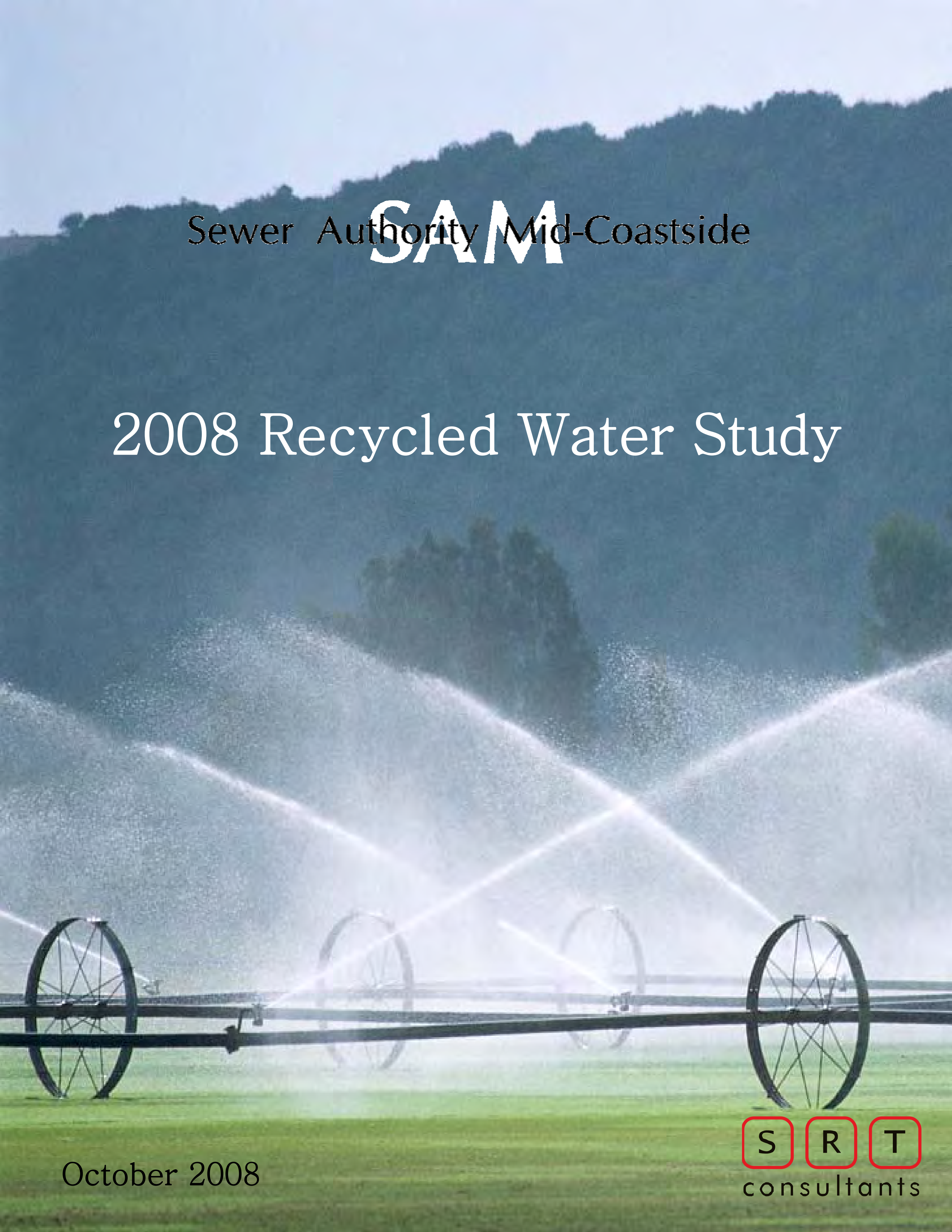

SAM
Sewer Authority Mid-Coastside

2008 Recycled Water Study

October 2008

SRT consultants

Table of Contents

List of Figures

List of Tables

List of Acronyms

ADWF	Average Dry Weather Flow
AF	Acre-Foot
AFY	Acre-Feet per Year
AWWARF	American Water Works Association Research Foundation
BARWC	Bay Area Recycled Water Coalition
BAWSCA	Bay Area Water Supply & Conservation Agency
CCWD	Coastside County Water District
CEQA	California Environmental Quality Act
CWSRF	California Water State Revolving Fund
EDCs	Endocrine Disrupting Compounds
ENR	Engineering News-Record
FPGP	Facilities Planning Grant Program
GPM	Gallons per Minute
HCF	Hundred Cubic Feet
HMB	City of Half Moon Bay
HRS	Hours
I-Bank	California Infrastructure & Economic Development Bank
IRWMP	Integrated Regional Water Management Program
ISRF	Infrastructure State Revolving Fund
kPa	Kilopascal
LP	Low-Pressure
MF	Microfiltration
µm	Micrometer
mg/L	Milligrams per Liter
mos	Months
MGD	Million Gallons per Day
MP	Medium-Pressure
NTU	Nephelometric Turbidity Unit

OCGC	Ocean Colony Golf Courses
OCP	Ocean Colony Partners
O&M	Operations & Maintenance
PPCPs	Pharmaceuticals and Personal Care Products
RCD	San Mateo Resource Conservation District
RO	Reverse Osmosis
SAM	Sewer Authority Mid-Coastside
SFPUC	San Francisco Public Utilities Commission
SM	San Mateo
SRF	State Revolving Fund
SRT	SRT Consultants
SWRCB	State Water Resources Control Board
TDS	Total Dissolved Solids
TFC	Thin Film Composite
UF	Ultrafiltration
UV	Ultraviolet
WRCP	Water Recycling Construction Program
WRFP	Water Recycling Funding Program
WWTP	Wastewater Treatment Plant
ZYI	ZYI Corporation

EXECUTIVE SUMMARY

Executive Summary

The Recycled Water Study (Study) has been prepared by SRT Consultants (SRT) for the Sewer Authority Mid-Coastside (SAM) with the goal of investigating the potential market for recycled water in the Midcoast region. As an agency, SAM is interested in pursuing the Recycled Water Project (Project) to both maintain its position in environmental stewardship in the Midcoast Region and to financially balance its other necessary capital improvement projects. The SAM Board established the following objectives for the Project:

- ✓ Utilize the SAM Wastewater Treatment Plant effluent, a valuable Midcoast water resource, for the benefit of the region;
- ✓ Facilitate reduction of water draw on local aquifers; and
- ✓ Facilitate reduction in ocean discharge of treated wastewater.

Potential Customers and Alternatives

Potential recycled water customers were identified by the SAM Board prior to this Study, and have been contacted by SRT to establish their current irrigation demands, water supply arrangement, potential benefits, and cost-effectiveness, including: Nurserymen's Exchange, Ocean Colony Golf Courses, Skylawn Memorial Park Cemetery, Giusti Farms, Bay City Flower Company, and Daylight Farms. The information compiled has been organized into a Recycled Water User Database.

SRT proceeded in evaluating two capacity alternatives and three treatment alternatives for the Project. The two capacity alternatives included: a 1.65 million gallons per day (MGD) tertiary facility to treat the total average dry weather flow, and a 0.6 MGD tertiary facility to initially supply Ocean Colony Golf Courses only, with the option to expand. The treatment alternatives considered included Sand Media Filtration with Chlorination, Microfiltration with Ultraviolet Disinfection, and Reverse Osmosis. Figure 1, below, illustrates the six options that SRT has developed and evaluated in regard to feasibility and cost.

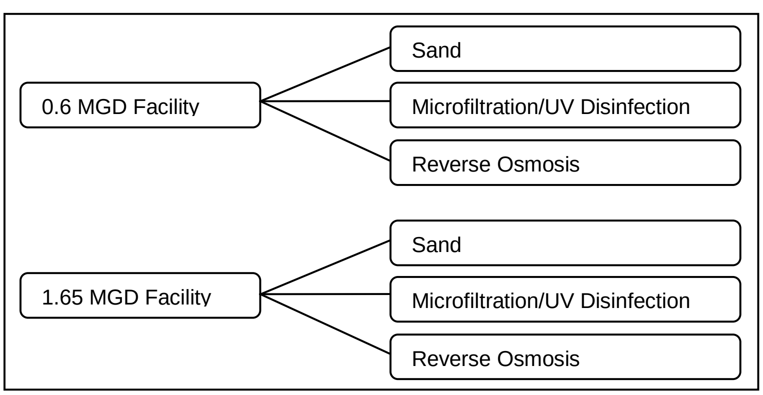

Figure ES-1 Capacity and Treatment Alternatives

Cost Estimates and Funding

All options are relatively feasible, but vary widely in cost depending on the size of the proposed facility, the desired level of treatment, and the piping infrastructure required. In order to compare the total capital expenditures of each of the six alternatives, SRT evaluated how each of these components individually varies. The cost of the two treatment facility sizes were assessed for each of the three treatment levels, resulting in capital cost estimates for each alternative, reported in dollars per acre foot of irrigation water. The following table presents the range of estimated costs, along with current and projected Coastside County Water District (CCWD) potable water costs.

Table ES-1 Cost Comparison for Cost per Acre Foot *(2008 Dollars)*

Recycled Water Facility Size	**CCWD Cost to Retail Customers** *($$/acre-foot)*		**Projected Recycled Water Cost Ranges** *($$/acre-foot)*	
	Current	**Projected** *(2015 dollars)*	**Debt Instrument Only**	**Grant Funding Included**
0.6 MGD - Phased Plant *Ocean Colony Golf Courses ONLY*	$2,120	$4,680	$710 - $2,335	$580 - $2,150
1.65 MGD - Full-Size Plant	$2,120	$4,680	$2,775 - $5,470	$2,140 - $5,000
1.65 MGD - Full-Size Plant *Not Including Skylawn Cemetery*	$2,120	$4,680	$1,700 - $4,000	$1,350 - $3,700

Assumptions:
1. CCWD commercial water rate is $4.86 hcf as per CCWD website includes distribution cost & wholesale rate
   a. CCWD distribution cost is $3.34 hcf as per CCWD website.
   b. SFPUC wholesale rate is $1.43 hcf as per CCWD website.
2. SFPUC stated wholesale rates will increase 300% by 2015 ($5.72 hcf)
3. CCWD projected (2015) distribution costs calculated using 6% annual inflation rate. ($5.02 hcf)
4. CCWD projected (2015) commercial water rate is $10.74 hcf.

Upon establishing estimates for the alternatives, several funding options were explored. These options are combinations of grant and loan funding, and are presented in this study to provide SAM with an overview of potential project financing.

Additional Research

In addition to the alternatives evaluation, SRT also researched several items of particular concern to SAM, namely endocrine disrupting compounds (EDCs) potentially found in recycled water, recycled water state regulations, and local stakeholders of the Project.

Research has shown that since recycled water used for irrigation is not consumed by humans, trace concentrations of EDCs have not been considered a serious risk to end users or the public. However, the effects of EDCs on irrigation crops and human ingestion have not been studied extensively. If SAM chooses to design the tertiary facility to specifically treat EDCs, it would be necessary to analyze EDC concentrations in the effluent of the SAM secondary treatment facility prior to evaluating how to effectively treat the water.

In May 2008, the State Water Regional Control Board (SWRCB) tasked a group of stakeholders to create their own statewide Recycled Water Policy, after receiving the strong opposition to the initial draft presented by the SWRCB. The alternative Recycled Water Policy was presented by the stakeholder group to the SWRCB in September 2008. The SWRCB indicated that the draft policy needed minor changes and that staff should move forward in preparing the environmental document. The draft Policy and the environmental document will then be released for public review.

SRT has also been in communication with several public, governmental, and private entities on the Midcoast that have economic, environmental, or public interest in the Project. These communications have been documented for the benefit of SAM, to help understand the political, economic and environmental paradigm of the Project.

Next Steps
The key findings of the Study assisted in establishing the next steps that SAM should consider for the Project, including:

1. Develop a recycled water supply agreement for potential customers in collaboration with SAM general counsel. This agreement should include the level of treatment of the recycled water, the means of distribution, the amount of water to be delivered, and the cost per acre foot for each customer.
    a. Develop a recycled water supply agreement specifically for OCGC, if SAM maintains the position of initially connecting to OCGC before all other customers.
2. Develop a Recycled Water Facilities Study to define the proposed project in terms of facility sizing and level of treatment. As the Project becomes further defined, public meetings and workshops should be held to inform the community about the details of the project and associated concerns.
3. Secure Project funding from grant and loan sources.
4. Initiate environmental review studies and necessary permitting.
5. Design and construct the facility.

THIS PAGE LEFT INTENTIONALLY BLANK

CHAPTER 1

Background and Purpose

Chapter 1: Background and Purpose

The Sewer Authority Mid-Coastside (SAM) contracted SRT Consultants (SRT) to prepare the Recycled Water Study (Study) with the goal of investigating the potential market for recycled water in the Midcoast Region.

This chapter presents the background and purpose for the Recycled Water Study as established by the SAM Board, and includes descriptions of the following:

- Project Need and Objective
- Study Scope
- SAM Goals
- Background and Status
- Previous Studies
- State Recycled Water Policy

1.1 Project Need and Objective

The SAM Board established the following objectives for the Recycled Water Project (Project):

- ✓ Utilize the SAM Wastewater Treatment Plant (WWTP) effluent, a valuable Midcoast water resource, for the benefit of the region;
- ✓ Facilitate reduction of water draw on local aquifers; and
- ✓ Facilitate reduction in ocean discharge of treated wastewater.

SAM's Recycled Water Project will help diversify the current Midcoast water supply portfolio and create a more sustainable watershed by reducing the region's dependency on imported water and improving the region's water supply reliability, affordability, and management. In addition, the reductions in water draw and in ocean discharge may potentially improve creek flows in Pilarcitos creek, restore aquatic habitat, and support the coastal environment of the Midcoast region.

1.2 Study Scope

The purpose of this Report is to present the information gathered and evaluated by SRT regarding the proposed SAM recycled water tertiary treatment facility. The information presented is based on the initial scope of work approved by the Board and the subsequent changes in direction.

1.2.1 Initial Scope

The initial scope of work included the development of a user database for potential recycled water customers, identification of the most feasible potential customers, preparation of cost estimates and funding alternatives, and an update on current health and regulatory issues regarding recycled water. A brief summary of scope tasks follows.

Task 1 Recycled Water User Database

Develop the Recycled Water User Database that includes the average and peak usage rates for each user, their level of interest, proximity to the treatment facility, and their desired level of treatment. This work was based on:

- ✓ Review of 2003 and 2005 Carollo Engineers reports for background information.

- ✓ Contacting the following irrigation water users to obtain current information about average and peak usage rates, desired level of treatment and water quality, and the level of interest in recycled water:

    1. Nurserymen’s Exchange
    2. Ocean Colony Golf Courses
    3. Skylawn Memorial Park Cemetery
    4. Guisti Farms
    5. Bay Cities Flower Company, Inc.
    6. Daylight Farms

- ✓ Continuing dialog with the Farm Bureau about their interest in starting an Irrigation District run by end users and determine the feasibility and timing of such an arrangement.

