2006-2010 (mgd/Yr)
San Francisco Retail

Supply/Demand	Year[1] 2006	2007	2008	2009	2010
Supplies					
SFPUC System Supply	82.8	76.6	76.6	76.6	76.6
Existing Groundwater	3.5	3.5	3.5	3.5	3.5
Total	86.3	80.1	80.1	80.1	80.1
Potential New Sources Not Utilized					
Potential Groundwater	*2.0*	*2.0*	*2.0*	*2.0*	*2.0*
Potential Recycled Water	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*
Potential Conservation	*3.1*	*3.1*	*3.1*	*3.1*	*3.1*
Demand					
San Francisco Retail	92.4	92.4	92.4	92.4	92.4
Supply and Demand Comparison					
Supply Totals	86.3	80.1	80.1	80.1	80.1
Demand Totals	92.4	92.4	92.4	92.4	92.4
Difference	-6.1	-12.3	-12.3	-12.3	-12.3
Difference as % of Supply	-7%	-15%	-15%	-15%	-15%
Difference as % of Demand	-7%	-13%	-13%	-13%	-13%

Table Notes:

1. The multiple dry-years shown in this table reflect years 2-6 of the SFPUC's 8.5 year design drought. It is assumed that in year 1 of the design drought there are no delivery reductions and full deliveries are made.

Table 14B
Projected Multiple Dry Year Water Supply and Demand Comparison 2011-2015 (mgd/Yr)
San Francisco Retail

Supply/Demand	Year[1] 2011	2012	2013	2014	2015
Supplies					
SFPUC System Supply	88.5	82.4	82.4	76.3	76.3
Existing Groundwater	3.5	3.5	3.5	3.5	3.5
Total	92.0	85.9	85.9	79.8	79.8
Potential New Sources Not Utilized					
Potential Groundwater	*2.0*	*2.0*	*2.0*	*2.0*	*2.0*
Potential Recycled Water	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*
Potential Conservation	*3.1*	*3.1*	*3.1*	*3.1*	*3.1*
Demand					
San Francisco Retail	92.0	92.0	92.0	92.0	92.0
Supply and Demand Comparison					
Supply Totals	92.0	85.9	85.9	79.8	79.8
Demand Totals	92.0	92.0	92.0	92.0	92.0
Difference	0.0	-6.1	-6.1	-12.2	-12.2
Difference as % of Supply	0%	-7%	-7%	-15%	-15%
Difference as % of Demand	0%	-7%	-7%	-13%	-13%

Table Notes:

1. The multiple dry-years shown in this table reflect years 2-6 of the SFPUC's 8.5 year design drought. It is

assumed that in year 1 of the design drought there are no delivery reductions and full deliveries are made.

Table 14C
Projected Multiple Dry Year Water Supply and Demand Comparison 2016-2020 (mgd/Yr)
San Francisco Retail

Supply/Demand	Year[1] 2016	2017	2018	2019	2020
Supplies					
SFPUC System Supply	88.4	82.3	82.3	82.3	82.3
Existing Groundwater	3.5	3.5	3.5	3.5	3.5
Total	91.9	85.8	85.8	85.8	85.8
Potential New Sources Not Utilized					
Potential Groundwater	*2.0*	*2.0*	*2.0*	*2.0*	*2.0*
Potential Recycled Water	*4.1*	*4.1*	*4.1*	*4.1*	*4.1*
Potential Conservation	*3.7*	*3.7*	*3.7*	*3.7*	*3.7*
Demand					
San Francisco Retail	91.9	91.9	91.9	91.9	91.9
Supply and Demand Comparison					
Supply Totals	91.9	85.8	85.8	85.8	85.8
Demand Totals	91.9	91.9	91.9	91.9	91.9
Difference	0.0	-6.1	-6.1	-6.1	-6.1
Difference as % of Supply	0%	-7%	-7%	-7%	-7%
Difference as % of Demand	0%	-7%	-7%	-7%	-7%

Table Notes:

1. The multiple dry-years shown in this table reflect years 2-6 of the SFPUC's 8.5 year design drought. It is assumed that in year 1 of the design drought there are no delivery reductions and full deliveries are made.

Table 14D
Projected Multiple Dry Year Water Supply and Demand Comparison 2021-2025 (mgd/Yr)
San Francisco Retail

Supply/Demand	Year[1] 2021	2022	2023	2024	2025
Supplies					
SFPUC System Supply	88.6	82.5	82.5	76.4	82.5
Existing Groundwater	3.5	3.5	3.5	3.5	3.5
Total	92.1	86.0	86.0	79.9	86.0
Potential New Sources Not Utilized					
Potential Groundwater	*2.0*	*2.0*	*2.0*	*2.0*	*2.0*
Potential Recycled Water	*4.1*	*4.1*	*4.1*	*4.1*	*4.1*
Potential Conservation	*4.2*	*4.2*	*4.2*	*4.2*	*4.2*
Demand					
San Francisco Retail	92.1	92.1	92.1	92.1	92.1
Supply and Demand Comparison					
Supply Totals	92.1	86.0	86.0	79.9	86.0
Demand Totals	92.1	92.1	92.1	92.1	92.1
Difference	0.0	-6.1	-6.1	-12.2	-6.1
Difference as % of Supply	0%	-7%	-7%	-15%	-7%
Difference as % of Demand	0%	-7%	-7%	-13%	-7%

Table Notes:

1. The multiple dry-years shown in this table reflect years 2-6 of the SFPUC's 8.5 year design drought. It is assumed that in year 1 of the design drought there are no delivery reductions and full deliveries are made.

Table 14E
Projected Multiple Dry Year Water Supply and Demand Comparison 2026-2030 (mgd/Yr)
San Francisco Retail

	Year[1]				
Supply/Demand	**2026**	**2027**	**2028**	**2029**	**2030**
Supplies					
SFPUC System Supply	89.1	82.9	82.9	76.8	76.8
Existing Groundwater	3.5	3.5	3.5	3.5	3.5
Total	92.6	86.4	86.4	80.3	80.3
Potential New Sources Not Utilized					
Potential Groundwater	*2.0*	*2.0*	*2.0*	*2.0*	*2.0*
Potential Recycled Water	*4.1*	*4.1*	*4.1*	*4.1*	*4.1*
Potential Conservation	*4.4*	*4.4*	*4.4*	*4.4*	*4.4*
Demand					
San Francisco Retail	92.6	92.6	92.6	92.6	92.6
Supply and Demand Comparison					
Supply Totals	92.6	86.4	86.4	80.3	80.3
Demand Totals	92.6	92.6	92.6	92.6	92.6
Difference	0.0	-6.2	-6.2	-12.3	-12.3
Difference as % of Supply	0%	-7%	-7%	-15%	-15%
Difference as % of Demand	0%	-7%	-7%	-13%	-13%

Table Notes:

1. The multiple dry-years shown in this table reflect years 2-6 of the SFPUC's 8.5 year design drought. It is assumed that in year 1 of the design drought there are no delivery reductions and full deliveries are made.

Section 8: Water Demand Management Measures

This section provides a description of the SFPUC's water demand management measures, including those currently being implemented or scheduled for implementation.

8.1 Introduction

San Francisco and its customers have a proven record of commitment to demand-side management programs. This commitment was demonstrated early on, with the inauguration of high bill inspections in 1928, and continues today with the SFPUC's recent receipt of the award for "Best Conservation Program-Large Utility" by the California Municipal Utilities Association (March 2000).

San Francisco's per capita water use has dropped by about one-third as a result of conservation programs. The first substantial decrease came following the 1976-77 drought in which gross per capita water use dropped from 160 to 130 gpcd. And despite continuous growth in San Francisco since then, water demands have remained lower than pre-drought levels.

A second substantial decrease in water use within San Francisco occurred as a result of the 1987-92 drought when a new level of conservation activities resulted in further water use savings. It is anticipated that through the continuation and expansion of these programs, per capita water use will continue to decrease into the future. Current gross per capita water use within San Francisco is 112 gallons per capita per day (gpcd) with residential water use calculated to be approximately 62 gpcd, the lowest use of any major urban area in the state.

The following provides a discussion of San Francisco's demand management programs, which range from financial incentives for plumbing devices to improvements in the distribution efficiency of the system.

8.2 Distribution Efficiency

An efficient distribution system is a key factor in ensuring efficient water use. The difference between the amount of water produced or purchased by an agency and the amount recorded as sold at customers' meters is referred to as unaccounted for water. Some amount of loss in distribution is unavoidable -- due to necessary, but un-metered uses such as fire fighting, main flushing, and storage facility cleaning. However, a portion of a system's losses can be controlled.

San Francisco has an ongoing program to minimize the loss of water within its distribution system. Measures include regular investments in replacement of old, leak-prone mains with new pipe, systematic leak detection programs and regular meter calibration and repair programs. The result of these activities is a reduced unaccounted for water level within San Francisco -- of approximately six to nine percent of total water production.[22] Additional activities associated with monitoring and controlling water losses are discussed later on in this section (refer to BMP 3).

[22] The American Water Works Association industry standard for system losses is 10 percent.

8.3 Demand Management BMPs

The conservation programs implemented by the SFPUC are based on the California Urban Water Conservation Council's (CUWCC) list of 14 Best Management Practices (BMPs) identified by signatories of the *Memorandum of Understanding Regarding Urban Water Conservation in California* (MOU) in 1991. The SFPUC is one of the original signatories to the MOU. Almost fifteen years in the making, the MOU is a unique achievement in the field of water conservation.

The BMPs identified in the MOU describe actions and activities that encourage water conservation and are a result of balanced collaboration of urban water agencies, public interest organizations and private entities.[23] The MOU recognizes the evolutionary nature of water conservation measures and makes provisions for the removal or addition of BMPs as the technical and economic reasonableness of measures are determined.

The current BMPs are:

1. Interior and Exterior Water Audits and Incentive Programs for Single Family Residential and Multi-Family Residential Customers
2. Residential Plumbing Retrofit
3. System Water Audits, Leak Detection and Repair
4. Metering With Commodity Rates For All New Connections And Retrofit Of Existing Connections
5. Large Landscape Conservation Programs and Incentives.
6. Horizontal Axis Washer Rebate Programs
7. Public Information
8. School Education Programs
9. Commercial, Industrial and Institutional Water Conservation
10. Wholesale Agency Assistance Programs
11. Conservation Pricing
12. Conservation Coordinator
13. Water Waste Prohibition
14. Residential ULFT Replacement Programs

The MOU also created the California Urban Water Conservation Council (CUWCC) which is charged with certain responsibilities and authorities, including but not limited to recommending study methodologies for BMPs, collecting and summarizing information on implementation of BMPs and making annual reports to the State Water Resources Control Board. The SFPUC has been an active member of CUWCC throughout its existence, currently serving as Vice-Convener of the Steering Committee.

Signatories of the MOU are required to submit bi-annual reports to CUWCC outlining progress toward implementing the BMP process. San Francisco's 2004 bi-annual report to CUWCC, which satisfies portions of the Urban Water Management Planning Act, is incorporated in this Urban Water Management Plan by reference.

A summary of San Francisco's progress with the BMPs is provided in this section. The current BMP activity and coverage reports submitted by the City to CUWCC are provided in Appendix D. Future planned activities and programs of SFPUC's retail water conservation program are presented in Section 8.5.

