City of Sunnyvale

Recycled Water Program Master Plan

December 2000

EOA, Inc.

Eisenberg, Olivieri, & Associates
Environmental and Public Health Engineering
1410 Jackson Street
Oakland, CA 94612

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December 22, 2000

Mr. Wil Bruhns
Regional Water Quality Control Board
1515 Clay Street
Suite 1400
Oakland, CA 94612

Re: City of Sunnyvale Water Pollution Control Plant
Recycled Water Master Plan

Dear Mr. Bruhns:

On behalf of the City of Sunnyvale, we are pleased to submit this Recycled Water Master Plan, pursuant to Provision 6b of Sunnyvale's NPDES Permit and the approved workplan. Chapter 5 of this Master Plan explores opportunities for recycled water streamflow augmentation projects, pursuant to NPDES Permit provision 7b and the approved workplan.

Per our discussion on May 1, 2000, a draft version of this document was submitted to the RWQCB on June 1, 2000. This final version updates that draft to address review comments from City staff and to incorporate other new information.

The City is proceeding with providing recycled water service to several of the "infill" sites described in Chapters 3 and 4 of this Plan. It has also just completed construction of the Phase IIb Storage and Pumping Facilities (two million gallon storage tank and 8 mgd pump station), and expansion of the WPCP's Recycled Water Pump Station's capacity, from 4.5 to 8 mgd. These new facilities will greatly enhance its ability to deliver recycled water in a cost-effective manner.

In the near term, the City will focus on maximizing recycled water deliveries to existing customers and to additional customers within the area served by existing distribution system. At the present time, no decisions have been made regarding future expansion of the distribution system as outlined in this Plan.

Please call me if you have questions or wish to discuss this Plan.

Sincerely,
EOA, Inc.

Ray Goebel, P.E.

cc: Lorrie Gervin, Mark Dettle
City of Sunnyvale

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Recycled Water Program
Master Plan

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Prepared by:

EOA, Inc
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CHAPTER 1. INTRODUCTION

This report presents a plan for future expansion of Sunnyvale's Water Recycling Program, with an emphasis on the physical facilities required for such expansion. The report describes existing City resources for the production and distribution of recycled water, examines opportunities for additional recycled water use within the City and beyond, and presents a staged plan for construction of new facilities to reach recycled water use sites.

REPORT ORGANIZATION

Chapter 1 provides background on the City's Water Recycling Program and the regulatory requirements that govern recycled water production and use. Chapter 2 describes the City's existing facilities for production and distribution. Chapter 3 provides estimates of potential recycled water demand within the City, and also looks at potential reuse sites in adjacent communities. Chapter 4 presents a plan for a phased expansion of the distribution system, designed to capture a portion of that demand in a cost effective manner. Chapter 5 examines the potential for using recycled water for streamflow augmentation in Steven's Creek.

RATIONAL FOR USING RECYCLED WATER

The City of Sunnyvale's Water Pollution Control Plant (WPCP) produces about 15 million gallons per day (MGD) of high quality tertiary effluent, which represents an untapped, drought-resistant, local water resource. Recycling this water for landscape irrigation and other purposes helps to conserve and augment potable water supplies, preserving these supplies for higher uses. During periods of drought, water recycling reduces the possible need for restrictions on the use of potable water for non-potable purposes. Water recycling also reduces the mass of certain constituents, such as copper, being discharged to the Bay, in a manner that provides greater environmental benefits than through construction of additional treatment facilities. The City's commitment to water recycling is driven, in part, the WPCP's National Pollutant Discharge Elimination System (NPDES) Permit, which requires that the City take "measures to maximize reclamation and minimize the effluent discharge."

PROGRAM BACKGROUND

In the mid 1980's, the City began investigating the feasibility of using recycled water (also referred to as reclaimed water) within its jurisdiction. In October 1991, the City Council approved $14.5 million to establish a Water Recycling Program, to develop and distribute this resource. Subsequent funding authorizations have brought the total investment to approximately $20 million.

Planning, design, and construction of facilities for production and distribution of recycled water proceeded steadily throughout the decade, under the City's Department of Public Works. An underlying principal reflected in the design of the initial facilities was that the system have the capacity to ultimately recycle up to 100% of the WPCP's total flow. Initial planning and feasibility studies determined that this volume (13 MGD at that time) exceeded projections of "in-City" demand that could reasonably be served, and that attaining this goal would involve export of

water outside the City limits. The distribution system's main east-west "header" pipeline, and one of the north-south mains were therefore sized to accommodate flows greater than the projected ultimate "in City" demand. Construction of the distribution system focused first on the large publicly owned sites (Sunnyvale Golf Course, Baylands Park) and the Moffett Park Industrial Area in northern Sunnyvale.

Over this same period, an implementation program was developed to formulate program policies and procedures, educate potential users and the general public about the use of recycled water, oversee the conversion (retrofit) of use sites, and provide ongoing monitoring of recycled water use as required under State regulations.

As of March 2000, recycled water was being delivered to 55 public and private sites throughout the northern part of Sunnyvale. During the 1999 recycled water production season (April through November) usage averaged 908,000 gallons/day. The primarily use was landscape irrigation, with small amounts also being used for ornamental ponds and fountains, and other approved uses.

REGULATORY REQUIREMENTS

Production and use of recycled water is regulated by the State of California's Department of Health Services (DOHS) and the State Water Resources Control Board (SWRCB). The governing regulations are contained in the California Code of Regulations Title 22 (Water Recycling Criteria) and Title 17 (Backflow Prevention).

Under Title 22, the proposed use and corresponding degree of public exposure dictate the quality of recycled water required. The Sunnyvale WPCP produces the highest quality Title 22 water, referred to as "disinfected tertiary" or "unrestricted quality". This quality is approved for a wide range of applications, including landscape irrigation, irrigation of food crops, recreational impoundments, firefighting, and many other uses. Water quality is monitored continuously at the WPCP, to ensure that all recycled water delivered meets all applicable water quality requirements.

The SWRCB is the lead agency for issuing and enforcing requirements for water recycling projects.[1] Through it's Regional Boards, the SWRCB issues permits (Water Reuse Orders) to producers and distributors of recycled water.[2] These Orders incorporate Title 22 and Title 17 requirements, and specify monitoring/reporting requirements for water quality testing and reuse site inspections. Water Reuse Orders also require producers to develop a permit program for individual recycled water use sites. The primary reason for issuing permits to individual sites is to ensure the absence of on-site interconnections ("cross-connections") between the potable and recycled water systems, and to ensure that the ongoing use of recycled water is in accordance with regulations. To provide an administrative framework for this permit process, the City developed its *Administrative Procedures for Program Staff.* The City also developed *Rules and Regulations for Recycled Water Users,* which provides users with information and detailed technical requirements for permitting, design and retrofit of recycled water facilities, and for use of recycled water.

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[1] Though the SWRCB is the lead agency, the DOHS maintains a role in reviewing Water Recycling Programs and (in some cases) individual reuse projects, particularly those that involve uses other than landscape irrigation.

[2] Because it owns and operates the distribution system, the City of Sunnyvale is both the producer and distributor.

PROMOTING USE OF RECYCLED WATER

The California Water Code[3] provides a legal basis for mandating the use of recycled water. The law states that the use of potable water for non-potable purposes (including irrigation) constitutes a waste or unreasonable use of water, if recycled water of suitable quality is available at reasonable cost. Based on State law, some jurisdictions have implemented "mandatory use" policies through local ordinance. Sunnyvale's Recycled Water Program currently operates on a voluntary use basis. The City promotes voluntary use through its recycled water price structure (recycled water is priced at 90% of the prevailing potable water rate), through financial support for on-site modifications (retrofits) that may be needed, through an active public education process, and through a "user-friendly" permit process. With few exceptions, that policy has been successful in encouraging prospective users to convert to recycled water in those areas where it is available. A re-occurrence of drought conditions could be expected to further enhance interest in recycled water.

The Santa Clara Valley Water District (SCVSD) also promotes water recycling through a rebate program, wherein producers receive $115 per acre-ft ($352 per million gallons) of water recycled. In addition, the SCVSD partners with recycled water producers in developing projects of particular interest to the District.

FUTURE OPPORTUNITIES FOR USE OF RECYCLED WATER

Landscape Irrigation

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

Industrial/Commercial Process Use

Recycled water is a suitable source of water for a variety of commercial/industrial processes, including use in cooling towers, wet scrubbers, boilers, car washes, commercial laundries, and other processes. From the producer's perspective, these commercial/industrial uses are attractive because they provide a baseline demand that is non-seasonal. To date, such uses have not developed to any significant degree in Sunnyvale. The principal barriers to commercial/industrial use include the decline of large scale "wet" manufacturing industries within the City, competition from other alternative water sources (e.g. flows from groundwater clean-up

[3] California Water Code, Division 7, Chapter 7, known as the Water Recycling Law.

projects), and the higher salinity of recycled water as compared to the available potable water supply. Nevertheless, the City supports non-irrigation industrial uses of recycled water and will evaluate individual projects on a case-by-case basis as they arise.

Streamflow Augmentation and Indirect Potable Reuse

Streamflow augmentation and indirect potable reuse (via groundwater recharge and/or addition to surface reservoirs) are applications that have potential to utilize large quantities of recycled water, benefit the environment, and play an important role in extending the potable water supply. Developments in either area may provide the basis for large scale utilization of recycled water that goes beyond the traditional use for landscape irrigation.

The City of San Jose has designed a pilot streamflow augmentation project in the Coyote Creek watershed which aims to create conditions that enhance the aquatic environment and support coldwater fish species. Under the proposed project, disinfected tertiary recycled water from the San Jose/Santa Clara WPCP will be dechlorinated, cooled, and released to Coyote Creek in the vicinity of Capitol Expressway. Sunnyvale has initiated discussions with the SCVSD, to explore the role that streamflow augmentation might play in the SCVSD's management of Stevens Creek. Streamflow augmentation is considered in greater detail in Chapter 5.

The SCVSD recently announced its intention to assess and evaluate the feasibility of pursuing an indirect potable reuse project in Santa Clara County. Studies to be conducted by the SCVSD will provide recommendations on treatment technologies and alternatives, conveyance and storage systems, project capital and operating costs, and permitting requirements. The SCVSD recognizes that public participation and public outreach are key to the success of projects of this type.

CHAPTER 2. EXISTING RECYCLED WATER FACILITIES

This chapter describes the existing facilities for production and distribution of recycled water within the City. These facilities were developed after planning studies conducted in 1992 and 1993 quantified potential recycled water demand throughout the City, analyzed alternatives for a distribution system to supply this demand in a phased manner, and identified improvements needed at the WPCP to facilitate the production of disinfected tertiary recycled water.

PIPELINES

The current network of pipelines is the result of five projects designed and constructed between 1992 and 2000. Projects locations are shown in Figure 2-1 and summarized in Table 2.1. The Baylands and Phase I projects provided the large diameter pipelines lines which form the backbone of the system, and which brought recycled water service to Baylands Park and Sunnyvale Golf Course. The Phase IIa project provided a network of smaller diameter distribution pipelines to reach over fifty sites throughout the Moffett Park Area. The Maude/Macara project extended the "west main" by a short distance in advance of the closure of Macara Avenue. Finally, the Phase IIb project extended the large diameter "east main" pipeline south to a new storage tank and pumping facilities near Wolfe Rd & Kifer Rd, and will provide the means to reach additional City parks and industrial customers along its route.

Table 2.1 Pipeline Projects

Project Name	Year Completed	Pipeline Diameter (inches)	Pipeline Length (feet)	Description
Baylands Pipeline	1993	12 – 36	6,300	Service to Baylands Park, Caltrans Future service to Twin Creeks
Phase I Reclaimed Water Distribution System	1994	16 – 24	16,000	Service to Sunnyvale Golf Course & Caltrans interchanges Future service to Lockheed Martin, NASA
Phase IIa Reclaimed Water Distribution System	1996	8 16	34,000 3,000	Service to Moffett Park Area 1st segment of "east main"
Maude/Macarra Extension	1999	16	1,160	Extension of west main to Encinal Park
Phase IIb Reclaimed Water Distribution System	2000	24	14,000	Extension of east main to storage and pumping facilities near Wolfe & Kifer Roads (San Lucar site)

PUMPING AND STORAGE FACILITIES

Facilities for recycled water pumping and storage are listed in Table 2.2. The Recycled Water Pump Station (originally referred to as the Interim Pump Station) is located adjacent to WPCP's chlorine contact tanks. The pump station includes capability for introducing potable water into the distribution system via an air gap, and for full or partial dechlorination of recycled water entering the distribution system.

The Phase IIb Pumping & Storage Facilities constructed near Wolfe Rd and Kifer Rd (San Lucar site) will provide much-needed storage for the recycled water system. The storage tank will increase utilization of recycled water produced at the WPCP, and will serve as the supply source during periods of low to moderate demand, thereby reducing production costs. As the total system-wide demand grows, the Phase II facilities will operate in parallel with the WPCP to supply peak demands. A portion of the Phase IIb pump station is designed to deliver water at a higher pressure needed to create a second "pressure zone" in Central Sunnyvale.

Table 2.2 Pumping and Storage Projects

Project Name	Year Completed	Description
Recycled Water Pump Station	1994	Capacity to 3100 gallons/minute (4.5 million gallons per day) Maintains 95-105 psi pressure in system.
Recycled Water Pump Station Expansion	2000	Expand capacity to 5400 gallons/minute (7.8 mgd)
Phase IIb Recycled Water Pumping and Storage Facilities	2000	2 million gallon storage tank and 5500 gal/min (8 mgd) pump station at Wolfe and Kifer Rds. (San Lucar site).

PRODUCTION FACILITIES

Certain improvements at the WPCP were necessary to meet the more stringent Title 22 water quality requirements for disinfected tertiary recycled water and to facilitate shifting between recycled water production and "normal" WPCP discharge modes[4] These projects are listed in Table 2.3.

Table 2.3 WPCP Improvements for Recycled Water Production

Project Name	Year Completed	Description
WPCP Polymer Feed System Improvements	1997	Expanded and upgraded facilities for adding polymer to the Air Flotation Tanks. The polymer is a coagulant used to promote removal of biomass produced during the secondary treatment process.
WPCP Tertiary Plant Improvements Project	1999	Provided additional instrumentation, control, and documentation capabilities for recycled water production, and new influent/effluent gates at the chlorine contact tanks to facilitate switching between recycled water production and normal discharge modes.

OTHER FACILITIES

The City has constructed a demonstration garden at Baylands Park to showcase the use of recycled waste for landscape irrigation and to serve as a research tool for examining potential impacts of recycled water on plants typically used for landscaping in Sunnyvale. The garden was constructed by the City's Trees and Landscape Division during 1999, and was planted in the

[4] Compared to normal plant discharge, the production of disinfected tertiary recycled water requires lower levels of turbidity prior to disinfection (chlorination), higher chlorine dosage rates, and longer chlorine contact times. As a result, operating costs during periods of recycled water production are higher than during periods of normal discharge. To minimize overall costs, the WPCP switches between recycled water production and normal discharge in response to changing recycled demand and availability of water in storage.

spring 2000. The garden will feature side-by-side comparisons of plants grown using recycled and potable water.

In addition to the capital projects described above, the City has a substantial investment in human resources in support of the Water Recycling Program. City staff from the WPCP, the Field Services Division, Trees and Landscape Division, and Engineering Services are involved in recycled water production, site evaluations, user permitting and monitoring, distribution system operations, public outreach, and construction of new facilities. Efforts are coordinated through a recycled water coordination committee.

CHAPTER 3. RECYCLED WATER DEMAND

INTRODUCTION

This chapter examines the recycled water demand that will drive any future expansion of the distribution system. The analysis begins with a summary of demand from those sites served by the current distribution system, followed by estimates of demand at near-term “infill” sites located along the current system that have yet to be served. Estimates are then presented for sites that are accessible via laterals from existing mains or via minor main extensions. This category is identified as "mid-term demand" under the assumption that service to these sites will be provided over a three to five year period.

For purposes of evaluating long-term recycled water demand for remaining sites within the City, the analysis considers user categories, rather than individual sites. The demand estimates for each category are presented without reference to a specific distribution system, and thus represent an upper limit for demand in that category. (Demand estimates corresponding to specific pipeline configurations are presented in Chapter 4). Finally, the analysis considers possible reuse sites located outside the City limits in adjacent communities.

Estimates of recycled water demand for sites within Sunnyvale were based on City water billing records. Analytical tools developed for earlier Recycled Water Program planning studies were used to categorize potential use sites from the City billing records and locate these sites on a desktop mapping system. Estimates presented below for current, near-term, and mid-term demand are based on recent (1997 through 1999) records. Estimates for long-term demand utilized earlier (1990) data, with key sites in each category verified (and if necessary updated) against the recent data. Demand for sites outside of Sunnyvale were not available, but can in some cases be inferred based on a comparison to sites within Sunnyvale.

Except where noted, demand estimates are based on use of recycled water for landscape irrigation.

CURRENT DEMAND

Recycled water has been delivered to Baylands Park and Sunnyvale Golf Course periodically for several years. With the completion of the WPCP improvement projects described in Chapter 2 and the provision of service to numerous sites in the Moffett Park Area, a regular schedule of production and delivery was initiated for the 1999 irrigation season. By the end of the 1999, 43 sites were using recycled water. Usage for these sites is summarized in Table 3.1. The values listed are derived primarily from 1999 recycled water meter readings, as recorded by the City’s Finance Department. In cases where 1999 usage was not totally representative (e.g. recycled water was not used for the full year), the usage listed reflects the average irrigation demand over several years.

Table 3.1 Current Recycled Water Demand

Site	Annual Total (million gallons/year)	Daily Average (gallons/day)*
Sunnyvale Golf Course	87.3	239,200
Baylands Park*	18.4	50,300
Orchard Properties	12.1	33,200
Lockheed-Martin Plant 1 (partial)	10.2	28,100
Stanford Telecom	8.6	23,600
Infoseek (1399 Moffett Park Drive)	6.5	17,800
Moffett Park Lake	5.6	15,400
Infoseek (1315 Chesapeake)	4.7	12,900
Biocircuits	4.4	12,100
Integrated Systems	4.1	11,200
TRW	3.9	10,700
All other sites (n=43)	66.2	181,300
Total	**232**	**635,800**

*365 day/year basis

NEAR-TERM DEMAND: "INFILL" SITES

Provision of recycled water to "infill" sites - those sites readily accessible from the existing distribution system - is an ongoing process. Most of these sites were previously targeted for service under the Phase I or Phase IIa Pipeline projects. Several key Phase I sites and a number of smaller Phase IIa sites are expected to be converted over the next few years. Some of these sites will require a significant retrofit effort prior to initiation of service.[5] Potential water demand associated with these "infill" site are discussed below and listed in Table 3.2.

Lockheed Martin Plant 1- additional. Lockheed-Martin completed a design in 1994 for a non-potable (recycled) water distribution system that would provide water for irrigation throughout Plant 1 (the area bound by Moffett Field Perimeter Road, Highway 237, Mathilda Drive, and the Bay), and for use in cooling towers. The system would link an existing 6" Lockheed pipeline on E St. to a network of new 2½" – 6" lines, to be supplied from the City's Phase I main at the north end of E St. and the west end of 11th Ave. The system was not constructed, and future implementation of that design remains uncertain. However, recycled water lines have been constructed to service landscaping at a number of existing and new buildings in the northeast corner of Lockheed Plant 1, and along the new H St extension in the southwest corner. The site's largest single irrigation site is the ball field located immediately north of the recycled water main pipeline. Future recycled water service to this site is not contingent upon construction of the on-site non-potable system described above. The potential Lockheed Martin Plant 1 recycled water demand (for landscape irrigation and cooling, in roughly equal proportions) is estimated to be approximately 60 million gallons/year. The City's goal will be to incrementally capture as large a fraction of the irrigation component as possible over the next several years. Use of recycled water for cooling appears unlikely in the foreseeable future. The demand estimate listed in Table 3-2 therefore reflects only the irrigation component.

[5] In scheduling site retrofits, City staff prioritizes their efforts based on the magnitude of irrigation demand, the cost complexity of the retrofit effort, and the owner's level of interest and commitment.