- ✓ Continuing dialog with the Pilarcitos Creek Restoration Workgroup led by the San Mateo Resource Conservation District (RCD) and Coastside County Water District (CCWD) to determine their involvement.

Task 2 Decision Tool

Develop a decision tool to identify the most feasible potential customers based on three factors: proximity to the treatment plant, the amount of irrigation water required, and the estimated cost per gallon.

Task 3 Public outreach

Facilitate a public meeting to inform the public about recycled water and its benefits; provide monthly reports on the project progress to SAM Board.

Task 4 Cost Estimates and Funding Alternatives

Develop planning level opinion of probable construction cost, total project cost, and 20-year present worth cost for each of the alternatives. Develop funding alternatives and evaluate them; recommend the apparent most cost-effective course of action and funding mechanisms for the project.

Task 5 Pharmaceuticals and Personal Care Products Update
Provide an update to the Board on the regulatory and other aspects of pharmaceuticals and personal care products (PPCPs) in wastewater and their impacts on recycled water.

Task 6 Study Report
Develop a report documenting the work conducted and outlining the next steps.

1.2.2 Scope Revision

SRT has prepared and presented two progress reports to the SAM Board of Directors, the first at the SAM Board meeting on July 28, 2008, and the second at the SAM Board meeting on August 25, 2008.

At the July 28, 2008 Board meeting, the SAM Board received a progress report and directed staff to develop additional information and provide a second progress report to the Board on the following two key issues:

1. A cost comparison between a recycled water facility initially sized to serve the Ocean Colony Golf Courses only and a facility sized to treat the entire SAM's WWTP average dry weather flow (ADWF); and
2. A cost comparison of treatment facilities with various treatment levels.

At the August 25, 2008 Board Meeting, the SAM Board received a progress report from SRT focusing on the July 28, 2008 requests of the SAM Board. The Board requested that the report include an overview of recycled water technologies and a timeline for project implementation together with the projected cash flow.

In addition, the public outreach workshop that was originally in the scope has been postponed until the project is further defined in the first quarter of 2009. After discussions with the San Mateo Resource Conservation District (RCD), which recently published the Pilarcitos Integrated Watershed Management Plan Draft, it was established that SAM would be more prepared for a public workshop after this document was reviewed, during facilities planning phase of the project.

1.3 SAM Goals

As an agency, SAM is interested in pursuing the Recycled Water project to both maintain its position in environmental stewardship on the Midcoast by utilizing its WWTP effluent, a valuable water resource, for the benefit of the region and to financially balance its other necessary capital improvement projects. To effectively address the Recycled Water Project objective and accomplish its goals, SAM has previously (2006) agreed to partner with other Midcoast agencies to balance the beneficial uses of the available water resources in the Pilarcitos Creek watershed by finding solutions that satisfy environmental, agricultural, public health, and economic interests.

1.4 Background and Status

Currently, the Midcoast region uses over 1.2 million gallons per day (MGD) of potable water for irrigation purposes. Some of this potable water is drawn from wells and withered creeks in the service region, while supplemental water is purchased from CCWD.

SAM has the potential to produce recycled water that can serve the needs of irrigation customers in the Midcoast region. Since irrigation water is normally supplied during the dry season by wells or CCWD, the average flow used for the SAM Recycled Water Facility sizing is the SAM WWTP average daily dry weather flow (ADWF). The SAM WWTP is designed to handle an ADWF of 4.0 MGD, however, the current ADWF is 1.65 MGD. For the purpose of this study, the maximum capacity of the proposed Recycled Water Facility is considered at 1.65 MGD, potentially serving customers with a combined demand of approximately 1.5 MGD to account for reliability.

1.5 Previous Studies

Background information and data were extracted from the previous Recycled Water Studies prepared by Carollo Engineers to provide an adequate foundation for this 2008 Recycled Water Study. The recycled water studies preceding this study include:

- August 2003: Water Reclamation Program Preliminary Economic Feasibility Study
- August 2005: Water Reuse Feasibility Study Supplement

The 2003 Feasibility Study was prepared by Carollo Engineers for CCWD. Carollo performed a preliminary economic feasibility evaluation of supplying recycled water from the SAM WWTP for irrigation at the Ocean Colony Golf Courses (OCGC) and the Skylawn Memorial Park Cemetery (Skylawn).

The 2005 Study prepared by Carollo for SAM included a supplement to the 2003 Water Reclamation Program Preliminary Economic Feasibility Study. The supplemental study focuses on identification of the process improvements that would be needed to meet Title 22 tertiary treatment requirements for unrestricted use for a dry weather flow of 1.65 MGD and peak wet weather flow of 15 MGD.

1.6 Stakeholder Communication

Several public, governmental, and private entities on the Midcoast have stakes in the Recycled Water Project. To stay up to date with all stakeholders and understand their desired level of participation, SRT has communicated with the following stakeholders:

- CCWD,

- Pilarcitos Creek Restoration Workgroup through the San Mateo County Resource Conservation District (RCD),
- San Francisco Public Utilities Commission (SFPUC),
- San Mateo County Farm Bureau,
- Bay Area Water Supply & Conservation Agency (BAWSCA),
- City of Half Moon Bay (HMB)

1.6.1 Coastside County Water District

The CCWD supplies drinking water to HMB and part of unincorporated San Mateo County, including Miramar, Princeton-by-the-Sea, and El Granada communities. CCWD is the current water distributor in the area where SAM would like to distribute recycled water.

1.6.2 Pilarcitos Creek Restoration Workgroup

The Pilarcitos Creek Restoration Workgroup (PCRW) includes various stakeholders determining how to more effectively manage the Pilarcitos Creek watershed to satisfy environmental, public health, domestic water supply, and economic interests. PCRW seeks input from local utilities, the agricultural community, public and private landowners, state and federal regulatory agencies, advocacy groups, local residents, and elected officials. RCD provides leadership to the PCRW.

1.6.3 San Francisco Public Utilities Commission

The SFPUC manages a multifaceted water supply system stretching from the Sierra Nevada Mountains to the City of San Francisco. The third largest municipal utility in California, SFPUC serves 2.4 million residential, commercial, and industrial customers in the Bay Area. Approximately two-thirds of wholesale deliveries are to 28 suburban agencies in Alameda, Santa Clara, and San Mateo counties.

As one of the SFPUC's wholesale customers, CCWD purchases over 80 percent of its water supply from SFPUC. In addition, SFPUC owns and operates the Pilarcitos Lake and serves as a major stakeholder for the Pilarcitos Creek Restoration Workgroup.

1.6.4 San Mateo County Resource Conservation District

Resource Conservation Districts were created by the state of California to be locally governed special districts that are center for local conservation efforts. San Mateo County RCD is supported with staffing from the Natural Resources Conservation Service. RCD plays a key role with the farming operations on the Midcoast. In addition, the RCD's Executive Director, Kellyx Nelson, heads the PCRW.

1.6.5 San Mateo County Farm Bureau

The San Mateo County Farm Bureau is a non-governmental political agency that works for farmers' rights. It is keenly interested in securing sustainable and affordable irrigation water for local farmers.

1.6.6 Bay Area Water Supply & Conservation Agency

BAWSCA was created to represent the interests of multiple cities, water districts, and private utilities that purchase wholesale water from the San Francisco regional water system. CCWD is one of the BAWSCA members.

CHAPTER 2

Recycled Water User Database

Chapter 2: Recycled Water User Database

This chapter describes potential customers based on location, irrigation water demands and potential irrigation water distribution pipelines. A potential customer database has been developed based on a comprehensive questionnaire, which acted as a basic guide for obtaining information from the potential customers. For more detailed information, the potential customer database is included in Appendix A.

2.1 Potential Customers

Potential recycled water customers in the Midcoast region have been identified by the SAM Board. In order to effectively market recycled water to each potential customer, their current irrigation demands, water supply arrangement, and potential benefits were evaluated in this Study. In addition, the feasibility and cost-effectiveness of connecting each customer to the recycled water source was established. SRT has contacted the following customers regarding their water needs, infrastructure requirements, and level of interest:

- Nurserymen's Exchange,
- Ocean Colony Golf Courses,
- Skylawn Memorial Park Cemetery,
- Giusti Farms,
- Bay City Flower Company,Inc. and
- Daylight Farms.

Detailed information on each of the potential customers is summarized below. Locations of potential customers can are depicted in Figure 2.1.

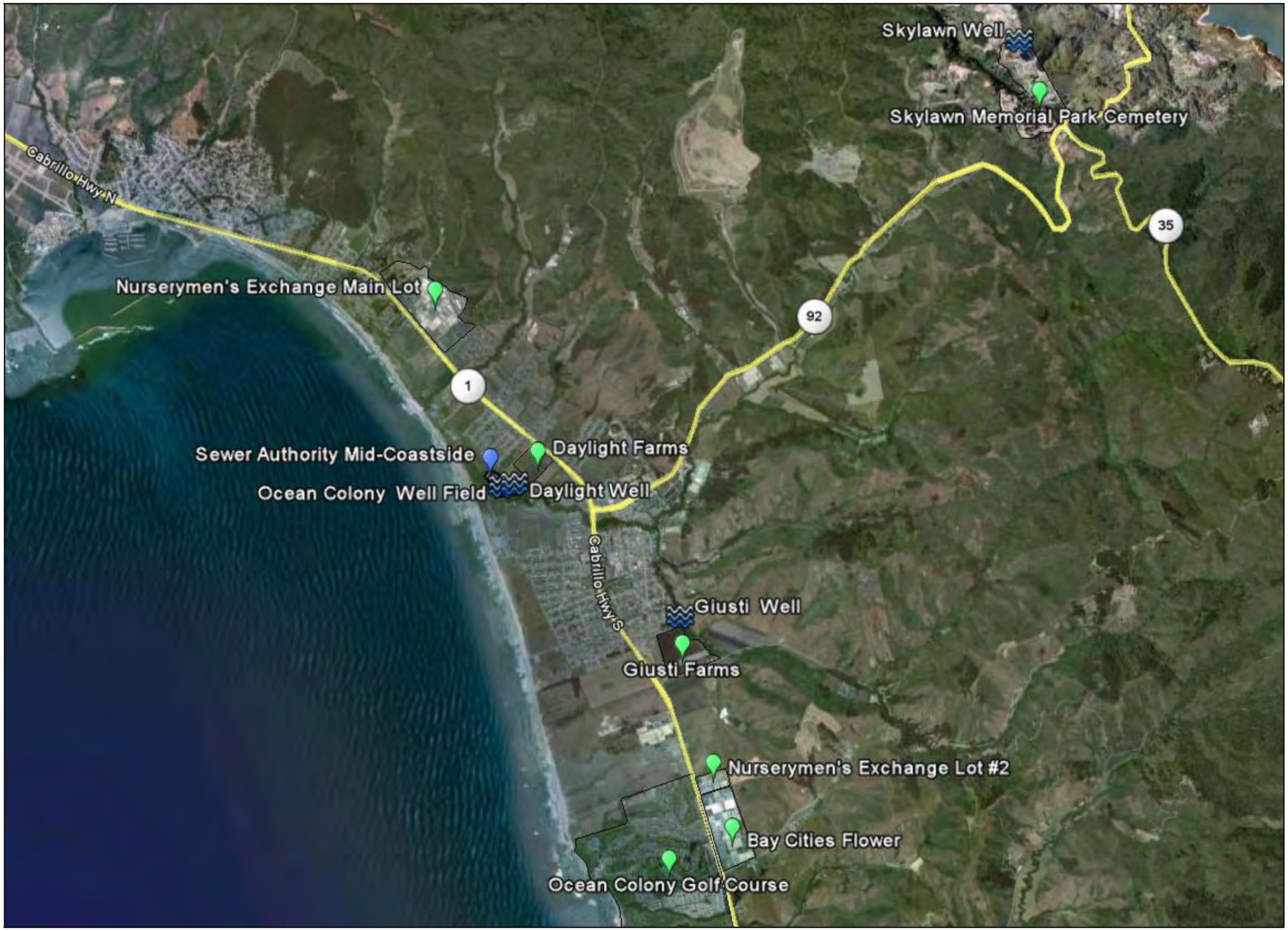

Figure 1.1 Locations of Potential Customers

2.1.1 Nurserymen's Exchange

Nurserymen's Exchange is a wholesale home and garden company in Half Moon Bay with two locations; the main lot located east of Route 1, approximately 1.75 miles north of the Highway 92 junction, and the second lot located east of Route 1 approximately 2 miles south of Highway 92. The total acreage of both lots is approximately 120 acres. Currently, Nurserymen's Exchange uses approximately 225 acre-feet per year (AFY) of potable water from CCWD at a current rate of $2,117/AF, which results in an estimated annual cost to Nurserymen's Exchange of approximately $474,269/year.

The construction of a pipeline from the SAM facility to Nurserymen's Exchange Main Lot will involve obtaining easements from several private land holders, an encroachment permit from the California Department of Transportation (Caltrans) to cross Route 1, and will involve the crossing of Frenchman's Creek. The construction of pipeline to Nurserymen's Exchange Lot #2 will include construction of the combined pipe, as explained in detail in Section 2.2, along with a tie-in from the main line to Lot #2 approximately 2 miles south of Highway 92. The quality of water requested from Nurserymen's Exchange has not been confirmed, although it is possible that certain cultivated plant species will require higher than tertiary unrestricted use water quality.

2.1.2 Ocean Colony Golf Courses

Ocean Colony Golf Courses (OCGC) consists of two eighteen-hole golf courses, the Links Course and the Ocean Course, which are owned and operated by Ocean Colony Partners (OCP). OCGC is located west of Route 1, approximately 2.5 miles south of the Highway 92. The Links course is intertwined with the housing subdivision, while the Ocean Course stands separately to the south. The total acreage of the golf courses and surrounding golf course community is 500 acres; approximately half of that acreage (250 acres) is served by the Ocean Colony irrigation system. OCGC presently obtains water from two sources, a well field located 2.15 miles north of the site, and from CCWD. The well field, consisting of five wells, is the primary source of irrigation water, and draws from the Pilarcitos Creek aquifer, near the mouth of the creek. The combined usage rate from the wells is approximately 500 AFY. Periodically, additional supply is needed to augment irrigation water supplied by the well field. This supplemental supply is purchased from CCWD at an average rate of 90 AFY. Including the supplemental supply from CCWD, OCGC has a total irrigation water demand of 590 AFY. Since OCP owns the well field, they do not currently pay a rate for the majority of their irrigation supply. CCWD supplies water at a rate of $2,117/AF for the 90 AFY, which results in an annual cost to OCGC of approximately $190,700/year for CCWD water alone.

