Appendix 3-D: Foothill Municipal Water District Recycled Water Project Supporting Documents

(Please see Appendix CD for additional documents)

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La Cañada United Methodist Church

open hearts open minds open doors

November 26, 2012

Mrs. Nina Jazmadarian
General Manager
Foothill Municipal Water District
4536 Hampton Road
La Canada Flintridge, CA 91011

Dear Nina:

We understand that Foothill Municipal Water District (FMWD) would like to build a membrane bioreactor (MBR) plant to recycle wastewater and recharge it using infiltration galleries under the athletic fields at La Canada High School. A promising site for constructing the MBR plant is on church property, near the 210 freeway exit ramp which was used for staging the construction of sewers in La Canada. This letter serves to inform those interested that we are proceeding with negotiations with FMWD.

Additionally, FMWD may conduct infiltration tests at the corner of the Church property near the intersection of Oak Grove Drive and Berkshire Place. It is anticipated that three tests would occur. Please coordinate with Mr. Bruce Bell on the date and time of the test to insure no interference with Church activities.

If you have any questions, please contact me.

Sincerely,

Bob Kemmerer
President, Board of Trustees
La Canada United Methodist Church

MAILING ADDRESS : P.O. Box 667, La Canada Flintridge, CA 91012 • CHURCH LOCATION : 104 Berkshire Place, La Cañada Flintridge, CA 91011
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Foothill Municipal Water District
Recycled Water Project
Update to Incorporate a Watershed Approach

Introduction

This paper will describe the Foothill Municipal Water District (FMWD) Recycled Water Project, its partnerships with Cal Poly Pomona and La Canada High School and elaborate on the multiple benefits that have evolved since conception of the project. Benefits start with the development of a reliable local supply, the associated energy savings as well as lower greenhouse gasses and carbon footprint reduction (water recycling will use one-third the electrical energy as compared to State Water Project (SWP) imported supplies). Through partnerships noted above, benefits have expanded to include a collaborative effort to develop a curriculum to be implemented in conjunction with the project. Education outreach serves as an important component of this watershed approach to include stormwater capture and the abatement of urban runoff. The collaboration includes conservation outreach with drought tolerant landscaping at both sites. This project also seeks to support habitat/ecosystem integrity in nearby Hahamongna Watershed Park, as noted below.

FMWD concluded its Recycled Water Feasibility Planning Study in January 2012. Three geographic areas were reviewed with various alternatives at each location for developing recycled water. One alternative is currently being pursued in the Arroyo Study Area for further development. In this alternative, a 250,000 gallon per day (GPD) membrane bioreactor (MBR) plant will be constructed. The location identified for the MBR site is adjacent to La Canada United Methodist Church off Berkshire Place in the City of La Canada Flintridge. Because of travel time limitations, a recycled water pipeline was to be constructed to the John Muir High School athletic fields located in Pasadena. The treated recycled water would then be recharged with new stormwater capture in the Monk Hill Basin, a sub-basin of the larger Raymond Groundwater Basin in compliance with the Salt Nutrient Plan approved by the Los Angeles Regional Water Quality Control Board, through the use of the infiltration galleries located underneath the athletic fields.

Since completion of that study, draft Title 22 groundwater recharge regulations for recycled water have changed so that the travel time requirements have been reduced and emphasis has been placed on the accumulation of water quality data for determining the impact of recharged recycled water into the basin. Thus, the possibility of using La Canada High School's athletic fields to construct the infiltration galleries is feasible which decreases construction cost and keeps the project within the City of La Canada Flintridge.

The modified recycled water project continues to be consistent with:

- The FMWD funded and State Water Resources Control Board approved recycled water feasibility study,

- The Arroyo Watershed Plan developed by the Army Corps of Engineers,
- Metropolitan Water District's Integrated Resources Plan approved in 2010,
- Pasadena Water and Power's Integrated Resources Plan, and
- Los Angeles Basin's Salt and Nutrient Management Plan.

This change of location for the infiltration galleries coupled with partnerships with Cal Poly Pomona and La Canada High School has allowed the FMWD Recycled Water Project to be integrated into the Arroyo Seco Watershed and a key feature to having a sustainable reliable supply within the Raymond Groundwater Basin. These partnerships, that previously had not existed, align with increased shared benefits. The remainder of this paper will describe the partnership with Cal Poly Pomona and La Canada High School and the benefits that this project incorporates.