BMP 1 -- Interior and Exterior Water Audits for Single Family and Multi-Family Customers

San Francisco has provided a water audit program to the residential accounts since the 1920s focusing on the identification and repair of leaks, as well as promoting any ongoing rebate programs for efficient fixtures. As incentive, bill adjustments are provided to customers who repair leaks that have resulted in high water bills. Since 1988, San Francisco has conducted water audits on almost 36,000 out of 108,000 single-family accounts and 54,000 out of 228,000 multi-family accounts, accounting for 22 and 24 percent of the respective housing populations.

San Francisco's program specifically targets the top 20 percent of water users in the single and multi-family residential sector. Customers on the list are notified by letter and encouraged to take advantage of the free water audit program.

The audits are conducted by the SFPUC's Water Conservation Inspectors and are free of charge to customers. During the audit, the inspector monitors the site's meter, laundry area, water heater, plumbing fixtures and landscape if applicable. Depending on the size of the building, the inspector will then typically inspect 25-50 percent of all of the building's apartments or flats to identify additional leaks.

Multi-family accounts that purchase four or more toilets from the SFPUC or that have purchased four or more toilets through the rebate program also receive a conservation audit to ensure that the fixtures have been installed.

For each site, the inspector will create a checklist on needed repairs and give a copy of the checklist to the owner or manager. A formal written report is then returned to the owner or manager. At the request of the customer, the inspectors will mark the building's water shut-off valve with a plastic tag to improve its visibility in case of an emergency.

The SFPUC alternates its water audit targets throughout the year between single-family, multi-family, and commercial accounts therefore certain customer classes may receive disproportionately more (or less) audits during the year. For example, in reporting period 2003-04, the SFPUC did not meet the BMP defined target of 20% for audits on multi-family accounts because the focus for most of the year was on single-family customers. However the program has already met the 10-year BMP goal for both single and multi-family accounts.

[23] Voting is balanced between water agencies and public interest groups. Private entities do not have voting rights.

BMP 2 -- Residential Plumbing Retrofit

Beginning with the adoption of *Ordinance 392-90*[24] in December 1990, San Francisco began efforts to require customers to install water-conserving devices. This ordinance changed San Francisco plumbing codes to require all new buildings (and all buildings in which the water drainage system is substantially altered modified or renovated) to retrofit toilets and urinals with fixtures using no more than 1.6 gallons per flush (gpf) and 1 gpf, respectively.

San Francisco followed the "new construction" ordinance with a series of additional ordinances, which address conservation within existing dwellings. In May and September 1991, San Francisco adopted *Ordinance 185-91* and *Ordinance 346-91*[25]*.* Collectively these ordinances require water conservation device retrofits within multi-family and single-family residential buildings upon sale, transfer of title, or major improvement to a dwelling. Those that have installed efficient devices are eligible for a lower water rate to further encourage conservation. Retrofit requirements include:

- Installation of Showerheads with a capacity not exceeding 2.5 gallons per minute,
- Installation of aerators attached to sinks and basins where possible, and
- Installation of flush reducers, flow restrictors, volume reducers, or toilets with a capacity not exceeding 3.5 gpf.

The SFPUC is currently working on updating the ordinances, reducing toilet flush volume to 1.6 gpf from the current 3.5 gpf.

Ordinance 359-91[26], passed in September 1991 required the same plumbing retrofit requirements for commercial buildings, including tourist hotels and motels.

BMP 3 -- System Water Audits, Leak Detection and Repair

Retail Service Area: Unaccounted for water losses are common in water delivery systems and are generally defined as the difference between the amount of water produced or purchased by an agency and the amount recorded as sold at customers' meters. Some amount of loss in distribution is unavoidable due to necessary, but un-metered uses such as fire fighting, main flushing, and storage facility cleaning. A portion of a system's losses, however, can be controlled, such as from leaks, breaks or overflows. Therefore, water loss can be broken into two key components – apparent losses and real losses. Apparent losses include potential inaccuracies associated with metering, data handling, water bill estimating and water theft. Real losses are physical losses, which include things such as leaks, breaks and overflows.

San Francisco has an ongoing program to minimize the loss of water within its distribution system. Measures include regular investments in replacement of old, leak-prone mains with new pipe, systematic leak detection programs and regular meter calibration and repair programs. Since the 1970s, San Francisco has implemented system-wide leak inspection and repair programs to reduce distribution system losses. Beginning in 1990, an innovative leak inspection program was

[24] San Francisco Plumbing Code sections 905 and 1001.1
[25] San Francisco Housing Code, Chapter 12A, Section 12A01-12A14
[26] San Francisco Building Code, Chapter 53B, Sections 53B01-53B15

instituted using advanced pitometer measurements and system zone analysis which involved manually sounding water mains to identify leaks. Zones for inspection were selected for evaluation by factors including age of the water mains, results of previous measurements and the time since last evaluation.

More recently, San Francisco has enhanced its ability to identify leaks within its distribution system through the use of Permaloggers, which are devices that electronically "listen" for leaks. The Permaloggers are being used in coordination with the regular unidirectional flushing program (system flushing), allowing them to be installed efficiently in the main valves after they have been cleaned in preparation for flushing. The program began in January of 2005 and during the first six months of the new program 60 miles of the 1,200 mile distribution system has been evaluated.

The result of these activities has been a reduced unaccounted water level within San Francisco – of approximately six to nine percent of total water production. The SFPUC currently estimates its system water losses to be around 7.3 mgd (or about 9.6% of the City metered use or 8.8% of the total water delivered to the City). This figure is a rough estimate based only on review of historical deliveries within the SFPUC and conveyance metering records for the water system. Consequently, it is difficult to use this existing information to determine how well the system is performing or where there is true potential for lowering system losses (real losses) or capturing related losses in revenue (apparent losses).

While current SFPUC operations include the activities described above to minimize water losses, currently San Francisco is not in compliance with BMP 3. Therefore, the SFPUC is preparing to carry out a formal auditing project which will effectively identify, quantify, monitor, and control water losses. In order to ensure accountability and efficient operation of the water system, this project will entail the following components:

- Converting existing water audit data to the new recognized, approved, and standardized American Water Works Association (AWWA) best practice water balance, which is specifically designed to promote reliable water use tracking and control unnecessary water and revenue loss in drinking water utilities; this step will ensure accountability and efficient operation of the water system; and

- Field verification and testing to ensure the accuracy of data (consumption volume, etc.) entered into the system.

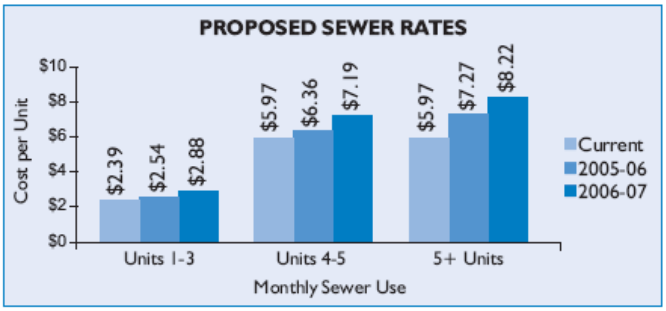
The audit will determine the types of losses in the SFPUC system, evaluate the economic viability of capturing these losses, and eventually implement the tools necessary to reduce the losses. Once this evaluation has been completed, San Francisco will be in compliance with this BMP.

Wholesale Customer Service Area: The SFPUC initiated a Pipeline Inspection Program in the early 1990s on its RWS 's 350 miles of water transmission lines. Routine inspections are considered preventative maintenance measures, but they also provide information on pipeline leaks. These inspections are usually conducted year-round with no more than one section of a major pipeline out of service at any time. The Pipeline Inspection Program is designed over a 20-year period and then repeats. The SFPUC has a goal to inspect one section per quarter (4/yr). These sections average 4-6 miles each. Technically, the regional system does not have any distribution system components, only transmission system components. Staff performs meter calculations that estimate the leakage rate by comparing customer usage, plant production and

water crossing the San Francisco County line.

BMP 4 -- Metering with Commodity Rates for All New Connections and Retrofit of Existing Connections

Retail Service Area: All of San Francisco's retail customers have been metered since 1916, and are billed by volume for both water and sewer use. On July 1, 2005, the SFPUC implemented a tiered sewer rate structure that promotes conservation by sending appropriate price signals.



As shown in the chart above, for Fiscal Year 2006, the residential sewer rate is $2.54 per Ccf for the first 3 Ccf of sewer discharged per dwelling unit, $6.36 per Ccf for the next 2 Ccf of sewer discharged per dwelling unit, and $7.27 per Ccf for all remaining usage. Non-residential sewer rates vary by the level of pollutants in the sewage discharged; the more polluted the sewage, the higher the sewer service charge per Ccf.

The SFPUC will be introducing a similar tiered conservation structure for water rates. Currently, the SFPUC is bound by Proposition H, passed in 1998, which restricted the SFPUC's ability to increase or restructure water rates. Proposition H expires in 2006 and until the statutory context permits restructuring of the water rates, the SFPUC will continue to use a uniform volumetric charge for water. For Fiscal Year 2006 (July 1, 2005 - June 30, 2006), the water rate is $1.71 per Ccf of metered water use. In addition, all water customers are charges a monthly service fee that varies based on tap size, from $4.60 per month for most residential taps to $544.40 per month for very large taps.

While a tiered conservation rate structure for water rates is not yet in place, San Francisco does currently use conservation pricing to promote the installation of efficient plumbing fixtures by retail customers. Customers who have retrofitted their plumbing fixtures, and filed an affidavit to that effect, are charged 50% less than those that have not.

Wholesale Customer Service Area: The SFPUC has no legal authority to require meters within its wholesale customers' retail service areas.

BMP 5 -- Large Landscape Conservation Programs and Incentives

San Francisco has a large landscape conservation program, which targets commercial, industrial, residential and governmental water users irrigating three acres or more. San Francisco requires separate meters on all irrigated park areas, median traffic strips, landscaped public areas, landscaped areas surrounding multi-residential and commercial developments, and industrial

parks. Under current accounts, about 3 percent of San Francisco's water use is for irrigation. To promote efficient water use in new and renovated landscaping, *Ordinance 92-91*[27] was passed in 1991. The ordinance applies to any new commercial, governmental or residential (two or more units) building on a lot exceeding 3,500 square feet with a landscaping area of more than 1,000 square feet. The ordinance requires that the Conservation Administrator approve landscape, irrigation, and soil amendment plans prior to having the meter approved for installation.

The specific requirements of the ordinance include:

- Total area devoted to turf grass; decorative water use and water intensive planting must be limited to 15% of the parcel area. The limitation does not apply to children's play areas, public recreation areas or other such areas.
- Strips of turf less than 8 feet wide are prohibited.
- Water intensive plants must be grouped together and must be irrigated on a separate cycle from turf grass.
- Slopes exceeding 10% adjacent to the hardscape cannot consist of turf grass.
- All large areas must have separately metered irrigation systems.
- Valves and circuits shall be separated based on water use and must be set to operate between 5 p.m. and 10 a.m.
- A soil analysis must be done on the soil used for the landscape. A report specifying how the soil deficiencies will be meet must accompany the application for the meter.

Revised in September 2000, the ordinance further requires that any commercial meter application with a landscape of more than 1,000 square feet must also meet the same requirements.