OCP owns the well field and the pipeline connecting the well field to the OCGC irrigation system. An eight-inch diameter pipe begins at the well field, runs approximately half the distance to the golf course, and connects to a six-inch diameter pipe, which connects to the OCGC irrigation system. OCP has easements through private properties the length of the entire pipeline. The construction of a pipeline from the SAM facility to the well field pipeline tie-in will involve crossing Pilarcitos Creek. Reportedly, there is an existing pipe with casing crossing the creek from SAM WWTP to the OCP well field. This information has not been field-verified by SRT. The quality of water requested from OCGC is tertiary unrestricted use. In addition, OCGC may consider allowing other potential customers to tie-in to their pipeline. This option, however, appears hydraulically infeasible. OCGC indicated that they would be looking for water quality similar to that received by the Olympic Club Golf Course in Daly City, California.

2.1.3 Skylawn Memorial Park Cemetery

Skylawn Memorial Park Cemetery (Skylawn) is a 500-acre cemetery located at the intersection of Highway 92 and Skyline Boulevard, approximately 5 miles east of Route 1. Of the 500 acres, Skylawn has developed 280 acres, of which 85 acres are irrigated. Two wells are located at Skylawn. One provides potable water to all buildings on site; the other is an irrigation well providing water at 12 gallons per minute (GPM). Skylawn is located outside the CCWD service area. The cemetery has an agreement with CCWD and SAM to purchase approximately 150 AFY of raw water from CCWD Crystal Springs Pipeline at a rate of $2,413/AF, which results in an annual cost to Skylawn of close to $372,443/year.

The construction of a pipeline from the SAM facility to Skylawn Memorial Park Cemetery will involve obtaining easements from several private land owners, an encroachment permit from Caltrans to cross Route 1, a creek crossing for Pilarcitos Creek, and the construction of a 5-mile-long pipeline along Highway 92. This five-mile pipeline will most likely require the use of the existing PG&E easement. Delivering the recycled water from the SAM facility to Skylawn would also require two booster pump stations along the pipeline, as the cemetery is at an elevation approximately 1075 feet above the SAM facility. The quality of water requested by Skylawn is tertiary unrestricted use.

2.1.4 Giusti Farms

Giusti Farms is a local vegetable and melon farm specializing in artichoke crops located just east of Route 1, approximately 1.25 miles south of Highway 92. Giusti Farms currently farms 50 acres with the potential to grow to a 180-acre farm if reliable irrigation water supply were available. Two small wells are currently used as the main irrigation source. The wells have a total capacity of 50 GPM. The annual usage rate is 4.5 AFY, assuming the well pumping at 2 hours per day for 8 months of the year. Two reservoirs are located at the north end of the property with 49 AF and 5 AF of storage, respectively. In 2002, Giusti Farms lost water rights to nearby Arroyo Leon Creek, which caused the business to downsize the amount of land farmed. At this time, Giusti Farms purchases no irrigation water from CCWD.

The pipeline to Giusti Farms will most likely be a pipeline that runs alongside the OCGC pipeline and is shared with two other potential customers. Giusti Farms will have its own tie-in to the shared pipeline. The quality of water requested from Giusti Farms is tertiary, with no specific requirements.

2.1.5 Bay City Flower Company

Bay City Flower Company, Inc. (Bay City) is a retail nursery and garden center providing flowers and flowering plants directly to retailers nationwide. Bay City is located just east of Route 1, approximately 2.25 miles south of Highway 92. The total irrigated acreage is nearly 75 acres. Bay City implements several water conservation measures including drip irrigation and flood irrigation, which requires flooding the plants and recapturing the water for future use. Presently, Bay City uses about 115 AFY of potable water from CCWD at a current rate of $2,117/AF, which results in an annual cost of approximately $238,500/year.

The pipeline to Bay City will most likely be a pipeline that runs alongside the OCGC pipeline and is shared with two other potential customers. Bay City will have its own tie-in to the shared pipeline. The quality of water requested from Bay City has not been confirmed, although it is possible that some cultivated plant species may require higher water quality than tertiary unrestricted use.

2.1.6 Daylight Farms

Daylight Farms (also commonly referred to as Farmer John's Pumpkin Farm) specializes in growing vegetables, herbs, flowers, and a wide variety of pumpkins. Daylight Farms is located just west of Route 1 approximately 0.6 miles north of Highway 92. The total irrigated acreage is 15 acres. Daylight Farms employs several water conservation measures including drip irrigation and cover crop management, which helps improve soil fertility, quality and diversity. One well, with an estimated annual usage rate of 2.65 AFY, is the primary source of irrigation water, and draws from the Pilarcitos Creek aquifer, not far from the mouth of the creek.

The construction of a pipeline to Daylight Farms would be minimal because of the farm's close proximity to SAM, approximately 1000 feet south east of the treatment facility. No easements, natural or roadway crossings would be necessary. The quality of water requested from Daylight Farms is tertiary, with no specific requirements.

2.2 Pipeline Assumptions

Multiple options for the construction of recycled water distribution piping were analyzed including individual pipelines to all customers, a tie-in to the Ocean Colony Golf Courses existing pipeline for all customers south-east of SAM WWTP, and a combined pipeline along Route 1 for Bay City Flowers, Giusti Farms and Nurserymen's Exchange Lot #2. A tie-in to the Ocean Colony pipeline was deemed infeasible based on the hydraulic capacity of the existing pipeline. The construction of a combined pipeline from the SAM facility to Bay City, Giusti Farms and Nurserymen's Lot#2 will involve an encroachment permit from the California Department of Transportation (Caltrans) to cross Route 1 and construction along Route 1 for approximately 2.5 miles.

CHAPTER 3

Alternatives

Chapter 3: Alternatives

The information gathered from the potential recycled water irrigation users was initially presented to the SAM Board on July 28, 2008. The Board directed SRT to proceed in evaluating two capacity alternatives and three treatment alternatives as described in this chapter.

3.1 Capacity Alternatives

Two capacity alternatives are evaluated in this Study:

- 1.65 MGD tertiary facility that will treat the total ADWF, and
- 0.6 MGD tertiary facility with the option to expand.

3.1.1 Full-Size Facility

In this alternative, a 1.65 MGD facility would be built to treat the total ADWF and serve the needs of all the potential customers evaluated in this Study. A 1.65 MGD plant will improve the Midcoast water supply portfolio, provide environmental benefits, and promote economic sustainability for some of the region's largest employers.

The full-size facility would produce water to be pumped to the six potential customers through a recycled water distribution system. All distribution pipelines, with the exception of the pipeline from the Golf Course well field to OCGC, would need to be newly constructed for the Project. The proposed distribution pipelines are included on Figure 3.1. Connecting all customers would decrease the demand on several high production wells in the area, which would decrease water draw on the local aquifers and on Pilarcitos Creek. In addition, SAM would have the capacity to treat the entire ADWF, and therefore decrease the amount of secondary effluent that is released into the ocean.

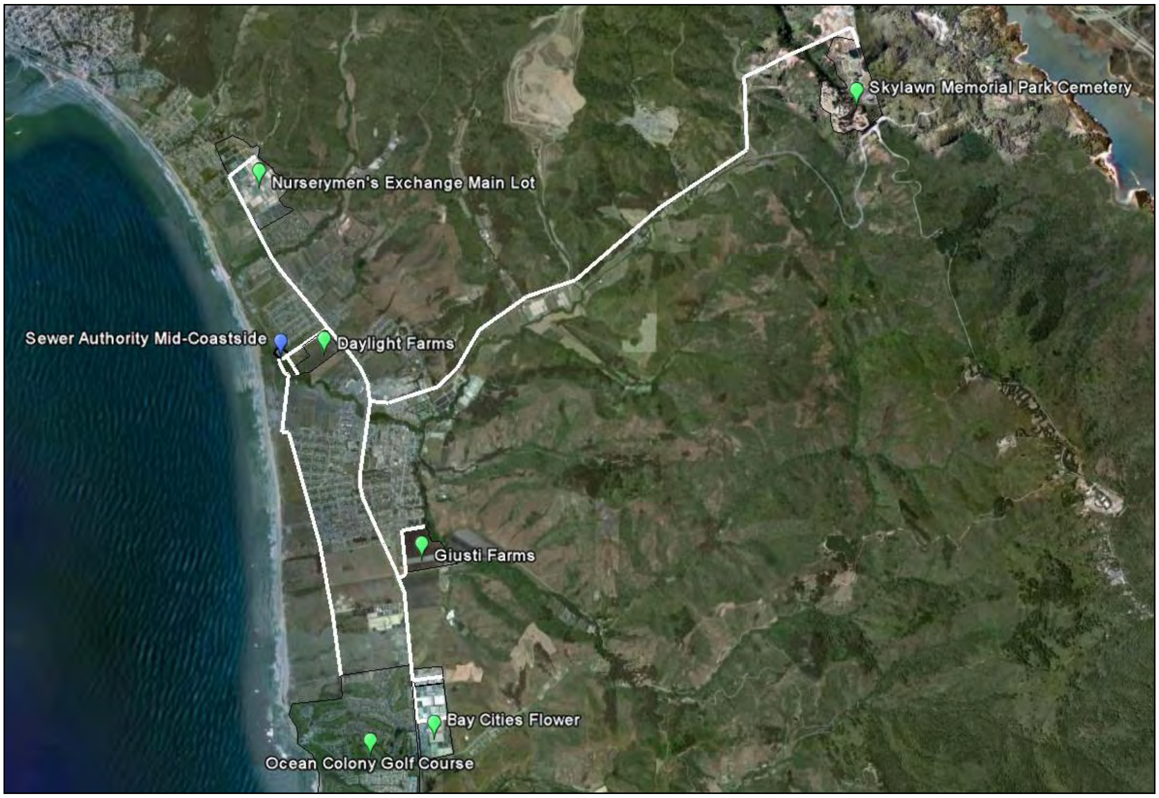

Figure 2.1 Full-Size Facility Pipelines

3.1.2 Phased Facility

In the phased alternative, a 0.6 MGD facility would be built to connect the Ocean Colony Golf Courses to the recycled water supply, with the option of connecting future irrigation customers at a later date. This option has been established by the SAM Board as an alternative to a full-size facility, to reduce the initial capital investment by SAM.

Upon initial evaluation, OCGC appears the most feasible customer to initially connect to the SAM facility based on demand, proximity of the pipeline tie-in, environmental benefits and customer motivation to connect. As discussed previously in Section 2.1.2, OCGC presently pumps approximately 0.5 MGD from 5 wells located along Pilarcitos Creek and delivers the water through a private pipeline to the irrigation system. Since OCGC stated that they are willing to use the pipeline to convey recycled water, connecting the customer to the SAM facility would require a minimal amount of new infrastructure improvements. If OCGC ceased using the wells along Pilarcitos Creek, the decreased demand on the aquifer could potentially restore flows near the mouth of the creek. In addition, OCP has been an active participant in providing information for this study and expressed its willingness to work with SAM to connect to the recycled water source.

The facility would be designed to initially handle the production of 0.6 MGD and provide water to OCGC, with the option to increase production when other potential customers are willing to commit to the project and pay for the project costs. All treatment and pumping equipment and storage would incorporate modular design, and piping infrastructure would be built when additional customer agreements are secured. Figure 3.2 depicts the pipeline to OCP facilities

Figure 3.2 Phased Facility Pipeline

3.2 Treatment Alternatives

The Board was also interested in investigating different levels of recycled water quality and the associated costs. The levels of treatment that were evaluated are included:

- Low Level - Sand Media Filtration with Chlorination,
- Medium Level - Microfiltration with Ultraviolet Disinfection, and

- High Level - Reverse Osmosis

The levels of treatment are discussed in more detail in Chapter 4, Recycled Water Technology Overview.

3.3 Capacity and Treatment Alternatives

Each level of treatment has been evaluated in terms of combined benefits and associated costs for the two capacity alternatives. Figure 3.3, below, illustrates the six options that SRT has developed based on the Board's direction. These six options are discussed in detail further in the Report.

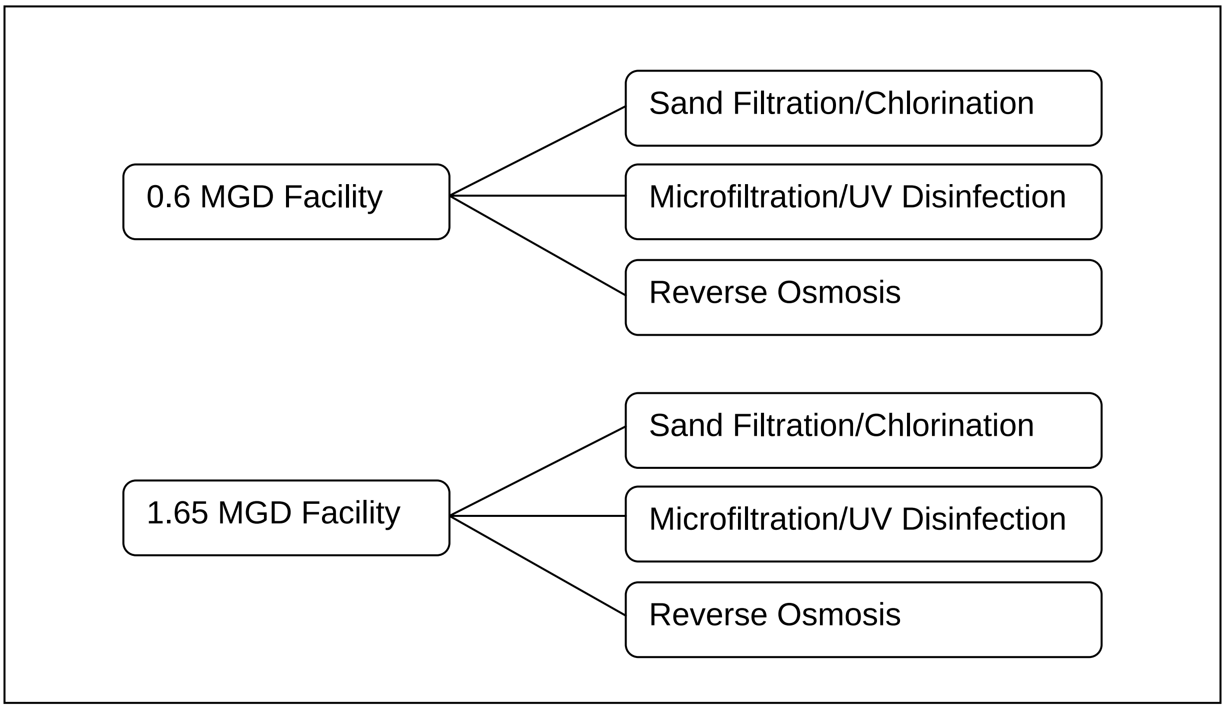

Figure 3.3 Capacity and Treatment Alternatives

CHAPTER 4

Recycled Water Technology Overview

Chapter 4: Recycled Water Technology Overview

This chapter presents a recycled water technology overview of three levels of treatment that have been evaluated by SRT for the either the phased (0.6 MGD) or the full-scale (1.65 MGD) plant. As noted in Chapter 3, the three different levels of treatment included:

- Sand /cloth media filtration and chlorination
- Microfiltration and UV disinfection
- Reverse osmosis

The technology review in this chapter is intended to provide the SAM Board with viable treatment options that:

- Meet or exceed Title 22 guidelines for recycled water treatment; and
- Treat specific chemical and turbidity levels in the secondary effluent discharged from SAM WWTP for irrigation use.