Partnership with Cal Poly Pomona

Three of Cal Poly Pomona's departments are involved with the partnership:

- Civil Engineering Department
- Department of Landscape Architecture
- Department of Urban and Regional Planning

The departments received a grant through the Cal Poly Pomona Strategic Interdisciplinary Research Grant Program to assist FMWD in the following aspects of the project:

1. Preparation of a 3D model of the infiltration galleries,
2. Development of a drought tolerant landscaping for both the MBR and school site, and
3. Development of a conservation and educational component to the Project.

As part of the challenge, Cal Poly Pomona must find outside grants to continue this type of grant funding program from the college.

Within the Civil Engineering department the project will be the focus of a one-year capstone course, which is required for graduation. For the Landscape Architecture and Urban and Regional Planning students, this project will provide them with a project based elective which contributes to their degree programs as well. In addition to the 3D model already mentioned, the Capstone project will involve 10 Civil Engineering students for one (1) academic year requiring them to develop preliminary facility designs and analyses needed to demonstrate the feasibility of the project. Because most of the engineering work is below ground, seven (7) Landscape architecture students will design the above ground space adjacent to the MBR plant and above the infiltration gallery. Additionally two (2) Urban and Regional Planning students will assess the impact of water recycling on city planning and examine the ideal policies to encourage these projects moving forward.

The progress made by the three student groups will be assessed a minimum of three times over the course of the project life-time in the form of oral presentations made to industry representatives and to representatives of FMWD. These assessments are tentatively scheduled to take place November 30, 2012, March 15, 2013, and May 31, 2013. The final presentation will be in conjunction with the College

Of Engineering's Capstone symposium. In addition to the on-campus reviews, the project will be reviewed nationally as part of the Parsons-Brinkerhoff Student Design Competition, presented at the Environmental and Water Resources Institute World Congress May 22, 2013.

Benefits of the New Approach

Benefits stemming from the original recycled water project were two-fold. First, the project inherently reduces dependency on imported water, which is unreliable when compared to the availability of recycled water. Please note that the initial development of recycled water is limited to 250,000 gallons per day or 280 acre-feet per year. This number was derived from the low flows in the Los Angeles County Sanitation District owned sewer pipeline, which contains the wastewater stream, during a time when demands for potable water and thus production of wastewater are low due to the economic downturn, increased conservation due to a water shortage and unusually cooler, rainy weather. As these factors change, this low flow number will increase slightly thus guaranteeing the output of 250,000 gallons per day of treated recycled water.

The second benefit with developing recycled water is the reduction of greenhouse gas emissions compared to importing water from Northern California to FMWD's service area. The problem with importing water is that significant amounts of energy are required to pump the water through the California Aqueduct to Southern California. This energy usage is compounded with the significant amount of energy used to pump water to FMWD's service area. During an average year, FMWD can use as much as 6,000 megawatts to pump this water to its service area. Thus, the net energy savings of developing 280 acre-feet of recycled water in FMWD's service area is enough to provide for 85 homes in Southern California for one year.

The partnership with Cal Poly Pomona, adds more benefits. The first benefit is the water conservation feature where the project sites are landscaped with drought tolerant plants. These sites can then be used for tours which showcase Southern California friendly landscaping and improved irrigation technologies. As these sites are used every day by both adults and students, they will naturally be exposed to the landscaping (tours will be documented for recordkeeping purposes). Also, appropriate signage will be placed in the landscaped sites along with information on FMWD's website.

In addition, an education curriculum will be developed. The California State Curricula for fifth grade requires the education of students in earth science, specifically water:

"*Students in grade five learn that cooling in the atmosphere returns water vapor to a liquid or a solid state as rain, hail, sleet, or snow. They are also introduced to factors that control clouds, precipitation, and other weather phenomena. Students also learn that most of Earth's water is present as salt water in the oceans, that oceans cover most of Earth's surface, and that the amount of fresh water on Earth is limited. They study their local watershed to learn about the origins of the water used by their local communities and learn that the availability of fresh water can be extended by recycling and conservation practices. Students in grade five learn that cooling in the atmosphere returns water vapor to a liquid or a solid state as rain, hail, sleet, or snow. They are also introduced to factors that control clouds, precipitation, and other weather phenomena. Students also learn that most of Earth's water is present* *as salt water in the oceans, that oceans cover most of Earth's surface, and that the amount of fresh water on Earth is limited. They study their local watershed to learn about the origins of the water used by their local communities and learn that the availability of fresh water can be extended by recycling and conservation practices."* [1]

As part of the outreach component of this project, a new curriculum will be developed to conform to and enhance this state standard.