The SFPUC ensures compliance with the ordinance by reviewing the applicant's landscape and irrigation plans as well as the soil analysis, and an applicant's plans for meeting any deficiencies identified in the soil analysis. If the plans do not meet the requirements of ordinance, the applicant is required to change the landscaping plans.

Irrigation surveys have been conducted for all of San Francisco's large irrigation accounts in order to establish a voluntary water budget account included on each water bill. The large irrigation accounts, are predominantly owned and operated by the National Park Service and the San Francisco Department of Recreation and Parks. Many of the large irrigation customers have several irrigation accounts, for example Golden Gate Park and McLaren Park. Initial surveys for all large irrigation accounts were conducted between 1992 and 1995. Follow-up surveys generally occur on a biennial cycle. In FY 98-99 and 99-00, the Conservation Inspectors completed 1,565 inspections on SFWD's 1,200 irrigation accounts. During the audit, the inspector surveys the irrigation system to identify inefficient water application and leaks in the system.

The San Francisco Water Department also prints out an irrigation budget based on the account's landscape size and the evapotranspiration (Eto) for all of its 1,200 irrigation accounts on their monthly meter bills. A bill message alerts the customer when they have exceeded their budget and indicates their water budget for the next billing period.

[27] San Francisco Administrative Code, Chapter 63, 63-63.11

BMP 6 -- Horizontal Axis Washer Rebate Program

In 1999, the SFPUC began a $75 washer rebate program for its residential customers, current rebates range from $100 to $200, depending on size and efficiency of the machine. Four hundred rebates were distributed during 1999. In 2004, the program was expanded to include commercial customers. To date, the SFPUC has rebated over 3,000 washers. The SFPUC is meeting the coverage requirements for BMP 6.

BMP 7 -- Public Information

Retail Service Area: San Francisco promotes water conservation through a variety of outreach efforts including brochures, public service announcements, radio spots, newspaper ads, bus interior posters, bill inserts, direct mailings, "attention-getters", presentations and bill messages.

In addition to the brochures listed above, San Francisco has developed and maintains numerous other publications for public distribution, such as these which are currently available:

- Installing Retrofit Devices
- Apartment Residents, If You Don't Think You're Paying for Water…. Then you're all wet.
- Water Conservation Checklist (English and Chinese)
- Water-wise Gardening Basics
- Water-Wise Plants
- How to Read Your Water Meter
- Use Your Meter to Check for Leaks
- Maintaining an Irrigation System
- Free Water Conservation Checkup
- Installing a Water Efficient Toilet (English, Chinese, Spanish)
- Fixing a High Water Level in Toilet Tank
- Testing for Leaks
- Basic Toilet Assemblies
- Home Composting
- Fertile Soil
- What To Do About Weeds
- S.F. Water…. Too Good To Waste (bumper sticker)
- SAVE WATER SAVE MONEY: Cash rebates, free fixtures and water saving tips for home and business.
- How to Look Good to Your Boss
- Water Conservation starts with you. Be a Water Wise Tenant
- Toilets: Save Water and Money with today's High-efficiency Models
- Clothes Washing Machines: Clean Up on Saving with Today's High Efficiency Models
- Shutting Off Water in an Emergency
- Toilets 101
- Receive Hundreds Of Dollars In Rebates And Save On Your Bills When You Install New Water-Smart Appliances In Your Home Or Business (in English, Chinese, Spanish.)

- Native Plant Gardening
- Your SFPUC Bill Has a Brand New Look!
- Being Green Can Help Your Business Stay In The Black
- 2005-06 Water and Wastewater Rates (provided in English, Spanish and Chinese)
- CAP Discount Now 35% (Community Assistance Program)
- SFPUC Public Service Numbers
- Water Conservation Starts At Home (Magnet)
- SFPUC Hetch Hetchy Water System (poster)
- Hetch Hetch Water System (cartoon poster)
- San Francisco Water System (cartoon poster)
- San Francisco Urban Water Cycle

For several years, San Francisco has marketed its "Toilets for $10" program which includes distributing 100,000 door hangers; acquiring radio spots in Cantonese, Spanish, Japanese and English; printing newspaper ads in English, Spanish, Chinese, Russian and German; mounting interior bus shelter posters; distributing 200,000 direct mailers each year; providing bill inserts and doing presentations on radio talk shows in English, Spanish and Cantonese. Today, San Francisco offers a two-tier rebate structure for low-volume flush toilets. San Francisco offers $25 rebates for ultra low flow toilets (1.6 gallon per flush toilets) and $125 rebates for high efficiency toilets or HETs (rated at about 1.0-1.2 gallon per flush). The goal is to catalyze a market transformation towards HETs which, unlike ULFTs, are not otherwise captured in the plumbing codes.

San Francisco has created videos available for free rental on how to install toilets and lead-free faucets in English, Spanish and Cantonese. The City has also been reaching the public directly through its billing process. On each bill, the account's current average daily water use is shown in comparison to its water use during the same period of the previous year. The bill also provides helpful water-saving tips for home and business owners. This information is helpful for the public to recognize their water use trends and alert them to any significant leakage issues.

Wholesale Customer Service Area: The SFPUC provides technical and administrative assistance for public information to its wholesale customer agencies, as requested. In addition, the SFPUC completed a series of comprehensive water demand and conservation potential studies with its wholesale customers in the Fall of 2004. These conservation studies evaluated the cost-effectiveness of 32 conservation measures and the resulting water savings potential for each individual wholesale customer. These studies provided informative and educational data for the wholesale customers about water conservation measures and associated water savings (Refer to Section 8.4.2 for further details).

The SFPUC has also been active in many regional activities to promote water conservation in the Bay Area. Currently, the SFPUC, in conjunction with BAWSCA, and several other Bay Area water agencies have prepared a Prop 50 implementation grant proposal for regional water conservation activities, including public information and outreach in the Bay Area.

BMP 8 -- School Education Programs

Retail Service Area: San Francisco works with the San Francisco Unified School District's Environmental Education Program, offering presentations to teachers and approximately 12,000 students each year about water and other environmental issues. San Francisco also makes presentations each year on how San Francisco gets its water, the water cycle and careers within the Water Department. In addition, the SFPUC has created a two-piece map series of the Hetch Hetchy/Peninsula Water Supply System and San Francisco's Water Distribution System for teachers of upper elementary grades. The SFPUC has also provided support and funding to teacher training programs that include a water conservation element in the curriculum.

For over ten years, San Francisco has sponsored a calendar contest for third, fourth, fifth and sixth graders. Following the California Water Awareness Month's theme, the contest encourages students to think about water conservation. The winning entries are showcased as a wall calendar.

Wholesale Customer Service Area: The SFPUC is available to provide technical and administrative assistance for school education to its wholesale customer agencies, as requested. In several instances, the SFPUC has provided information packets on the SFPUC water system to wholesale customers for inclusion in their school education programs.

BMP 9 -- Commercial, Industrial and Institutional Water Conservation

The SFPUC is meeting the coverage requirements for BMP 9. Similar to the single-family audit program, San Francisco has offered a commercial and industrial audit program to identify and repair leaks. Since 1989, the SFPUC has conducted conservation audits on almost 13,000 Commercial, Industrial and Institutional (CII) accounts.

San Francisco's municipal and industrial water use audit program includes the review of the following items when applicable: plumbing fixtures, cooling towers, meter(s), laundry facilities, kitchens, restrooms, boilers and landscape. In 1998 and 2000 San Francisco targeted the top 20 percent of its commercial and industrial accounts to participate in the conservation audit program. These large commercial and industrial customers received a letter informing them of their high use status and encouraging their participation for a free audit.

In 1999, the SFPUC worked with San Francisco's Department of the Environment to pass an ordinance, *Ordinance 148-99*[28], requiring all municipal buildings to replace their water-inefficient toilets with 1.6 gallons per flush toilets and showerheads with 1.5 gallons per minute showerheads. In July 1999, the San Francisco Board of Supervisors passed an ordinance requiring that all municipal buildings be in compliance with the requirements by June 6, 2005.

The ordinance also requires monitoring to ensure progress of the City departments on these two goals. San Francisco owns approximately 2,200 buildings that have 9,900 toilets and 1,000 showerheads. To gauge the progress of the ordinance, the Water Department conducted 271 inspections on City department municipal accounts. Approximately 98 percent of all municipal buildings in San Francisco have been retrofitted with the required plumbing fixtures.

New Commercial and Industrial Water Use Review: Before receiving a certification of occupancy, all new commercial and industrial buildings must have an inspection by an inspector from the Department of Building Inspection that includes verification of water-efficient plumbing, recirculating cooling towers and other water efficient plumbing fixtures.

BMP 10 -- Wholesale Agency Assistance Programs

The SFPUC has a long-term Master Water sales contract with its wholesale customers. Under the terms of this contract, the SFPUC cannot provide direct financial assistance for conservation programs to a wholesale customer and subsequently add this expense to the suburban wholesale rate base for that year. The SFPUC can provide staff to assist wholesale customer conservation efforts and through agreement with the Bay Area Water Supply and Conservation Agency can develop service-area wide conservation programs that can be funded as a joint expense by its retail and wholesale customers. For example, the SFPUC has worked to provide the following technical and administrative assistance to its wholesales customer agencies:

- In FY 2003-2004, the SFPUC participated in the CUWCC Pre-Rinse Spray Valve Program. The SFPUC administered the program on behalf of its wholesale customer agencies that chose to participate. In FY 04-05, the SFPUC and BAWSCA entered into a Memorandum of Understanding (MOU) regarding the administration of the program. Through this MOU, SFPUC and BAWSCA work cooperatively to offer and coordinate installation of water conserving spray valves to food service providers in the SFPUC retail and BAWSCA member service areas.
- In Fall 2004, the SFPUC completed a series of comprehensive water demand and conservation potential studies with its wholesale customers.[29] (Refer to Section 8.4.2 for further details).
- In 2005, the SFPUC has been coordinating with it wholesale customer agencies to identify additional conservation, recycled water and renewable groundwater within the SFPUC service area. This effort will build upon the Fall 2004 wholesale conservation and retail conservation studies and is being performed as part of the alternative analysis needed for the WSIP PEIR.

BMP 11 -- Conservation Pricing

Retail Service Area: For many years, San Francisco has used conservation pricing as an incentive to conserve water. To promote the installation of efficient plumbing fixtures, San Francisco implemented an incentive rate structure for its retail customers. Customers who have retrofitted their plumbing fixtures, and filed an affidavit to that effect, are charged 50% less than those that have not.

In addition to unit rate charges, San Francisco addresses water use violations through its rate schedule. Violations of any water use restriction may result in the discontinuance of water service or the installation of flow restricting devices. The costs of these actions are borne by the customer.

On March 22, 2005, the SFPUC adopted a new conservation rate structure for sewer rates in which low levels of sewer use (0-3 units) are charged at a low rate, additional sewer use (4-5 units) is charged a higher rate, and high levels of sewer use (5+ units) are charged a higher rate.

[28] San Francisco Administrative Code, Chapter 82, Section 4.
[29] *Wholesale Customer Water Conservation Potential Technical Report* (URS, Dec.2004).

In 1998, voters approved Proposition H, which, among other things, restricted San Francisco's ability to restructure water rates; currently, San Francisco is only allowed to apply the conservation rate structure to sewer rates, not water rates. Proposition H expires in 2006, and San Francisco anticipates implementing a conservation rate structure for water rates as soon as the statutory context allows.