4.1 Sand/Cloth Media Filtration and Chlorination

Sand filtration is a conventional treatment process which has been used traditionally in drinking water treatment plants and as tertiary treatment for wastewater.

4.1.1 Pretreatment

Pretreatment of incoming effluent may be required if wastewater composition is determined to contain species which may diminish the performance of the filter. High suspended solids concentration is usually the main indicator for pretreatment. The 2005 Carollo Water Reuse Feasibility Study Supplement (2005 Supplement) determined that pretreatment would be required with conventional sand filtration to achieve the 2 nephelometric turbidity unit (NTU) pre-filtration requirement. Pretreatment for filtration is achieved through addition of chemicals which allow coagulation and flocculation to occur, precipitating suspended solids out of the wastewater stream. Pre-treatment may also be required for one or more of the following reasons:

- Prevent filter scaling;
- Stop biofilms (layers of algae and other microorganisms) from forming on filters;
- Too high or too low pH which may lead to filter corrosion.

4.1.2 Sand Media Filtration

Sand filtration is a deep bed filtration technology which has been used commonly in water treatment plants to treat potable water. It is also one of the most common tertiary treatment technologies utilized for wastewater effluent reuse. The process works by forcing water downward through a single or dual media filter system by gravity. The media are generally composed of sand, anthracite, or a combination of the two. Figure 4.1 shows a representation of the granular sand media. As solids accumulate in the filter, the sand beds must be periodically backwashed (cleaned) to maintain treatment capacity. Backwashing requires extra pumping, piping systems and storage tanks. Because of the nature of the sand filters and Title 22 regulations, pretreatment to remove suspended solids is usually necessary. Figure 4.2 shows a typical filtration bed.

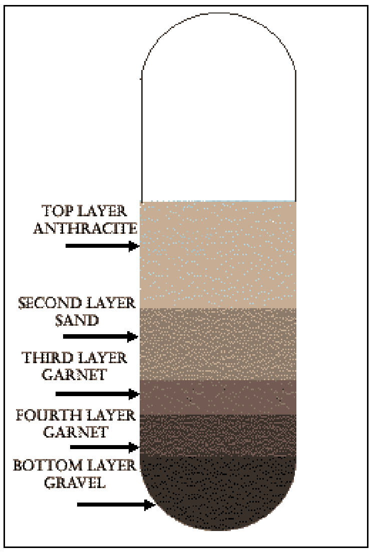

Figure 3.1 Filter Media

Figure 4.2 Typical Filter Bed

4.1.3 Cloth Media Filtration

Cloth media filtration, also known as surface filtration, removes particulate matter suspended in water by passing the water through a thin septum which retains particles of a certain size. The septum or filter can be composed of many different materials including: cloth fabrics of different weaves, woven metal fabrics, and synthetic materials. The main types of cloth media filters used in water reuse are the cloth-media filter, the disc-filter and the diamond cloth-media filter. Over time, solids accumulate on cloth filters and they must be backwashed to maintain performance. Certain solids eventually become embedded in the filters, which backwashing will not remove. This condition requires a high pressure spray to clean the filters and is determined to be necessary when the pressure wash across the filter reaches a certain level. Comparative testing of cloth versus granular filters has revealed a better overall ability of cloth filters to remove particles. The same testing also revealed a better ability of cloth filters to inactivate total coliform when coupled with UV disinfection. For new installations, pilot studies are recommended which may be a significant disadvantage to this technology. In addition, it is a fairly new technology and little data is available on filter lifespan. One cited operational advantage to cloth media filters is that they can be removed and washed in a heavy duty washing machine.

4.1.4 Chlorination

Chlorination is the most common form of disinfection in potable water, and is a simple and relatively inexpensive option for a finishing treatment at a tertiary facility. Typically, sodium hypochlorite is added to water to achieve disinfection. Hydrolysis of these compounds produces hypochlorous acid, which then kills bacteria, viruses, and other microorganisms. Depending on chlorine dosage and contact time, a number of different microorganisms and viruses can be deactivated to a varying degree.

4.1.5 Modular Options

Since the SAM facility will potentially use phased design, modular treatment units will be necessary. Two options for modular media filters are presented below, from Ashbrook Process Systems Inc. and the Parkson Corporation. These modules are described as examples of modular sand and cloth filters. Specific recommendations for the SAM facility are beyond the scope of this Study.

Modular Sand Filtration

Several companies offer modular alternatives to the conventional sand filtration unit; one example is the DynaSand Filter (Figure 4.3). DynaSand©, offered by Ashbrook Process Technologies Inc., is a deep bed upflow continuous granular filter which operates by filtering secondary wastewater effluent while simultaneously cleaning sand filter particles for reuse. It requires no backwash tanks or storage tanks.

DynaSand© operates by forcing upward flow of secondary wastewater effluent through sand settling downward. Effluent enters the top of the filter tank at (A, Figure 4.3) and flows down through a cylinder that has an airlift pipe running through its center. As the influent wastewater enters the bottom of the tank it is evenly distributed downward through 8 horizontal pipes with holes facing down. As the base of the tank fills, the wastewater flows upward through the sand and suspended matter is retained by the sand particles.

While the filter is removing suspended matter, a compressor provides suction pressure to the inner airlift tube, which carries sand slurry containing the removed solids upward through a weir and sand washer system. Sand is heavier than the removed solids allowing them to flow over the weir and through the reject pipe as backwash. Filtrate flowing through the sand further cleans sand particles as they fall downward through the washer on their way back to replenish the sand bed.

Two-stage filtration has been used by connecting two DynaSand© filters with different size sand particles in series. The waste washwater from the second filter, containing finer sand, is recycled to the first filter to improve flocculation of particles there. This configuration is reportedly able to produce a finer quality effluent and also is able to remove phosphorous to less than or equal to 0.02 milligrams per liter (mg/L).

More filter surface area is achieved by adding additional filters side by side in a concrete tank (see Figure 4.4) or by adding more steel “all-in-one” tank units on a platform and splitting the secondary wastewater to apply it evenly to all filters.

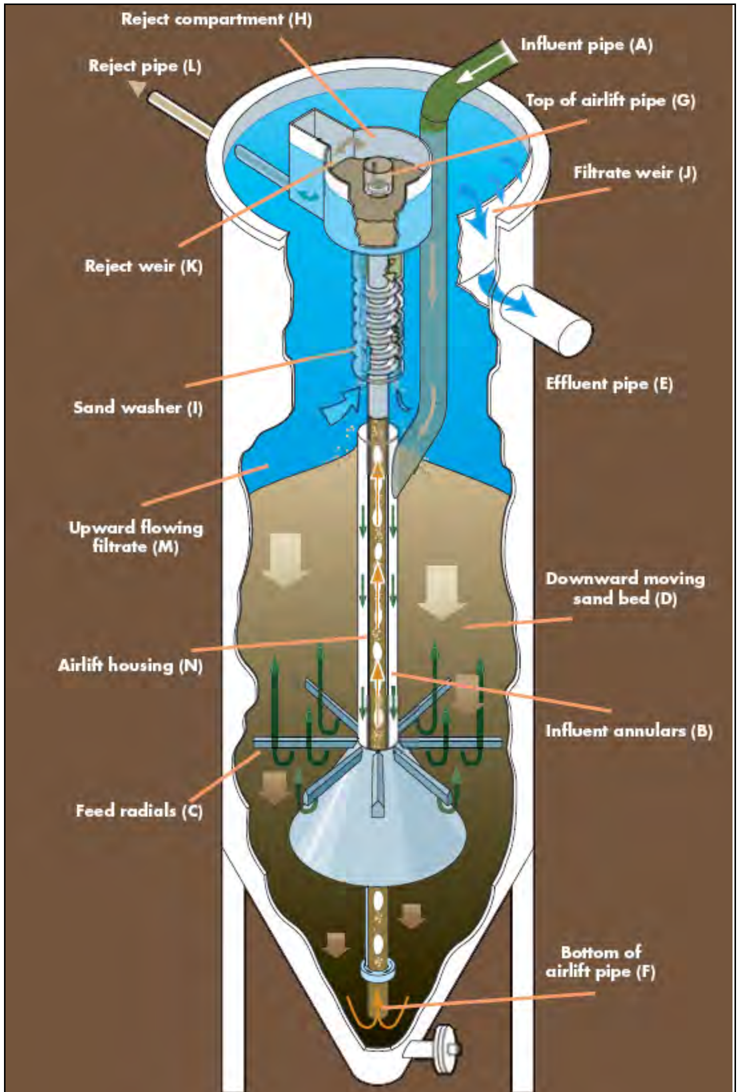

Figure 4.3 DynaSand© Filter

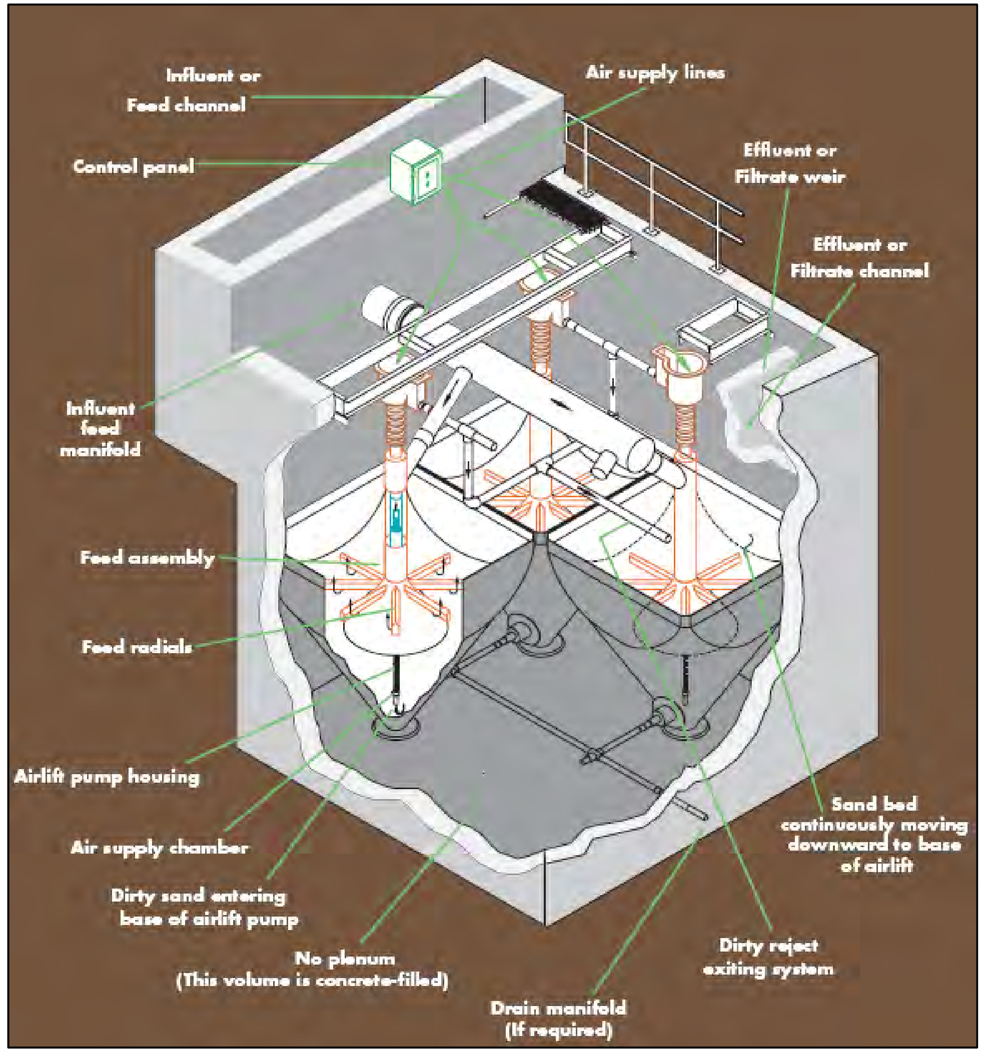

Figure 4.4 DynaSand© Filter Modular Concrete Design

Modular Cloth Filtration

DynaDisc© cloth media filter, shown in Figure 4.5, is a product offered by Parkson Corporation and is a modular solution for tertiary filtration. Utilizing a concept known as surface filtration, the DynaDisc© serves as an alternative for deep-bed filters. Cloth filters are used in many applications including pretreatment for membrane filtration, ultraviolet (UV) disinfection and removal of residual suspended solids from secondary effluent. This technology works through mechanical sieving or passing liquid through a thin septum.

During normal operation secondary effluent enters the filter trough through the feed nozzle and then passes into the filter disc, composed of two filter cartridges. The filtrate exits through individual ports for each cartridge to a final effluent nozzle.

Backwash is performed when pressure drop across the filter increases to a specified level. During backwash the vacuum heads rotate around the stationary disc, cleaning accumulated solids from its surface to be discharged through the sludge port. Filtration can proceed during backwash as only 5% of the filter is backwashed at a time.

Figure 4.5 DynaDisc© Cloth Media Filter

4.2 Micro/Ultrafiltration and UV Disinfection

Microfiltration (MF) and Ultrafiltration (UF) technologies are typically used to replace sand filtration with chemical addition, flocculation and settling in wastewater and water treatment applications. Both technologies have the ability to remove most turbidity, total suspended solids, bacteria, organic matter, nutrients and viruses.

4.2.1 Micro/Ultrafiltration

Microfiltration (MF) is capable of removing particles in effluent at 0.008 to 2 micrometers in diameter. This technology is mainly used to remove turbidity and some types of colloidal suspended solids. The membrane pore sizes are greater than 50 nanometers. The media is typically composed of ceramic, polypropylene or Teflon. MF is also capable of removing organic substances and many microorganisms from wastewater. These technologies are offered by several manufacturers, including Instrumech Inc., Parsons, Memtek, and others.

Ultrafiltration (UF) removes particles in the 0.005 to 0.2 micrometers (µm) range and contains membranes with pores from 2 to 50 nm. These membranes offer higher removal ratios but require more energy to operate than conventional filtration. Some of the lower diameter UF membranes have been proven to remove high molecular weight dissolved compounds like colloids, proteins and carbohydrates.

Some advantages of UF and MF over conventional filters are that they can reduce use of treatment chemicals, are operated more easily and require smaller footprints than traditional filter beds. The technology is becoming more streamlined, bringing costs to within a competitive range of conventional sand filtration.

Disadvantages are the high cost of electricity associated with pumping, possible pretreatment requirements to prevent fouling and in addition ineffective methods of monitoring their performance to date. Dealing with the concentrated waste stream presents disposal problems adding to operating costs. The membranes must be replaced every 5 years. Scale formation is a major problem which must be dealt with prior to implementation through field testing as over time scale formation will greatly decrease product water recovery.