Twin Creeks Sports Complex The Twin Creeks complex is located on the north side of Caribbean Drive adjacent to Baylands Park. It includes six softball fields; two soccer field have been proposed. The annual water use for the softball fields is approximately 17 million gallons per year. The City is in ongoing discussions with the owner regarding the possible use of recycled water at the site.

Moffett Park Industrial Area - Additional Sites Fifty-two sites in the Moffett Park Industrial Area are currently served by recycled water. An estimated 30 to 35 additional sites in the area will be converted to recycled water over the next several years, with an estimated irrigation demand of about 63 million gallons per year.

Encinal Park, Fair Oaks Park, 237/101 Interchange Extension of the West Main on Macara Avenue prior to that street's closure in 1999 provided the opportunity for service to the City's Encinal Park, while construction of Phase IIb Pipeline (East Main) will allow service to Fair Oaks Park. The Phase I pipeline included a lateral to the northwest side of the highway 237/101 interchange, for irrigating that portion which lies north of US101. The estimated irrigation demand for these three sites is 13 million gallons per year.

Table 3.2
Estimated Recycled Water Demand for Near-term "Infill" Sites

Site Description	Annual Total (million gallons/year)	Daily Average (gallons/day)*
Lockheed-Martin Plant 1 Add'l	30	82,000
Twin Creeks Sports Complex	17	47,000
Moffett Park Add'l (30-35 sites)	63	173,000
Encinal Park, Fair Oaks Park, 237/101 Interchange	13	36,000
Total	**123**	**338,000**

*365 day/year basis

MID-TERM DEMAND: LATERALS FROM EXISTING MAINS

The sites in this category all exhibit moderate to high levels of water usage, and all are accessible via laterals from the existing main pipelines. Service to these sites would provide a higher return on investment (water usage per construction dollar) than projects involving major extensions of either the east of west main pipelines. Therefore, unless a particular project, such as streamflow augmentation, drives the planning process in the direction of extending a main line, these sites constitute the next logical phase for system expansion. The sites are discussed briefly below and summarized in Table 3.2. Their locations are shown on Figure 2-1. Water usage estimates are based on recent (1997-1999) billing records. The lengths and estimated costs of pipelines needed to reach the sites are discussed in Chapter 4.

Where feasible, provision service to the infill sites described above will be the Program's first priority. Service to sites in the "mid-term" demand category described below will require additional funding authorization for design, construction, and retrofit. Given these requirements, the expected time frame for provision of service to sites in the "mid-term" category is 3-5 years.

1184-1260 Mathilda These four sites, located on the east side Mathilda Avenue in the vicinity of 5th Ave, are north of the existing pipeline on Mathida Ave. Access to the sites via an extension of that line is probably not feasible because of the high concentration of utilities on Mathilda. However, the City has a utility easement between Bordeaux and Mathilda that could provide access to the back side of the sites from the existing 8-inch line on Bordeaux.

Columbia Park, Lakewood Park, San Miguel School These sites can be reached via lateral extensions from the Phase IIb main pipeline. The main pipeline was constructed with tees at the each lateral location.

Argo Systems The site has five irrigation services, four of which are accessible from Mary Ave. Service would require construction of lateral lines on Corte Madera and Mary Avenues.

AMD, King Academy, National Semiconductor These three sites are located in the East Duane Industrial Area, and are accessible via lateral lines from the Phase IIb pipeline at East Duane Avenue (AMD), Britton Ave (King Academy) and Kifer Rd. (National Semiconductor). The two industrial sites have large areas of landscaping and turf served by existing landscape meters.[6] The King Academy (formerly Sunnyvale High School) has large athletic fields, but is served by a single (combined irrigation plus domestic) meter, therefore some on-site piping would also be required. Pipelines to these sites, and to other smaller sites located along the way to these sites, would constitute a scaled-back version of the project identified in previous planning studies as "Phase IIc".

Table 3.3
Estimated Recycled Water Demand for Mid-term Sites

Site Description	Annual Total	Daily Average
	(million gallons/year)	(gallons/day)
1184-1260 Mathilda	7.3	20,000
Columbia Park	10.6	29,000
Lakewood Park	8.8	24,000
San Miguel Playground	3.5	10,000
AMD	36.2	99,000
King Academy	4.7	13,000
National Semiconductor	9.1	25,000
Argo	8.4	23,000
Total	**88.6**	**243,000**

*365 day/year basis

LONG-TERM DEMAND: SITES WITHIN SUNNYVALE

Significant increases in recycled water deliveries, beyond the levels identified above, will require extension of the main pipelines into the central and southern parts of the City (and beyond), and construction of numerous laterals from those mains. Potential irrigation sites within the City limits include City parks and playgrounds, other landscaped maintained by the City and transportation agencies, homeowners associations (HOAs) and multi-family residential sites, and commercial/industrial sites. The potential recycled water demand for each of these categories is

[6] Sites with existing landscape meters are generally easier and less costly to retrofit for recycled.

discussed below. Residential sites are discussed briefly, although service to individual residences is not considered practical.

City Parks, Playgrounds, and Recreation Facilities Figure 3-1 shows the locations of City parks, playgrounds, and other recreation facilities. The are approximately 20 such sites with landscape meters that which are not included in the infill or midterm listings above. The largest of these facilities is Sunken Garden Golf Course, with an average water usage of about 130,000 gal/day (annual average basis). Usage for each of the remaining sites is typically between 5,000 and 40,000 gallons/day. Based on the water billing records, the total potential landscape demand for these facilities is estimated to be 459,000 gallons/day. As the recycled water distribution system is extended to the south, the specific layout (alignment) of pipelines will, to a large extent, be determined by the locations of these City facilities.

School Playgrounds Figure 3-1 also shows the locations of schools, some of which are adjacent to or associated with City parks. There are 22 such sites which are not included in the infill or mid-term listings above. Estimates for irrigation usage are subject to greater uncertainty, as most do not have separate landscape meters. Based on the available data, the total potential irrigation demand is estimated to be about 230,000 gallons/day.

Cityscapes (green belts and medians) The term cityscape is used to describe a variety of landscape areas maintained by the City and other agencies. These landscape uses include median and roadside planting strips, small civic parks, and landscape areas located adjacent to public buildings. In addition to the City of Sunnyvale's cityscape and median areas, there are similar areas maintained by the California Department of Transportation (Caltrans) and Santa Clara County Transportation Agency.[7] The estimated potential irrigation demand for cityscape not already included in the listings above is about 75,000 gallons/day, of which approximately 75% is at City of Sunnyvale sites. This figure does not include landscaping along Highways 85 or 280, most of which lies outside the City limits.

Home Owners Associations Home owners associations (HOA's) have large landscape areas maintained by the associations. The City's water billing database lists over 60 HOA accounts with landscape meters. Of these, 25 sites show usage of 2,000 gallons/day or more, and usage at two of the sites exceeded 10,0000 gallons/day. The combined total average annual usage for these 25 sites is approximately 140,000 gallons/day.[8]

Figure 3-2 shows the distribution of all landscape meters which have a reference to "HOA" or "Home Owners Association" in the City's water billing database. Many of these facilities are located in close proximity to the schools and parks described above. In addition, since many of these sites are located near or along major thoroughfares, providing recycled water to the HOA's would facilitate service to a number of cityscape meters.

[7] Portions of the new SCVTA light rail landscaping in the Moffett Park area are currently irrigated with recycled water. Recycled water is also used for Caltrans landscaping at the Caribbean/237, and Maude/237 interchanges.

[8] For purposes of this analysis it was assumed that the landscape-meters supply water for irrigation or fountains only. However, in some cases these meters may also be supplying water to swimming pools.

Industrial/Commercial Sites with Irrigation Meters Water billing records identify over 1,800 commercial and industrial accounts. Of these, approximately 225 also have irrigation accounts, with water usage exceeding 500 gallons/day. Sixty of these are sites included in the "current" and "near term" categories above. For the remaining 165 irrigation accounts, the estimated total annual demand is 660,000 gallons/day.

Industrial/Commercial Sites without Irrigation Meters A significant number of the commercial/industrial sites that do not have separate landscape meters have an irrigation demand, as evidenced by the pattern of water usage over the year. Earlier analysis by EOA estimated the irrigation fraction to be 30% of the total commercial/industrial water use at these sites.[9] Based on this factor, the total water usage for commercial/industrial sites without separate irrigation meters is estimated to be 0.7 million gallons/day.[10] However, the sites are widely dispersed, and tend to require more extensive on-site retrofit work as compared to sites with separate irrigation meters. Therefore, these sites do not "drive" the design of new pipelines, but may nonetheless be converted to recycled water when pipelines pass in their vicinity. Figure 3-3 shows the locations of industrial/commercial sites both with and without landscape meter.

Industrial/Commercial - Process Earlier planning studies considered varying scenarios of recycled water usage for industrial processes such as use in cooling towers and wet scrubbers. This study differs in that it does not anticipate a significant recycled water demand from these processes. Reasons for this include: 1) the higher levels of salinity (and other constituents) present in recycled water reduces the allowable number of concentration "cycles" for the cooling/scrubber water. This typically increases total water usage, and provides a disincentive to such use, 2) the declining number of "wet process" industries located in the City, and 3) competition from on-site water resources (i.e. groundwater clean-up projects). As the pipeline network is extended, it is likely that some process uses will arise, and the Program will evaluate these on a case-by-case basis.

Dual Plumbing - Title 22's "dual plumbing" provisions allow use of recycled water for toilet flushing within buildings used by the public[11]. Currently, there is one site (the City's SMaRT Station) where recycled water is used for this purpose. Although this use has the potential for generating year-round demand, the associated costs can be high, particularly in retrofit applications. For this reason, this report does not anticipate significant demand associated with the use of recycled water for toilet flushing.

Residential Use The use of recycled water for landscape irrigation at individual residences is also allowed under Title 22, and there is some precedence within California for such use (e.g. Irvine Ranch Water District). City-wide, the landscape irrigation demand is estimated to be on the order of 1.5 – 2.0 million gallons per year, distributed among 22,500+ sites. Because of the very high costs associated with delivering water to individual residences, and administering large numbers of small sites, service of recycled water to individual residences is not considered practical, and therefore not included in Table 3.4.

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[9] Usage by industries regulated under the WPCP's Pretreatment Program were developed separately, because some of these sites have large process water requirements, and the 30% factor would overestimate irrigation usage.

[10] Based on approximately 400 sites with estimated irrigation demand greater than 500 gallons/day. If only those sites with demand greater than 1000 gallons/day are considered, the number of sites is 190, and the total demand is 0.56 mgd. Some of these sites are located within the general areas described above for near and mid-term expansion, though not included in those listings.

[11] This wording is interpreted to exclude such use within individual residences.

Table 3.4
Potential Recycled Water Demand - Long-Term
Sites within Sunnyvale
(excludes sites listed in Tables 3.1 - 3.3)

Site Description	Approx. Number of Sites	Annual Total (million gal/yr)	Daily Average (gallons/day)*
City Parks, Playgrounds, and Recreation Facilities	20	168	460,000
School Playgrounds	22	84	230,000
Cityscapes (green belts and medians)	75	27	75,000
Home Owners Associations (largest 25 only)	25	51	140,000
Industrial/Commercial w/ Irrigation meters **	165	241	660,000
Industrial/Commercial w/o Irrigation meters **	400	256	700,000
Total		**827**	**2,265,000**

*365 day/year basis ** Sites >500gpd only

LONG-TERM DEMAND: SITES OUTSIDE SUNNYVALE

A number of potential recycled water customers lie outside the City of Sunnyvale in neighboring communities. The locations of these sites are shown in Figure 3-4, with the Sunnyvale Golf Course included to provide an approximate area scale. None of these sites have been characterized with regard to water usage or site specific conditions that may enhance or limit use of recycled water. A rough estimate would be that the sites listed below represent a total annual average demand of about 1 – 1.5 million gallons/day.

Except for Moffett Air Field/NASA Ames, these sites would be reached from extensions of the east and west mains, which are described in Chapter 4 of this plan. Service to most of these sites would require crossing Interstate 280 (I280) and/or Highway 85. The sites are briefly described below, starting in Santa Clara, then moving to the south and west through Cupertino, and up through Los Altos and Mountain View.

Central Park and Pruneridge Farms Golf Course, Santa Clara Central Park and the Pruneridge Farms Golf Course lie to the south and east of Sunnyvale within the City of Santa Clara. Each of these recreational facilities are approximately one-third the size of the City of Sunnyvale Municipal Golf Course. Santa Clara High School is located near Central Park.

Wolfe Road North of I-280 - Office Parks/Shopping Center Service to this large industrial/commercial area in the City of Cupertino would not entail crossing I-280. The Hewlett-Packard site is located at Homestead and Wolfe Roads, with several other office complexes located immediately to the south. Landscaped areas at these sites are similar to those in the City's Moffett Park Area. The Vallco Shopping Center located along Wolfe Road north of H-P also has extensive landscaping.

Wolfe Road & Stevens Creek Boulevard - Office Parks/Shopping Center Several office parks area located south of I-280 along Tantau Road and Stevens Creek Boulevard. Vallco Fashion Park is located on Wolfe Road south of the I-280 interchange. This shopping center has the potential for both landscape irrigation and cooling tower use. Cupertino High School is also located in this area.

De Anza Boulevard - Office Parks/Hotels/City Center Several opportunities for recycled water use in Cupertino lie south of I-280 along De Anza Boulevard (Sunnyvale-Saratoga Road). On the west side of De Anza there are several office complexes occupied by Apple Computer. Apple's corporate headquarters are located on the east side of De Anza. South of Stevens Creek Boulevard there is a hotel/office complex, an apartment complex and the Cupertino Civic Center, which all have landscaped areas.

Homestead High School Homestead High School is located North of I-280 at South Mary Avenue. Typical of high schools, it has large athletic fields. The I-280/Highway 85 interchange lies immediately to the southwest.

De Anza College and Memorial Park The De Anza campus is located immediately south of Stevens Creek Boulevard at Stelling Road and Stevens Creek Boulevard. Memorial Park is located across the street from the campus, north of Stevens Creek Boulevard.

Deep Cliff and Blackberry Farm Golf Courses Further east on Stevens Creek Boulevard is the Blackberry Farm Golf Course, a small nine-hole course and park which is approximately one-third the size of the Sunnyvale Golf Course. To the south of Blackberry Farm is Deep Cliff Golf Course, an eighteen-hole course approximately two-thirds the size of the Sunnyvale Golf Course.

Kaiser Cement Plant and San Antonio County Park The Kaiser Cement plant is located east of the City of Cupertino at the end of Permanente road. Possible uses of water include gravel washing and dust abatement. San Antonio County Park is immediately north the Kaiser Plant. Although most of the park is not irrigated, some opportunities for recycled water use may exist at the site.

Los Altos Country Club The Los Altos Country Club is an eighteen-hole golf course located north of Interstate 280 in Los Altos, approximately 1.6 miles east of the Sunnyvale City limits near Fremont Avenue. It is approximately two-thirds the size of the Sunnyvale Golf Course.

Parks & Schools in Los Altos and Mountain View To the north, and closer to the Sunnyvale City limits are Grant Park in Los Altos, and Mountain View High School, Cooper Park, Cuesta Park, St Francis High School, and Sylvan Park in Mountain View.

NASA's Ames Research Center & Moffett Federal Air Field The recycled water "west main" pipeline passes by the Moffett Golf Course, and an 8-inch service lateral to course's primary point of connection was constructed as part of the Phase I pipeline project.[12] However, in July 1997, golf course managers informed the City of their intention to use groundwater generated from the Navy's groundwater cleanup project for irrigation, in lieu of the current (potable) supply or recycled water. Future use of recycled water at the site will be contingent upon irrigation system improvements to the address certain hydraulic limitations and to eliminate potential cross-connections. Funding for needed improvements has been complicated by uncertainties regarding

[12] This primary point of connection to the San Francisco Water Department system is on the south side of the course near Macon Ave. Because of pressure/flow limitations associated with the course's irrigation system, there is a second, smaller point of connection to SFWD on the west side of the course.

agency jurisdiction over the golf course in the long term. For all these reasons, it is not anticipated that recycled water will be used at Moffett Golf Course in the near future. However, conditions may change, so recycled water use at Moffett Golf Course should be revisited periodically by the Program. The large water demand (estimated 150,000 gal/day yearly average) and proximity of existing recycled water facilities makes the Moffett Golf Course a particularly attractive site.

Other areas within NASA-Ames with potential for using recycled water include: the land around the runways (which in the past were leased for agricultural use and could be served from the existing main pipeline), a park and athletic field located along US101 at Dailey Road, landscaping located throughout the facility and the NASA Ames cooling towers. Significant use of water at NASA Ames for agricultural purposes or cooling towers at could push the total water use associated with sites outside Sunnyvale well above 1 – 1.5 mgd estimate cited above.

CHAPTER 4. SYSTEM EXPANSION

This chapter presents a plan for expanding the recycled water distribution system to capture progressively greater portions of the potential recycled water demand described in the previous chapter. The expansion is presented as a series of phases, each of which is characterized in terms of pipeline requirements, estimated costs, quantity of recycled water delivered.

BASIS FOR COST ESTIMATES

Cost estimates developed for this chapter are based primarily on the estimated unit construction costs ($/ft) for pipelines. Added to this was an allowance for service laterals, based on the anticipated size and number of connections, "special" construction costs (such as tunneling under major thoroughfares), pumping, and site retrofit.[13] Contractor overhead and profit and a 15% construction contingency allowance are included in the unit construction costs.

Unit costs were estimated based on construction cost manuals (regionally adjusted) and experience from recent projects. Costs reflect conditions as of January 2000. The majority of construction is expected to occur in City rights-of-way, which are paved, and which have a high density of other utilities. Unit pipeline costs are based on standard City construction standards (e.g. use of ductile iron pipe), and include an allowance for normal pipeline appurtenances (valves and fittings, corrosion protection, etc). Distribution pipelines are sized at six inches diameter minimum.[14] Service laterals were assumed to be 75 feet in length, unless otherwise noted. Assumptions regarding site retrofit costs are presented in the description of each phase. Unit construction costs are listed in Table 4-1.

Total project costs are based on total construction cost plus 35% for design, contract administration, and other miscellaneous costs. Not included in these estimates are costs of special studies or permits that might be needed for unusual projects, or costs associated with administering the Water Reclamation Program. The costs presented in this report should be considered planning level estimates only, and subject to a relatively high level of uncertainty.

PHASE I/II COMPLETION

Phase I/II Completion is defined as the provision of recycled water service to the sites described in the Chapter 3 under the headings of "Near-Term Infill Sites" and "Mid-Term Demand: Laterals from Existing Mains". Most of these sites were identified for service in earlier planning studies and construction phases, and the "Phase I/II" designation is used for consistency with those efforts.

[13] The City provides financial support for on-site modifications (retrofit) that may be needed in order to use recycled water, such as the isolation of irrigation systems from potable systems, removal of hose bibs on irrigation systems, etc. The level of support is based on expected water usage, at a rate of up to $500/acre-ft/year ($1530/million gallons/year). Sites which exceed this amount are considered on a case-by-case basis.

[14] Lines which may see significant additional demands in future demands were sized at 8 inches minimum. There are a number of cases in Phases III, IV, and V where a 4-inch line would have sufficient capacity to serve anticipated demands, and would provide a cost savings over use of a 6" line.

Table 4-1. Unit Construction Costs

Pipeline costs	$/ft
6”	55
8”	80
10”	105
12”	130
14”	153
16”	175
18”	190
20”	205
24”	230
Bore & Jack Crossings	200% of unit pipeline cost
Service laterals	**$**
2”	$1500
3”	$2250
4”	$3000

Near-Term: Infill Sites

Recycled water services exist to most of the sites designated as infill sites. Therefore, future costs associated with these sites are primarily the retrofit costs. The two largest sites (Lockheed Martin, Twin Creeks) are special cases, for which the City’s retrofit contributions have yet to be determined. A value of $150,000 is used in Table 4-2 as a “placeholder” estimate only. Future efforts at the Lockheed Martin site should focus first on providing service to the ball field. This is the largest irrigation site at the facility, and is located directly adjacent to the City’s recycled water main. For Encinal Park, Fair Oaks Park, and the 237 interchange, costs are based on $4,000/site, plus a $24,000 allowance for a 600 ft service feed across Fair Oaks park. For the sites in the Moffett Park Area, the total estimated retrofit cost of $72,000 was based on a value of $1800/site, which represents the historic average for sites in this area.