Conservation staff are working with SFPUC Customer Services and Communications to include information on customer bills which would provide addition information such as: "if you conserved X gallons you would save $Y."

Wholesale Customer Service Area: The SFPUC's wholesale rate structure complies with conservation pricing principles and is designed to recover the cost of providing service. Billing is based on meter readings, and utilizes an uniform rate structure. In addition, the SFPUC utilizes excess use surcharges during drought periods.

BMP 12 -- Water Conservation Coordinator

Retail Service Area: San Francisco hired its first full-time water conservation administrator in 1986. The Water Conservation Section of SFPUC has five full-time positions: the Conservation Administrator, two Inspectors, Water Conservation Clerk and a Toilet Rebate Coordinator.

The Conservation Section also uses high school interns. Working with the Mayor's Youth Works program, Vietnamese Youth Development Center and the Chinese Youth Development Center, the Conservation Section trains 2-3 interns each spring and fall and another 1-2 interns in the summer.

Wholesale Customer Service Area: In early 2000, the SFPUC instituted a wholesale conservation coordinator position. In 2005, the retail conservation and wholesale conservation programs were consolidated under a single conservation coordinator position.

BMP 13 -- Water Waste Prohibition

In Section D of the SFPUC's Rules and Regulations for Water Service there is a provision regarding water waste prohibition. During the 1987-92 drought, San Francisco enacted numerous water use restrictions and prohibitions in response to the severe water shortage. These measures are discussed in the Water Shortage Contingency Planning section of this report. With the ending of the drought in 1993, San Francisco decided to continue certain water use restrictions in furtherance of a long-term conservation program. These measures are listed below and included in Section D of the SFPUC's Rules and Regulations for Water Service:

- Avoid water waste, including but not limited to flooding or runoff into the sewers or gutters.
- Hoses used for any purpose must have positive shutoff valves.
- Restaurants shall serve water to customers only upon request.
- Decorative fountains must recycle water.
- Use of potable water for consolidation of backfill, dust control or other non-essential construction purposes is prohibited if other sources such as groundwater or reclaimed water are available and approved by the Department of Health.
- Water used for all cooling purposes and commercial car washes must be recycled.

Violation of any water use restriction may result in the installation of a flow-restricting device in the service line of the customer. Continued violation could result in termination of service. The customer bears the cost of any enforcement action.

BMP 14 -- Ultra Low Flush Toilet Replacement Program

San Francisco established a highly visible Ultra Low Flush Toilet (ULFT) residential rebate program in 1995 providing a rebate of up to $50 per toilet. The rebate program, was expanded to include all non-residential customers in 2003, and in 2005, the rebates were tiered to provide higher rebates of $125 for High Efficiency Toilets (HET). San Francisco has replaced 30,000 toilets since the rebate program's inception.

For many years, San Francisco also offered high quality, water efficient toilets for only $10 to its residential customers each spring. This program, referred to as "toilets for $10" has replaced over 30,000 toilets. This program in combination with the ULFT rebate program has been successful in replacing 12 percent of residential toilets in the City.

The "Toilets for $10" program engages community groups and high schools in the transfer of the toilets to the intended customer. Through their help the volunteer group receives $4 per toilet. In 1999, San Francisco was awarded "Best Community Partnership" from the California Water Awareness Campaign for this program.

Today San Francisco offers a two-tier rebate structure for low-volume flush toilets. San Francisco offers $25 rebates for ultralow-flush toilets (1.6 gallon per flush toilets) and $125 rebates for high efficiency toilets or HETs (rated at about 1.0-1.2 gallon per flush). The goal is to catalyze a market transformation towards the more efficient HETs, which, unlike ULFTs, are not captured in the plumbing codes.

The SFPUC is developing a retrofit on resale ordinance requiring water conservation device retrofits within multi-family and single-family residential buildings as well as commercial buildings upon sale, transfer of title, or major improvement. This will accelerate the replacement of inefficient devices.

8.4 Beyond the BMP's

8.4.1 Spray Valve Replacement Program

Starting in October 2004, the SFPUC participated in the "Rinse and Save" pre-rinse spray valve replacement program administered by the CUWCC. Rinse and Save is a direct marketing program which replaces older model valves, which flow at about 3 to 6 gpm, with a 1.6 gpm device (Fisher model 2949). The device and installation are free of charge to the customer. Over 2,000 valves have been installed to date.

8.4.2 Regional Coordination on Demand Management

On an ongoing basis, the SFPUC seeks opportunities to work with BAWSCA and its member agencies, other water agencies, including the SCVWD, to leverage available resources. For example, in 2005, the SFPUC and BAWSCA entered into a Memorandum of Understanding (MOU) regarding the administration of a Spray Valve Installation Program. Through this MOU, SFPUC and BAWSCA work cooperatively to offer and coordinate installation of water conserving spray valves to food service providers in the SFPUC retail and BAWSCA member service areas.

Recently the Bay Area Efficient Clothes Washer Rebate Program, a single rebate program offered by all major water agencies in the greater Bay Area including BAWSCA and the SFPUC, was recipient of $1.5M in Proposition 50 grant funds for implementation as early as FY 2006/2007.
In Fall 2004, the SFPUC completed a series of comprehensive water demand and conservation potential studies with its wholesale customers. The conservation study evaluated the cost-effectiveness of 32 conservation measures and the resultant water savings potential for each individual wholesale customer. The study presented a range of potential for conservation savings in the SFPUC wholesale service area. The results of the study have been used by the SFPUC wholesale customers to develop future SFPUC purchase estimates and to design conservation program activities.

The SFPUC, BAWSCA and its member agencies are currently investigating opportunities for implementing regional conservation measures for the entire service area that look beyond local issues of supply and cost-effectiveness to examine costs, benefits and other related issues on a system-wide level. The goal is to maximize the efficient use of water regionally by capitalizing on variations in local conditions and economies of scale.

8.5 SFPUC's Planned Retail Water Conservation Program

Section 8.3 presented SFPUC's retail water conservation activities as they relate to the California Urban Water Conservation Council's (CUWCC) list of 14 Best Management Practices. This section presents the findings of a cost-benefit analysis completed by the SFPUC to identify the most appropriate and effective water conservation measures for future implementation in San Francisco. As a result of this analysis, the SFPUC has identified a package of conservation measures, also described below, that it plans to pursue for implementation.

8.5.1 Effectiveness of Water Conservation Measures

Per capita water use in San Francisco has been declining since the early 1980s and is one of the lowest in the region and the state.[30] Between 1994 and 2000 residential per capita water use has decreased from 74 gallons per capita per day (gpcd) to 62 gpcd. It is assumed that much of the decrease in per capita use is a result of San Francisco's long-term conservation programs and a change in water use habits. However, as detailed in this section, the SFPUC estimates that approximately 4.5 mgd of additional water conservation can be achieved by 2030 and San Francisco is currently working to further identify, quantify, and develop programs to capture these savings.

In 2004 the SFPUC utilized an end-use model to model water use in the City, based on customer type, demographic data, economic projections, water end use, and market penetration of various low volume plumbing fixture, among other things, in order to develop a long-term conservation program. The end-use based demand model examined water use characteristics in three sectors: single-family residential, multi-family residential, and non-residential (commercial, industrial and institutional or CII).

The SFPUC identified an extensive list of forty-eight different conservation measures by reviewing water conservation measures currently being implemented by the SFPUC and measures that other water agencies around the country have considered or are currently implementing. A screening process was then undertaken in which the water savings potential of each measure was

[30] Certain characteristics unique to the City, primarily its relatively low outdoor water use, factor into this comparison.

quantified, along with the cost and feasibility of implementation based on the service areas use patterns. Based on this benefit-cost analysis, the initial list of conservation measures was reduced to thirty-eight measures that were considered the most appropriate for San Francisco.
The thirty-eight water conservation measures that remained after the screening process were packaged into three distinct conservation program options (Packages A, B and C), each increasing in water savings potential. Table 15 below summarizes these findings:

TABLE 15
SFPUC Retail Conservation Packages – Evaluation Results

	Package A	***Package B***	***Package C***
Number of Conservation Measures Included in Package	12	32	38
Utility Cost of Water Saved ($/AF)	$325	$260	$255
Present value of Total Water Utility Costs thru 2030 ($1,000)	$6,901	$24,085	$25,663
Water Utility Benefit-Cost Ratio[1]	3.31	4.14	4.22
Expected Water Use Reduction by 2030	0.64 mgd	3.93 mgd	4.45 mgd

Source: *City and County of San Francisco: Retail Water Demands and Conservation Potential* Technical Report (Hannaford, 2004). [31]

***Table Notes*:**

1. Computation based on 26-year period; year 2005 through 2030.
2. Packages A, B, and C do not incorporate the savings generated by the natural replacement of plumbing fixtures in accordance with the existing plumbing code. These plumbing code savings are estimated at 10.3 mgd by 2030.

SFPUC will pursue the most aggressive conservation package identified (Package C) and has begun to implement the measures included in this package. In 5-year increments, the savings from this package of conservation measures is estimated as follows:

- Cumulative through Year 2010: 3.1 mgd
- Cumulative through Year 2015: 3.7 mgd
- Cumulative through Year 2020: 4.2 mgd
- Cumulative through Year 2025: 4.4 mgd
- Cumulative through Year 2030: 4.5 mgd

Appendix E contains detailed tables from the evaluation of the conservation measures included in Package C.

In this 2005 UWMP, as previously stated, water conservation has not been quantitatively applied to meet retail customer demand because, at this point in time, it has not been determined how these conservation savings will be used to benefit either the retail customers or the SFPUC Regional Water System. In the San Francisco Local Water Resources Study (SF LWRS), however, the SFPUC is using the estimated water savings of this more aggressive conservation package in its evaluation of water supply options for San Francisco.

[31] Some of the data in Table 15 differs slightly from the data presented in the source document cited (Hannaford, 2004). This is due to adjustments completed in the modeling after publication of the 2004 Technical Report. An errata sheet will be issued by the SFPUC in the near future.

The following section provides more detail on these conservation measures that the SFPUC will be pursuing in order to achieve the savings projected by the end-use model described above.

8.5.2 Conservation Measures for Future Implementation

The SFPUC has been implementing water conservation programs for its retail customers for over 20 years. These programs have historically been focused on residential fixture replacement, primarily showerheads, ultra low flow toilets and efficient clothes washers, and conservation inspection programs. Current SFPUC programs also include offering of free low-flow spray valve devices and installation to all food service establishments and other expansions in the non-residential sectors. Additionally, the SFPUC is using rates to encourage efficient use -- a newly approved 3-tiered wastewater rate structure was approved in June 2005.

As describe in the previous section, in 2004 SFPUC conducted a detailed cost-benefit analysis in order to identify the most feasible and effective water conservation measures for San Francisco to pursue in the future. The study described water use in the City based on demographic data, economic projections, and water end use (how, why and where water is being used). The end-use model was then used to determine how the SFPUC could best promote more efficient use of water. Forty-eight conservation measures were identified, quantified for water savings, cost and feasibility of implementation. The results were used to choose and package the measures into three conservation program options (packaged), increasing in aggressiveness, cost and water savings. The SFPUC will pursue the most aggressive conservation package identified (Package C) and has begun to implement the measures identified in this package.