4.2.2 MF and UF Modular Options

Most MF and UF systems have modular design options. For example, Instrumech Inc. offers a MF modular unit, specifically the *Exxflow*, which integrates membrane filtration with ion exchange for recycled water and other applications. See Figure 4.6, the modular unit, on the following page.

In addition, Memtek offers a modular option that consists of individual hollow fiber membranes arranged inside of arrays or skids, as in Figure 4.7. These arrays or skids can be switched out, added, or removed to meet additional flow requirements or quality concerns in an existing system.

Figure 4.6 Instrumech Modular

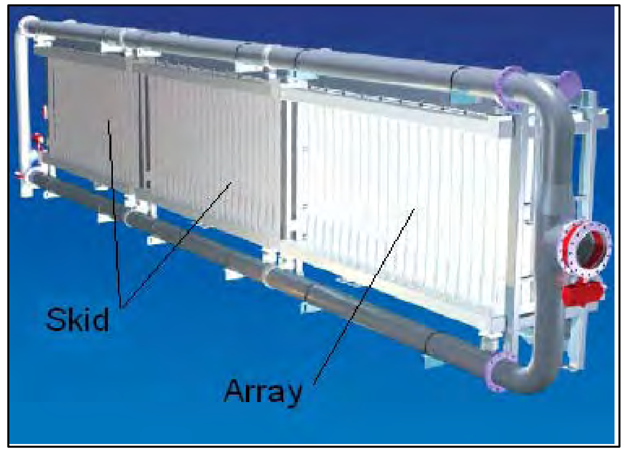

Figure 4.7 Memtek Modular Skid

4.2.3 Ultraviolet Disinfection

Ultraviolet (UV) disinfection is a technology that disinfects water and wastewater by utilizing UV light to reacts with and break down biological and chemical constituents in the water. UV works without producing potentially harmful byproducts. The polychromatic medium-pressure (MP) and low-pressure (LP) UV radiation source has demonstrated effectiveness in direct photolysis of Endocrine Disrupting Compounds (EDCs), although MP sources are more effective. In all cases the EDCs were more effectively degraded using UV/H_2O_2 advanced oxidation as compared to direct UV photolysis treatment.

One disadvantage of UV is that inorganics, organics, and complex compounds in wastewater can reduce absorptivity of UV light waves. These constituents can block UV light and allow bacteria to pass UV chambers without full disinfection. This phenomenon occurs most commonly in industrial wastewater and storm water where inorganic and organic substances can have high variation on a seasonal basis. This problem can be addressed by monitoring influent and adjusting UV dose where necessary.

4.3 Reverse Osmosis

Reverse Osmosis (RO) effectively uses pressure to push feed water through a semi-permeable membrane, which allows only water to pass, retaining ions and other chemicals. RO produces high quality effluent, stripped of almost all contaminants, and a waste stream highly concentrated with ions of various chemicals. In many cases the water is so stripped of constituents that it is extremely corrosive to pipes and equipment unless supplemented with replacement minerals.

RO membranes have the ability to remove both soluble organic and inorganic matter. In addition, RO has shown high removal rates (>90%) for emerging pollutants of concern such as pharmaceuticals, hormones, and industrial chemicals. RO has been used traditionally to treat reclaimed municipal wastewater for groundwater discharge, cooling towers, and high pressure feed water for boilers.

4.3.1 Pretreatment

Pretreatment of RO feed water has the largest effect on the life of RO membranes as over time the membranes may become scaled or fouled. Pretreatment of secondary effluent for RO preparation is site specific depending on the chemical and biological composition of the feed water. With high levels of iron and manganese, ion exchange or chemical coagulants are added to prevent scale formation. To prevent microorganisms from clogging the membranes, disinfection through UV, chlorine dosing or micro/ultra filtration is used. Adjustment of the feed water pH may also be required to prevent membrane corrosion.

4.3.2 RO Membranes

RO membranes are usually thin film composite (TFC) membranes, either spiral wound or hollow fiber. See Figure 4.8, below, for a general depiction. They operate under pressures ranging from 1200 to 1800 kilopascal (kPa) for low total dissolved solids (TDS) water such as secondary effluent. They are effective at removing compounds below molecular weight 300 and solute sizes from 0.0001 to 0.001 µm.

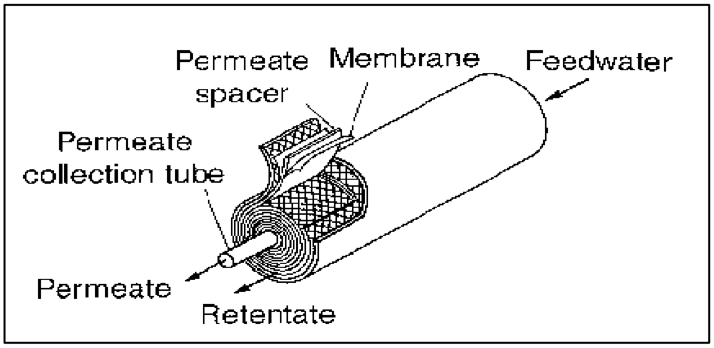

Figure 4.8 RO Membrane Cross Section

Spiral Wound RO Membranes

Spiral wound membranes are typically composed of aromatic polyamide polymers, and are known for high fouling rates when subjected to feeds of high organic content. Low surface charge membranes perform better and are more resistant to fouling due to hydrophilic nature and a diminished ion adsorption at their surfaces.

Hollow Fiber RO Membranes

Another type of membrane used for RO is the hollow fiber membrane, which is a similar membrane to those found in MF and UF filters. Hollow fiber membranes have comparatively high surface area to volume ratio and low operating pressure drop making them attractive in terms of energy efficiency. They are also considered easy to clean by backwashing, but due to their small diameter, fibers are prone to clogging.

4.3.3 RO Modular Options

Similar to modular options for MF and UF, RO modular units are offered from most manufactures. ZYI Corporation (ZYI), for example, offers a number of modular options for RO treatment, which are designed for the specific water quality needs of the customer and the feed water composition. Figure 4.9, below, illustrates one such modular option that comes assembled and is customized with chemical feed, monitoring, and pre-filtration systems within the unit.

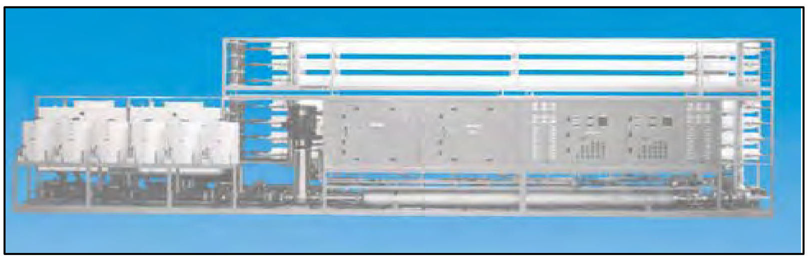

Figure 4.9 ZYI Reverse Osmosis Modular Unit

CHAPTER 5

Cost Estimates

Chapter 5: Cost Estimates

The cost information presented in this chapter contains planning level estimates of probable costs to plan, design, permit and construct a recycled water treatment facility and associated distribution pipelines. The costs are presented as a comparison between the six options developed and described in Chapter 3 of this report.

5.1 Capital Construction Costs

The capital cost of the recycled water project varies depending on the size of the proposed facility, the desired level of treatment, and the piping infrastructure required.

5.1.1 Facility Sizing

This study explored the possibilities of sizing the facility in two different ways, a 0.6 MGD phased plant that will initially only connect to OCGC, and a 1.65 MGD plant that will treat the ADWF of the SAM WWTP. The costs of these two options vary based on the footprint of the tertiary treatment facility, the sizing of the treatment equipment, and necessary storage.

5.1.2 Level of Treatment

The capital cost varies substantially depending on the desired level of treatment for the tertiary facility. The three levels of treatment that are economically evaluated in this section are sand filtration with coagulation and sedimentation, microfiltration with UV disinfection, and reverse osmosis (RO). The water quality benefits and technological details of the treatment options are described in Chapter 4 of this report.

The costs of the two treatment facility sizes were assessed for each of the three treatment levels resulting in estimates of probable construction cost for the treatment facility (Table 5.1).

Table 5.1 Probable Construction Costs for Various Treatment Facility Options

Tertiary Treatment Plant Size	Level of Treatment	Probable Construction Cost *2008 Dollars*
0.6 MGD - Phased Plant *Ocean Colony Golf Courses ONLY*	Filtration	$1,500,000
	MF/UV	$3,050,000
	RO	$6,100,000
1.65 MGD - Full-Size Plant	Filtration	$4,620,000
	MF/UV	$9,150,000
	RO	$15,000,000

5.1.3 Pipeline Infrastructure

The costs of pipeline infrastructure were developed in addition to treatment facility capital costs for each of the facility sizes. The 0.6 MGD facility initially requires the installation of approximately 800 feet of piping to connect the SAM facility to OCGC through an already existing pipeline tie-in at the OCGC well field (see Figure 2.3 for locations). Table 5.2 presents the initial pipeline infrastructure cost estimate for the 0.6 MGD facility.

Table 5.2 Probable Construction Costs for OCGC Pipeline ONLY
(2008 Dollars)

Parameter \ Customer	Ocean Colony
Length of Pipeline (linear ft)	792
Pipeline Material & Installation Cost	
PVC Pipe	$179,784
Steel Pipe	--
Road Crossings	--
Natural Crossings	$1,000,000
Total Pipeline Construction Cost	**$1,179,784**

Assumptions:
1. PVC Pipe for all customers with exception of Skylawn Memorial Cemetery.
2. Ocean Colony Golf Course would use their existing pipeline for recycled water distribution.
3. Cost of PVC Pipe installed = $227/linear ft
4. Existing Pilarcitos Creek crossing is unavailable

The 1.65 MGD facility requires the installation of piping to serve all six potential customers. Two different potential distribution systems have been evaluated hydraulically and logistically: a connected distribution system serving all six customers, and system of individual pipelines connecting each customer to the facility. Table 5.3, on the following page, illustrates the probable construction costs for running a transmission pipeline to each potential recycled water customer considered in this study. A more economically feasible option is summarized in Table 5.4, on the following page, in which Bay City Flower Company, Nurserymen’s Exchange Lot No. 2, and Giusti Farms share one pipeline along Route 1.

Table 5.3 Probable Construction Costs for Individual Recycled Water Pipelines *(2008 Dollars)*

Parameter \ Customer	Ocean Colony	NSE Lot#1	NSE Lot#2	Skylawn Cemetery	Bay City Flower	Giusti Farms	Daylight Farms
Length of Pipeline (linear ft)	792	10,560	17,424	30,360	18,216	14,784	1,056
Pipeline Material & Installation Cost							
PVC Pipe	$179,784	$2,397,120	$3,955,248	--	$4,135,032	$3,355,968	$239,712
Steel Pipe	--	--	--	$9,108,000	--	--	--
Road Crossings	--	$300,000	$300,000	$300,000	$300,000	$300,000	--
Natural Crossings	$1,000,000	$1,000,000	--	$1,000,000	--	--	--
Total Pipeline Construction Cost	**$1,179,784**	**$3,697,120**	**$4,255,248**	**$10,408,000**	**$4,435,032**	**$3,655,968**	**$239,712**
						TOTAL	**$27,870,864**

Assumptions:
1. Individual pipeline to each customer.
2. PVC pipe for all customers with exception of Skylawn Memorial Cemetery.
3. Steel pipe for the pipeline to Skylawn Memorial Cemetery.
4. Ocean Colony Golf Course would use their existing pipeline for recycled water distribution.
5. Cost of PVC pipe installed = $227/linear ft; Cost of Steel pipe installed = $300/linear ft
6. Existing Pilarcitos Creek crossing is unavailable

Table 5.4 Probable Construction Costs for Recycled Water Combined Pipelines *(2008 Dollars)*

Parameter \ Customer	Ocean Colony	NSE Lot#1	Skylawn Cemetery	Bay City Flower, Giusti Farms, & NSE Lot#2	Daylight Farms
Length of Pipeline (linear ft)	792	10,560	30,360	18,216	1,056
Pipeline Material & Installation Cost					
PVC Pipe	$179,784	$2,397,120	--	$4,135,032	$239,712
Steel Pipe	--	--	$9,108,000	--	--
Road Crossings	--	$300,000	$300,000	$300,000	--
Natural Crossings	$1,000,000	$1,000,000	$1,000,000	--	--
Total Pipeline Construction Cost	**$1,179,784**	**$3,697,120**	**$10,408,000**	**$4,435,032**	**$239,712**
				TOTAL	**$19,959,648**

Assumptions:
1. A Combined pipeline would be used by Bay City Flower Company, Giusti Farms and Nurserymen's Exchange Lot#2.
2. PVC pipe for all customers with exception of Skylawn Memorial Cemetery.
3. Steel pipe for the pipeline to Skylawn Memorial Cemetery.
4. Ocean Colony Golf Course would use their existing pipeline for recycled water distribution.
5. Cost of PVC pipe installed = $227/linear ft; Cost of Steel pipe installed = $300/linear ft
6. Existing Pilarcitos Creek crossing is unavailable.

5.1.4 Total Capital Construction Costs

Based on the cost estimates presented for the facility size, level of treatment and pipeline infrastructure, the total capital construction cost for the six options was developed. For the purpose of this estimate, the more economically feasible pipeline distribution option was used in evaluating the cost of the 1.65 MGD facility. Table 5.5 summarizes the results.

Table 5.5 Probable Construction Costs for Various Treatment Facility Options & Pipeline

Tertiary Treatment Plant Size	Level of Treatment	Probable Construction Cost Including Pipeline[1](s) *2008 Dollars*
0.6 MGD - Phased Plant *Ocean Colony Golf Courses ONLY*	Filtration	$2,679,784
	MF/UV	$4,229,784
	RO	$7,279,784
1.65 MGD - Full-Size Plant	Filtration	$24,579,648
	MF/UV	$29,109,648
	RO	$34,959,648
[1] Combined pipelines' cost from Table 3 is included in Full-Size Plant probable cost		

5.1.5 Total Project Capital Cost

The total project capital cost estimated for the Recycled Water Project is based on the total capital construction costs, with the addition of contingencies and allowances for legal, administration, planning, environmental review, permitting, design, and construction management costs. Table 5.6, on the following page, summarizes the total capital cost for the six potential facilities. The level of accuracy is at +50/-30 percent level, meaning that the actual costs can range between probable costs minus 30 percent to probable costs plus 50 percent. The information provided is intended only for the purpose of comparing various options as requested by the Board.