Table 4-2 Phase I/II Completion Summary of Future Costs – Infill Sites

Site Description	Future Project Costs	Est. Water Use (gal/day)
Lockheed-Martin Plant 1 (add’l), Twin Creeks Sports Complex	$150,000	184,000
Encinal Park, Fair Oaks Park, 237/101 Interchange	$36,000	36,000
Moffett Park Add’l (35 sites)	$63,000	173,000

All sites in this group have already had at least one site visit and a preliminary site evaluation. Many sites still require a detailed evaluation by City staff to identify site-specific retrofit needs. Others are currently in the permitting process or scheduled for hookup. A small number of sites are on “hold” pending change in ownership or other factors.

Mid-Term Sites: Laterals from Existing Mains

Pipelines needed to reach sites in this category are shown in Figure 4-1. Table 4-3 summarizes pipeline lengths and sizes, estimated project costs, and expected recycled water usage. A more detailed cost breakdown is provided in Appendix B, including a "cost of service" value, defined as the ratio of total project cost to expected annual water use.[15]

Table 4-3
Phase I/II Completion Laterals from Existing Mains
Summary of Pipeline Properties and Project Costs

Site Description	Pipe Dia. (inch)	Pipe Length (feet)	Total Project Cost ($)	Est. Water Use (gal/day)
1184 – 1260 Mathilda (4 sites)	6	1,600	$142,000	20,000
Argo Systems (3 services[16])	18	950	$139,000	23,000
Parks from Phase IIb (east) main Lakewood Park	6	3,350	$259,000	23,500
Columbia Park	6, 8	4,560	$434,000	29,300
San Miguel Playground	6	900	$66,000	9,500
AMD (3 services)	8	6,760	$773,000	100,000
King Academy (off E. main)	-	-	$28,000	13,000
National Semiconductor	8	2,300	$267,000	30,000
Total		**20,600**	**$2,108,000**	**248,300**

The four Mathilda Avenue sites would be reached via a City easement that runs between the sites from Bordeaux Ave. Lateral piping through the parking areas behind the buildings is included in the pipe length cited in Table 4-3. Service to the Argo Systems sites will require lateral lines on Corte Madera and Mary Avenue (north and south) to the services.[17] Services to the three City parks would run along City streets.[18] The line to Columbia Park could potentially serve a new housing development en route to the park. This would improve the economics of serving this site, which might otherwise be considered not cost-effective.[19] The line to AMD would originate from the east main at Duane Avenue, and "wrap around" much of the site on E. Duane, Stewart Drive and DeGuigne to reach the site's three irrigation services. The line to King Academy would originate from the east main on Britton Ave.[20] The line to National Semiconductor would originate from the main line at Kifer Road, or from the San Lucar Pump Station/Storage Tank site via Kifer Court.

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[15] The "cost of service" value is presented to assist in comparing and prioritizing projects within this group. It includes only future capital costs, i.e. it does not reflect the costs of the existing pipeline system.

[16] These are the three northernmost Argo services on Mary Ave. A fourth (LID #48198, listed as 929 Hermosa Ct,) located at Mary & Escalon, can be more economically served when the West Main is extended to Mary Ave (Phase IV).

[17] Earlier planning maps show the west main itself jogging east on Corte Madera Ave before turning south on Mary Ave. However, it appears preferably to continue running the west main in a straight southerly direction, within an unpaved City right-of-way, until it intersects with Mary Avenue (a distance of approximately 700 feet from the current terminus).

[18] The San Francisco Water Department rejected a request made by the City in 1998 to locate the future pipeline to Lakewood Park in the SFWD's Bay Pipeline easement (a more direct route).

[19] The 2200 ft segment of the Columbia Park lateral on Duane Ave was sized at 8-inches, which far exceeds the needs of the Park. However, this would be the only recycled water line into this area of the City, so the excess capacity is justified in the long run.

[20] The service line needs to reach the "subtract meter" located north of the oval, 400 feet east of the main. The site investigation will need to determine if the line downstream from the subtract meter also serves the swimming pool.

The sites in this category all have irrigation services, but have not been as well characterized as the “infill” sites described above. Therefore, the next step in the process will be to initiate discussions with the owners and occupants regarding use of recycled water, and to do on-site evaluations. Lakewood Park, Columbia Park, and San Miguel Playground have adjacent schools, and as such represent a new type of customer for the Program. Factors identified during the outreach and site investigation process could impact costs and/or feasibility of providing recycled water to these sites.

Maude Avenue Connector

With completion of Phase I/II, the distribution system will not be looped. Looping of water distribution systems is desirable because it increases system reliability and moderates pressure losses that sites far from the supply source may experience during certain flow conditions. Examination of Figure 4-1 shows that Maude Avenue would be the natural location for a line connecting the east and west mains, thereby looping the Phase I/II system, and providing a more direct route from the San Lucar storage and pumping facilities to the west main. The cost of a 12-inch line from Macara Avenue to Wolfe Road is estimated to be $1.55 million. Unfortunately, there is only one significant reuse site on Maude Avenue (Bishop Elementary School @ 6,360 gal/yr), so that the "cost of service" ($/gal delivered) of this segment would be very high.[21] For this reason, a Maude Avenue connector loop has not been incorporated into proposed system expansion.

Looping of the system via a line on Fremont Avenue is proposed for Phase V, as described below. However, if the City decides to limit future development of the recycled water system to the area north of the railroad tracks (i.e. the Phase I/II area), or if significant growth in demand takes place on the northwestern side of the City, then greater consideration should be given to a Maude Avenue connector line.

FUTURE EXPANSION - OVERVIEW

The design of the distribution system anticipates future expansion of both the east and west main pipelines to customers in central and southern Sunnyvale. As indicated in the maps presented in Chapter 3, these customers are distributed fairly uniformly in those areas. As a consequence, expansion of either main captures roughly the same volume of demand per mile of pipeline installed. Earlier planning studies anticipated that large volumes of recycled water might be used for groundwater recharge or other “export” purposes to the southeast. For this reason, the east main was sized to accommodate a higher ultimate flow than the west main. Therefore, units costs for extending the east main are greater than for the west. Offsetting this is the fact that the east main currently extends further to the south than the west main.

Chapter 5 examines the concept of releasing recycled water to Stevens Creek during the dry season as part of a streamflow augmentation project. Although there are significant uncertainties, such a project could involve flows up to four cubic feet per second (1,800 gallons/minute), with a expected release point in the vicinity of Fremont Avenue. In combination with the current and other

[21] Murphy Park, located approximately 2100 ft south of Maude Avenue, has an annual water demand of 12,500 gal/yr. However, because service to Murphy Park from Maude Avenue would involve an expensive bore and jack crossing of Central Expressway, its inclusion would not significantly improve the cost effectiveness. Reconfiguring the lateral from Columbia Park (service via Maude rather than via Duane Avenue) would provide some cost offset.

future demands on the west side of the City, this flow would tax the capacity of the west main. A possible solution would be to construct a recycled water storage tank on the west main, which would be filled during off-peak times. A preferred solution would be to construct an east-west pipeline along Fremont Avenue, in order to draw water from the (extended) east main on Wolfe Road, which has a greater flow capacity. The Fremont Ave line would also provide service to numerous sites along the way, and would link the east and west mains. Such interconnection of main lines enhances overall reliability by providing a multiple path to users, and is a prized feature of water utility systems. The proposed phasing presented below incorporates an east-west link on Fremont Ave.

The City's topography slopes gently from the sea level at the north end to a maximum of 300 feet above sea level at the southwest corner. This elevation difference, along with friction losses that occur as water flows through the pipelines, result in a loss of pressure as distance from the source (Water Pollution Control Plant) increases. As the system is extended to the south, it becomes necessary to boost the water pressure. On the west main, there is a provision for installing a booster pump station on the Sunnyvale Golf Course near Maude Avenue.[22] On the east main, the Phase IIb (San Lucar) pumping facilities near Wolfe Road and Kifer Road have provision for boosting a portion of the stations' output (approximately 1400 gallon/minute) to the higher pressure needed for expansion to the south[23] If demands south of Kifer Road exceed this amount, additional booster capacity will be required.

All sites listed for Phases III through V require thorough on-site evaluations. Preliminary site investigations should be conducted prior to commencing any engineering design work for each phase, as such investigations could determine that service to a particular site is not feasible, or that a more efficient pipeline alignment is possible.

PHASE III: EXTENSION OF THE EAST MAIN TO SUNKEN GARDENS TERRACE

The City's Sunken Garden Golf Course is the largest irrigation user south of the existing pipeline network, with an estimate annual demand of 130,000 gallons per day. Extending the east main along Wolf Road to Sunken Garden Terrace would allow service (via lateral pipelines) to the golf course, to Ponderosa Park/Elementary School and to Braly Park/
Elementary School. Although the new terminus would still be north of El Camino Ave, the extension would set the stage for a later east-west connecting line on Fremont Avenue, as discussed above.

Figure 4-2 shows the layout of the proposed main and lateral lines. Table 4-4 summarizes pipeline properties and costs, with a more detailed breakdown presented in Appendix B. Construction will require a bore and jack crossing of the railroad tracks immediately south of the existing pipeline terminus. It is assumed that a 20-inch diameter line would be used for the new main segment. A more detailed demand analysis and network optimization might show that a smaller line (e.g. 18-inch) would be sufficient. The retrofit allowance for Sunken Garden Golf

[22] Service to sites immediately south of this location (e.g. Encinal Park and the ARGO site on Mary Avenue) may not require installation of a booster station immediately. However, as the system is extended and overall demand system increases, such a station will be needed.

[23] The bulk of that station's pumping capacity is designed to pump water from the storage tank back (north) into the distribution system for use in northern Sunnyvale. It may not be necessary to create a pressure zone boundary at this time, if Sunken Gardens Golf Course's on-site irrigation pumps are used to serve that facility.

Course assumes that the greens will remain on potable water, and thus the allowance includes costs for a new “greens-only” irrigation main.

Table 4-4
Phase III: Extension of the East Main to Sunken Gardens Terrace
Summary of Pipeline Properties and Project Costs

Description	Pipe Dia. (inch)	Pipe Length (feet)	Total Project Cost ($)	Est. Water Use (gal/day)
Extension of main	20	6,800	$1,959,000	
Laterals & Retofit				
Sunken Garden	6	940	$151,000	130,000
Ponderosa Park/school	6	2,400	$193,000	20,000
Braly Park/School	6	2,390	$191,000	15,000
Total		**12,530**	**$2,494,000**	**165,000**

PHASE IV: EXTENSION OF WEST MAIN TO FREMONT AVENUE

Extending the west main along Mary Avenue to Fremont Avenue woull allow service to a number of City facilities and school playgrounds, including Cannery Park, Washington Park, Sunnyvale Civic Center, Las Palmas Park, DeAnza Park, Sunnyvale Middle School, Vargus Elementary School, Cumberland Elementary School, Cherry Chase School. It is expected that at least twenty industrial/commercial sites and ten Cityscape sites could also be served from these new lines.

Figure 4-2 shows the layout of the proposed main and lateral lines. Table 4-5 summarizes pipeline properties and costs, with a more detailed breakdown presented in Appendix B. Construction will require a bore and jack crossing of the railroad tracks near Evelyn Ave. It is assumed that main pipeline would remain 16-inch diameter to West Iowa Ave, and then be reduced to 14-inch for the segment to Fremont Avenue. Future analysis of demands and network optimization might show that smaller lines would be sufficient.

Table 4-5
Phase IV: Extension of West Main to Fremont Avenue
Summary of Pipeline Properties and Project Costs

Description	Pipe Dia. (inch)	Pipe Length (feet)	Total Project Cost ($)	Est. Water Use (gal/day)
Extension of main	14, 16	14,400	$3,211,000	
Pump Station		-	$270,000	
Laterals (includes est. retofit)				
Cannery Park	6	940	$72,000	2,000
Vargus Elementary School	6	700	$38,500	8,200
Washington Park	6	2,100	$198,000	15,000
Sunnyvale Civic Center	8, 6	3,250	$327,000	12,200
Las Palmas Park	6	3,000	$237,000	86,000
Brookline HOA	6	1,020	$83,000	7,800
Cumberland Elemen. School	6	130	$17,000	9,500
DeAnza Park	6	2,150	$112,000	21,200
Sunnyvale Middle School	6	1,750	$141,000	29,500
Cherry Chase School	6	2,050	$159,000	12,800
Misc. Industrial/Commercial	-	-	$89,000	60,000
Misc. Street Median	-	-	$17,000	15,000
Total		**26,000**	**$5,048,000**	**279,000**

PHASE V: FREMONT AVENUE INTERCONNECTING MAIN & LATERALS

An east-west pipeline along Fremont Avenue could deliver the large flows needed for a streamflow augmentation project in Stevens Creek. However, even without such a project, a Fremont Avenue main could provide service (via lateral lines) to most of the remaining major irrigation sites in the southern part of the City, including the Sunnyvale Community Center, Ortega Park, Panama Park, Fremont High School, Challenger School, San Antonio Park, several large HOAs, and various industrial/commercial and Cityscape sites. If construction occurred in the sequence described in this plan (after Phase IV), the line would provide an interconnection between the two mains. (Note, however, that construction of Phase IV is not a prerequisite to that of Phase V).

Figure 4-2 shows the layout of the proposed main and lateral lines. Table 4-6 summarizes pipeline properties and costs, with a more detailed breakdown is presented in Appendix B. A short extension of the east main, from Sunken Garden Terrace, across El Camino Avenue to Fremont Avenue, is required. It is assumed that this line would remain at 20-inch diameter to Fremont Ave, to preserve the option for large-scale exports to the southeast. Sizing of the Fremont Avenue main could vary from 12-inch to 16-inch, depending on the demand for streamflow augmentation.

Table 4-5 presents costs without a Steven's Creek streamflow augmentation element. Without this project, the Fremont Avenue main is sized at 12-inches. The demands of Phase V will require that an additional pump be installed at the Phase IIb (San Lucar) Pump Station.

Table 4-6
Phase V: Fremont Avenue Interconnect
Summary of Pipeline Properties and Project Costs
(without Streamflow Augmentation)

Description	Pipe Dia.* (inch)	Pipe Length* (feet)	Total Project Cost ($)	Est. Water Use (gal/day)
Extension of east main to Fremont Ave	20	1,300	360,000	-
Interconnecting main on Fremont Ave	12	10,550	1,852,000	-
Pump station expansion			101,000	-
Laterals (includes est. retrofit)			0	
Sunnyvale Community Center	6	2,770	209,000	50,000
Ortega Park/Stocklmeir School	6	3,500	288,000	29,600
Patterson Middle School	6, 8	2,800	288,000	50,700
Panama Park	6	1,650	130,000	7,650
Raynor Park	6	2,920	245,000	22,500
Fremont High School	6	800	89,000	29,600
Challenger School	6	940	78,000	9,500
Serra Park	8	3,300	363,000	36,800
Woodgate HOA	6	1,050	112,000	10,800
Nimitz Park/School	6	690	81,000	7,700
Sunset HOA	6	1,100	142,000	29,000
Sunset Oaks HOA	-		68,000	13,300
Misc Industrial/Commercial/HOA	-		45,000	30,000
Misc Cityscape	-		8,000	7,500
Total		**27,300**	**$4,459,000**	**334,650**

* Does not include smaller diameter on-site lines (if required). See Table B-4.

Pressures at Serra Park and San Antonio Park (both are located at an elevation of approximately 210 feet) will be approximately 50 psi, which is at the low end of the acceptable range of pressures.[24]

Potential recycled water demands at Homestead High School (in Cupertino) and Cupertino Jr. High School (in Sunnyvale) are fairly high, and both locations could be reached via extension of the Serra Park lateral. However, relatively long pipeline runs and a booster pump station would be required. As a result, the cost of service to these sites is high compared to other "lateral only" projects identified in this plan. Because Homestead HS is not currently served by the Sunnyvale's potable water system, service would also entail arrangements with the current supplier (Cal Water Co). For these reason, these two sites were not incorporated in the Phase V total. Service to these sites would be more feasible within the context of a future line which extends the Serra Park lateral to additional sites in Cupertino.

Phase V adds approximately 335,000 gallons per day to the annual average demand at a cost of $4.6 million. The overall "cost of service" value ($13.33/gpd) compares favorably to Phase III ($15.12/gpd) and Phase IV ($18.09/gpd), even without a streamflow augmentation element. This

[24] Modern irrigation systems are often designed to operate at pressures this low (or lower). However, the existing irrigation systems at these parks are probably designed for higher pressures, and some retrofit of irrigation equipment, or installation of on-site booster pumps, may be required.

in part reflects the fact that Phase V does not carry the costs of future phases (in the form of large main pipelines) to the extent that Phases III and Phase IV do.

For a streamflow augmentation project (see Chapter 5), the Fremont Avenue main line is sized at 16-inches. The lateral to Stevens Creek is sized at 10-inches. The latter would accommodate flowrates up to about 3 cubic feet per second (1350 gpm, or 1.94 million gallons/day). If higher flows were required, or expansion west along Fremont Ave into Los Altos were anticipated, a larger line would be needed. Additional pumping capacity at one or both of the booster stations would also be required to match overall demands.

Estimated costs for the streamflow augmentation component are presented in Table 4-7, along with an overall total for Phase V with streamflow augmentation included. The water usage shown is based on a 3 cubic feet per second rate for a duration of six months per year. The streamflow augmentation cost includes an allowance for dechlorination and equipment/structure at the release point, but assumes that cooling is not required. (This issue is discussed in Chapter 5. If required, cooling would add about $1,000,000 to the cost). Service to San Antonio Park is grouped with streamflow augmentation project, because this service utilizes a portion of the Stevens Creek lateral line. With a streamflow augmentation project, the "cost of service" value for Phase V drops sharply, to $4.30/gpd. This reflects the large volume of water associated with the project, and the fact that the project reaps the benefits of earlier investments in pipeline capacity.

Table 4-7
Phase V: Fremont Avenue Interconnect
Summary of Pipeline Properties and Project Costs
(with Streamflow Augmentation)

Description	Pipe Length (feet)	Total Project Cost ($)	Est. Water Use (gal/day)
Total, w/o streamflow (from Table 4-5)	31,100	$3,832,000	256,000
Streamflow augmentation component (see Appendix B, Table B-4)	2,520	$1,471,000	1,030,000
San Antonio Park	1,050	$89,000	15,500
Total, with streamflow augmentation	**34,670**	**$5,392,000**	**1,301,500**

* Plus upsizing 10,550 ft of Fremont Ave main from 12" to 16".

BEYOND PHASE V

Beyond Phase V, expansion of the system would be in the form of additional infill and service to sites outside Sunnyvale. These opportunities are described qualitatively below.

Additional Infill

Several areas within the City provide opportunities for expanded use of recycled water, but were not included in the above-described phases. The Tasman Industrial Area (east of Lawrence Expressway), has a number of small to medium size irrigation sites, but lacks a large park to "anchor" an expansion project. Just to the south, the line to Lakewood Park could be extended across Lawrence Expressway to reach Fairwood Park and Playground. The East Duane Area industrial area has several medium to large industrial/commercial/HOA sites that were not

included in Phase the I/II Completion category, most notably sites on Arques Ave and Oakmead Parkway.[25] The Fairwood and East Duane Area sites were not included in the Phase I/II Completion category, which focussed on a relatively small number of high demand sites closer to existing mains, so as to maximize the cost effectiveness. However, the East Duane area would be a logical place to look for additional infill.

Highway interchanges, with their relatively large areas, have the potential to utilize moderate amounts water. The City currently provides recycled water for landscaping at Highway 237 & Caribbean and at 237 & Maude Ave. A number of interchanges within the City are currently not landscaped and/or irrigated. Those that are tend have very water-efficient landscaping, so that water usage per unit area is much less than for parks, which have large areas of turf. In addition, highway interchanges typically have multiple points of connection to the water system, which increases the costs of providing recycled water service.[26] On the positive side, State law strongly supports use of recycled water for highway landscaping, and Caltrans staff is familiar with use of recycled water. For this reason, highway landscaping within the vicinity of recycled water lines should always be explored.