One of the main findings of the cost-benefit analysis completed in 2004 was that the SFPUC should direct more conservation programs toward non-residential (commercial, industrial and municipal) customers, which have historically not been the focus of the City's conservation efforts. Although non-residential accounts use slightly less water than residential customers, water use by this sector is projected to grow, while residential use is expected to remain relatively flat. Additionally, lack of focus on these customers to date means that the potential for efficiency improvements in this sector are greater.

The individual water conservation measures to be implemented are listed below, along with their planned implementation schedule. For a more detailed description of these measures, refer to Appendix E**.**

SINGLE-FAMILY RESIDENTIAL (RSF)

Washing Machines (RFS-1)	Rebates for 25 gallon per load machines (2005-2006) Rebates for 17 gallon per load machines (2005-2006) Rebates for 17 gallon per load machines (2007-2014)
Toilets (RFS-2)	Rebates for 6/3 dual flush or 4-liter toilets (2005-2014) Rebates 1.6 gallon per flush toilets (2005- 2007) Require 1.6 gal flush toilets be installed at the time of sale (2005-2030)
Public Information (RSF-3)	Public Information Program (2005-2030)
Water Surveys (RSF-5)	Water Surveys – indoor and outdoor (2005-2030)
Dishwashers (RSF-7)	Rebates for high efficiency dishwashers (2005-2014)

MULTI-FAMILY RESIDENTIAL (RMF)

Washing Machines (RMF-1)	Rebates for 25 gallon per load machines (2005-2006) Rebates for 17 gallon per load machines (2005-2006) Rebates for 17 gallon per load machines (2007-2014)
Toilets (RMF-2)	Rebates for 6/3 dual flush or 4-liter toilets (2005-2014) Rebates 1.6 gallon per flush toilets (2005- 2007) Require 1.6 gal flush toilets be installed at the time of sale (2005-2030)
Sub-metering Requirements for New Units (RMF-4)	Incentives for retrofitting sub-metering (2005-2014)
Water Surveys (RMF-5)	Water Surveys – indoor and outdoor (2005-2030)

NON-RESIDENTIAL (NR)

Landscape Audits (NR-1)	Landscape audits and financial incentives for irrigation upgrades (2005-2014)
Water Savings Awards (NR-3)	Award program for water savings by businesses (2005-2030)
Water Audit (NR-4)	Water Audits for non-residential accounts (2005-2030)
Urinals (NR-5)	Rebates for replacing high use commercial urinals with 0.5 gal/flush urinals (2005-2014) Require 0.5 gal/flush urinals in new buildings (2005-2030)
Toilets (NR-6)	Rebates 1.6 gallon per flush toilets (2005-2007)
Large Innovative Retrofit Incentives (NR-7)	Replace inefficient water using equipment (2007-2016)
Large New Project Incentives (NR-8)	Conservation incentives for new/proposed large non-residential projects (2007-2016)
Audits-Hospitals (NR-11)	Water audits for hospitals (2005-2014)
Audits-Laundry Self-serve Rebates (NR-12)	Offer incentives for replacement or lease of clothes washers in coin-operated laundries (2005-2010)
Audits-Schools and Universities (NR-13)	Provide water audits to schools and universities (2005-2010)
Audits-Schools and Universities Landscaping (NR-15)	Landscape audits and financial incentives for irrigation upgrades, schools/universities (2005-2014)
Low Flow Sprayers – Grocery/Flower (NR-18)	Grocery/Flower low flow spray rinse nozzles (2005-2009)
Low Flow Sprayers – Restaurants (NR-19)	Restaurant low flow spray rinse nozzles (2005-2009)
NR-19a Steamers – Restaurants (NR-19a)	Provide rebates for electric steam cookers to restaurants (2005-2009)
City/PUC Water Broom (NR-21)	Provide water brooms to City departments (2005-2009)
City/PUC Water Landscape (NR-21a)	Landscape audits and financial incentives for irrigation upgrades to all City departments (Years 2005-2014)
Water Broom (NR-22)	Provide water brooms to non-residential customers (Years 2005-2009)
NR-23 Audits-Hotel/Motels	Focused water audits for hotels/motels (Years 2005-2014)

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Section 9: Water Shortage Contingency Plan

This section presents the SFPUC's water shortage contingency plan and includes the following information:

- An overview of SFPUC's response to past water shortage experiences;
- A summary of the procedures for allocating reduced deliveries from the SFPUC RWS;
- A summary of San Francisco's retail plan for responding to water shortages; and
- An overview of San Francisco's preparation for a catastrophic interruption of water supply.

9.1 Introduction

Every water system has vulnerabilities in terms of its ability to provide a safe and reliable supply of water. Water shortages can occur in a number of ways. Very localized shortages can occur due to distribution system problems and system shortages may occur due to major facility failures. Yet, beyond system facility contingencies, there exists the potential vulnerability to drought, which limits the amount of water that is available over a series of years. This latter type of contingency is not necessarily caused by physical facility limitations. Within the last 15 years San Francisco has experienced both localized shortages due to earthquakes and system-wide shortages due to drought.

San Francisco's past experiences with water shortages, due to drought and earthquakes, have helped shape it's current plans and policies relative to water shortage preparedness and response:

- In 1987-92 San Francisco experienced a serious drought. This six year drought provides an example of how various stages of action were taken in times when the operational capabilities of Hetch Hetchy and other water supplies available to the SFPUC are taxed to a point that forces drastic actions to avoid running out of water.
- In 1989, San Francisco experienced the Loma Prieta earthquake. The SFPUC worked with the Mayor's Office of Emergency Response to reconnect service to those who were impacted by the earthquake. Most of the homes that lost water service were reconnected back to the water system's lines within 72 hours.

9.2 Management Response to Past Water Shortage Experiences

The 1987-92 drought illustrated the deficit between San Francisco's water supplies and its demands. Other than the 1976-77 drought, drought sequences in the past did not seriously affect the ability of the SFPUC to sustain full deliveries to its customers. As the SFPUC progressed into the drought and reservoir storage continued to decline, it became evident that full water deliveries could not be sustained without a risk of running out of water before the drought was over. This circumstance became a painful reality in early 1991 when the Hetch Hetchy Reservoir became so depleted (less than 25,000 acre-feet of storage in a reservoir with over 360,000 acre-feet of capacity) that minimum fishery releases and anticipated demands required the SFPUC to initiate programs to achieve a 45 percent reduction in system-wide water deliveries to balance water supplies with deliveries. Fortunately, unexpected runoff provided relief from the severity of that instance of water shortage; however, the drought was far from over. Appendix F provides a more

detailed summary of San Francisco's 1987-92 drought experience and the actions taken at the time.

The SFPUC could not know how severe the 1987-92 drought would become. However, by necessity the SFPUC operated under a general procedure relating water supply and deliveries. This procedure led to the implementation of water rationing. The procedure triggered different levels of rationing in relation to projected reservoir storage: less water in storage led to higher levels of rationing. The procedure was developed to protect water customers from being subjected to shortages in supply that could not be achieved by drought-related water demand reduction programs. The concept was to provide drought water delivery protection. That is, some level of assurance that water would be delivered continuously during drought.

SFPUC's response to water shortages also included adoption of new agreements regarding how water would be allocated in future drought periods, such as:

- The *Interim Water Shortage Allocation Plan* (IWSAP), adopted in 2000, which, among other things, provides a fair and reasonable method for allocating water between the SFPUC and its wholesale customers during times of system-wide shortages up to 20 percent due to drought; and
- The *Retail Water Shortage Allocation Plan* (RWSAP), adopted in 2001, which describes the measures that would be implemented by the City to reduce water use in San Francisco during a drought.

The IWSAP is discussed in greater detail in Section 9.3 and the RWSAP is discussed in greater detail in Section 9.4.

More recently, in January 2005, the SFPUC Commission recommended a policy that drought-related delivery reductions (rationing) should be considered when evaluating system performance in the Water System Improvement Program (WSIP). The Commission recommended a reliability goal of 80 percent, i.e., the customers would be subjected to water delivery shortages of no greater than 20 percent in any one year, assuming no drought occurred greater than the Design Drought. All planning currently being performed by the SFPUC related to the WSIP incorporates the Commission reliability objective of 80 percent. The WSIP PEIR will evaluate the impacts of this reliability goal while also evaluating the impacts of a reliability goal of 70 percent and 90 percent for comparison.

9.3 RWS Water Shortage Allocation Procedures

Interim Water Shortage Allocation Plan (IWSAP): The SFPUC can meet the demands of its retail and wholesale customers in years of average and above-average precipitation. In order to plan for any needed allocation of water from the RWS in dry years, the SFPUC and its wholesale customers negotiated an *Interim Water Shortage Allocation Plan* (IWSAP) which was adopted by the SFPUC in 2000. The IWSAP provides a fair and reasonable method for allocating water between the SFPUC and its wholesale customers (collectively) during times of system-wide shortages up to 20 percent due to drought. In addition to providing an allocation method, the plan also identifies conditions for both voluntary and mandatory rationing; provides for excess use charges; establishes a water bank for use during droughts; and provides for transfers of banked water.

Prior to the adoption of the IWSAP, allocation of water from the RWS between SFPUC retail

customers and wholesale customers collectively was based on the *Settlement Agreement and Master Water Sales Contract* (Master Contract), which allows the SFPUC to reduce water deliveries to wholesale customers during periods of water shortage. Under the current Master Contract, reductions to wholesale customers are to be based on each agency's proportional purchases of water from the SFPUC during the year immediately preceding the onset of shortage, unless this formula is supplanted by a water conservation plan agreed to by all parties. The Master Contract's default formula, because it was based on deliveries during the year immediately preceding the onset of the shortage, discouraged SFPUC's wholesale and retail customers from reducing purchases from SFPUC during periods of normal water supply through demand management programs or development of alternative supplies. The IWSAP somewhat addressed this issue by basing the allocation formula on the three immediate years preceding the shortage and allowing transfers of banked water credits (water within a drought allotment that is not used).

The IWSAP allocates water between San Francisco retail customers and the wholesale customer agencies collectively. The IWSAP distributes water between two customer classes based on the level of shortage:

Level of System Wide Reduction in Water Use Required	Share of Available Water	
	SFPUC Share	Suburban Purchasers Share (collectively)
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 IWSAP also refers to adoption and implementation of a separate allocation plan by suburban customers to address allocation amongst suburban purchasers during water shortages (described below). The IWSAP allows for voluntary transfers of shortage allocations between SFPUC and any wholesale customer and between wholesale customer agencies. Also, water “banked” by a wholesale customer, through reductions in usage greater than required, may also be transferred.

Interim Water Shortage Allocation Plan Among Suburban Customers: In 2000, the wholesale customers adopted a plan detailing how the SFPUC water allocated to wholesale customers collectively would be allocated among themselves. This plan – the Interim Water Shortage Allocation Plan Among Suburban Customers - allocates the collective wholesale customer share among each of the wholesale customers. This allocation is based on a formula that takes three factors into account, the first two of which are fixed: (1) each agency’s Supply Assurance from SFPUC, with certain exceptions, and (2) each agency’s purchases from SFPUC during the three years preceding adoption of the Plan. The third factor is the agency’s rolling average of purchases of water from SFPUC during the three years immediately preceding the onset of shortage.