Table 5.6 Probable Total Project Capital Costs *(2008 Dollars)*

0.6 MGD - Phased Plant *Ocean Colony Golf Courses ONLY*	**Level of Treatment**		
	Filtration	MF/UV	RO
Subtotal	$2,679,784	$4,229,784	$7,279,784
Contingency +50%	*$1,339,892*	*$2,114,892*	*$3,639,892*
Contingency -30%	*$803,935*	*$1,268,935*	*$2,183,935*
Estimating Contingency 25%	$669,946	$1,057,446	$1,819,946
Total Construction Cost	**$3,349,730**	**$5,287,230**	**$9,099,730**
Administration, Legal, Planning, Coastal Act Compliance, CEQA, Design, Permitting, Construction Management 40%	$1,339,892	$2,114,892	$3,639,892
Project Cost	**$4,689,622**	**$7,402,122**	**$12,739,622**
1.65 MGD - Full-Size Plant	**Level of Treatment**		
	Filtration	MF/UV	RO
Subtotal	$24,579,648	$29,109,648	$34,959,648
Contingency +50%	*$12,289,824*	*$14,554,824*	*$17,479,824*
Contingency -30%	*$7,373,894*	*$8,732,894*	*$10,487,894*
Estimating Contingency 25%	$6,144,912	$7,277,412	$8,739,912
Total Construction Cost	**$30,724,560**	**$36,387,060**	**$43,699,560**
Administration, Legal, Planning, Coastal Act Compliance, CEQA, Design, Permitting, Construction Management 40%	$12,289,824	$14,554,824	$17,479,824
Project Cost	**$43,014,384**	**$50,941,884**	**$61,179,384**

5.2 Operation and Maintenance Costs

Annual operation and maintenance (O & M) costs were estimated for each of the potential facility sizes and treatment options. Table 5.7, below, summarizes the results.

Table 5.7 Probable Annual Operation & Maintenance Costs

Tertiary Treatment Plant Size	Level of Treatment	Probable O&M Cost *(2008 Dollars)*
0.6 MGD - Phased Plant *Ocean Colony Golf Courses ONLY*	Filtration	$114,232
	MF/UV	$132,837
	RO	$260,000
1.65 MGD - Full-Size Plant	Filtration	$254,659
	MF/UV	$304,944
	RO	$600,000

Assumptions:
1. O&M costs from Water Reuse Feasibility Study Supplement by Carollo Engineers, Aug-05 ENR=7479
2. Based on 20-Cities ENR Cost Index, Aug-08 ENR=9293
3. O&M Cost for RO estimated based on vendor data

SRT consultants

THIS PAGE LEFT INTENTIONALLY BLANK

CHAPTER 6

Funding Alternatives

Chapter 6: Funding Alternatives

The funding of the recycled water project may come from several different sources. Several funding options have been explored, and the best combination of funding sources is presented below to adequately meet the project budget.

6.1 Charge Breakdown

The following section provides a breakdown of the cost to customer to connect to the recycled water source.

6.1.1 Rate Revenues

Rate revenues will be collected from recycled water customers that are directly connected to the SAM recycled water supply. A complete economic evaluation will need to be conducted to establish a rate that is reasonable for irrigation customers and allows for a reasonable payback of total project costs.

6.1.2 Capital Facilities Charges

Capital facilities charges, or capacity charges, are the charges that new customers must pay to “buy in” to the recycle water facilities. Capital facility charges will vary depending on the size of the connection to the recycled water system and the delivery system required to serve each customer.

6.2 Funding Sources

There are several sources of funding available from the State of California and Federal Sources. Most of these sources are either grants or loans. The following are the options available to SAM for the recycled water projects funding.

6.2.1 Grants

Grant funding can be acquired by SAM from State and Federal sources dedicated to water conservation, water use efficiency, water reclamation projects, and the protection of beaches, bays, and coastal waters along the California Coastline. The following grants are opportunities that may be consistent with the objectives of the SAM Recycled Water Project.

The Water Recycling Funding Program (WRFP)

The WRFP manages all State Water Board grants and loans for the design and construction of recycled water projects. The grant funding that can be available for the design and construction of the SAM recycled water project has been researched and is outlined below:

1. *Water Recycling Construction Program (WRCP)*

   The WRCP provides grants to eligible applicants for the design and construction of water recycling facilities. Applications are accepted on a continuous basis; however, limited grant funding is available. The available funding is distributed to projects that meet the requirements of the WRCP Guidelines and are immediately ready to proceed to construction.

2. Water Recycling Facilities Planning Grant Program (FPGP)
The FPGP provides grants up to $75,000 to study the feasibility of water recycling and to prepare facilities plan documenting the analyses and conclusions of the investigation. Applications are accepted on a continuous basis.

The Integrated Regional Water Management Program (IRWMP) (Proposition 84, Chapter 2)
This program is available through the State Department of Water Resources and is designed to fund long term water-supply projects. In the San Francisco funding area the funding limit is $138 million and applications are expected to be formally solicited in the fall of 2008.

Federal Funding for Recycled Water Projects through the Bay Area Recycled Water Coalition (BARWC)
This grant program requires entering into an MOU (Memorandum Of Understanding) with BARWC and attaining a membership to the coalition which costs between $10k and $20k per year. In addition NEPA compliance and determination of feasibility from the US Bureau of Reclamation will be required.

6.2.2 Debt Instruments

A debt instrument enables the issuing party to raise funds by promising to repay in accordance with terms of a contract. Types of debt instruments include loans, bonds, certificates, leases or other agreements between a lender and a borrower. Although SAM is attempting to acquire the funding necessary for the project through grants, rate revenue, and capital facility charges, it will most likely be necessary for SAM to borrow money to cover the initial planning and permitting costs of the project. The following loan options exist:

State Revolving Fund (SRF)
SRF lends $200-$300 million dollars annually for the construction of facilities or implementation of measures necessary to address water quality problems and to prevent water pollution. Interest accrued by this loan is one half of prime and is currently set at 2.5%. In the past, interest rates for CWSRF loans averaged 2.1 percent, compared to market rates that averaged 4.3 percent. For a CWSRF program offering this rate, a CWSRF funded project would cost 18 percent less than projects funded at the market rate. CWSRFs can fund 100 percent of project costs and provide flexible repayment terms up to 20 years. This program has assisted a range of borrowers including municipalities and public agencies.

California Infrastructure and Economic Development Bank (I-Bank)

I-Bank administers funds from the Infrastructure State Revolving Fund (ISRF) Program, which provides low-cost financing to public agencies for a wide variety of infrastructure projects. ISRF Program provides low-cost financing to public agencies for a wide variety of infrastructure projects. ISRF Program funding is available in amounts ranging from $250,000 to $10,000,000. Current loan interest rates are fixed at 3.5% for a 30 year loan and 3.1% for a 20 Year loan; these fluctuate slightly on a monthly basis.

Conventional Bank Financing

Conventional Financing could also be used to make up for other loans and grants which could not be acquired. These loans typically accrue interest at rates between four to six percent.

6.2.3 Capital Reserve Balances

SAM may utilize some capital reserves to initially fund the Recycled Water Project. These balances have been reserved for long-term capital investment projects or any other large and anticipated expense(s) in the future, and would have to be re-paid through rate revenues, SRF funding, or other sources.

6.3 Funding Alternatives

There are several options available for public enterprises and or entities to secure funding for water projects and infrastructure through loans and grants and a combination of the two. For the purpose of this Study, it has been assumed that the capital cost, operation and maintenance and the annual interest paid on all loans attained by SAM to provide distribution and treatment services will be recovered through recycled water rates. This means that the service of recycled water will be offered to the customer at a rate which will have factored in all costs of the project. Detailed below are several options available to SAM.

6.3.1 No Grant Funding

If no grant funding is obtained, the entire cost of the project must be charged to the recycled water customers in the form of water rates and capital facility charges. For this alternative all of the project monies would come from loans and be reimbursed by the customers over the life of the project. This option is detailed with a column for each treatment option studied in Table 6.1. In addition, the necessary financing for each loan and associated interest rates are specified.

The data presented in this table is based on 20-year present worth costs, and results in the cost per acre-foot to the customer for each specific lending alternative. Annual operation and maintenance costs are included in the total project cost.

SRT consultants

THIS PAGE LEFT INTENTIONALLY BLANK

Table 6.1 Probable Total Project Annualized Costs (2008 Dollars)

0.6 MGD - Phased Plant *Ocean Colony Golf Courses ONLY*	**Level of Treatment**								
	Filtration			MF/UV			RO		
Total Project Capital Cost	**$4,689,622**			**$7,402,122**			**$12,739,622**		
Debt Instrument	SRF Loan	I-Bank	Private Financing	SRF Loan	I-Bank	Private Financing	SRF Loan	I-Bank	Private Financing
Interest Rate	20-yr @ 2.5%	20-yr @ 3%	20-yr @ 6%	20-yr @ 2.5%	20-yr @ 3%	20-yr @ 6%	20-yr @ 2.5%	20-yr @ 3%	20-yr @ 6%
Annualized Project Cost	*$300,605*	*$315,143*	*$408,935*	*$474,476*	*$497,423*	*$645,465*	*$816,610*	*$856,103*	*$1,110,895*
Total Operations & Maintenance Cost	*$114,232*			*$132,837*			*$260,000*		
Total Annual Cost	*$414,837*	*$429,374*	*$523,167*	*$607,313*	*$630,260*	*$778,302*	*$1,076,610*	*$1,116,103*	*$1,370,895*
AF per Year Used	*587*			*587*			*587*		
Dollars per AF (annual basis)	**$706.71**	**$731.47**	**$891.26**	**$1,034.60**	**$1,073.70**	**$1,325.90**	**$1,834.09**	**$1,901.37**	**$2,335.43**

1.65 MGD - Full-Size Plant	**Level of Treatment**								
	Filtration			MF/UV			RO		
Total Project Capital Cost	**$43,014,384**			**$50,941,884**			**$61,179,384**		
Debt Instrument	SRF Loan	I-Bank	Private Financing	SRF Loan	I-Bank	Private Financing	SRF Loan	I-Bank	Private Financing
Interest Rate	20-yr @ 2.5%	20-yr @ 3%	20-yr @ 6%	20-yr @ 2.5%	20-yr @ 3%	20-yr @ 6%	20-yr @ 2.5%	20-yr @ 3%	20-yr @ 6%
Annualized Cost	*$2,757,222*	*$2,890,567*	*$3,750,854*	*$3,265,375*	*$3,423,295*	*$4,442,132*	*$3,921,599*	*$4,111,255*	*$5,334,842*
Total Operations & Maintenance Cost	*$254,659*			*$304,944*			*$600,000*		
Total Annual Cost	*$3,011,881*	*$3,145,226*	*$4,005,514*	*$3,570,319*	*$3,728,239*	*$4,747,076*	*$4,521,599*	*$4,711,255*	*$5,934,842*
AF per Year Used	*1086*			*1086*			*1086*		
Dollars per AF (annual basis)	**$2,773.37**	**$2,896.16**	**$3,688.32**	**$3,287.59**	**$3,433.00**	**$4,371.16**	**$4,163.53**	**$4,338.17**	**$5,464.86**

Assumptions:
1. O&M costs from Water Reuse Feasibility Study Supplement by Carollo Engineers, Aug-05 ENR=7479
2. Based on 20-Cities ENR Cost Index, Aug-08 ENR=9293
3. No Grant Funding included
4. AF per Year Used based on the Current Annual Estimated Irrigation Water Usage (Appendix A)
5. O&M Cost for RO estimated based on vendor data

6.3.2 Grant Funding

If SAM decides to apply for grant funding, the estimated percentage of the project budget that would be covered by grants is 10-25%, with the rest of the budget to be covered by the aforementioned loans. Details regarding the potential applicable grants for the Recycled Water Project are included in Appendix B.

Three tables have been developed to outline the combined grant and loan funding alternatives. Tables 6.2, 6.3, and 6.4 address funding alternatives for sand filtration, membrane filtration, and reverse osmosis, respectively, and are included on the following pages. Each table provides estimated amounts of SRF, I-Bank, and Private loans based on the percentage of grant coverage. The final results are included on cost per acre-foot of recycled water to be delivered to the potential customers on an annualized basis.

THIS PAGE LEFT INTENTIONALLY BLANK

Table 6.2 Probable Total Project Annualized Costs including Grant Funding for Filtration Treatment *(2008 Dollars)*

0.6 MGD - Phased Plant *Ocean Colony Golf Courses ONLY*	**Level of Treatment** Filtration								
Total Project Capital Cost	**$4,689,622**								
	Grant Funding			Grant Funding			Grant Funding		
Percentage Provided by Grant	25%	15%	10%	25%	15%	10%	25%	15%	10%
Project Cost financed by Grant	***$3,517,217***	***$3,986,179***	***$4,220,660***	***$3,517,217***	***$3,986,179***	***$4,220,660***	***$3,517,217***	***$3,986,179***	***$4,220,660***
Debt Instrument	SRF Loan			I-Bank			Private Financing		
Interest Rate	20-yr @ 2.5%			20-yr @ 3%			20-yr @ 6%		
Annualized Project Cost	*$225,454*	*$255,514*	*$270,544*	*$236,357*	*$267,871*	*$283,628*	*$306,701*	*$347,595*	*$368,042*
Total Operations & Maintenance Cost	*$114,232*								
Total Annual Cost	*$339,685*	*$369,746*	*$384,776*	*$350,589*	*$382,103*	*$397,860*	*$420,933*	*$461,827*	*$482,273*
AF per Year Used	*587*								
Dollars per AF (annual basis)	**$578.68**	**$629.89**	**$655.50**	**$597.26**	**$650.94**	**$677.79**	**$717.09**	**$786.76**	**$821.59**

1.65 MGD - Full-Size Plant	**Level of Treatment** Filtration								
Total Project Capital Cost	**$43,014,384**								
	Grant Funding			Grant Funding			Grant Funding		
Percentage Provided by Grant	25%	15%	10%	25%	15%	10%	25%	15%	10%
Project Cost financed by Grant	***$32,260,788***	***$36,562,226***	***$38,712,946***	***$32,260,788***	***$36,562,226***	***$38,712,946***	***$32,260,788***	***$36,562,226***	***$38,712,946***
Debt Instrument	SRF Loan			I-Bank			Private Financing		
Interest Rate	20-yr @ 2.5%			20-yr @ 3%			20-yr @ 6%		
Annualized Cost	*$2,067,917*	*$2,343,639*	*$2,481,500*	*$2,167,925*	*$2,456,982*	*$2,601,510*	*$2,813,141*	*$3,188,226*	*$3,375,769*
Total Operations & Maintenance Cost	*$254,659*								
Total Annual Cost	*$2,322,576*	*$2,598,298*	*$2,736,159*	*$2,422,584*	*$2,711,641*	*$2,856,169*	*$3,067,800*	*$3,442,886*	*$3,630,428*
AF per Year Used	*1086*								
Dollars per AF (annual basis)	**$2,138.65**	**$2,392.54**	**$2,519.48**	**$2,230.74**	**$2,496.91**	**$2,629.99**	**$2,824.86**	**$3,170.24**	**$3,342.94**

Assumptions:
1. O&M costs from Water Reuse Feasibility Study Supplement by Carollo Engineers, Aug-05 ENR=7479
2. Based on 20-Cities ENR Cost Index, Aug-08 ENR=9293
3. Grant Funding included
4. AF per Year Used based on the Current Annual Estimated Irrigation Water Usage (Appendix A)
5. O&M Cost for RO estimated based on vendor data.