Sites Outside Sunnyvale

Chapter 3 identified the largest of the "close" irrigation sites in neighboring communities. The total annual average demand for sites identified in Figure 3-5 is probably in the range of 1 to 1.5 mgd. Although specific alignments and water usage were not evaluated as part of this plan, it is reasonable to assume that the cost of service for these sites would be in roughly the same range as for Phase III - Phase V for the closer sites in Cupertino and for Sylvan Park in Mountain View. (The former depends upon completion of Phase V, while the latter could be incorporated into Phase IV). The cluster of sites in Mountain View (Cuesta Park, St Francis HS, and Cooper Park) is attractive in terms of water demand and proximity to the west main. However, the cost of service to these sites would be relatively high because the pipeline route to this area is indirect and involves crossing both Highway 85 and Stevens Creek.

As noted above in reference to Homestead High School and Cupertino Jr. High School, expansion to the south will require construction of additional pumping facilities. These facilities are of moderate cost and footprint, and do not represent a significant barrier. Of much greater significance would be the need for additional storage, which could be necessary to accommodate large additional irrigation demands outside the City, particularly if a streamflow augmentation project is implemented as part of Phase V.[27] The high cost and scarcity of land for siting storage facilities dictates that these facilities be constructed below ground, with overlying land used for (or restored to) non-structural purposes such as parks, playing fields, etc. Underground storage is likely to cost $2-$3 per gallon for tanks in the 1–2 million gallon range, and would add significantly to the project cost. Open impoundments (e.g. golf course lakes) can sometimes provide on-site storage at a greatly reduced cost. Large additional demands that occurred during "off-peak" (daytime) hours could be readily accommodated without constructing additional storage facilities.

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[25] Earlier planning studies envisioned a more extensive distribution network in the East Duane area ("Phase IIc"), with lines on Arques, DeGuigne,Santa Trinita, Oakmead, and Lakewood. After the Moffett Park Area, this area has the highest concentration of commercial/industrial irrigation sites.

[26] For example, the 237/101 interchange has separate irrigation system for the north and south sides of US101, and the south side is not accessible from the existing recycled water network. Other interchanges in the City typically have from two to four points of connection to the water system.

[27] The "average daily demand" figures cited in this plan can be misleading in this respect. These figures represent annual average usage only. Irrigation takes place over a limited number of hours each day, and peak instantaneous demand during the peak irrigation season is many times greater (estimated. 8x-10x) than the annual average daily rate.

CHAPTER 5. STREAMFLOW AUGMENTATION

INTRODUCTION

This chapter examines opportunities for using recycled water from the City of Sunnyvale for purposes of augmenting flows in appropriate streams. The chapter provides a brief overview of regional streamflow augmentation (SFA) developments, and examines the potential for a SFA project in Stevens Creek. This chapter is intended to provide only a "first look" at such a project, and not the detailed environmental and engineering analyses that would be required if such a project were to go forward.

BACKGROUND

The objective of streamflow augmentation (SFA) is to create or maintain conditions that enhance the stream's aquatic habitat and riparian environment. Recycled water can play a role in this process by supplementing or replacing other water resources that might be used for this purpose. The concept has recently generated a high level of interest, and has been studied by the Bay Area Regional Water Recycling Program (BARWRP), the South Bay Water Recycling (SBWR) Program, the City of San Jose's Environmental Enhancement Program (EEP), and the Santa Clara Valley Water District (SCVWD). BARWRP looked at SFA from a broad regional perspective, with a view toward maximizing the overall use of recycled water in the Bay Area. The EEP looked more closely at projects that could be integrated into the SBWR Program, and reduce the discharge of wastewater from the San Jose/Santa Clara WPCP to Artesian Slough, while providing other environmental benefits. The SCVWD has conducted detailed studies of several streams within its service area as part of the Fisheries and Aquatic Habitat Collaborative Effort (FAHCE) program effort.[28] The studies by EEP and the SCVWD include local streams, and are the most relevant to potential SFA projects involving the City of Sunnyvale.

The EEP has conducted detailed investigations over the past two years in support of a pilot SFA project on Coyote Creek, which will be the first recycled water SFA project in the region. As the first project in Phase 1 of the Program, it will involve the release of 8 million gallons per day of disinfected tertiary recycled water during summer months to the creek, for purposes of enhancing the aquatic environment and supporting coldwater fish species. The project will include facilities for cooling and dechlorination of the water prior to release. The project will be conducted for three years as a pilot effort, and if successful, would continue and potentially be expanded to SFA in the Guadalupe River. As of December 2000, the project had secured an NPDES permit, but was still in formal consultations with the SCVWD regarding groundwater impacts and monitoring issues, and with the National Marine Fisheries Service regarding potential impacts on the fishery.

The EEP Development Report (July 1999 Preliminary Draft) surveyed other candidate SFA sites including two in or adjacent to Sunnyvale. Calabazas Creek in eastern Sunnyvale was not highly rated, since it is primarily earth levee and concrete in those portions which lie over the confined

[28] FAHCE is a cooperative, multi-part stakeholder process for resolving a complaint filed before the State Water Resources Control Board for alleged violations of Fish and Game Code, Water Code and Public Trust Doctrine related to cumulative impacts on salmon and steelhead and their habitats within the Guadalupe River, Coyote Creek, and Stevens Creek. FAHCE participants include the SCVWD, the California Department of Fish and Game, US Fish and Wildlife Service, the National Marine Fisheries Service, the National Heritage Institute, the Guadalupe-Coyote Resource Conservation District, and the City of San Jose. FAHCE's goal is to develop an interim fisheries and aquatic habitat management plan by December 2000.

aquifer.[29] Stevens Creek along the Sunnyvale/Mountain View border had greater environmental potential, but was ruled out due to its distance from SBWR facilities. However, Stevens Creek is the focus of studies by the SCVWD, which are discussed below.

REGULATORY REQUIREMENTS

Chapter 6 of the EEP report reviews the regulatory and policy requirements that are likely to apply to a SFA project. These are briefly summarized below, supplemented with information of relevance to a Sunnyvale SFA project. The reader is referred to the EEP report for a more thorough discussion.

SCVWD: The SCWVD's primary concern is protection of the drinking water aquifer, particularly the unconfined zone where recharge occurs. The SCVWD currently has no formal policies in this area, and defers to the Regional Water Quality Control Board's non-degredation policy. However, SCVSD has begun the process of identifying appropriate water quality criteria for future surface and groundwater augmentation projects.

California Department of Health Services: DOHS is responsible for establishing uniform recycled water quality criteria that are protective of public health. SFA is not a use covered under the current (or proposed) Title 22 criteria, so projects are evaluated by DOHS on a case-by-case basis. An SFA project would most likely be subject to the requirements for nonrestricted recreational impoundments, i.e. impoundments for which there are no limitations imposed on body contact recreational activities. Title 22 allows the use of disinfected tertiary recycled water for this application, with supplemental monitoring required in some cases. SFA projects in areas over the unconfined aquifer recharge zones would likely be subject to DOHS requirements developed to protect groundwater supplies, such as those which apply to surface spreading of recycled water.

California Water Resources Control Board The California Water Resources Control Board is required to identify waters that fail to meet water quality standards, and to adopt total maximum daily loads (TMDL's) for these "impaired" bodies. Neither Calabasas Creek nor Stevens Creek are listed as impaired bodies. However, release to either creek would be subject to water quality requirements under the National Pollutant Discharge Elimination System (NPDES) program, which is administered by the Bay Area Regional Water Quality Control Board (RWQCB). NPDES effluent and receiving water limitations developed for discharges to fresh water would most likely form the basis for NPDES permit limits.

Department of Fish and Game The Department of Fish and Game does not have established policies for SFA projects involving recycled water, and works with the RWQCB to establish criteria (particularly temperature and flow) for such projects on a case-by-case basis, which are

[29] The term "confined aquifer" refers to groundwater which is overlain with material sufficiently impervious so as to isolate it hydraulically from overlying (shallow) groundwater. Most of Sunnyvale lies over the confined aquifer, except at the extreme southwest corner, where the confined aquifer boundary cuts through diagonally (parallel to the base of the hills) just north of the Highway 85/I-280 interchange. On the other (uphill) side of this boundary, the aquifer is "unconfined" (i.e. not overlain with impermeable material), and it is in this unconfined area where recharge of the aquifer from surface water occurs. Groundwater pumped from the confined aquifer by the SCVWD and other agencies comprise a significant fraction of the potable water supply in Santa Clara Valley. At this point in time, planned SFA projects involving release of disinfected tertiary (Title 22) recycled water are being limited to areas where the streams are above the confined aquifer only.

then incorporated into the NPDES permit. The Coyote Creek pilot project, which is designed to support cold water fish species, has water temperature criteria that vary over the year, depending on the salmon and steelhead lifestages.[30] Temperature criteria based on support of cold water fish species typically cannot be met by recycled water without supplemental cooling.

SUNNYVALE RECYCLED WATER QUALITY

Sunnyvale WPCP effluent water quality data for selected parameters (temperature, dissolved oxygen, ammonia, pH, CBOD, and TSS) are shown in Figure 5-1.[31] Temperature values at the point of release for a SFA project could be expected to be several degrees lower than indicated in the figure, as a result of the water traveling 7 to 8 miles through underground pipelines. However, temperature values during the summer months are still likely to be above the levels required for support of cold water species.[32] Values for ammonia, pH, CBOD, and TSS appear to be within acceptable ranges during the likely months of release (assumed to be May–October). Levels of dissolved oxygen may be unacceptably low during periods in the fall. However, it may be possible to increase dissolved oxygen levels through operational measures at the WPCP.

Coliform levels in recycled water (not shown in Figure 5-1) are consistently less than 2 MPN/100 ml. Levels of total inorganic nitrogen and soluble phosphorous (also not shown) will be greater than normal stream levels, and have the potential to stimulate plant growth. Biostimulatory effects would need to be carefully tracked as part of any SFA project's monitoring program. Concentrations for metals and other toxics meet all current NPDES limits. These limits are based on discharge to salt water, and are more restrictive than the fresh water limits for most constituents.

The WPCP provides partial dechlorination of the recycled water sidestream. Current practice is to maintain a small chlorine residual (e.g. 1-2 mg/l) into recycled water pipeline. Unless it could be demonstrated that no chlorine residual would remain at the point of release, it would be necessary to provide dechlorination at some point prior to release into the stream.

OPPORTUNITIES FOR SFA PROJECT IN STEVENS CREEK

Stevens Creek offers the greatest potential for a SFA project utilizing recycled water from the City of Sunnyvale. As part of FAHCE effort, the SCVWD has recently completed an biological habitat assessment of Steven Creek. That report, to be issued in late 2000, will provide the framework for a habitat management plan for the creek.

The SCVWD has historically managed flows in Stevens Creek with the primary goal of optimizing the District's water supply. Typically, five to six cubic feet per second were from Stevens Creek Reservoir during summer months. Much of this flow percolated into the unconfined aquifer south (upstream) of Fremont Avenue to recharge groundwater supplies. In the future, releases from the

[30] Target release temperatures for the Coyote Creek project are 57 °F for October-May, 65 °F for June, 68 °F for July-September. Maximum target temperatures are 3 °F above the values. (Ref 4)

[31] Values shown are for the NPDES discharge stream. Values for the recycled water stream are very similar for these constituents.

[32] The critical factor is stream temperature, which is determined by a number of factors, including the temperatures of the recycled and other water in the stream, air temperature and humidity, and degree of shading. Stream temperatures will vary seasonally, diurnally, and with distance from the release point.

reservoir will be designed to balance the sometime conflicting goals of maximizing water supply, maintenance of cold water fish habitant, and maintenance of the riparian environment.

Maintenance of fish habitat requires that certain conditions of streamflow and stream temperature be provided during key life stages. High base flows, with periodic "pulse" flow are needed in January and February to support migration. Adequate flows and sufficiently low stream temperatures are needed during the May to October juvenile rearing period. It is anticipated that the Department of Fish and Game will require stream temperatures of 17 °C average, 22 °C maximum (62.6 °F, 71.6 °F, respectively). Because there is a limited pool of cold water in the reservoir from which to draw, it may not be possible to maintain dry season flow from the reservoir at historic (or higher) levels and simultaneously meet the temperature criteria. Lower flows would provide the necessary temperature environment for cold water fish habitat in the area downstream from the reservoir, but would not necessarily provide streamflow in the lower reaches of the creek, (i.e. downstream from Fremont Avenue) during the dry season.

Recycled water from the Sunnyvale WPCP could play a role in providing flows to the lower portion of the stream during the dry season (approximately May through October). A release point near (or north of) Fremont Avenue would be above the confined portion of the aquifer, which would minimize concerns regarding groundwater impacts and allow the current quality of recycled water to be used. The key issue would be that of temperature. Although the temperature of Sunnyvale's recycled water is somewhat lower than other POTWs (a consequence of the plant's large secondary treatment ponds), it is not low enough to meet the expected cold water temperature criteria described above. However, if the goal of providing cold water fish habitat for juvenile rearing were met in the upper reaches of the creek by cold water releases from the reservoir, and if a migration corridor existed during the appropriate times of the year, it may not be necessary to apply the same temperature criteria to dry season flows in the lower reaches of the creek. Under this approach, the objective of the recycled water SFA project would be that of maintaining streamflows primarily for purposes of riparian enhancement. Without a requirement for cooling, the economics of a SFA project designed for the lower reaches of the creek would improve significantly.

Potential recycled water SFA flow requirements cannot be predicted at this time, but would likely fall in the range of 2-4 cubic feet per second (approximately 900-1800 gallons/minute, or 1.3 – 2.6 million gallons/day). Although this demand would be seasonal, it would provide a significant "baseline" component to the City's overall recycled water demand, since water releases would not be limited to nighttime hours. Such "off peak" demand allows for greater utilization of pipeline capacity, which remains idle during much of the day.

As indicated in Chapter 4, a SFA project on Stevens Creek would integrate well into the proposed Phase V expansion of the recycled water distribution system. From the intersection of Mary Ave/Fremont Ave, a 10-inch line would be constructed along Fremont to Write Avenue, with an 8-inch line from Write Avenue to the release point. Potential release points have yet to be identified and evaluated, but it is assumed that the release point would be at (or just north of) Fremont Avenue.[33] It will be necessary to site dechlorination facilities[34] and flow control valve at some point along the pipeline west of Write Ave. The "footprint" required for these facilities will be fairly small for the range of anticipated flows. If cooling of the water were required, the required

[33] Stevens Creek crosses to the east side of Highway 85 just north of Fremont Avenue. City maps indicate that several large storm drains discharge into Stevens Creek in this area. These drains may provide possible release structure(s). This approach of using a storm drain as a release point is planned for the Coyote Creek project.

[34] Likely to consist of a sodium bisulfite storage tank, metering pumps, and associated controls.

footprint would grow, and the associated environmental impacts would be greater, making the siting of facilities more difficult.

Rough estimates for the costs of facilities for a Steven's Creek SFA project are included in Chapter 4 and Appendix B. Since Phases IV and V do not depend upon each other, construction of Phase V (with SFA component) could be done first.

FUTURE EFFORTS

Any future SFA efforts that Sunnyvale may undertake will need to be closely coordinated with the FAHCE program, SCVWD, and San Jose's EEP programs. The Coyote Creek pilot project will uncover key CEQA, water quality, permitting, and technical issues, and provide much of the framework for future SFA projects in the region. The FAHCE process will culminate in a management plan for Stevens Creek. At that point, it should be possible to determine what, if any, role a recycled water SFA project might play in the Stevens Creek watershed.

The cost of pipelines and related infrastructure represent a significant barrier to expansion of the recycled water system and development of an SFA project. Up to this point, costs of developing the recycled water infrastructure have been borne by the City. However, a Stevens Creek SFA project would provide benefits to the entire region and its water supply. Therefore, future efforts will also need to include development of multi-agency funding arrangements and investigations into outside funding sources.

As specified under Task 3 of the City's approved workplan for Provision E.7 of NPDES Order No. 98-053, the results of new or ongoing studies, investigations, and other developments related to the regional SFA and other water recycling opportunities described above will be summarized annually hereafter (through 2003) in a letter report. The report will also include a regulatory update section on changes in pertinent regulations.

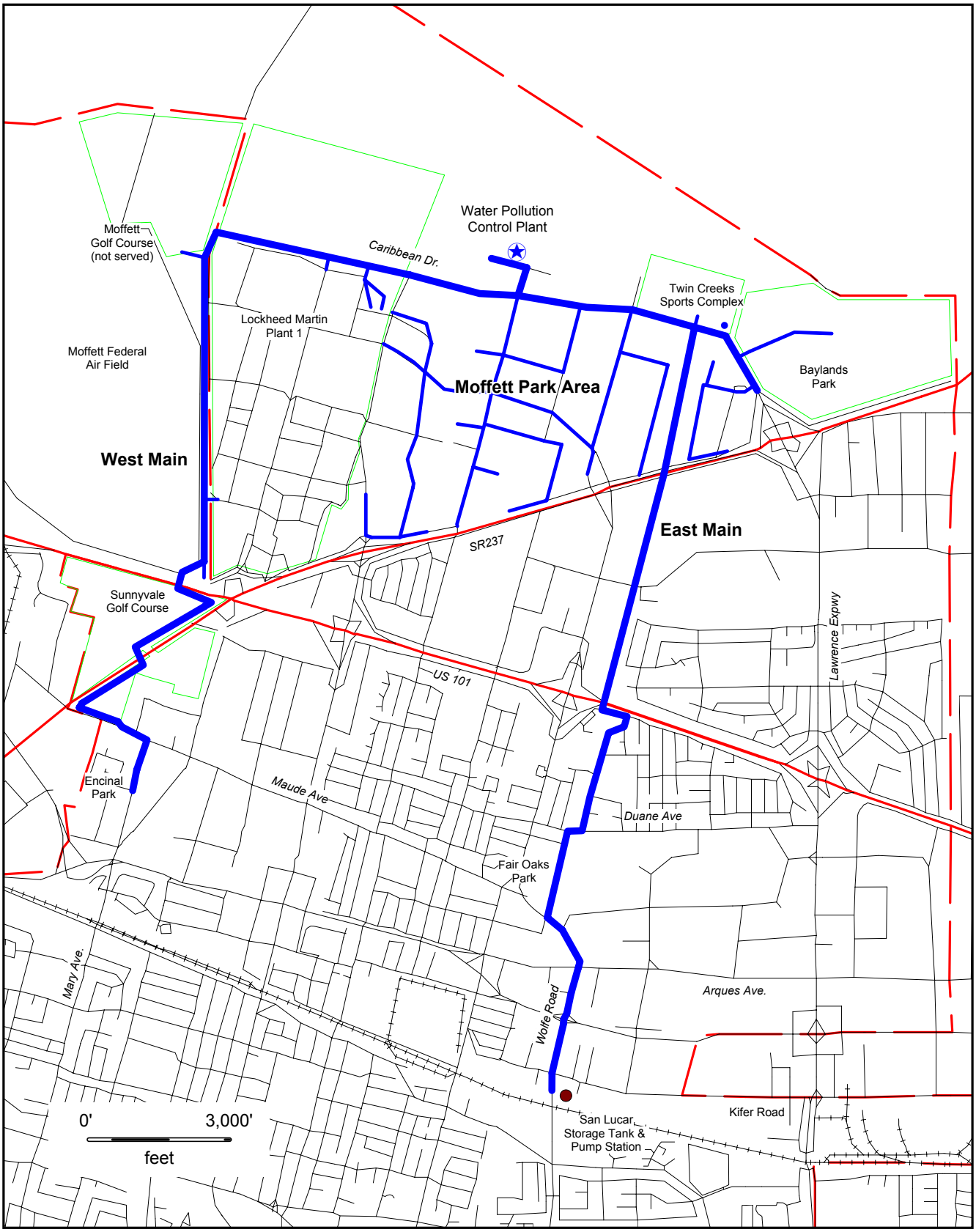
REFERENCES

1. EOA, Inc., *City of Sunnyvale Wastewater Reclamation Program, Draft Conceptual Design Report.* May 1992.

2. EOA, Inc., *City of Sunnyvale Water Recycling Program, Revised Phase II Pipelines Preliminary Design Report Update*. June 1993.