Appendix C contains a copy of the SFPUC IWSAP and the wholesale customer’s plan for allocation amongst themselves (the IWSAP Among Suburban Purchasers). Each of these plans as adopted is set to expire in June 30, 2009, unless each plan were to be extended by the SFPUC and the wholesale customers, respectively. This is likely to be a topic of discussion during pending negotiations for renewal of the Master Contract between the SFPUC and the wholesale customers of the RWS.

9.4 San Francisco's Retail Water Shortage Contingency Plan

During the 1987-1992 drought, the SFPUC experienced significant system-wide water shortages of 25 to nearly 45 percent. Subsequent to this experience, new plans and agreements were made regarding how water would be allocated in future droughts. As previously described (Section 9.3), the SFPUC and its wholesale customers adopted the *Interim Water Shortage Allocation Plan* (IWSAP) in 2000 which, among other things, provides a fair and reasonable method for allocating water between the SFPUC and its wholesale customers during times of system-wide shortages up to 20 percent. In December of the following year, the SFPUC adopted a *Retail Water Shortage Allocation Plan* (RWSAP), which describes a three-stage plan for water delivery reductions to SFPUC retail customers. This section provides a more detailed discussion of these plans.

9.4.1 Water Availability Assessment and Declaration of Shortage

In accordance with procedures set forth in both the RWSAP and ISWAP, each year the SFPUC forecasts the amount of water that will become available for its use. This water includes runoff from the local Bay Area watersheds and runoff within the Tuolumne River basin. This forecast is updated periodically during the year and is fairly certain by early summer. The forecasted water supply is then compared to the anticipated water demands of the SFPUC's retail and wholesale customers and other water obligations such as stream flow requirements below San Francisco's reservoirs. Also entering into this comparison are objectives for carry-over reservoir storage for drought water delivery protection.

In accordance with the IWSAP, the SFPUC will compare the available water supply with projected system-wide purchases. A shortage conditions exists if the SFPUC determine that the projected available water supply is less than the projected system-wide water purchases in the upcoming supply year (defined as the period from July 1 through June 30). If the RWS appears to be incapable of meeting system-wide demand due to a drought, the SFPUC would declare a water shortage by March 31st of that drought year.

In accordance with the RWSAP, prior to the initiation of any water delivery reductions in San Francisco, whether it be initial implementation of reduction delivery or increasing the severity of water shortage, the SFPUC would outline a drought response plan that would address the following: the water supply situation; proposed water use reduction objectives; alternatives to water use reductions; methods to calculate water use allocations and adjustments; compliance methodology and enforcement measures; and budget considerations. This drought response plan will be presented at a regularly scheduled SFPUC Commission meeting for public input. The meeting will be advertised in accordance with the requirements of California Water Code Section 6066 of the Government Code, and the public will be invited to comment on the SFPUC's intent to reduce deliveries.

Pursuant to the drought response plan, which the SFPUC would present to its Commission, a Water Shortage Resolution would be adopted by the Commission. Appendix G contains a copy of sample resolution. A copy of the resolution adopted during the drought in 1998 is included in Appendix F.

9.4.2 Three-Stage Program of Action

San Francisco has established criteria that relate water deliveries to water supply and SFPUC's objectives to manage water deliveries during extended drought. These criteria provide guidance to the SFPUC for the determination of the annual availability of water. The structure of the criteria was developed during the course of the 1987-92 drought and incorporates procedures which were implemented during actual operations.

The water delivery criteria established incorporate a three-level staging of delivery reductions, as summarized in Table 16 -- the first stage is associated with voluntary actions by customers and the second and third stages are associated with mandatory rationing programs enforced by the SFPUC. Depending on the level of water demand and the desired maximum delivery reduction, one, two or all three of the stages are required. These criteria have been found to be viable through computer simulation of historical drought events and resultant SFPUC operations.

Based on this past drought experience and the established criteria, San Francisco's Retail Water Shortage Allocation Plan was adopted to formalize the three-stage program of action to be taken in San Francisco to reduce water use during a drought. Depending on the level of water demand and the desired objective for water use reduction, one, two or all three stages of the RWSAP may be required

Table 16

SFPUC Retail Water Shortage Stages of Action

Stage 1 (Voluntary)

- System-wide demand reductions of 5-10 percent experienced
- Voluntary rationing request of customers
- Customers are alerted to water supply conditions
- Remind customers of existing water use prohibitions
- Education on, and possible acceleration of, incentive programs (e.g., toilet rebates)

Stage 2 (Mandatory)

- System-wide demand reductions of 11-20 percent experienced
- All Stage 1 actions implemented
- All customers receive an "allotment" of water based on the Inside/Outside allocation method (based on base year water usages for each account)
- Water use above the "allocation" level will be subject to excess use charges, installation of flow restrictor devices and shut-off of water

Stage 3 (Mandatory)

- System-wide demand reductions of 20 percent or greater experienced
- Same actions as in Stage 2 with further reduced allocations

First Stage Program (Voluntary):

The first stage of action will rely on a voluntary public response to a declared water shortage. The objective of this first stage of program is to achieve a system-wide reduction of 10 percent in water use.

San Francisco currently enforces numerous water use prohibitions and restrictions, and continues to use public information venues for the discouragement of wasteful uses of water. Examples of existing prohibitions include water waste, including but not limited to, any flooding or runoff into the street or gutters, and a requirement that restaurants only serve water to customers upon request.

Through an increase in public information dissemination, retail water customers will be alerted to the current status of water supply conditions and reminded of water use prohibitions and restrictions, as well as currently available incentives and programs that will lead to reductions in water use (such as rebates). The SFPUC may also choose to initiate new rebate programs for water-efficient fixtures ahead of their planned implementation dates, in order to receive the associated water savings in the near-term. Public information will also target discretionary uses of water.

The water use reduction goal of this first stage program would also be coordinated with voluntary actions and programs by San Francisco's wholesale water customers to reduce their water demands on SFPUC by 10 percent. The reduction of water demands to SFPUC from these customers may be achieved through a variety of alternative mechanisms available to each individual wholesale customer including increased utilization of alternative water supplies.

Second Stage Program (Mandatory):

The second stage of response will include a mandatory water delivery-rationing program. The objective of this second stage of program is to achieve a system-wide reduction of 12-20 percent in water use.

The second stage will entail the enumeration of additional water use prohibitions and restrictions with disincentive consequences resulting from retail water customer non-compliance (such as excess use charges, installation of flow restrictor devices, or shut-off of water). Appendix F contains on the excess use charges during the 1987-92 drought, as well as the fees that were charged for installation of flow restricting devices.

The specific prohibitions and restrictions that will be enforced will be determined at the time that the need for the second stage program occurs. The water use prohibitions and restrictions implemented by San Francisco's in the 1987-92 drought serve as a menu for potential actions to be adopted in time of need, and are listed below. Note that these prohibitions, and more, are listed in the RWSAP as prohibitions that may be enforced during a drought. The prohibitions are as follows:

- Water waste, including but not limited to, any flooding or runoff into the street or gutters, was prohibited.
- Hoses could not be used to clean sidewalks, driveways, patios, plazas, homes, businesses, parking lots, roofs, awnings or other hard surfaces areas.
- Hoses used for any purpose had to have positive shutoff valves.

- Restaurants served water to customers only upon request.
- Potable water was not to be used to clean, fill or maintain levels in decorative fountains.
- Use of additional water was not allowed for new landscaping or expansion of existing facilities unless low water use landscaping designs and irrigation systems were employed.
- Water service connections for new construction were granted only if water saving fixtures or devices were incorporated into the plumbing system.
- Use of potable water for consolidation of backfill, dust control or other non-essential construction purposes was prohibited.
- Irrigation of lawns, play fields, parks, golf courses, cemeteries, and landscaping of any type with potable water would be reduced by at least the amount specified for outside use in the adopted rationing plan.
- Verified water waste as determined by the Water Department would serve as prima facie evidence that the allocation assigned to the water account is excessive; therefore, the allocation was subject to review and possible reduction, including termination of service.
- Water used for all cooling purposes was to be recycled.
- The use of groundwater and/or reclaimed water for irrigation of golf courses, median strips, and similar turf areas was strongly encouraged.
- The use of groundwater and/or reclaimed water for street sweepers/washers was strongly encouraged.

The second stage program will also provide a specific goal for water use reduction by individual retail customers, and will be coordinated with identification of a water use reduction goal by the wholesale water customers, collectively. Individual retail customer water use, by account or entity, will be targeted for reduction through application of formulas, which consider historical use and indoor and outdoor water consumption. Compliance to water delivery allocations will be addressed through the assessment of excess use charges to those customers, which exceed their allocations.

As an incentive for San Francisco retail water customers to reduce their water, the acceleration of long-term water conservation programs may also be considered during the second stage program (such as the initiation of rebates prior to their planned implementation date).

The specific level of water use reduction that will be targeted by the second stage program is dependent on several factors, which include the current water supply condition and the characteristics of water demand after being affected by the first stage program.

Analysis of current water demand characteristics indicates that a permanent reduction (hardening) of water demand occurred as a result of conservation programs employed during the 1987-92 drought. While San Francisco's customers achieved almost a 30 percent reduction in pre-drought demands during one year of the 1987-92 drought, this level of accomplishment is not expected to be achievable subsequent to the drought on a sustained or short-term basis. It is estimated that implementation of programs similar in effect to those applied during the 1987-92 drought will achieve a 20 percent reduction in current water demands.

Third Stage Program (Mandatory):

The third stage program will be implemented at such time that water supply conditions reach a hydrologic circumstance not previously experienced by the SFPUC. The third stage program will require additional retail water customer response to an increased number of enforced water use prohibitions and restrictions, and an increased level of rationing. The objective of the third stage program will be to achieve water use reductions in excess of 20 percent. For example, these third stage reductions would be used should there be supply shortages of 50 percent, and could include absolute limitations on water use.

Appendix C contains a copy of the RWSAP. Also, Appendix F discusses various measures employed during the 1987-92 drought in an attempt to achieve a 45 percent reduction in retail water customer demands (as applied to the pre-drought demand). These measures included absolute limitations on water use based on residential customer classification and a proportion of historical use within the non-residential sectors. Although not anticipated to be required in the near-term, San Francisco would employ similar procedures to accommodate system-wide water shortages in excess of 20 percent, if necessary.

In the 1987-92 drought, when reductions of over 20 percent were needed, San Francisco purchased water from the State Water Bank. In the future, if system-wide reductions were in excess of 20 percent, the SFPUC may employ the same Third Stage Program measures detailed above, with lower minimum and maximum criteria to achieve more reductions, or augment supplies through water purchases as it did in the past.

9.4.3 Mechanisms to Determine Reductions in Water Use

All SFPUC retail and wholesale customers are metered. Monthly water use reports are prepared by customer service. Based on a comparison between months the SFPUC is able to determine reductions in water use for both wholesale and retail customers.