Table 6.3 Probable Total Project Annualized Costs including Grant Funding for MF/UV Treatment *(2008 Dollars)*

0.6 MGD - Phased Plant *Ocean Colony Golf Courses ONLY*	**Level of Treatment**								
	MF/UV								
Total Project Capital Cost	**$7,402,122**								
	Grant Funding			Grant Funding			Grant Funding		
Percentage Provided by Grant	25%	15%	10%	25%	15%	10%	25%	15%	10%
Project Cost financed by Grant	***$5,551,592***	***$6,291,804***	***$6,661,910***	***$5,551,592***	***$6,291,804***	***$6,661,910***	***$5,551,592***	***$6,291,804***	***$6,661,910***
Debt Instrument	SRF Loan			I-Bank			Private Financing		
Interest Rate	20-yr @ 2.5%			20-yr @ 3%			20-yr @ 6%		
Annualized Project Cost	*$355,857*	*$403,305*	*$427,028*	*$373,067*	*$422,809*	*$447,680*	*$484,099*	*$548,645*	*$580,919*
Total Operations & Maintenance Cost	*$132,837*								
Total Annual Cost	*$488,694*	*$536,142*	*$559,865*	*$505,904*	*$555,646*	*$580,517*	*$616,936*	*$681,482*	*$713,756*
AF per Year Used	*587*								
Dollars per AF (annual basis)	**$832.53**	**$913.36**	**$953.77**	**$861.85**	**$946.59**	**$988.96**	**$1,051.00**	**$1,160.96**	**$1,215.94**
1.65 MGD - Full-Size Plant	**Level of Treatment**								
	MF/UV								
Total Project Capital Cost	**$50,941,884**								
	Grant Funding			Grant Funding			Grant Funding		
Percentage Provided by Grant	25%	15%	10%	25%	15%	10%	25%	15%	10%
Project Cost financed by Grant	***$38,206,413***	***$43,300,601***	***$45,847,696***	***$38,206,413***	***$43,300,601***	***$45,847,696***	***$38,206,413***	***$43,300,601***	***$45,847,696***
Debt Instrument	SRF Loan			I-Bank			Private Financing		
Interest Rate	20-yr @ 2.5%			20-yr @ 3%			20-yr @ 6%		
Annualized Cost	*$2,449,031*	*$2,775,569*	*$2,938,837*	*$2,567,471*	*$2,909,800*	*$3,080,965*	*$3,331,599*	*$3,775,812*	*$3,997,919*
Total Operations & Maintenance Cost	*$304,944*								
Total Annual Cost	*$2,753,975*	*$3,080,513*	*$3,243,781*	*$2,872,415*	*$3,214,744*	*$3,385,909*	*$3,636,543*	*$4,080,757*	*$4,302,863*
AF per Year Used	*1086*								
Dollars per AF (annual basis)	**$2,535.89**	**$2,836.57**	**$2,986.91**	**$2,644.95**	**$2,960.17**	**$3,117.78**	**$3,348.57**	**$3,757.60**	**$3,962.12**

Assumptions:
1. O&M costs from Water Reuse Feasibility Study Supplement by Carollo Engineers, Aug-05 ENR=7479
2. Based on 20-Cities ENR Cost Index, Aug-08 ENR=9293
3. Grant Funding included
4. AF per Year Used based on the Current Annual Estimated Irrigation Water Usage (Appendix A)
5. O&M Cost for RO estimated based on vendor data.

Table 6.4 Probable Total Project Annualized Costs including Grant Funding for RO Treatment *(2008 Dollars)*

0.6 MGD - Phased Plant *Ocean Colony Golf Courses ONLY*	**Level of Treatment** RO								
Total Project Capital Cost	**$12,739,622**								
	Grant Funding			Grant Funding			Grant Funding		
Percentage Provided by Grant	25%	15%	10%	25%	15%	10%	25%	15%	10%
Project Cost financed by Grant	***$9,554,717***	***$10,828,679***	***$11,465,660***	***$9,554,717***	***$10,828,679***	***$11,465,660***	***$9,554,717***	***$10,828,679***	***$11,465,660***
Debt Instrument / *Interest Rate*	SRF Loan 20-yr @ 2.5%			I-Bank 20-yr @ 3%			Private Financing 20-yr @ 6%		
Annualized Project Cost	*$612,457*	*$694,118*	*$734,949*	*$642,077*	*$727,687*	*$770,492*	*$833,171*	*$944,261*	*$999,806*
Total Operations & Maintenance Cost	*$260,000*								
Total Annual Cost	*$872,457*	*$954,118*	*$994,949*	*$902,077*	*$987,687*	*$1,030,492*	*$1,093,171*	*$1,204,261*	*$1,259,806*
AF per Year Used	*587*								
Dollars per AF (annual basis)	**$1,486.30**	**$1,625.41**	**$1,694.97**	**$1,536.76**	**$1,682.60**	**$1,755.52**	**$1,862.30**	**$2,051.55**	**$2,146.18**

1.65 MGD - Full-Size Plant	**Level of Treatment** RO								
Total Project Capital Cost	**$61,179,384**								
	Grant Funding			Grant Funding			Grant Funding		
Percentage Provided by Grant	25%	15%	10%	25%	15%	10%	25%	15%	10%
Project Cost financed by Grant	***$45,884,538***	***$52,002,476***	***$55,061,446***	***$45,884,538***	***$52,002,476***	***$55,061,446***	***$45,884,538***	***$52,002,476***	***$55,061,446***
Debt Instrument / *Interest Rate*	SRF Loan 20-yr @ 2.5%			I-Bank 20-yr @ 3%			Private Financing 20-yr @ 6%		
Annualized Cost	*$2,941,199*	*$3,333,359*	*$3,529,439*	*$3,083,441*	*$3,494,566*	*$3,700,129*	*$4,001,132*	*$4,534,616*	*$4,801,358*
Total Operations & Maintenance Cost	*$600,000*								
Total Annual Cost	*$3,541,199*	*$3,933,359*	*$4,129,439*	*$3,683,441*	*$4,094,566*	*$4,300,129*	*$4,601,132*	*$5,134,616*	*$5,401,358*
AF per Year Used	*1086*								
Dollars per AF (annual basis)	**$3,260.77**	**$3,621.88**	**$3,802.43**	**$3,391.75**	**$3,770.32**	**$3,959.60**	**$4,236.77**	**$4,728.01**	**$4,973.63**

Assumptions:
1. O&M costs from Water Reuse Feasibility Study Supplement by Carollo Engineers, Aug-05 ENR=7479
2. Based on 20-Cities ENR Cost Index, Aug-08 ENR=9293
3. Grant Funding included
4. AF per Year Used based on the Current Annual Estimated Irrigation Water Usage (Appendix A)
5. O&M Cost for RO estimated based on vendor data.

CHAPTER 7

Emerging Contaminants and Regulations

Chapter 7: Emerging Contaminants and Regulations

This chapter addresses other issues related to recycled water that were documented as part of the this Study, specifically information regarding contaminants of public concern in secondary wastewater effluent and state regulations being developed by the State Water Resources Control Board (SWRCB).

7.1 Pharmaceuticals and Personal Care Products

Endocrine disrupting compounds (EDCs) and pharmaceuticals and personal care products (PPCPs) are not unique to recycled water, but ubiquitous to most water supply and wastewater sources. Even though these compounds are found in all surface and groundwater supplies, their possible presence in recycled water has been often cited as a reason for public opposition to a recycled water project, typically for potable use. However, it is now known that trace amounts (parts per million to parts per billion) of EDCs and PPCPs are found in many other potable water supply sources, including rivers and reservoirs, as these sources are often the drainage points for treated wastewater and surface water runoff. Regardless, the public is concerned with the human health risks associated with the potential EDCs and PPCPs in recycled water, and to what degree the recycled water should be treated to minimize potential health risks. Current information on human health risks and effectiveness of treatment technologies is summarized below.

7.1.1 Human Health Risks

To date, there is no firm evidence for a causal association between low-level exposure to EDCs and PPCPs and adverse human health outcomes. Significant research supports that response to endocrine disruptors is dose/potency related: there is a ‘no-effect’ threshold. In laboratory studies, high doses are required to give weak hormone activity, and these doses are not likely to be encountered in the environment. With respect to humans, there are no convincing studies that show that any adverse hormone related effects are occurring. Epidemiological evidence does not support such a link, although isolated studies may be interpreted that way. The suggestions that many human reproductive changes are a result of environmental contaminants are not based on a significant body of scientific findings. Consequently, EPA and other federal and state agencies continue to provide substantial funding for research to better understand the risks posed by endocrine disruptors.

Most research being conducted regarding EDCs and PPCPs is in regard to trace concentrations present in recycled water to be treated and used as potable water. Recharging aquifers and blending recycled water with non-recycled water sources have been identified as the main concern of the public and potential customers in studies focused on the trace contaminants. Since recycled water used for irrigation is not consumed by humans, trace concentrations of EDCs and

PPCPs have not been considered a serious risk to end users or the public and have not been studied extensively.

7.1.2 Advanced Treatment for EDCs and PPCPs

It is not typical for a recycled water irrigation facility to invest in technologies for high efficiency removal of EDCs and PPCPs, however treatment options are available that will provide this degree of removal, if desired. Recycled water used for irrigation must meet all irrigation water requirements for parameters such as salt content, sodium adsorption ratio, and trace elements. Statewide regulations regarding the recycled water quality requirements (for both potable and non-potable uses) are currently being drafted.

An American Water Works Association Research Foundation (AWWARF) study, published in 2007, evaluated conventional and advanced treatment processes for removal of EDCs and PPCPs. The study resulted in several conclusions on the effectiveness of tertiary treatment methods and various forms of disinfection for the specific effluent analyzed. A summary of the results from the AWWARF study are summarized in Table 7.1 on the following page. Since the study focused on several target analytes that were present in the study-specific effluent, not all of the results may be pertinent to SAM's effluent. In order to establish the most effective EDC and PPCP removal technologies for the SAM tertiary treatment facility, it would be necessary to analyze EDC and PPCP concentrations in the effluent of the SAM secondary treatment facility.

Table 7.1 Effectiveness of Treatment Technologies in Removing EDCs

Treatment Technology	Type of Treatment	Demonstrated effectiveness in Removing EDCs and PPCPs
Activated Carbon	Tertiary	Highly effective for removal of target analytes
Reverse Osmosis	Tertiary	Highly effective for removal of all EDCs and PPCPs
Nanofiltration	Tertiary	Highly effective for removal of all EDCs and PPCPs
Ultrafiltration/ Microfiltration	Tertiary	Largely ineffective for removal of EDCs and PPCPs
Chlorination	Disinfection	Free chlorine is effective in the removal of many target compounds, depending on the structure of the contaminant
Ozone	Disinfection	Much more effective than free chlorine, and is able to remove the majority of target analytes
Ultraviolet (UV) Radiation	Disinfection	UV is ineffective for removal of most EDCs and PPCPs at typical disinfection doses; high energy oxidative doses, however, can be highly effective

7.2 State Recycled Water Policy

The State Water Resources Control Board (SWRCB) is in the process of developing a statewide Recycled Water Policy (Policy) to establish more uniform requirements for recycled water projects. The SWRCB released the Policy in March 2008 and received many comments, causing the Board to review again. In May 2008, the SWRCB tasked a group of stakeholders to create their own statewide Recycled Water Policy, to be presented at a public meeting and potentially be approved by the SWRCB. The alternative Recycled Water Policy was presented by the stakeholder group to the SWRCB on September 2, 2008. After the presentation, the SWRCB asked staff to review the stakeholder's proposal and edit as necessary to meet legal requirements, add language to address incidental runoff of recycled water, and return the edited draft back to the stakeholder group for review and comment. Following the internal review, the staff should move forward in preparing the environmental document and release the revised draft and the environmental document for public comment. After the public review period, the draft policy and the environmental document can be presented for Board consideration.

The SWRCB is also in the process of developing a statewide general permit for landscape irrigation uses of recycled water. New law, California Water Code section 13552.51, requires the State Water Board to adopt the General Permit by July 30, 2009. The intent of the new law is to develop a uniform interpretation of state standards to ensure the safe, reliable use of recycled water for landscape irrigation uses, consistent with state and federal water quality law. The new law is also intended to expedite permitting for use of recycled water for landscape irrigation. On June 18, 2008, the SWRCB held a workshop and CEQA scoping meeting, where staff provided a description of the General Permit adoption process and its schedule. Staff also presented an overview of the regulatory and technical issues associated with landscape irrigation uses of recycled water and discussed the potential elements of the General Permit. The meeting participants had an opportunity to provide comments regarding the appropriate scope and content of the General Permit and the environmental documents to be prepared pursuant to CEQA. There was no action taken as a result of this meeting. No draft of the permit is available at this time, but electronic versions of the presentations and comments are presently available on line at the California SWRCB website.

CHAPTER 8

Findings and Next Steps

Chapter 8: Findings and Next Steps

This report was prepared to provide SAM with a comprehensive overview of the treatment options, associated costs, and other issues surrounding the planning and construction of a recycled water facility. This chapter summarizes the findings of the Recycled Water Study and provides recommendations for next steps.

8.1 Findings

This Study resulted in several key findings outlined below.

1. Potential customers interviewed for the purpose of this study currently have a high level of interest in recycled water. Customers are particularly motivated due to the following anticipated economic and environmental benefits of the Recycled Water Project:

    - Recycled water is a more drought resistant and affordable source for irrigation water users. Several potential customers do not currently have access to a reliable and affordable water source.
    - Recycled water availability will improve the economic sustainability of the Midcoast as two of the customers are the region's largest employers and their reliance on imported, expensive water will be reduced.
    - The environmental sustainability of the Midcoast region will be improved by reducing reliance on local aquifers, potentially recharging the aquifers and restoring flows and aquatic life in Pilarcitos Creek.

2. OCGC was identified as the most feasible customer to initially connect to the recycled water facility.

3. Several viable treatment options exist for producing irrigation quality recycled water; these treatment options differ in water quality produced and the cost of production.

4. The cost analysis completed in this report provides estimates for six different alternatives and the associated costs per acre-foot of recycled water that the potential customers would pay for each alternative. The following Table 8.1 provides a cost summary and comparison between the current and projected CCWD potable water rates and the range of projected recycled water costs for the six alternatives considered in this study.