3. Tetra Tech, Inc. and RMC, Inc., *City of San Jose, Environmental Enhancement Program Development, Environmental Services Department, Preliminary Draft*, July 1999

4. Jones & Stokes*, Initial Study/Mitigated Negative Declaration, Coyote Creek Streamflow Augmentation Pilot Project*, March 2000



N

Existing Recycled Water Distribution System

City of Sunnyvale
Water Recycling Program

Legend

Existing Main Lines

Existing Secondary Lines

Figure No. 2-1

EOA, Inc.

July 2000

N

Location of Parks, Golf Courses, and School Playgrounds

City of Sunnyvale
Water Recycling Program - Master Plan

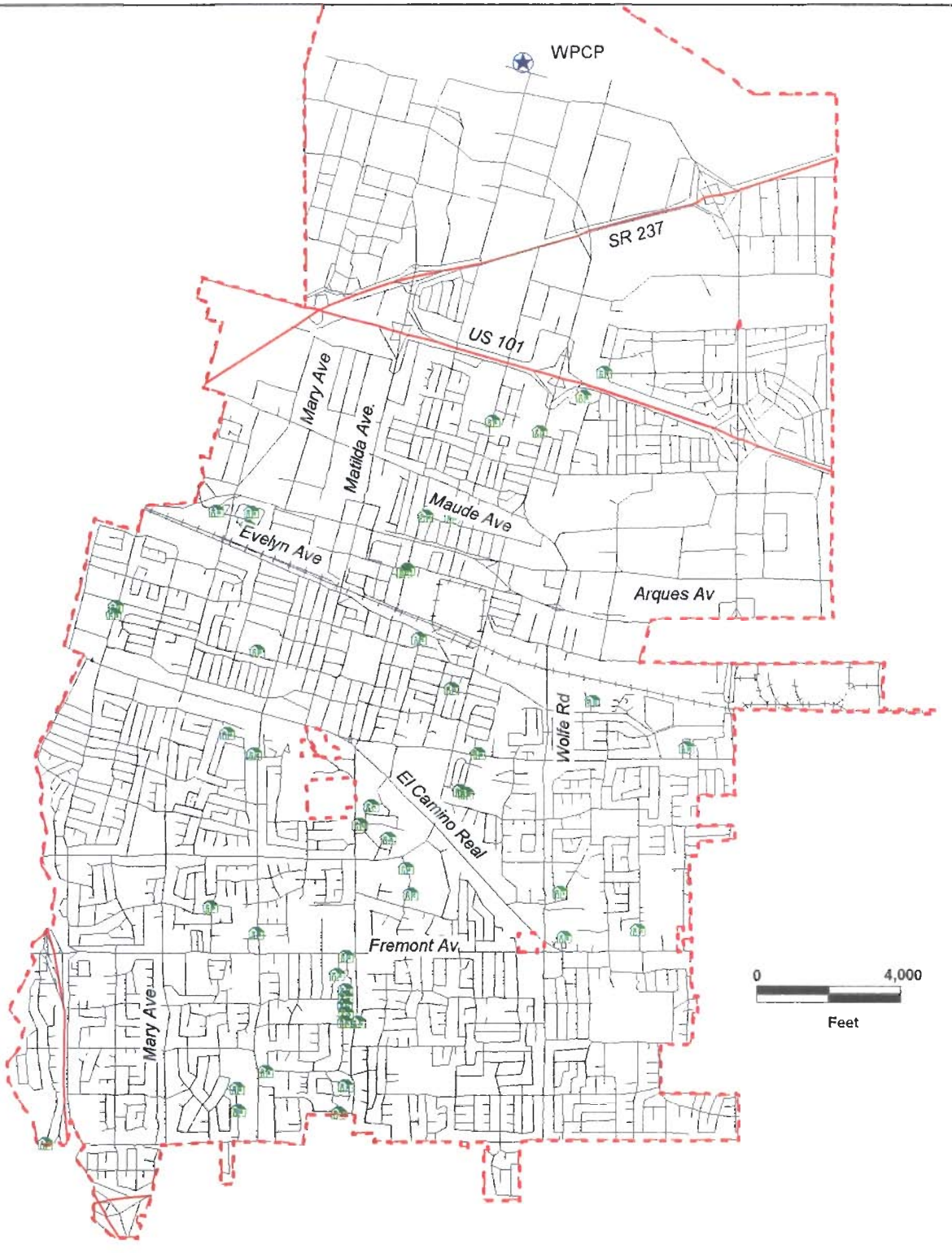
Legend

City Park
Golf Course
School Playground
City Limits

Figure No. 3-1

EOA, Inc.

Jan. 1996



N

Location of Home Owner Associations with Irrigation Meters

City of Sunnyvale
Water Recycling Program - Master Plan

Legend

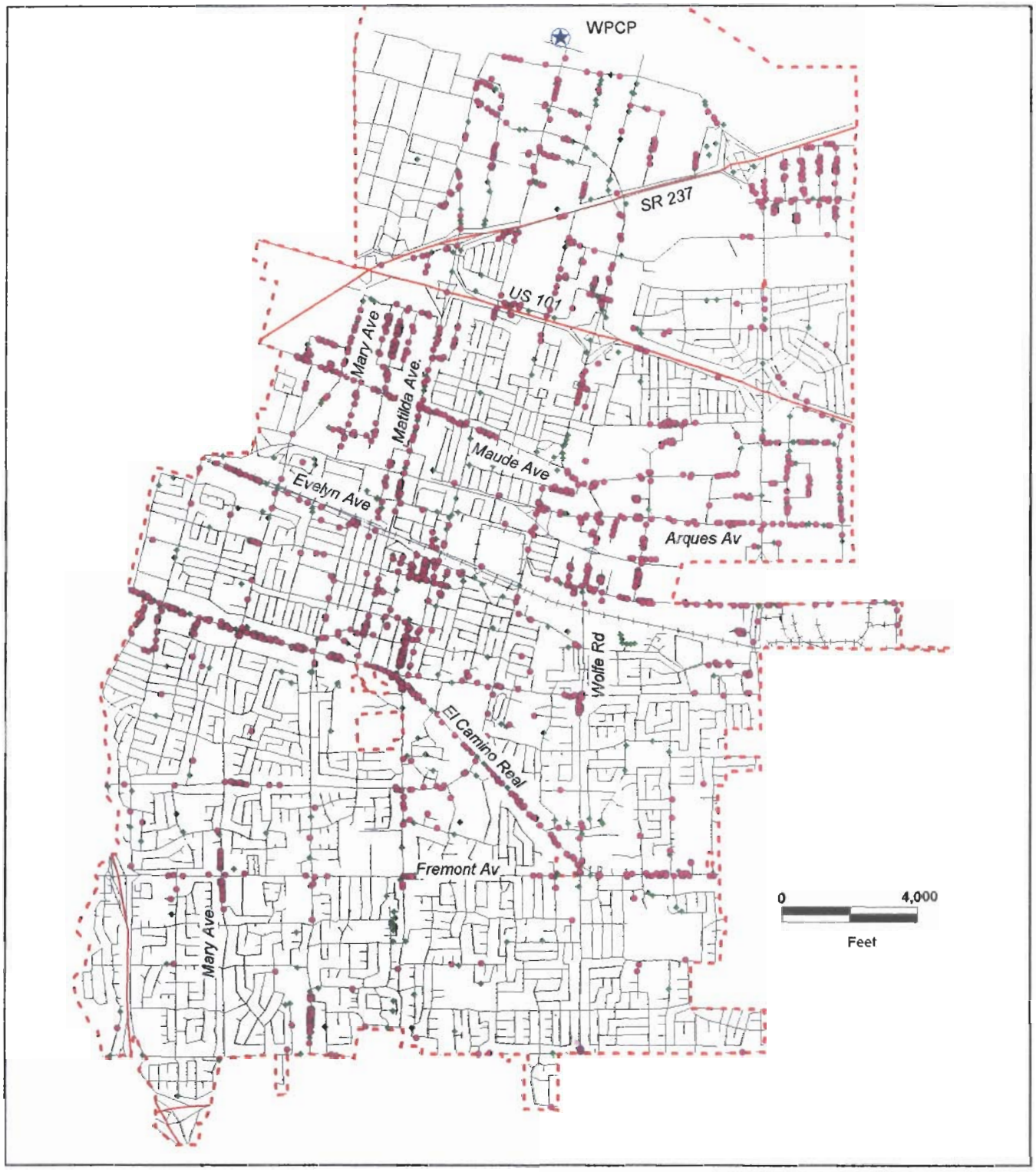
Home Owner Associations

City Limits

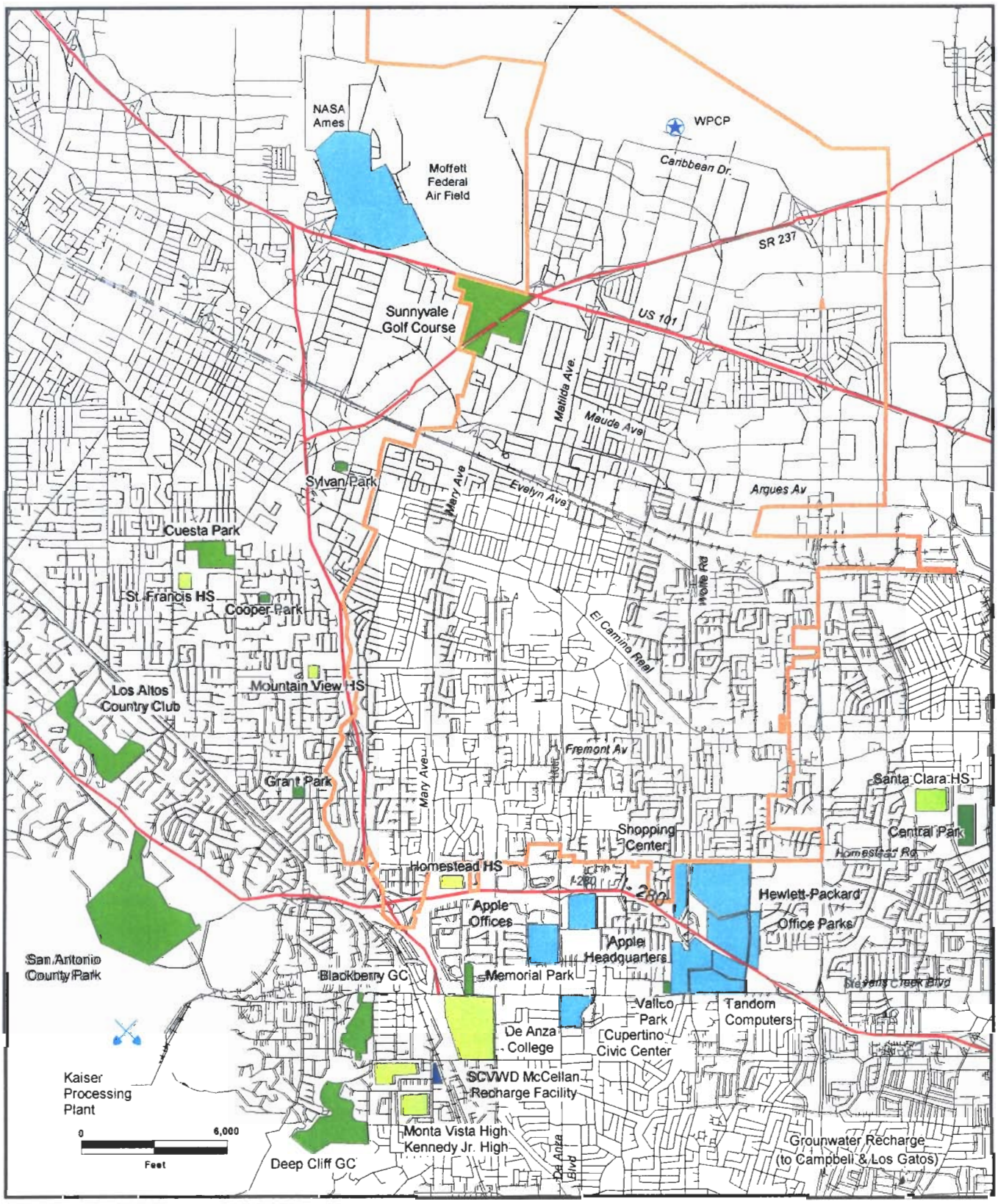
Figure No. 3-2

EOA, Inc.

Jan. 1996



N	**Location of Industrial and Commercials Accounts** City of Sunnyvale Water Recycling Program - Master Plan	**Legend** with irrigation meters ◆ without irrigation meters ● City Limits - - -	Figure No. 3-3 EOA, Inc. Jan. 1996



N

Potential Users of Recycled Water Outside of Sunnyvale

Note: Sunnyvale Golf Course shown as an area scale.

City of Sunnyvale
Water Recyling Program

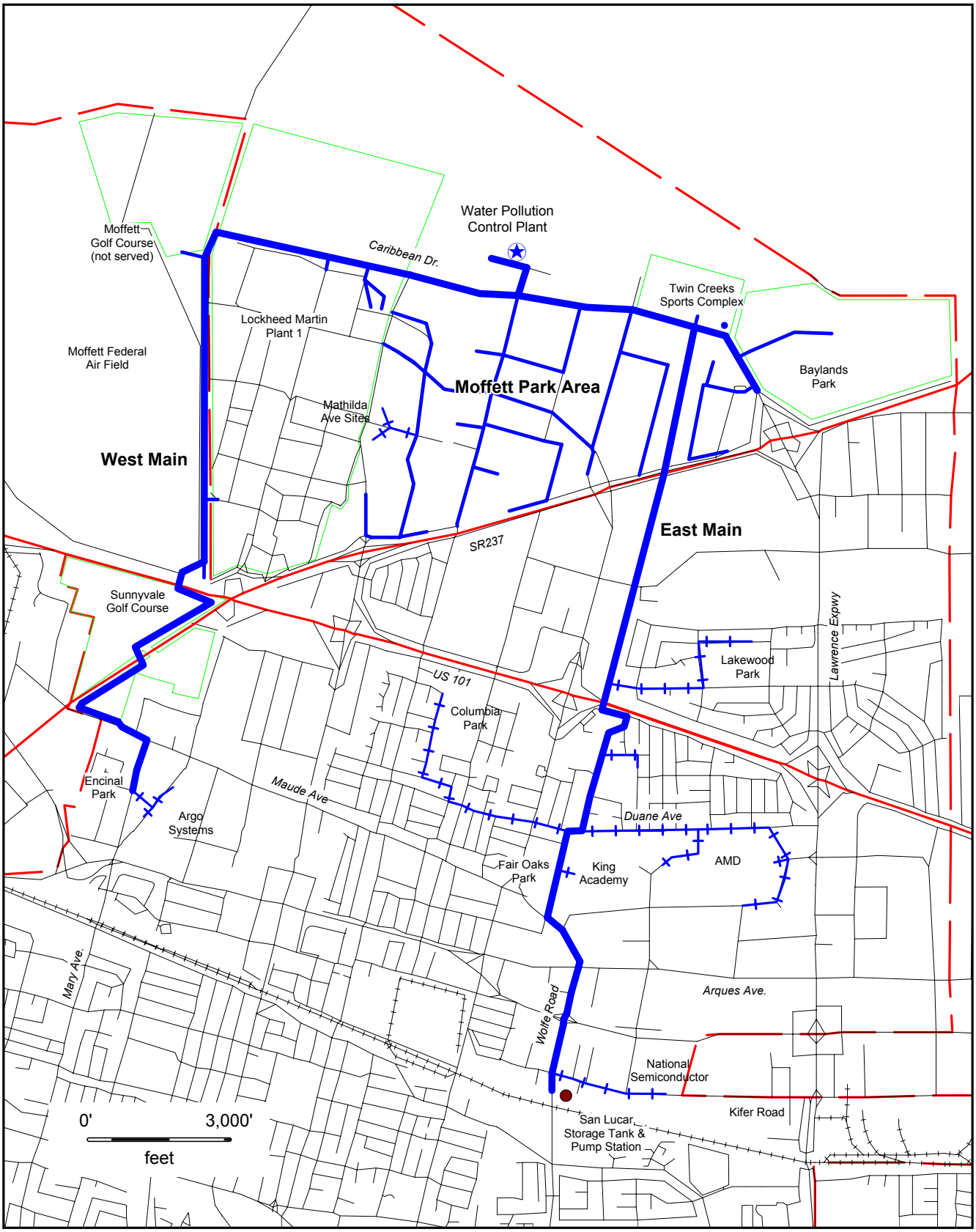
Legend

- Parks & Golf Courses
- Schools/Colleges
- Office Parks/Commercial
- City Sunnyvale Boundary

Figure No. 3-4

EOA, Inc.

May 2000



N

Phase I/II Completion
Infill Sites and Laterals from
Existing Mains

City of Sunnyvale
Water Recycling Program - Master Plan

Legend

Existing Main Lines

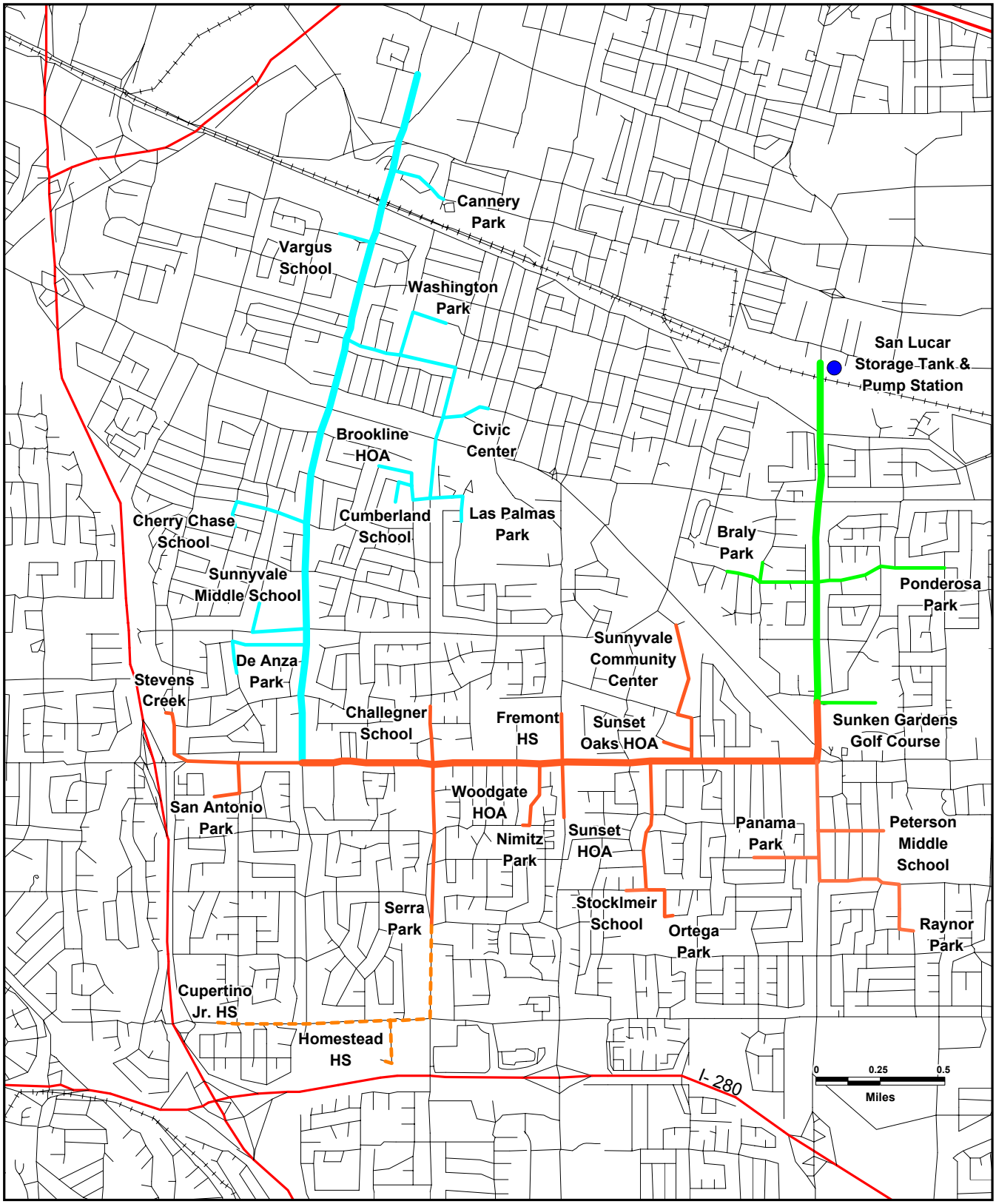
Existing Secondary Lines

Phase I/II Completion Lines

Figure No.
4-1

EOA, Inc.