9.4.4 Revenue and Expenditure Impacts During Water Shortages

The SFPUC uses a uniform volume charge. As a result, as sales decrease, revenues are lost on a per unit basis. Because the marginal cost of water production is miniscule, as production is reduced the cost of service remains the same. Therefore, during a water shortage, as occurred during the 1987-92 drought, the SFPUC may need to raise water rates to make up for lost revenue due to less water use. The SFPUC retail rates, however, are frozen until 2006 due to Proposition H. As a result, retail rates cannot be adjusted to make up for revenue shortfalls unless voters repeal the Proposition or the Mayor declares an emergency as provided for in the City's Charter. The SFPUC does maintain an unappropriated fund balance that can be used to offset the effects of revenue shortfall. In addition, the current contracts between the SFPUC and its wholesale customers allow the SFPUC to recover through rates the cost of water service to the wholesale customers.

9.5 Preparation for Catastrophic Water Supply Interruption

The SFPUC has various planning documents which in combination address its emergency preparedness and planned response in case of a catastrophic interruption of water supplies due to power outages, earthquakes or other disasters. Additionally, the SFPUC WSIP, previously discussed in this document, includes capital projects related to seismic reliability and overall system reliability.

9.5.1 Emergency Preparedness Plans

Following San Francisco's experienced in 1989 with the Loma Prieta Earthquake, the SFPUC created a departmental *SFPUC Emergency Operations Plan (EOP).* The *SFPUC EOP*, originally released in 1992, was updated in 2000 and again in 2004. The *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 *Emergency Operations Plan* prepared by the Mayor's office in 1996 and update in 2005. Specifically, the purpose of the *SFPUC EOP* is to describe the department's emergency management organization, roles and responsibilities and emergency policies and procedures.

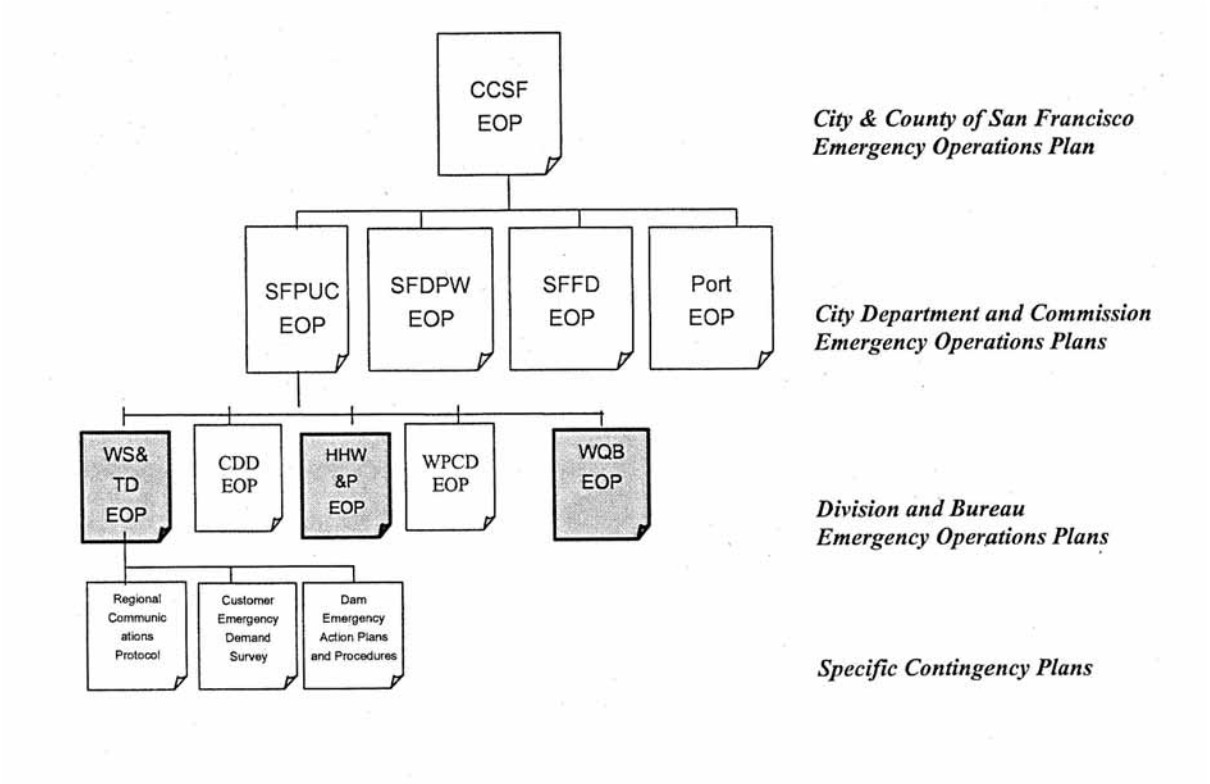
Also, SFPUC division EOPs and bureau EOPs have been developed that are in alignment with the SFPUC EOP and which describe each division's/bureau's emergency management organization, roles and responsibilities and emergency policies and procedures.

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 a major disaster damages and/or contaminates the SFPUC raw and/or treated water system. The report addresses immediate response after a major disaster. The recommended four-stage strategy developed by this project included the items listed below:

- Initial actions that build on existing resources at a relatively low cost and can be implemented quickly (such as public education and augmenting equipment & storage locations for SFPUC treated water);
- Items that provide additional emergency response capacity for some additional costs (such as upgrading existing groundwater wells for emergency use and new contracts and/or emergency clauses with vendors);
- Longer-range actions consistent with other planned activities that require coordination with other program to determine priorities for resources (such as accelerating implementation of WSIP project); and
- Items that are relatively higher cost and could be implemented in the future if there are multiple benefits with other projects/plans (such as RO Units – i.e, desalination).

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. 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 various plans are illustrated in the flow-chart below:



The SFPUC has also prepared in an *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 April 2002 (revision 5). 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 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, as described in the next section, the WSIP includes projects which will expand the SFPUC's ability to remain in operation during power outages and other emergency situations.

9.5.2 Capital Projects For Seismic Reliability and Overall System Reliability

As discussed previously in Section 5 (Reliability Planning), the SFPUC is also undertaking a WSIP 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.

As illustrated previously in Figure 4, the WSIP projects include several projects located in San Francisco to improve the seismic reliability of the in-city distribution system, as well as many projects related to the SFPUC RWS to address both seismic reliability and overall system reliability. All WSIP projects are expected to be completed by 2016.

In addition to the improvements that will come from the WSIP, San Francisco has already constructed the following system interties for use during catastrophic emergencies, short-term facility maintenance and upgrade activities, and in times of water shortages:

- A 40 mgd system intertie between the SFPUC and the Santa Clara Valley Water District (Milpitas Intertie); and
- The SFPUC also has one permanent and one temporary intertie to the South Bay Aqueduct, which would enable the SFPUC to receive State Water Project water.

The WSIP includes intertie projects, such as the EBMUD-Hayward-SFPUC Intertie. The SFPUC and EBMUD are constructing this 30 mgd intertie between their two systems in the City of Hayward, as part of the WSIP. The expected completion date for this intertie is August 2006.

The WSIP also includes projects related to standby power facilities at various locations. These projects will provide for standby electrical power at six critical facilities to allow these facilities to remain in operation during power outages and other emergency situations. Permanent engine generators will be provided at four locations (San Pedro Valve Lot, Millbrae Facility, Alameda West, and Harry Tracy Water Treatment Plant), while hookups for portable engine generators will be provided at two locations (San Antonio Reservoir and Calaveras Reservoir).

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Section 10: Water Recycling

10.1 Wastewater Generation, Collection, Treatment, and Disposal

San Francisco's wastewater collection, treatment and disposal system consists of a combined sewer system (which collects both sewer and storm water), three water pollution control plants (WPCP) and outfalls to San Francisco Bay and the Pacific Ocean. The collection and conveyance system consists of approximately 900 miles of various sizes of underground sewer pipes and transport structures located throughout the City. Two of the City's water pollution control plants, the Southeast WPCP and Oceanside WPCP, operate year-round, while the third plant, the North Point WPCP, operates only during wet weather. Ultimate disposal of treated wastewater effluent is currently through outfalls to both the San Francisco Bay and the Pacific Ocean.

Design Capacity: The Oceanside WPCP, the City's newest treatment facility, was completed in 1993. This facility serves the westside of the City with a design average dry-weather flow of 15 to 20 mgd and a peak wet-weather flow of 65 mgd (i.e. primary treatment capacity of 65 mgd, and secondary treatment capacity of 43 mgd). It provides primary and secondary-level treatment prior to discharge to the Pacific Ocean through a 4.5 mile Southwest Ocean Outfall. The Southeast WPCP, built in 1952, and later expanded between 1977 and 1982, is located on the eastside of the City and treats all eastside sewage flows during dry weather. This facility treats an average dry weather flow of 65 to 70 mgd and can treat up to 250 mgd during wet weather (i.e. primary treatment capacity of 250 mgd, and secondary treatment capacity of 150 mgd). Secondary-treated dry-weather effluent from the Southeast WPCP is discharged to the San Francisco Bay through Pier 80 Outfall. The North Point WPCP has been in operation since 1951. This facility provides primary treatment to combined flows collected in the northern area of the City during storm events and has a treatment capacity of 150 mgd. Primary-treated wet-weather effluent is discharged to San Francisco Bay, through outfalls at Piers 33 and 45.

Actual and Projected Volumes: Tables 17A and 17B summarize the actual and projected volumes of wastewater collected, treated and disposed of in San Francisco.

Table 17A
Wastewater Collection and Treatment

Type of Wastewater	1999-2000	2004-05	2010	2015	2020	2025
Wastewater collected and treated	109,394 AFY 97.6 mgd	119,787 AFY 106.9 mgd	119,003 AFY 106.2 mgd	118,779 AFY 106.0 mgd	119,227 AFY 106.4 mgd	119,675 AFY 106.8 mgd
Volume that meets recycled water standard	N/A	767 AFY 0.7 mgd	867 AFY 0.8 mgd	4,592 AFY 4.1 mgd	4,592 AFY 4.1 mgd	4,592 AFY 4.1 mgd

AFY: Acre-feet/year mgd: millions of gallons/day

Table 17B Disposal of Wastewater (non-recycled)					
Method of Disposal and Treatment Level	**2004-05**	**2010**	**2015**	**2020**	**2025**
Outfalls (Blended: Primary/Secondary)[1]	15,081 AFY 13.5 mgd	15,081 AFY 13.5 mgd	15,081 AFY 13.5 mgd	15,081 AFY 13.5 mgd	15,081 AFY 13.5 mgd
Outfalls (Secondary)	104,706 AFY 93.5 mgd	94,530 AFY 84.4 mgd	94,306 AFY 84.2 mgd	94,754 AFY 84.6 mgd	95,202 AFY 85.0 mgd
TOTAL	119,787 AFY 107 mgd	109,611 AFY 97.9 mgd	109,387 AFY 97.7 mgd	109,835 AFY 98.1 mgd	110,283 AFY 98.5 mgd

AFY: Acre-feet/year mgd: millions of gallons/day

Table Notes:

1. During some wet weather events, SFPUC water pollution control plants may reach their secondary-level treatment capacity and are permitted to discharge a blend of primary and secondary-treated wastewater.

10.2 Recycled Water Uses

10.2.1 Recycled Water Currently Being Used

The SFPUC is looking to expand the use of recycled water within the City. The amount of recycled water use presently within the City is limited. Currently, tertiary-treated wastewater from the Southeast WPCP is used for in-plant wash-down operations. Less than 1 mgd of recycled water is used for these purposes. In addition to these existing recycled water uses, the SFPUC provided funding to the North San Mateo County Sanitation District (a subsidiary of Daly City) to upgrade their wastewater treatment plant to produce tertiary-level recycled water. This facility serves 2.77 mgd of recycled water to three golf courses, one located in the City of Daly City, and two in the City and County of San Francisco, as well as serving other sites in Daly City for irrigation purposes. Use of recycled water at these locations offsets groundwater currently being used for irrigation.