Table 8.1 Cost Comparison for Cost per Acre-Foot *(2008 Dollars)*

Recycled Water Facility Size	CCWD Cost to Retail Customers *($$/AF)*		Projected Recycled Water Cost Ranges *($$/AF)*	
	Current	**Projected** *(2015 dollars)*	**Debt Instrument Only**	**Grant Funding Included**
0.6 MGD - Phased Plant *Ocean Colony Golf Courses ONLY*	$2,120	$4,680	$710 - $2,335	$580 - $2,150
1.65 MGD - Full-Size Plant	$2,120	$4,680	$2,775 - $5,470	$2,140 - $5,000

Assumptions:
1. CCWD commercial water rate is $4.86 HCF. Source: CCWD website. (includes distribution cost & SFPUC wholesale)
   a. CCWD distribution cost is $3.34 HCF. Source: CCWD website.
   b. SFPUC wholesale rate is $1.43 HCF. Source: CCWD website.
4. SFPUC wholesale rates will increase 300% by 2015 to $5.72 HCF. Source: SFPUC website.
5. CCWD projected 2015 distribution costs calculated using 6% annual inflation rate is $5.02 HCF.
6. CCWD projected 2015 commercial water rate is $10.74 HCF. Estimated based on above.

5. An agreement to cooperate in treating and distributing the recycled water must be made between SAM and CCWD, or an Irrigation District comprised of recycled water users must be formed. The option of SAM distributing the recycled water has been considered and it appears improbable.

8.2 Next Steps

The next steps of the Recycled Water Project are as follows:

1. Develop a recycled water supply agreement for potential customers in collaboration with SAM's general counsel. This agreement should include the level of treatment of the recycled water, the means of distribution, the amount of water to be delivered, and the cost per acre foot for each customer.

    a. Develop a recycled water supply agreement specifically for OCGC, if SAM maintains the position of initially connecting to OCGC before all other customers.

2. Develop a Recycled Water Facilities Study to define the proposed project in terms of facility sizing and level of treatment. As the project becomes further defined, public meetings and workshops will be held to inform the community about the details of the project and associated concerns.

3. Secure funding from grant and loan sources.

4. Initiate environmental review studies and necessary permitting.

5. Design and construct the facility.

Table 8.2 on the following page provides a schedule that has been developed to provide SAM with an estimated timeline for the next steps for the Recycled Water Project.

THIS PAGE LEFT INTENTIONALLY BLANK

Task Name ***Recycled Water Project – PHASED Approach***	Duration	Predecessor
Task 1 Recycled Water Study	**12 mos**	
Task 2 Secure Agreement w/ OCP	**12 mos**	**1**
Task 3 Secure Funding	**18 mos**	**2**
Task 4 Planning, Environmental Review & Permitting	**27 mos**	**3**
Subtask 4.1 Preliminary Design Report	6 mos	
Subtask 4.2 Refine Project Description/Alternatives	30 days	
Subtask 4.3 CEQA Review	12 mos	4.2
Subtask 4.4 Permitting	18 mos	4.3
Task 5 Design Phase	**16 mos**	**4.4**
Subtask 5.1 Design	12 mos	4.1
Subtask 5.2 Bid/Award Phase	4 mos	5.1
Task 6 Construction	**18 mos**	**5**

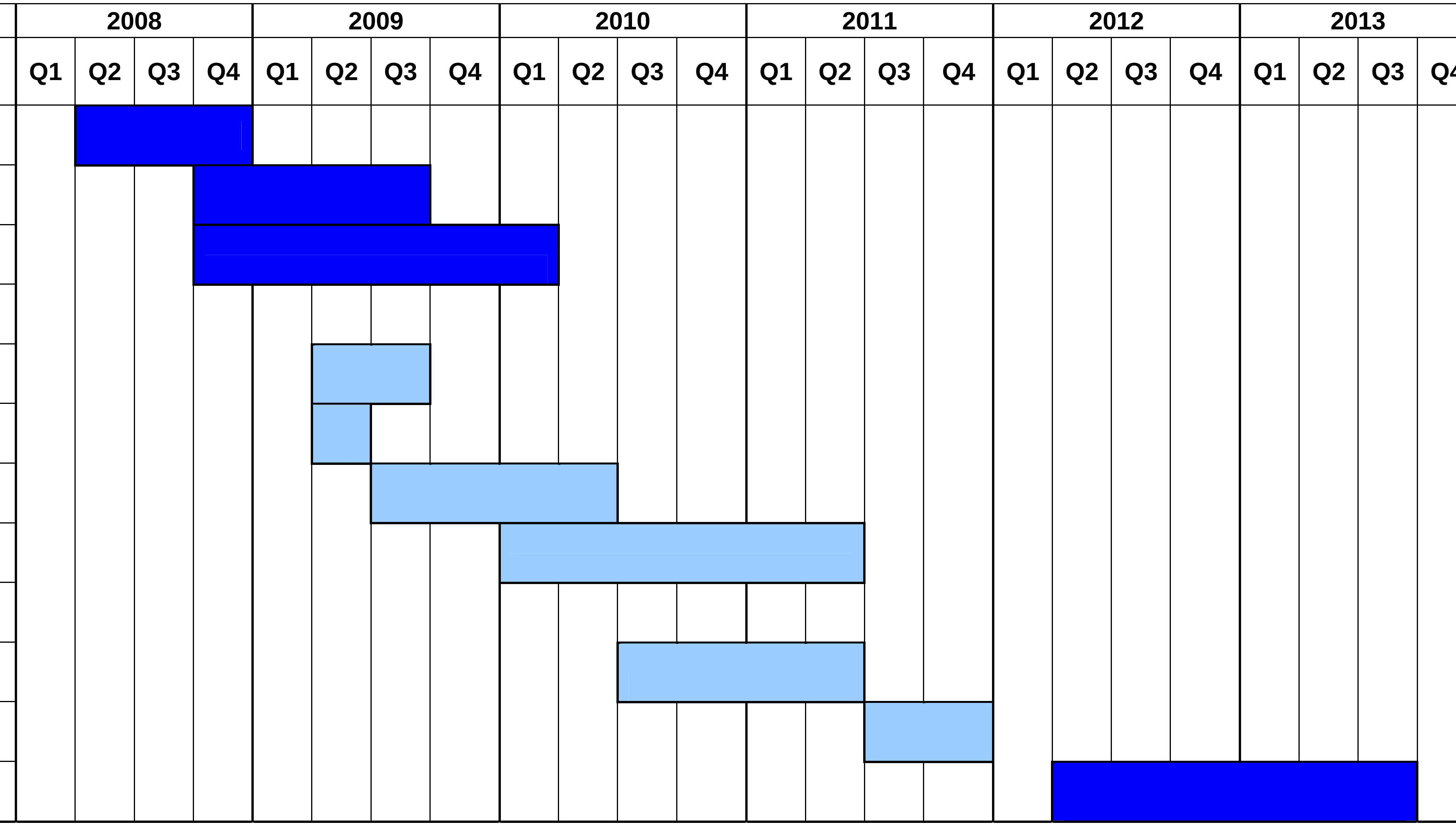

Figure 8.2 SAM Recycled Water Project Schedule *(Phased Plant – 0.6 MGD)*

APPENDIX A

Recycled Water Potential User Database

Recycled Water User Database

Customer	Jurisdiction	Pipeline Length *SAM to Customer*	Pipeline Details *SAM to Customer*	Elevation	Total Acreage	Irrigated Acreage	Desired Level of Treatment	Number of Irrigation Wells *(Capacity)*	Number of On-Site Reservoirs *(Capacity)*
Nurserymen's Exchange 2651 Cabrillo Hwy N Half Moon Bay, CA 94019	HMB & SM County	Main Lot = 1.75 miles Lot #2 = 3.0 miles	Main Lot: *Crossing - Hwy 1* *Crossing - Frenchman's Creek* Lot #2 Combination Pipeline: *Bay City, NSE Lot#2 & Giusti* *Crossing – Hwy 1* *Construction – Along Hwy 1*	Main Lot = 80-ft Lot 2 = 83-ft	120 acres	*No Information Provided*	*No Information Provided*	*No Information Provided*	*No Information Provided*
Ocean Colony Golf Course Two Miramontes Point Rd Half Moon Bay, CA 94019	HMB	SAM to Well Field = 0.15 miles Wells to Golf Course = 2.15 miles	SAM to Well Field Connection: *Crossing - Pilarcitos Creek* Wells to Golf Course: *Existing Irrigation Pipeline*	Well Field = 24-ft Golf Course = 67-ft	500 acres	250 acres	Tertiary *Possible Salinity Issue*	5 Wells *(312.5 GPM)*	5 Reservoirs *(Not Provided)*
Skylawn Memorial Park Cemetery 10600 Skyline Blvd Redwood City, CA 94062	SM County	6.5 miles	*Crossing - Hwy 1* *Crossing - Pilarcitos Creek* *Construction - Along Hwy 92*	1100-ft	280 acres	85 acres	Tertiary	1 Well *(12 GPM)*	1 Reservoir *(12 AF)* 1 Tank *(100,000 gal)*
Bay City Flower Company 2265 Cabrillo Hwy. S Half Moon Bay, CA 94109	SM County	3.15 miles	Combination Pipeline: *Bay City, NSE Lot#2 & Giusti* *Crossing – Hwy 1* *Construction – Along Hwy 1*	85-ft	75 acres	*No Information Provided*	Tertiary *Possible Salinity Issue*	0 Wells *(N/A)*	1 Reservoir *(Not Provided)*
Daylight Farms 850 Cabrillo Hwy N Half Moon Bay, CA 94019	HMB	0.25 miles	*1000-ft adjacent to SAM*	23-ft	*No Information Provided*	15 acres	Tertiary	1 Well *(30 GPM)*	1 Reservoir *(3.5 AF)*
Giusti Farms 1800 Higgins Canyon Rd Half Moon Bay, CA 94019	SM County	2.75 miles	Combination Pipeline: *Bay City, NSE Lot#2 & Giusti* *Crossing – Hwy 1* *Construction – Along Hwy 1*	90-ft	180 acres	80 acres	Tertiary	2 Wells *(50 GPM)*	2 Reservoirs *(54 AF)*

Assumptions:
Combined Irrigated Water Distribution Pipeline used for Bay City, Nurserymen's Lot #2 & Giusti
OCGC Well Pumping Rate assumed continuous (24 hrs/day)
Skylawn, Daylight & Giusti Well Pumping Rate assumed to occur 2hrs/day, 8 months/year

Sources:
CCWD Estimated Irrigated Water Usage based on 2007-2008 Consumption History data provided by CCWD (Bi-monthly Billing Cyle)
All Potential Customers

Recycled Water User Database (cont.)

Customer	Current Irrigation Water Provider *(Price)*	Irrigation Water Provided by CCWD *(Percent)*	Irrigation Season *(months)*		Estimated Irrigation Water Usage: Annual *MG*	Estimated Irrigation Water Usage: Annual *AF*	Estimated Irrigation Water Usage: Average Daily *(MGD)*	Estimated Irrigation Water Usage: Peak Daily *(MGD)*	Estimated Annual Cost for CCWD Irrigation Water *(2008 dollars)*
Nurserymen's Exchange 2651 Cabrillo Hwy N Half Moon Bay, CA 94019	CCWD *($4.86 HCF)* *$2117.02/AF*	100%	12	*CCWD*	73	224	0.20	0.25	$474,269
				CCWD	*29.35*	*90*			
Ocean Colony Golf Course Two Miramontes Point Rd Half Moon Bay, CA 94019	CCWD *($4.86 HCF)* *$2117.02/AF*	5%	12	*Wells*	*162.00*	*497*	0.53	0.62	$190,682
				Total	191.35	587			
				CCWD	*50.3*	*154*			
Skylawn Memorial Park Cemetery 10600 Skyline Blvd Redwood City, CA 94062	CCWD *($5.54 HCF)* *$2412.74/AF*	88%	8	*Well*	*0.35*	*1*	0.21	0.31	$372,443
				Total	50.6	155			
Bay City Flower Company 2265 Cabrillo Hwy. S Half Moon Bay, CA 94109	CCWD *($4.86 HCF)* *$2117.02/AF*	100%	12	*CCWD*	36.7	113	0.10	0.14	$238,434
Daylight Farms 850 Cabrillo Hwy N Half Moon Bay, CA 94019	Self	0%	8	*Well*	0.86	2.65	0.004	0.004	--
Giusti Farms 1800 Higgins Canyon Rd Half Moon Bay, CA 94019	Self	0%	8	*Wells*	1.44	4.42	0.01	0.01	--
			TOTAL		**354.00**	**1086.38**	**1.06**	**1.33**	**$1,275,828**

Assumptions:
Combined Irrigated Water Distribution Pipeline used for Bay City, Nurserymen's Lot #2 & Giusti
OCGC Well Pumping Rate assumed continuous (24 hrs/day)
Skylawn, Daylight & Giusti Well Pumping Rate assumed to occur 2hrs/day, 8 months/year

Sources:
CCWD Estimated Irrigated Water Usage based on 2007-2008 Consumption History data provided by CCWD (Bi-monthly Billing Cycle)
All Potential Customers

APPENDIX B

Recycled Water Grant Tracking Table

Recycled Water Grant Tracking Table

Program	*Purpose*	*Eligible Uses*	*Funding Limits*	*Terms & Dates*	*Actions and Recommendations*
Water Recycling State Revolving Fund (part of CWSRF) State Water Resources Control Board www.waterboards.ca.gov/funding/srf.html	Fund water recycling projects (excludes costs for land, O&M, change orders, decorative items)	• Treatment • Storage • Distribution • Emergency/Backup water supplies	$25 million per agency per year (funding cap raise to $50 million under review)	• Interest rate set at ½ of the most recent State General Obligation bond (typically 2.5-3.5%) • 20-year repayment • Continuous filing	• Submit a pre-application to be placed on the priority list
Water Recycling Construction Program (part of WRFP) State Water Resources Control Board www.waterboards.ca.gov/recycling/construction.html	Fund design and construction of water recycling projects and reclamation of groundwater unusable due to human activities (excludes costs for planning, land, easements, O&M)	• Treatment • Storage • Distribution • Emergency/Backup water supplies	Grant: 25% of eligible construction costs; $5 million max. (very limited availability) Loan: Determined by funding source	Grant: N/A Loan: Interest rate set at ½ of the most recent State General Obligation bond (typically 2.5-3.5%); 20-year repayment Continuous filing	▪ Submit a pre-application to be placed on the priority list
Water Recycling Facilities Planning Grant Program (part of WRFP) State Water Resources Control Board www.waterboards.ca.gov/recycling/construction.html	Fund facilities planning and/or feasibility study of water recycling (excludes studies for pollution control)	Study focus on the use of treated wastewater to offset freshwater supply use	50% of eligible costs; $75,000 max.	Continuous application period until funding is gone	▪ Submit grant application, including plan of study and resolution by local agency to SWRCB for review
Integrated Regional Water Management Program (Proposition 84, Chapter 2) State Department of Water Resources www.grantsloans.water.ca.gov/grants/irwm/integregio.cfm	Fund long-term water supplies	• IRWMP development • Implement projects consistent with an adopted IRWMP	San Francisco Funding Area: $138 million	PSP to be issued April 2008	▪ Apply when becomes available

SRT consultants