May 2000



N

Future Expansion
Phase III, IV, V
(Proposed)

City of Sunnyvale
Water Recyling Program

Legend

Phase III

Phase IV

Phase V

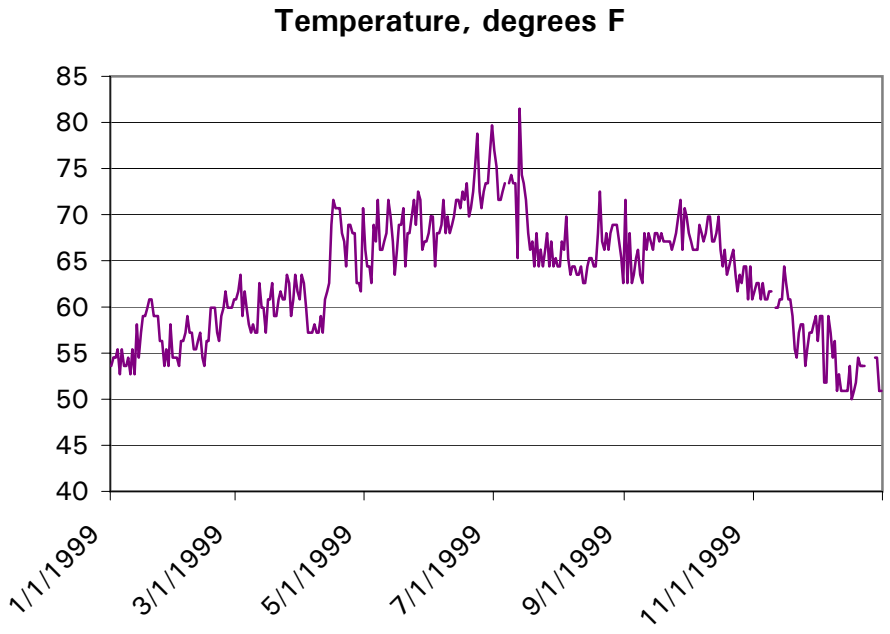
Bold lines indicate mains.

Figure No. 4-2

EOA, Inc.

May 2000

Figure 5-1
Sunnyvale WPCP Effluent Water Quality - 1999



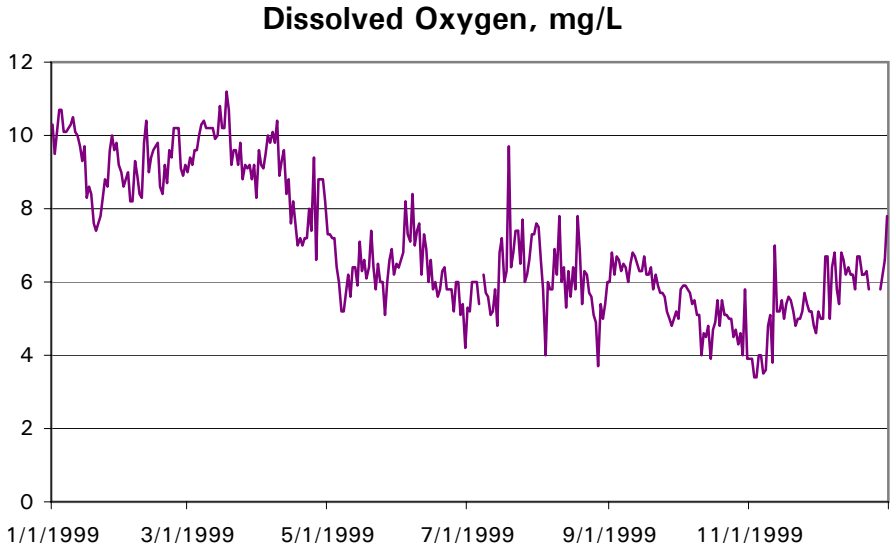
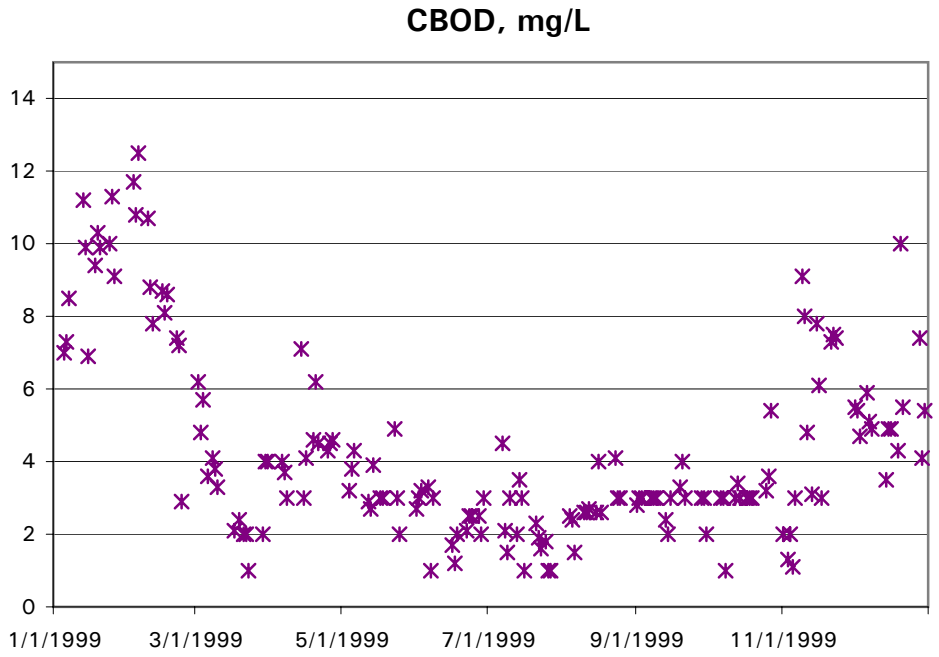


Figure 5-1, continued
Sunnyvale WPCP Effluent Water Quality - 1999



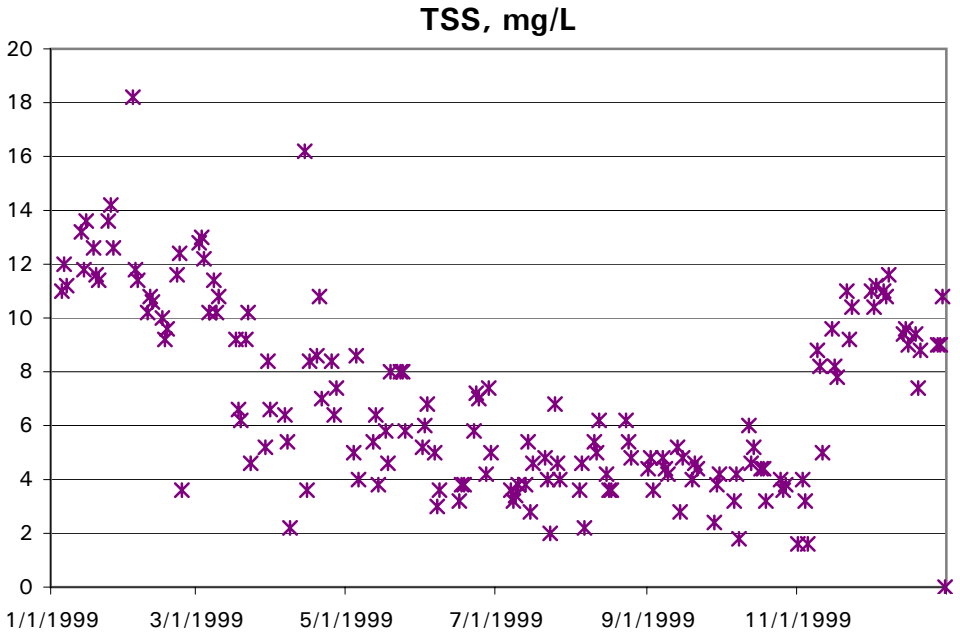
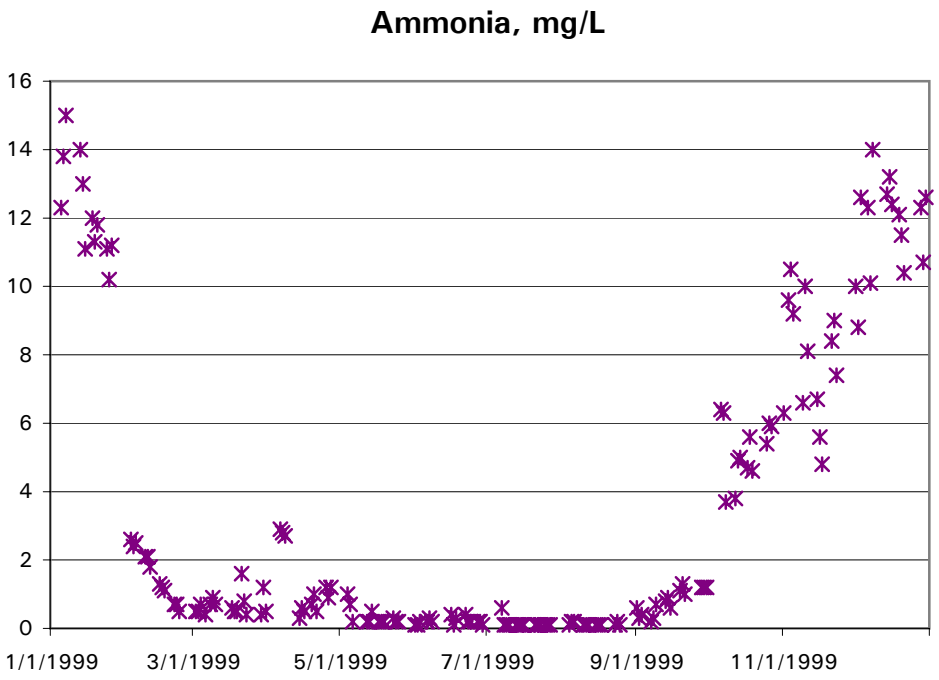
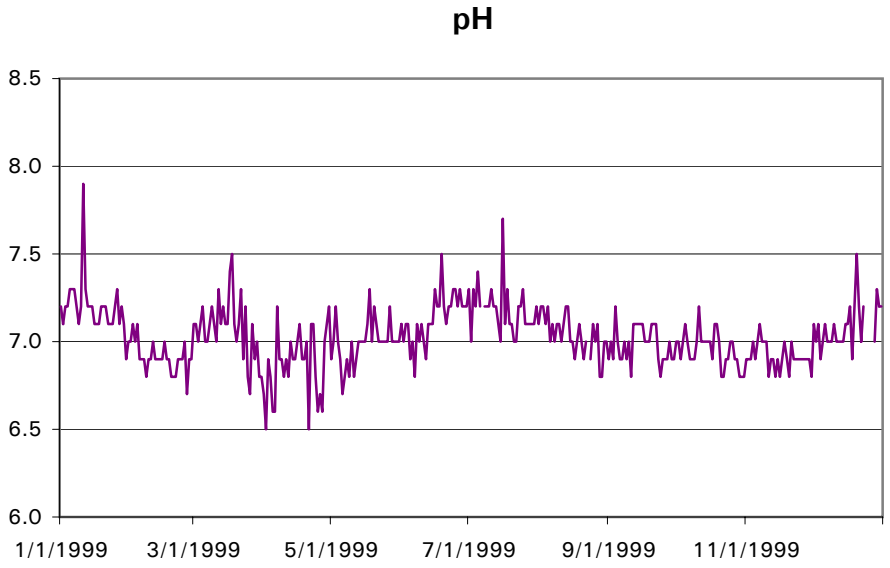


Figure 5-1, continued
Sunnyvale WPCP Effluent Water Quality - 1999





Appendix A

Tabulations of Recycled Water Demands

Table A-1 Irrigation Demand at Parks and Schools

PARKS	PHASE	ADDRESS	GALLONS/DAY	BASIS
BRALY PARK	III	0 IRIS AV	11,497	97/98
CANNERY PARK	IV	00 CANNERY PARK DR	2,018	97/98
CIVIC CENTER	IV	0 ALL AMERICA WY	3,851	97/98
CIVIC CENTER	IV	550 E. OLIVE	8,395	97/98
COLUMBIA PARK	I/II	707 MORSE AV	33,995	97/98
DE ANZA PARK/SCHOOL	V	1150 LIME DR	21,203	97/98
ENCINAL PARK	I/II	0 MACARA AV	9,105	95/96
FAIR OAKS PARK	I/II	540 N FAIROAKS AV	23,186	97/98
FAIRWOOD PLAYGROUND	-	1255 SANDIA AV	3,709	97/98
LAKEWOOD PARK/SCHOOL	I/II	834 LAKECHIME DR	25,900	97/98
LAS PALMAS PARK	IV	850 RUSSETT DR	86,200	97/98
MANGO PARK	IV	1050 MANGO AV	; Sunny. Mid School	
MURPHY PARK	-	260 N SUNNYVALE AV	12,545	97/98
NIMITZ PARK/SCHOOL	V	545 CHEYENNE DR	7,702	97/98
ORCHARD GARDENS PARK	-	238 GARNER DR	8,233	97/98
ORTEGA PARK	V	636 HARROW WAY	29,610	97/98
PANAMA PARK	V	817 DARTSHIRE WY	7,650	97/98
PONDEROSA PARK	III	811 HENDERSON AV	16,072	97/98
RAYNOR PARK	V	1565 QUAIL AV	22,468	97/98
SAN ANTONIO PARK	V	1026 ASTORIA DR	3,323	97
SERRA PARK	V	730 THE DALLES	34,861	97/98
SUNKEN GARDENS G.C.	III	1010 WOLFE RD	130,000	Est
WASHINGTON PARK	IV	SUNSET @ MCKINLEY	15,132	97/98
TOTAL PARK DEMAND			**517,000**	

SCHOOL PLAYGROUNDS		ADDRESS	GALLONS/DAY	BASIS
BISHOP SCHOOL	-	450 N SUNNYVALE AV	6,360	97/98
BRALY SCHOOL	III	675 GAIL AV	3,668	97/98
CHALLENGER SCHOOL	-	1185 HOLLENBECK AV	9,500	Est
CHERRY CHASE SCHOOL	IV	1138 HEATHERSTONE AV	12,844	97/98
CUMBERLAND SCHOOL	IV	824 CUMBERLAND DR	9,538	97/98
CUPERTINO JR HIGH SCHO	V	1160 S. BERNARDO	22,205	97/98
ELLIS SCHOOL	IV	550 E OLIVE AV	4,474	97/98
FAIRWOOD SCHOOL	-	1110 FAIRWOOD AV	8,549	97/98
FREMONT HIGH SCHOOL	-	1279 SUNNYVALE-SARATOG.	29,500	Est
HEWBREW DAY SCHOOL	-	1026 ASTORIA DR	2,155	97/98
KING ACADEMY	I/II	550 BRITTON AV	13,000	99
LAKEWOOD SCHOOL	-	750 LAKECHIME DR	see Lakewood Park	
NIMITZ SCHOOL	-	545 CHEYENNE DR	see Nimitz Park	
PALMER COLLEGE OF CHIR	-	1095 DUNFORD WY	5,000	*
PETERSON MID. SCHOOL*	V	1380 ROSALIA AV	50,700	97/98
PIPPIN SCHOOL	-	877 PIPPIN AV	5,000	*
PONDEROSA SCHOOL	III	804 PONDEROSA AV	3,959	97/98
SAINTS MARTINS SCHOOL	-	540 CENTRAL AV	5,000	*
SAN MIGUEL PLAYGROUND	I/II	777 SAN MIGUEL AV	9,161	97/98
STOCKLMEIR SCHOOL	V	572 DUNHOLME WY	5,000	*
SERRA SCHOOL	V	1510 LEWISTON DR	see Serra Park	
SUNNYVALE MIDDLE SCHO	IV	1090 MANGO AVE	29,458	97/98
VARGUS SCHOOL	IV	1094 CARSON DR	8,214	97/98
WEST VALLEY SCHOOL	-	1635 BELLEVILLE WY	5,000	*
TOTAL SCHOOL DEMAND			**253,000**	

GRAND TOTAL	**770,000**
GRAND TOTAL, excluding Phase I/II Completion Sites	**712,000**

Notes:

* Demand from City water records inconclusive (e.g. no separate landscape meter). Assume average 5000 gpd min.

** Designated as "SSPEB" meter. May include non-irrigation uses.

Table A-2
Industrial/Commercial Landscape Accounts (1990 basis)

SERV_NBR	ACCOUNT NAME	ADDRESS	ZONE	GAL/DAY	EXCL
025644	AMPRO COMPUTER INC.	990 ALMANOR AV		6,541	
017776	HARDAGE, ENTERPRISES	635 E EL CAMINO REAL XX		6,511	
020760	ST CYPRIAN CHURCH	1133 W WASHINGTON AV		6,418	
025627	CALIF MICROWAVE	985 ALMANOR AV		6,211	
025072	THE PRINCIPAL FINANCIAL GROUP	601 W CALIFORNIA AV		5,515	
000583	FERRARI BROTHERS	610 WEDDELL DR		5,427	
024982	ARGO SYSTEMS	929 HERMOSA CT		5,347	*
025630	OKI SEMI CONDUCTOR	785 N MARY AV		4,000	
025042	EXAR CORPORATION	433 MATHILDA AV		3,189	
000528	SOBRANTO DEVELOPMENT CO	1150 MORSE AV		2,896	
025643	RAYTHEON	760 N MARY AV		2,644	
011894	CREEKWOOD ASSOC	1195 BLACKBERRY TR		2,527	
000486	SYNTELLIGENCE INC	1000 HAMLIN CT		2,297	
030572	DIONEX COPRORATION	445 LAKESIDE DR		2,129	
003164	INMAC	470 MERCURY DR		2,121	
016190	ORCHARD SUPPLY	777 SUNNYVALE-SARATOGA		1,834	
000531	BERG & BERG DEVELOPMENT	1170 MORSE AV		1,824	
005298	CALIF CAFE BAR & GRILL	855 E HOMESTEAD RD		1,496	
017132	TRINITY METH CHR	583 FREMONT AV		1,373	
030569	MANOR HEALTH CARE	1075 SUNNYVALE-SARATOG.		1,314	
025853	LUCKY STORE	462 MATHILDA AV		1,185	
027413	MATHILDA LODGE	590 MATHILDA AV		1,135	
012567	ACC-U-TUNE	1004 W EL CAMINO REAL XX		1,121	
029750	FAIR OAKS INN	385 WEDDELL DR		1,115	
030262	PENINSULA INN	852 W EL CAMINO REAL XX		1,064	
029937	TEMPLE EL MONTE	455 MAUDE AV		1,031	
000561	PSMI CA40102	347 WEDDELL DR		947	
030421	SUNWEST PLAZA PARTNERSHIP	1049 E EL CAMINO REAL XX		781	
022319	JIFFY LUBE #295	999 W EL CAMINO REAL		738	
022506	SCHAWB CHARLES	204 MATHILDA AV		734	
030358	TUREK, ROSARIO D	670686 N FAIROAKS		500	
030357	U S CALIFORNIA ASSOCIATES INC	147 CRESCENT AV		467	*
030629	EL POLLO LOCO	996 W EL CAMINO REAL XX		447	*
008104	CAMINO DEL PRADO	0 CASTLETON TR		340	*
025290	PACIFIC MONOLITHICS INC	245 SANTA ANA CT		166	*
022313	PETERS, DON	901 W EL CAMINO REAL XX		135	*
022972	SUNNYVALE MEDICAL CTR	582 S SUNNYVALE AV		135	*
026007	COX, O L	303 WALNUT AV		121	*
030601	LEUNG, PATRICK	150 W EL CAMINO REAL XX		121	*
030614	PETERS, DON	913 W EL CAMINO REAL XX		100	*
030600	MARTIRE, CLEMENTINA	994 W EL CAMINO REAL XX		98	*
025841	SUNNYVALE SQUARE SHOPPING CT	352 MAUDE AV		74	*
021668	ADRIATIC DATSUN	848 W EVELYN AV		53	*
030582	JERRY BAKER ENTERPRISES	1151 WHITE PINE TR		41	*
027374	ABE, SHAHEEN	251 MAUDE AV		12	*
029153	MAPLELEAF INVEST	925 E DUANE AV		4	*
000372	TWIN CREEK SPORT	969 E CARIBBEAN DR		45,810	*
025565	AT&T TECHNOLOGIES INC	1090 E DUANE AV	E. DUANE IND. AR	81,116	*
025183	NATIONAL SEMICONDUCTOR	1091 KIFER RD	E. DUANE IND. AR	32,332	*
025478	HEWLETT PACKARD	974 E ARQUES AV	E. DUANE IND. AR	24,452	
029887	AMDAHL	1280 E ARQUES AV	E. DUANE IND. AR	18,460	
025494	H & R CHRISTENSEN	1140 E ARQUES AV	E. DUANE IND. AR	16,302	
025575	MIPS COMPUTER SYSTEMS, INC.	920 DE GUIGNE DR	E. DUANE IND. AR	14,056	
024908	IKOS	145 N WOLFE RD	E. DUANE IND. AR	10,685	
029886	AMDAHL	1240 E ARQUES AV	E. DUANE IND. AR	10,126	
003300	HEWLETT PACKARD	1266 KIFER RD	E. DUANE IND. AR	8,109	
003087	RESIDENCE INN CORP/FREY	0 OAKMEAD PY	E. DUANE IND. AR	8,054	
003090	BAYSHORE LAWRENCE PARTNERSH	0 OAKMEAD PY	E. DUANE IND. AR	6,896	
025137	SOLA/BARNES-HIND	810 KIFER RD	E. DUANE IND. AR	6,658	