In 1991, the San Francisco Board of Supervisors passed *Ordinances 390-91* and *391-91*[32] that outlined specific components to be addressed in the Recycled Water Master Plan, and defined recycled water use areas within San Francisco. The ordinances require dual-plumbing system installation within the designed recycled water use areas for the following situations:

- *New or remodeled buildings and all subdivisions (except condominium conversions) with a total area of 40,000 square feet or more*
- *New and existing irrigated areas of 10,000 square feet or more*

[32] San Francisco Public Works Code, Article 22, Sections 1200-1210. Note that this Ordinance was amended in 1994 by Ordinance 393-94, which expanded the designated recycled water use area to include Treasure Island, Yerba Buena Island, and Hunters Point Shipyard.

The SFPUC first developed a Recycled Water Master Plan that outlined a phased water recycling project for San Francisco in 1996. The Plan was taken before the Commission but was not approved due to the high cost at that time. The SFPUC is in the process of updating the 1996 Recycled Water Master Plan (RWMP). The Draft 2005 RWMP will form the basis for developing new recycled water project alternatives, and updating the plan for implementation of recycled water projects in the City. These projects will help the City meet its long-term water demands in a more reliable and sustainable manner, as shown in Table 18.

Table 18
Recycled Water Benefits to San Francisco

City's Needs	Recycled Water Benefits
Improved Water Supply Reliability	• Provides a new water source that is reliable ("drought-resistant") and locally controlled. • Frees up potable water, currently used for landscape irrigation and other purposes. • Frees up local groundwater, currently used for landscape irrigation and other purposes, for other beneficial uses. • Reduces reliance on imported water for irrigation and other purposes.
Improved Water Supply Sustainability	• Promotes efficient use of water resources by supplying nonpotable water demand with recycled water. • Reduces level of rationing during drought periods, thereby benefiting the entire community. • Reduces treated wastewater discharges into the Pacific Ocean and the Bay. • Sustains landscape value during droughts when potable water use may be restricted. • Provides a water source for recreational impoundments. • Upholds state regulations mandating or encouraging the use of recycled water.

10.2.2 Potential Uses of Recycled Water

One of the objectives of the Draft 2005 RWMP is to re-assess the recycled water use opportunities identified in the 1996 RWMP. This provides a basis for defining and evaluating potential recycled water project alternatives, and identifying additional opportunities that the City could pursue in the long-term. Potential recycled water uses in the City were identified for all allowable recycled water uses, except for a few including agricultural uses (not applicable in San Francisco). With the results of these efforts, a list was created of potential recycled water users, including San Francisco's major urban irrigation areas (parks, golf courses and schools), commercial centers and industrial users. Given the potential recycled water users identified, several key stakeholders were identified and involved in the development of the Draft 2005 RWMP, such as staff from the Recreation and Park Department, Department of Public Works, City Planning, and SFPUC Wastewater Enterprise staff.

10.2.3 Potential San Francisco Recycled Water Projects

The current Draft 2005 RWMP has initially identified a potential Phase 1 project that includes the four project alternatives described below. At this time, the Draft 2005 RWMP is recommending that design and development of Alternatives 1 and 2 proceed, while more analysis is done on the costs and feasibility of Alternatives 3 and 4. Alternatives 1 and 2 combined would produce approximately 4.1 mgd.

- Project Alternative1/Westside Baseline Project would produce recycled water primarily for irrigation use on the westside of the City, in areas such as Golden Gate Park.
- Project Alternative 2/Harding Park & Lake Merced Project would involve using recycled water for irrigation of the Harding Park/Fleming Golf Course, and recharge of Lake Merced; treatment for recycled water used for this alternative might require advanced tertiary treatment for nutrient removal to prevent eutrophication of Lake Merced.
- Project Alternative 3/Expanded Westside Baseline Project would serve smaller users located off of the "backbone" pipeline included in the Westside Baseline Project.
- Project Alternative 4/Marina Corridor Project would serve users along the Marina Corridor (such as the Marina Green and Fort Mason), and would involve a partnership with The Presidio Trust.

These four project alternatives were developed at the "facility-plan" level necessary to prepare separate environmental review documents. Refinement of the project alternatives at the facility-plan level involved the following:

- Identification of targeted users and their associated demands, potable water savings, and major implementation issues
- Development of treatment, storage/pumping, and distribution facilities to serve identified users
- Estimate of costs for construction, and operation and maintenance
- Quantification of project benefits, such as potential potable water and groundwater savings
- Identification of potential implementation issues and actions to address those issues

10.2.4 Quantification of Current and Projected Recycled Water Uses

Table 19 summarizes the current and projected uses of recycled water in San Francisco, assuming Project Alternatives 1 and 2 (previously described) were developed.

Table 19
Recycled Water Uses: Current and Projected (AFY)

User Type/ Treatment Level	2004-05	2010	2015	2020	2025
Landscape/Tertiary			3,808 AFY 3.4 mgd	3,808 AFY 3.4 mgd	3,808 AFY 3.4 mgd
Lake Recharge/ Advanced Tertiary[1]			784 AFY 0.7 mgd	784 AFY 0.7 mgd	784 AFY 0.7 mgd
In-Plant Use/Tertiary	767 AFY 0.7 mgd	867 AFY 0.8 mgd	967 AFY 0.9 mgd	967 AFY 0.9 mgd	967 AFY 0.9 mgd
TOTAL	767 AFY 0.7 mgd	867 AFY 0.8 mgd	5,559 AFY 5.0 mgd	5,559 AFY 5.0 mgd	5,559 AFY 5.0 mgd

Table Notes: AFY: Acre-feet/year mgd: millions of gallons/day 1. Advanced Tertiary treatment includes reverse osmosis and microfiltration.

10.2.5 Regional Recycled Water Partnerships

The SFPUC is working with local agencies to develop recycled water projects that will benefit the SFPUC and local partners. Examples of these projects are described below:

Pacifica Recycled Water Project

The SFPUC is partnering with the North Coast County Water District (NCCWD) on a recycled water project to irrigate areas in the City of Pacifica, including the Sharp Park Golf Course (owned and operated by the City). Recycled water will be produced at the City of Pacifica's Calera Creek Water Recycling Plant. The NCCWD is serving as the lead agency on this project.

South San Francisco/San Bruno Recycled Water Project

The SFPUC is partnering with the cities of South San Francisco, San Bruno, and Cal Water Service Company (Bayshore District) to conduct a recycled water feasibility study. This study will evaluate the use of recycled water to reduce both potable water and groundwater use. It is proposed that recycled water for the project will be produced at the South San Francisco/San Bruno Water Quality Control Plant jointly operated by the cities of South San Francisco and San Bruno. The City of South San Francisco is serving as the lead agency on this project.

10.2.6 Participation in Regional Recycled Water Planning Efforts

The SFPUC is involved in the Bay Area Regional Water Recycling Program (BARWRP) as part of its retail efforts to develop its Recycled Water Program. BARWRP is a partnership of San Francisco Bay Area water and wastewater agencies that joined together with state and federal agencies to study the feasibility of using high-quality recycled water to augment supplies and help the Bay-Delta ecosystem. In December 1999, BARWRP produced a Recycled Water Master Plan for regional water recycling that identifies demands and provides a plan to achieve 125,000 AF/yr of recycled water in the Bay Area within the next 10 years.

The SFPUC is also a member of the newly created Bay Area Clean Water Agencies (BACWA), Recycled Water Committee. BAWCA is comprised of Bay Area wastewater agencies that discharge into The San Francisco Bay Estuary. The purpose of the Committee is to further regional water recycling efforts from a wastewater agency perspective. The SFPUC is currently serving as the Chair of this committee.

The City is an active member in the National, California Section, and the Northern California Chapter of the WateReuse Association. The National organization is dedicated to increasing the amount of recycled water produced, and used in a beneficial and efficient manner in the United States. The California Chapter focuses on promoting this mission in California.

10.3 Encouraging Recycled Water Use

10.3.1 Proposed Actions to Encourage Use of Recycled Water

To encourage the use of recycled water in San Francisco, San Francisco adopted *Ordinances 390-91* and *391-91*[33]. As mentioned previously, these ordinances require within a geographic area dual-plumbing for the following:

- *New or remodeled buildings and all subdivisions (with exception of condominium conversions) with a total of 40,000 square feet, or greater, to install dual-plumbing for purposes such as irrigation, toilet flushing, and industrial processes*

- *New and existing landscaped areas 10,000 square feet or larger, to install dual-plumbing for irrigation.*

San Francisco also passed *Ordinance 175-91*[34] which requires the use of non-potable water for soil compaction and dust control during construction and demolition projects.

10.3.2 Marketing and Financing Strategy

The Draft RWMP is proposing that recycled water projects be structured in phases, and includes proposed Phase 1 projects. As with all municipal projects, funding is limited, and the phased approach allows flexibility in constructing and implementing these projects. There are funds available to begin implementation of recycled water projects in the City. In 2002, San Francisco voters approved a $1.6 billion revenue bond to fund renovations of the SFPUC's water delivery system. Development of the WSIP began in 2003 to implement capital projects authorized under the bond measure. The WSIP adopted by the Commission in November 2005 includes approximately $205 million for recycled water projects that will benefit San Francisco.

Additionally, San Francisco is currently proceeding with the evaluation of other financial options to implement additional recycled water projects. San Francisco has applied for Proposition 50 funds (Chapter 8) from the State Water Resources Control Board, and will pursue other grant opportunities as they become available.

10.3.3 Economic Considerations

The estimated capital cost for the Proposed Phase 1 projects (Westside Baseline Project and the Harding Park/Lake Merced Project) described in the Draft RWMP is $130 million (2005 cost). The costs are based on planning-level estimates (approximately $\pm$ 30%). The total annual cost for operations and maintenance was estimated to be $2.6 million per year with an annual recycled water delivery of 4,510 AFA. It has been assumed that various project beneficiaries would likely repay costs of these multi-purpose recycled water use projects.

[33] San Francisco Public Works Code, Article 22, Sections 1200-1210. Note that this Ordinance was amended in 1994 by Ordinance 393-94, which expanded the designated recycled water use area to include Treasure Island, Yerba Buena Island, and Hunters Point Shipyard.
[34] San Francisco Public Works Code, Article 21, Sections 1100-1107.

10.4 Recycled Water Optimization Plan

As mentioned above, the San Francisco Board of Supervisors passed *Ordinances 390-91* and *391-91* that require installation of dual-plumbing in buildings and subdivisions within a specific geographic area under the following conditions:

- *New or remodeled buildings and all subdivisions (with exception of condominium conversions) with a total of 40,000 square feet, or greater, to install dual-plumbing for purposes such as irrigation, toilet flushing, and industrial processes*

- *New and existing landscaped areas 10,000 square feet or larger, to install dual-plumbing for irrigation.*

Also, as discussed previously in this section, the 2005 Draft RWMP currently being prepared will develop recycled water project alternatives and provide a plan for implementation of recycled water projects in the City.

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