Table A-2, continued
Industrial/Commercial Landscape Accounts (1990 basis)

SERV_NBR	ACCOUNT NAME	ADDRESS	ZONE	GAL/DAY	EXCL
003212	OAKMEAD TER OFFICE BLDG	1270 OAKMEAD PY	E. DUANE IND. AR	6,144	
003225	XEROX CORPORATION - DSBU	0 OAKMEAD PY	E. DUANE IND. AR	5,900	
025563	MORRIS ASSOC IX	595 LAWRENCE EX	E. DUANE IND. AR	5,015	
030507	W LESLIE PELIO	929 E ARQUES AV	E. DUANE IND. AR	4,644	
003189	TAIMEC	1220 MIDAS WY	E. DUANE IND. AR	4,638	
003110	MERRILL LYNCH	1255 OAKMEAD PY	E. DUANE IND. AR	4,586	
003207	OAKMEAD TER OFFICE BUILD	1230 OAKMEAD PY	E. DUANE IND. AR	4,543	
003102	RENCO PROPERTIES	1299 OAKMEAD PY	E. DUANE IND. AR	4,474	
003095	SUNNYVALE HILTON%DUELCE	0 OAKMEAD PY	E. DUANE IND. AR	4,172	
025169	MARTIN/DEVCON	1170 KIFER RD	E. DUANE IND. AR	3,883	
003071	CAL 1ST LTD I/MCCANDLESS	510 OAKMEAD PY	E. DUANE IND. AR	3,621	
003303	HEWLETT PACKARD	1272 KIFER RD	E. DUANE IND. AR	3,334	
029888	ALACON	158 COMMERCIAL ST	E. DUANE IND. AR	3,303	
025259	NANOMETRICS INC	690 ARQUES AV	E. DUANE IND. AR	3,279	
003048	AMDAHL CORP % FAC MAINT	350 OAKMEAD PY	E. DUANE IND. AR	3,162	
003320	KIM CAMP NO VII	1450 KIFER RD	E. DUANE IND. AR	2,818	
003259	C&H ASSOC%ALPHA INVEST PROP	520 LAWRENCE EX	E. DUANE IND. AR	2,779	
025406	CONSOLIDATED PUBLI INC	1127 SONORA CT	E. DUANE IND. AR	2,611	
003232	AMDAHL COPR	1255 E ARQUES AV	E. DUANE IND. AR	2,594	
003252	C%N ASSOC%ALPHA INVEST PROP	510 LAWRENCE EX	E. DUANE IND. AR	2,494	
003064	CALIF 1ST LTD PHASE III	460 OAKMEAD PY	E. DUANE IND. AR	2,293	
003245	WONG, MANTAN	500 LAWRENCE EX	E. DUANE IND. AR	2,191	
025535	ADVANTAGE PRODUCT TECH	310 DE GUIGNE DR	E. DUANE IND. AR	1,879	
003296	XIDEX CORP ATTN:A/P	1242 KIFER RD	E. DUANE IND. AR	1,488	
003078	ELSIN CORP	540 OAKMEAD PY	E. DUANE IND. AR	1,174	
003289	KIFER LAWRENCE STATION PARTNE	1202 KIFER RD	E. DUANE IND. AR	1,062	
029691	FRANCISCIAN BUILDERS	1190 MIRALOMA WY	E. DUANE IND. AR	998	
025345	BANK OF AMERICA 710834	921 E ARQUES AV	E. DUANE IND. AR	766	
003068	ANDO CORP	480 OAKMEAD PY	E. DUANE IND. AR	742	
003081	ELSIN CORPORATION	0 OAKMEAD PY	E. DUANE IND. AR	691	
025520	FRY'S ELECTRONICS INC.	1177 KERN AV	E. DUANE IND. AR	605	
003287	PRICE CLUB	164 LAWRENCE EX	E. DUANE IND. AR	457	*
003089	CALFI DEPT OF TRANS	0 OAKMEAD PY	E. DUANE IND. AR	39	*
020955	P G & E/SUBSTATION	730 KIFER RD	E. DUANE IND. AR	16	*
000587	GIBSON SPENO CO	615 TASMAN DR	E. SUNNYVALE RE	3,574	
001969	SAN JOSE ASSOC/NOVICK R	1139 TASMAN DR	E. SUNNYVALE RE	2,203	
000579	LION & COMPASS RESTAURNT	1023 N FAIROAKS AV	E. SUNNYVALE RE	2,187	
001496	DICKS MARKET	1133 LAWRENCE EX	E. SUNNYVALE RE	1,041	
002280	WILDWOOD SHOPPING CTR	1203 WILDWOOD AV	E. SUNNYVALE RE	12	*
002102	IDEC	1213 ELKO DR	E. TASMAN IND. A	5,472	
002169	BEST LABS	1248 REAMWOOD AVE	E. TASMAN IND. A	4,451	
002034	UNITED PARCEL SVCS	0 ELKO/HAMMERWOOD	E. TASMAN IND. A	2,808	
002066	XIDEX CORP ATTN:A/P	1282 REAMWOOD AV	E. TASMAN IND. A	2,150	
002018	FUZERE MFG	1237 BIRCHWOOD DR	E. TASMAN IND. A	1,803	
002054	NEW YORK SAUSAGE	1228 REAMWOOD AV	E. TASMAN IND. A	1,033	
001977	JOHN, PARKER CHEV	1265 LAWRENCE STATION RI	E. TASMAN IND. A	687	
026208	CALIHAHNS CO/DBA DAISY RIDGE	201 W CALIFORNIA AV	EVELYN IND. AREA	7,787	
025111	WESTINGHOUSE A/P	175 SOBRANTE WY	EVELYN IND. AREA	5,757	
025273	J J & W	703 E EVELYN AV	EVELYN IND. AREA	3,072	
025109	LINCOLN MATHILDA ASSOC	800 W CALIFORNIA AV	EVELYN IND. AREA	3,053	
030399	FAIROAKS VILLAGE	555 E WASHINGTON AV	EVELYN IND. AREA	2,769	
026860	J J & W	707 E EVELYN AV	EVELYN IND. AREA	2,232	
023726	GOLDEN GATE COMMERCIAL	457 E EVELYN AV	EVELYN IND. AREA	2,137	
025067	TONY MELLOW	221 MATHILDA AV	EVELYN IND. AREA	1,928	
023730	GOLDEN GATE COMMERCIAL	477 E EVELYN AV	EVELYN IND. AREA	1,228	
020992	SOUTHLAND CORP	1002 W EVELYN AV	EVELYN IND. AREA	416	*
001485	P G & E	0 N FAIROAKS AV	EVELYN IND. AREA	162	*
000520	PACIFIC DATA IMAGE	1111 KARLSTAD DR	INDUSTRY N. OF	5,457	
000537	SOBRANTO DEVELOPMENT CO	1139 KARLSTAD DR	INDUSTRY N. OF	5,148	

Table A-2, continued
Industrial/Commercial Landscape Accounts (1990 basis)

SERV_NBR	ACCOUNT NAME	ADDRESS	ZONE	GAL/DAY	EXCL
000619	PRECISION CIRCUIT	539 WEDDELL DR	INDUSTRY N. OF	2,078	
000614	GOLDEN GATE COMMERCIAL	549 WEDDELL DR	INDUSTRY N. OF	2,029	
000602	GOLDEN GATE COMMERCIAL	1030 KIEL CT	INDUSTRY N. OF	1,826	
030056	J & S DEVELOPMENT	102 PERSIAN DR	INDUSTRY N. OF	613	
000156	AETNA PROPERTY SERVIES	1221 CROSSMAN AV	INDUSTRY N. OF	22,081	*
000036	RREEF	155 MOFFETT PARK DR	INDUSTRY N. OF	20,499	*
000046	MOFFET PARK LAKE %K.K.S.	0 MOFFETT PARK DR	INDUSTRY N. OF	15,382	*
000313	ESL INCORPORATED	1345 CROSSMAN AV	INDUSTRY N. OF	10,167	*
000369	AETNA PROPERTY SERVICES	1308 MOFFETT PARK DR	INDUSTRY N. OF	9,796	*
029929	ESL CORP.	1350 GENEVA DR	INDUSTRY N. OF	8,615	*
000032	ESL INCORPORATED	1330 GENEVA DR	INDUSTRY N. OF	8,396	*
000339	AUGUST/WDG MOFFETT LTD	611 BALTIC WY	INDUSTRY N. OF	7,777	*
000293	LORAL SPACE & RANGE SYSTEMS	1260 CROSSMAN AV	INDUSTRY N. OF	5,869	*
000062	LOCKHEED (LMSC B-563)	1260 MATHILDA AV	INDUSTRY N. OF	5,798	*
000309	ESL INC. %P J NICKOL	0 CARIBBEAN DR	INDUSTRY N. OF	5,787	*
030422	SOUTH BAY CONSTRUCTION	1320 CHESAPEAKE TR	INDUSTRY N. OF	5,654	*
000145	JOHN HANCOCK PROP INC	324 GIBRALTAR DR	INDUSTRY N. OF	5,603	*
029931	WYNDHAM GARDEN HOTELS%B TY	1300 CHESAPEAKE TR	INDUSTRY N. OF	5,507	*
000348	AETNA PROPERTY SERVICES	908 E CARIBBEAN DR	INDUSTRY N. OF	5,343	*
000118	MCCANDLESS MOFFET #1 PARTNER	215 MOFFETT PARK DR	INDUSTRY N. OF	5,322	*
030458	SOUTH BAY CONSTRUCTION	1310 CHESAPEAKE TR	INDUSTRY N. OF	5,103	*
000204	ATHERTON TECHNOLOGY	1333 BORDEAUX DR	INDUSTRY N. OF	5,017	*
000175	ASK ASSOCIATES III	1220 CROSSMAN AV	INDUSTRY N. OF	4,900	*
000238	A G ASSOCIATES	1325 BORREGAS AV	INDUSTRY N. OF	4,812	*
000050	PACIFIC FRESH RESTAURANT	1130 MATHILDA AV	INDUSTRY N. OF	4,455	*
000233	HIGH TECHNOLOGY TRANSPORTATI	1383 BORREGAS AV	INDUSTRY N. OF	4,418	*
000039	LOCKHEED	375 MOFFETT PARK DR	INDUSTRY N. OF	4,416	*
030455	TELEBIT CORPORATION	1325 CHESAPEAKE TR	INDUSTRY N. OF	4,353	*
000042	SHERATON SUNNYVALE INN	1100 MATHILDA AV	INDUSTRY N. OF	4,084	*
001051	ATARI CORP% ACCOUNTS PAYABLE	210 HUMBOLDT CT	INDUSTRY N. OF	4,054	*
000075	GRUBB & ELLIS PROPERTY MGMT	1183 BORDEAUX DR	INDUSTRY N. OF	4,049	*
030452	TELEBIT CORPORATION	1315 CHESAPEAKE TR	INDUSTRY N. OF	3,945	*
000296	LORAL SPACE & RANGE SYSTEMS	1312 CROSSMAN AV	INDUSTRY N. OF	3,896	*
000043	BENTLEY'S AT SHERATON S'VALE	321 MOFFETT PARK DR	INDUSTRY N. OF	3,881	*
000078	BAYD INC	1175 BORDEAUX DR	INDUSTRY N. OF	3,869	*
000310	ULTRA SYSTEMS	1327 ORLEANS DR	INDUSTRY N. OF	3,527	*
000208	RREEF	1330 BORDEAUX DR	INDUSTRY N. OF	3,420	*
000357	LOCKHEED MISSLES & SPACE CO	1349 MOFFETT PARK DR	INDUSTRY N. OF	3,326	*
000362	CONSOLIDATED FREIGHT WAYS	1319 MOFFETT PARK DR	INDUSTRY N. OF	3,236	*
000302	LOCKHEED (LMSC B-581)	1344 CROSSMAN AV	INDUSTRY N. OF	3,172	*
000083	1153 BORDEAUX DR LMT PTR	1153 BORDEAUX DR	INDUSTRY N. OF	3,062	*
000164	LORD RAYLEIGH'S	352 JAVA DR	INDUSTRY N. OF	2,996	*
000342	LOCKHEED (LMSC B-577)	1366 CROSSMAN AV	INDUSTRY N. OF	2,574	*
000319	CASTLEHILL	1299 ORLEANS DR	INDUSTRY N. OF	2,570	*
030462	LOCKHEED	0 MATHILDA & 6TH XX	INDUSTRY N. OF	2,375	*
000124	HUMBOLDT COURT ASSOC 4	220 HUMBOLDT CT	INDUSTRY N. OF	2,312	*
000279	GCW ASSOCIATES	1358 BORREGAS AV	INDUSTRY N. OF	2,303	*
000270	EPOCH	1375 GENEVA DR	INDUSTRY N. OF	2,174	*
000254	LOCKHEED	266 CASPIAN DR	INDUSTRY N. OF	2,162	*
000100	LOCKHEED (LMSC B-584)	350 JAVA DR	INDUSTRY N. OF	2,121	*
000249	WESTMINISTER MGMT	207 JAVA DR	INDUSTRY N. OF	1,933	*
000136	LOCKHEED (LMSC B 556)	217 HUMBOLDT CT	INDUSTRY N. OF	1,908	*
000029	RREEF	140 CARIBBEAN DR	INDUSTRY N. OF	1,662	*
000266	SUN ENTERPRISES	1391 GENEVA DR	INDUSTRY N. OF	1,510	*
000162	BAYD INC *	343 GIBRALTAR DR	INDUSTRY N. OF	1,508	*
000257	E S L INC	1313 GENEVA DR	INDUSTRY N. OF	1,502	*
000127	CAVRO SCIENTIFIC INSTR	242 HUMBOLDT CT	INDUSTRY N. OF	1,367	*
000152	I B M CORP	1213 INNSBRUCK DR	INDUSTRY N. OF	1,174	*
000193	LOCKHEED B535	169 JAVA DR	INDUSTRY N. OF	855	*

Table A-2, continued
Industrial/Commercial Landscape Accounts (1990 basis)

SERV_NBR	ACCOUNT NAME	ADDRESS	ZONE	GAL/DAY	EXCL
030521	ARGO SYSTEMS	410 N MARY AV	INDUSTRY S. OF 1	36,045	*
025748	H L S DUPLICATION	520 ALMANOR AV	INDUSTRY S. OF 1	4,472	
030355	MOTEL 6 OLP1054	775 N MATHILDA AV	INDUSTRY S. OF 1	4,369	
030516	TARIGO PAUL LIMITED PTR	415 N MARY AV	INDUSTRY S. OF 1	2,652	
020995	FOXCONN INTERNATIONAL	930 MAUDE AV	INDUSTRY S. OF 1	1,353	
027416	CAPTAINS COVE	600 MATHILDA AV	INDUSTRY S. OF 1	1,348	
030417	KUMAR	595 N MATHILDA AV	INDUSTRY S. OF 1	1,057	
025014	ELKS	375 N PASTORIA AV	INDUSTRY S. OF 1	848	
026668	HALCOMB ASSOC	510 MAUDE AV	INDUSTRY S. OF 1	59	*
000097	LOCKHEED (LMSC B-102)	0 MATHILDA AV	LOCKHEED	2	*
025767	SUNNYVALE RESEARCH PLAZA	555 MATHILDA AV	N. SUNNYVALE RE	11,702	
017518	WOLFE-REED CENTER	0 S WOLFE RD	N. SUNNYVALE RE	346	*
029910	EDWARD, BRUGGE	695 E ARQUES AV	N. SUNNYVALE RE	293	*
029135	KAVALIK, JOSEPH	0 E DUANE AV	N. SUNNYVALE RE	199	*
022403	TOWN CENTER	0 TOWNCENTER DR	S.E. SUNNYVALE	44,466	
017828	LIFES GARDEN	450 OLD SAN FRANCISCO RD	S.E. SUNNYVALE	11,294	
022402	TOWN CENTER	104 W WASHINGTON AV	S.E. SUNNYVALE	9,923	
018691	THE FAIRWAYS %ABSTRACT P	1275 POPLAR AV	S.E. SUNNYVALE	8,718	
005933	MANNINA, H	1331 S WOLFE RD	S.E. SUNNYVALE	7,310	
023329	SUNNYVALE MEDICAL CLINIC	596 CARROLL ST	S.E. SUNNYVALE	6,787	
017830	HOME DEPOT #621	121 E EL CAMINO REAL	S.E. SUNNYVALE	5,873	
018857	HIDDEN VALLEY CONDO ASSN	0 POPLAR@PONDEROSA XX	S.E. SUNNYVALE	5,357	
017752	J B PROPERTIES %EPIS	940 LINDEN AV	S.E. SUNNYVALE	5,021	
017396	CHERRYWOOD%BRIDGECLIFF INC	0 OLD SF RD%FAIROAKS XX	S.E. SUNNYVALE	3,967	
016460	DE ANZA PROP	460 E EL CAMINO REAL	S.E. SUNNYVALE	3,914	
016420	LA HACIENDA,	475 CUMULUS AV	S.E. SUNNYVALE	3,752	
017837	NOB HILL GENERAL STORE	111 E EL CAMINO REAL	S.E. SUNNYVALE	3,158	
017762	B P MGMT-COMMERCL	717 E EL CAMINO REAL	S.E. SUNNYVALE	3,062	
008028	CAMINO DEL PRADO	1007 BRYANT WY	S.E. SUNNYVALE	2,974	
017767	MAPLE TREE INN	711 E EL CAMINO REAL XX	S.E. SUNNYVALE	2,568	
008081	CAMINO DEL PRADO	1377 SAGE HEN WY	S.E. SUNNYVALE	2,355	
008056	CAMINO DEL PRADO	1010 BRYANT WY	S.E. SUNNYVALE	2,330	
017728	BOGOMILSKY ENGINEERING	899 E EL CAMINO REAL	S.E. SUNNYVALE	2,301	
024651	BAYWEST 11	1156 ASTER AV	S.E. SUNNYVALE	1,941	
017792	SPOON RESTAURANT INC	725 S FAIROAKS AV	S.E. SUNNYVALE	1,912	
023896	GOLDEN GATE COMMERCIAL	624 E EVELYN AV	S.E. SUNNYVALE	1,728	
023899	GOLDEN GATE COMMERCIAL	698 E EVELYN AV	S.E. SUNNYVALE	1,713	
017820	TIKVICA FAM TRUST	419 E EL CAMINO REAL	S.E. SUNNYVALE	1,650	
017803	LYON'S RESTAURANT	415 E EL CAMINO REAL	S.E. SUNNYVALE	1,412	
016177	BURGER KING 3668	144 W EL CAMINO REAL	S.E. SUNNYVALE	1,406	
017798	CAMINO OAKS LTD	589 E EL CAMINO REAL	S.E. SUNNYVALE	1,365	
024630	ASTER AVE ASSOC	1122 ASTER AV	S.E. SUNNYVALE	1,361	
004088	VILLAGE COURT OF SUNNYVALE	1661 ALBATROSS DR	S.E. SUNNYVALE	1,256	
017769	V E CORP	685 E EL CAMINO REAL	S.E. SUNNYVALE	1,199	
004112	1ST CHURCH OF CHRIST SCI	1575 ALBATROSS DR	S.E. SUNNYVALE	1,086	
023890	AL S LIQUORS	610 E EVELYN AV	S.E. SUNNYVALE	928	
007772	PAN-CAL MGMT. CO.	1034 E EL CAMINO REAL	S.E. SUNNYVALE	887	
017541	CHIN, WESLEY	747 S WOLFE RD	S.E. SUNNYVALE	812	
029859	FAIROAKS ASSOC	605 E EL CAMINO REAL XX	S.E. SUNNYVALE	748	
016910	WOLFE MEDICAL CLINIC	895 E FREMONT AV	S.E. SUNNYVALE	746	
007767	CITRARO, PAUL	1008 E EL CAMINO REAL	S.E. SUNNYVALE	568	
030586	LOW, LESLIE	826 E FREMONT AV	S.E. SUNNYVALE	533	
010952	TIERNEY & CO	0 HOPE TR	S.E. SUNNYVALE	523	
019136	EL PASEO LOMAS	1103 E EL CAMINO REAL	S.E. SUNNYVALE	387	*
018278	NORMANDY VILLA	998 PONDEROSA AV	S.E. SUNNYVALE	385	*
016571	MARINOVICH, ANTON	455 CUMULUS AV	S.E. SUNNYVALE	377	*
029883	EL-C VET CLINIC	832 E FREMONT AV	S.E. SUNNYVALE	369	*
023333	SUNNYVALE MEDICAL CLINIC	577 S BAYVIEW AV	S.E. SUNNYVALE	363	*
029916	E G M PARTNERSHIP	438 S MURPHY AV	S.E. SUNNYVALE	328	*

Table A-2, continued
Industrial/Commercial Landscape Accounts (1990 basis)

SERV_NBR	ACCOUNT NAME	ADDRESS	ZONE	GAL/DAY	EXCL
011196	CHURCH OF NAZARENE	636 E FREMONT AV	S.E. SUNNYVALE	318	*
029881	SOUTHLAND CORP	834 E FREMONT AV	S.E. SUNNYVALE	195	*
016824	FREMONT SHOPPER	0 FREMONT AV	S.E. SUNNYVALE	166	*
006094	TAPADERA HOME OWN	837 E FREMONT AV	S.E. SUNNYVALE	137	*
023144	THOMAS, ARTHUR R	341 E WASHINGTON AV	S.E. SUNNYVALE	64	*
020860	S & J PROPERTIES	0 W WASHINGTON AV	S.E. SUNNYVALE	4	*
020209	CALA CENTER	1111 W EL CAMINO REAL	S.WEST SUNNYVA	9,097	
008691	ST LUKE LUTHERAN	1025 THE DALLES	S.WEST SUNNYVA	9,081	
010871	BLAINE PROP-CAL PROP SER	1674 HOLLENBECK AV	S.WEST SUNNYVA	8,376	
030351	MONTVALE CORP	1025 CARSON DR	S.WEST SUNNYVA	6,226	
020089	WOODACRE APTS	150 ACALANES DR	S.WEST SUNNYVA	5,068	
010540	RREEF	1685 HOLLENBECK AV	S.WEST SUNNYVA	4,383	
012448	ALTAMIRA CORP	601 S BERNARDO AV	S.WEST SUNNYVA	3,871	
008299	OAK CREEK OWNERS	1610 BELLEVILLE WY	S.WEST SUNNYVA	3,519	
020093	WOODACRE APTS	1260 AYALA DR	S.WEST SUNNYVA	2,894	
030406	BARRY'S SHOE REPAIR	505 S PASTORIA AV	S.WEST SUNNYVA	2,312	
020181	YONEDA PROPERTIES	1253 W EL CAMINO REAL XX	S.WEST SUNNYVA	2,201	
010577	SERRA PARK ASSOC	1565 HOLLENBECK AV	S.WEST SUNNYVA	2,008	
011906	CREEKWOOD ASSN	1195 S BERNARDO AV	S.WEST SUNNYVA	1,851	
014836	OLSON C J CIVIC SQ	800 W EL CAMINO REAL	S.WEST SUNNYVA	1,125	
022317	TACO BELL #3208	991 W EL CAMINO REAL	S.WEST SUNNYVA	918	
030322	U S FLEET LEASING	855 W EL CAMINO REAL XX	S.WEST SUNNYVA	838	
030224	OIL CHANGERS #201	1240 W EL CAMINO REAL XX	S.WEST SUNNYVA	697	
020184	PIER 1 IMPORTS #773	1255 W EL CAMINO REAL	S.WEST SUNNYVA	639	
010671	ONTARIO OAKS APTS % F WANG	1635 ONTARIO DR	S.WEST SUNNYVA	633	
012454	NORTH AMERICAN TITLE CO	660 S BERNARDO AV	S.WEST SUNNYVA	361	*
010139	VIDOVICH, S	1302 S MARY AV	S.WEST SUNNYVA	186	*
016157	EXXON CO USA 70285	696 W EL CAMINO REAL	S.WEST SUNNYVA	113	*
012368	WESTMOOR SHOP	1211 S MARY AV	S.WEST SUNNYVA	113	*
021472	SLOVODAN GALEB	103 SUNSET AV	S.WEST SUNNYVA	98	*

TOTAL DEMAND, all sites listed	**Number =**	**269**	**1,095,787**
Excluded Sites		**103**	**47,653**
TOTAL DEMAND, all sites exluding *	**Number =**	**166**	**619,258**

* These sites are already counted in the Phase I/II completion or "Mid-term sites" estimates, or have usage less than 500 gpd

Appendix B

Cost Estimates

Table B-1
Phase I-II Completion - Laterals from Existing Mains
Estimated Costs

Description	Pipe Dia (inch)	Pipe Length (feet)	Pipe Unit Cost ($)	Estimated Construction Cost, ($)	Estimated Total Cost[1] ($)	Estimated RW Use (gal/day)	Cost of Service ($/gpd)
1184 - 1260 Mathilda (4 sites)[2]							
Pipelines (6" avg)		1,600	55	88,000			
Service feeds (est. 3" @ 100' ea)				9,000			
Retrofit cost[3]				8,000			
Subtotal				$105,000	$142,000	20,000	$7.10
Argo Systems (from west main)							
Pipelines to three services (8")		950	80	76,000			
Service feeds (est 3" x 75')				6,750			
Retrofit cost[3]				20,000			
Subtotal				$102,750	$139,000	23,000	$6.04
Parks from Phase IIb (east) main							
Lakewood Park	6	3,350	55	184,250			
Service feed (3")				2,250			
Retrofit cost[3]				5,000			
Subtotal				$191,500	$259,000	23,500	$11.02
Columbia Park (Duane Ave segment)	8	2,500	80	200,000			
Columbia Park (remainder)	6	2,060	55	113,300			
Service feed (4")				3,000			
Retrofit cost[3]				5,000			
Subtotal				$321,300	$434,000	29,300	$14.81
San Miguel Plygd	6	800	55	44,000			
Service feed (3")				2,250			
Retrofit cost[3]				3,000			
Subtotal				$49,250	$66,000	9,500	$6.95

Table B-1, continued
Phase I-II Completion - Laterals from Existing Mains
Estimated Costs

AMD (from east main)							
To AMD services	8	6,760	80	540,800			
Service feeds (est 3 x 4" @ 100')				12,000			
Retrofit cost[3]				20,000			
Subtotal				$572,800	$773,000	100,000	$7.73
King Academy							
Service feed (est 4" @ 400')[4]				16,000			
Retrofit cost[3]				5,000			
Subtotal				$21,000	$28,000	13,000	$2.15
National Semiconductor (from east main)							
To Nat'l Services		2,300	80	184,000			
Service feed (est 4" @ 100')				4,000			
Retrofit cost[3]				10,000			
Subtotal				$198,000	$267,000	30,000	$8.90
Totals		**20,300**		**$1,561,000**	**$2,108,000**	**248,000**	**$8.50**

Notes:
1. Total cost estimated as construction cost x 1.35 to account for design, constr. contract administration, permitting, and misc. costs. Total cost rounded to neares $1000.
2. Water usage and pipe lengths for these services are estimates.
3. Retrofit costs are "placeholder" estimates.
4. Assumes service is directly from east main on Britton Ave.

Table B-2
Phase III: Extension of East Main to Sunken Garden Terrace
Estimated Costs

Description	Pipe Dia (inch)	Pipe Length (feet)	Pipe Unit Cost ($)	Estimated Construction Cost, ($)	Estimated Total Cost[1] ($)	Estimated RW Use (gal/day)	Cost of Service ($/gpd)
Main Extension							
Pipeline (20")[2]	20	6800	205	1,394,000			
Bore & Jack crossing at RR tracks		140	410	57,400			
Subtotal				$1,451,400	$1,959,000		
Laterals							
Sunken Gardens	6	940	55	51,700			
Retrofit cost[3]				60,000			
Subtotal				$111,700	$151,000	130,000	$1.16
Ponderosa Park & School	6	2400	55	132,000			
Service feeds (2 x 4")				6,000			
Retrofit cost				5,000			
Subtotal				$143,000	$193,000	20,000	$9.65
Braly Park & School	6	2390	55	131,450			
Service feeds (3", 4')				5,250			
Retrofit cost				5,000			
Subtotal				$141,700	$191,000	14,800	$12.91
Totals		**13,000**		**$1,847,000**	**$2,494,000**	**165,000**	**$15.12**

Notes:

1 Total cost estimated as construction cost x 1.35 to account for design, constr. contract administration, permitting, and misc. costs. Total cost rounded to nearest $1000.

2 Includes 200 feet of piping on the pump station/storage tank site, needed to convey water at the higher (boosted) pressure back to the main's north-south alignment. However, it may be not be necessary to create a pressure zone boundary at this time, since Sunken Gardens Golf Course has its own booster pumps.

3 Assumes new "greens" irrigation main required

Table B-3
Phase IV: Extension of West Main to Fremont Ave.
Estimated Costs

Description	Pipe Dia (inch)	Pipe Length (feet)	Pipe Unit Cost ($)	Estimated Construction Cost, ($)	Estimated Total Cost[1] ($)	Estimated RW Use (gal/day)	Cost of Service ($/gpd)
Main Extension							
Encinal Park to W. Iowa Ave	16	5750	175	1,006,250			
W. Iowa Ave to Fremont Ave	14	8650	153	1,323,450			
Bore & Jack crossing at RR tracks	16	140	350	49,000			
Subtotal				$2,378,700	$3,211,000	N/A	N/A
Pump Station, at Sunnyvale Golf Course (1800 gpm, 40-50 psi boost)				$200,000	$270,000	N/A	N/A
Laterals							
Cannery Park	6	940	55	51,700			
Service (2")				1,500			
Retrofit cost				1,800			
Subtotal				$53,200	$72,000	2,000	$36.00
Vargus Elementary School	6	700	55	38,500			
Service (3")				2,250			
Retrofit cost				2,500			
Subtotal				$40,750	$55,000	8,200	$6.71
Washington Park	6	1170	55	64,350			
	8	930	80	74,400			
Service feed (4")				3,000			
Retrofit cost				5,000			
Subtotal				$146,750	$198,000	15,000	$13.20
Civic Center (from Washington Park line)	8	2250	80	180,000			
Civic Center, Pastoria to Charles	6	1000	55	55,000			
Service feeds (2", 3")				3,750			
Retrofit cost				3,600			
Subtotal				$242,350	$327,000	12,200	$26.80
Las Palmas Park (from Civic Center line)	6	3000	55	165,000			
Service feeds (3", 4")				5,250			
Retrofit cost				5,000			
Subtotal				$175,250	$237,000	86,000	$2.76

Table B-3, continued
Phase IV: Extension of West Main to Fremont Ave.
Estimated Costs

Brookline HOA (from Las Palmas Line)	6	1020	55	56,100			
Service feed (3")				2,250			
Retrofit cost				3,000			
Subtotal				$61,350	$83,000	7,800	$10.64
Cumberland School (from Brookline HOA lir	6	130	55	7,150			
Service feed (3")				2,250			
Retrofit cost				3,000			
Subtotal				$12,400	$17,000	9,500	$1.79
Cherry Chase School	6	2050	55	112,750			
Service feed (3")				2,250			
Retrofit cost				3,000			
Subtotal				$118,000	$159,000	12,800	$12.42
Sunnyvale Middle School	6	1750	55	96,250			
Service feed (4")				3,000			
Retrofit cost				5,000			
Subtotal				$104,250	$141,000	29,500	$4.78
DeAnza Park	6	2150	55	118,250			
Service feed (2 @ 3")				4,500			
Retrofit cost				5,000			
Subtotal				$127,750	$172,000	21,200	$8.11
Misc Industrial/Commercial (assume 20 sites @ 3000 gpd)							
Service feeds (20 @ 2")				30,000			
Retrofit (20 @ $1800)				36,000			
Subtotal				$66,000	$89,000	60,000	$1.48
Misc Cityscape (assume 10 sites @ 1500 gpd)							
Services (10 @ 1")				7,500			
Retrofit (10 @ $500)				5,000			
Subtotal				$12,500	$17,000	15,000	$1.13
Total		**26,000**		**$3,739,000**	**$5,048,000**	**279,000**	**$18.09**

Notes:

1 Total cost estimated as construction cost x 1.35 to account for design, constr. contract administration, permitting, and misc. costs. Total cost rounded to nearest $1000.

2 Cost of Service ratio for individual lateral projects do not include cost of main, to allow comparison among projects. Cost of Service total includes main.

Table B-4
Phase V: Fremont Ave. Main Interconnecting Main and Laterals
Estimated Costs

Description	Pipe Dia (inch)	Pipe Length (feet)	Pipe Unit Cost ($)	Estimated Construction Cost, ($)	Estimated Total Cost[1] ($)	Estimated RW Use (gal/day)	Cost of Service[2] ($/gpd)
Fremont Avenue Main & Laterals (without Streamflow Augmentation)							
Main Pipelines & Pump Station Expansion							
East main, extension to Fremont Ave	20	1,300	205	266,500	$360,000	N/A	N/A
Interconnecting main (Wolfe - Mary)	12	10,550	130	1,371,500	$1,852,000	N/A	N/A
Expand Wolfe/Kifer Pump Station Capacity				75,000	$101,000	N/A	N/A
Laterals							
Sunnyvale Community Center	6	2,770	55	152,350			
Service (3")				2,250			
Retrofit cost				3,000			
Subtotal				$154,600	$209,000	50,000	$4.18
Ortega Park/Stocklmeir School[3]	6	3,500	55	192,500			
Service feed across park (4" unpaved)	4	600	30	18,000			
Retrofit cost				3,000			
Subtotal				$213,500	$288,000	29,600	$9.73
Patterson Middle School[4]	8	1,450	80	116,000			
	6	1,350	55	74,250			
On-site service line (est)	4	600	30	18,000			
Retrofit cost				5,000			
Subtotal				$213,250	$288,000	50,700	$5.68
Panama Park (from Patterson line)	6	1,650	55	90,750			
Service (3")				2,250			
Retrofit cost				3,000			
Subtotal				$96,000	$130,000	7,650	$16.99
Raynor Park (from Panama line)[5]	6	2,920	55	160,600			
Service feed across park (4" unpaved)	4	600	30	18,000			
Retrofit cost				3,000			
Subtotal				$181,600	$245,000	22,500	$10.89

Table B-4, continued
Phase V: Fremont Ave. Main Interconnecting Main and Laterals
Estimated Costs

Fremont Snr. HS[6]	6	800	80	64,000			
Service (3")				2,250			
Retrofit cost				3,000			
Subtotal				$66,250	$89,000	29,500	$3.02
Challenger School[7]	6	940	55	51,700			
Service feed (3")				3,000			
Retrofit cost				3,000			
Subtotal				$57,700	$78,000	9,500	$8.21
Serra Park	8	3,300	80	264,000			
Service feed (3")				2,250			
Retrofit cost				3,000			
Subtotal				$269,250	$363,000	36,800	$9.86
Woodgate HOA (1364 Yukon Tr.)	6	1,050	55	57,750			
On-site service lines (5 services)	2-3	800	25	20,000			
Retrofit				5,000			
Subtotal				$82,750	$112,000	10,800	$10.37
Nimitz Park & School (from Woodgate line)	6	690	55	37,950			
Service feeds (2 x 3")				4,500			
On-site service line	3	500	25	12,500			
Retrofit				5,000			
Subtotal				$59,950	$81,000	7,700	$10.52
Sunset HOA (125 Connemara Way)	6	1,100	55	60,500			
On-site service lines (11 services)	2-4	1,000	30	30,000			
Retrofit				15,000			
Subtotal				$105,500	$142,000	29,000	$4.90
Sunset Oaks HOA (675 Picasso Tr.)	-			0			
On-site service lines (2 services)	4	1,500	30	45,000			
Retrofit				5,000			
Subtotal				$50,000	$68,000	13,300	$5.11

Table B-4, continued
Phase V: Fremont Ave. Main Interconnecting Main and Laterals
Estimated Costs

Misc Industrial/Commercial/HOA (assume 10 sites @ 3000 gpd)							
Service feeds (20 @ 2")				15,000			
Retrofit (10 @ $1800)				18,000			
Subtotal				$33,000	$45,000	30,000	$1.50
Misc Cityscape (assume 5 sites @ 1500 gpd)							
Services (5 @ 1")				3,750			
Retrofit (5 @ $500)				2,500			
Subtotal				$6,250	$8,000	7,500	$1.07
Total, without Streamflow Augmentation[8]		**27,500**		**$3,303,000**	**$4,459,000**	**334,600**	**$13.33**

Streamflow Augmentation							
Expand Pump Station(s) Capacity				100,000			
Upsize main	12->16	10,550	45	474,750			
Lateral	10	2,520	105	264,600			
Dechlorination				150,000			
Other costs (does not include cooling)				100,000			
Subtotal				$1,089,350	$1,471,000	970,000	$1.52
San Antonio Park[b]	6	1,050	55	57,750			
Service feed (4")				3,000			
Retrofit cost				5,000			
Subtotal				$65,750	$89,000	15,500	$5.74
Total, Streamflow Augmentation		**14,100**		**$1,156,000**	**$1,560,000**	**985,500**	**$1.58**

Table B-4, continued
Phase V: Fremont Ave. Main Interconnecting Main and Laterals
Estimated Costs

Homestead High School & Cupertino Jr. High School (not included in Phase V totals)							
Pump Station				$100,000	$135,000	N/A	N/A
Homestead HS (to Noranda Dr)	8	2,780	80	222,400			
Homestead HS (Noranda to HS)	6	1,200	55	66,000			
Service feed (4")				3,000			
Retrofit cost				3,000			
Subtotal				$294,400	$397,000	29,500	$13.46
Curpertino Jr. HS (from Homestead HS lin	6	3,750	55	206,250			
Service feed (3")				2,250			
Retrofit cost				3,000			
Subtotal				$211,500	$286,000	22,200	$12.88
Total, Homestead HS & Cupertino Jr. HS		**7,700**		**$606,000**	**$818,000**	**51,700**	**$15.82**

Notes:

1. Total cost estimated as construction cost x 1.35 to account for design, constr. contract administration, permitting, and misc. costs. Total cost rounded to nearest $1000.
2. Cost of Service value for individual lateral projects do not include cost of main, to allow comparison among projects. However, total Cost of Service includes cost of main.
3. Water records show one landscape account for park, and two commercial accounts (with relatively low usage) for school. Usage shown is landscape account only.
4. Service location(s) need to be determined.
5. Could possibly serve Palmer Chiropractic site from extension of this line.
6. Water usage is estimated (assumed to be same as Sunnyvale Middle School)
7. Water usage is estimated (assumed to be same as Cumberland School)
8. Pipe Length Total does not include service laterals or on-site service lines.
9. Requires 1330 feet of Stevens Creek Lateral on Fremont Ave