When Cal Poly Pomona and FMWD staff met with representatives of La Canada High School they expressed an interest in developing more than the component listed above. A social science component was suggested with a "Careers in Water/Environment" addition. These will be included as part of the newly developed curriculum.

Tours of the MBR plant will be provided and the infiltration galleries explained as well as a model of the infiltration galleries can be provided for further education. Design of the MBR plant will consider public access to allow for tours to promote further education with regards to the treatment process of recycled water. Topics will include imported water and local water sources as well as highlighting conservation inside the home and drought tolerant landscaping. Tours will then go across the street to Hahamongna Park where the watershed, stewardship of the Arroyo Seco and history of the area will be described, with an emphasis on ecosystem and natural habitat features. All tours will be documented and reported each year.

<u>Partnering with La Canada High School</u>

When the site of the infiltration galleries was moved to La Canada High School from John Muir High School, more benefits were derived through the Project. La Canada High School has two athletic fields (baseball and softball fields) with natural turf in addition to a football/soccer field which has artificial turf. Both rainfall and irrigation on the all athletic fields is captured through a subsurface drainage system and diverted to storm drains. Rather than diverting to storm drains, flows will be channeled to the MBR plant, treated and then discharged into the infiltration galleries thus increasing the recharge of the Basin, reducing flows in the storm drains and improving water quality. It is estimated that on average approximately 15 acre-feet per year of stormwater runoff and 23 acre-feet per year of urban runoff will be recharged (see attached tables for calculations). The two athletic fields are jointly utilized by La Canada High School and the City of La Canada Flintridge. This new site location provides additional opportunities to partner with the City of La Canada Flintridge, which allows the project greater communal benefit in education with regards to conservation, imported water, recycled water, storm water, groundwater and overall water supply cycle with FMWD.

<u>A Model for the Future</u>

Most importantly, the Foothill MWD Recycled Water Project offers benefits beyond the local scope of the project, since the infiltration system design, landscape palate, educational curricula and ecosystem

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1 http://www.cde.ca.gov/ci/cr/cf/documents/glc5thgradecurriculum.pdf

field trips will be created in such a way that they can be modeled for use by other water agencies, school districts, and community groups throughout the state. To our knowledge, this is the first stormwater infiltration gallery project of its type in California and offers a new era of innovation for local source water reliability and sustainability.

Summary

As this project has evolved, benefits continue to increase as new partnerships and input from stakeholders contribute more to the project. The excitement of these stakeholders continues to increase as this project evolves to one which the entire community will embrace and will be a showcase of what successful partnerships with multiple stakeholders can achieve.

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WATER RECYCLING FACILITIES PLANNING/PROJECT REPORT

FOOTHILL MUNICIPAL WATER DISTRICT

January 27, 2012

Table of Contents

LIST OF TABLES

LIST OF FIGURES

LIST OF APPENDICES

LIST OF ABBREVIATIONS

AF – acre-foot or acre-feet
AFY - acre-feet per year
Avg - Average
BMPs - Best Management Practices
Ccf – hundred cubic feet
CDPH - California Department of Public Health
CECs- Emerging Constituents/Constituents of Emerging Concern
Cf – cubic feet
cfs - cubic feet per second
CMLC - cement mortar lined and coated
Crescenta Valley – Crescenta Valley Water District
CTC - carbon tetrachloride
CVWD – Crescenta Valley Water District
Dep - deposit
Ea - Each
Eff. - effective
FHCUP - Foothill Conjunctive Use Project
FMWD – Foothill Municipal Water District
FY – fiscal year
Glendale - City of Glendale
gpm - gallons per minute
GWP - City of Glendale Water & Power
IRP - Integrated Water Resources Plan
JPL - Jet Propulsion Laboratory
JWPCP - Joint Water Pollution Control Plant
KID – Kinneloa Irrigation District
Kinneloa – Kinneloa Irrigation District
La Cañada – La Cañada Irrigation District
LACSD - County Sanitation Districts of Los Angeles County
LAGWRP - Los Angeles-Glendale Water Reclamation Plant
LARWQCB - California Regional Water Quality Control Board, Los Angeles Region
Las Flores – Las Flores Water Company
LAWC – Lincoln Avenue Water Company
LCID – La Cañada Irrigation District
LFWC – Las Flores Water Company
Lincoln – Lincoln Avenue Water Company
MAF – million acre-feet
Max - Maximum
MCL - Maximum contaminant level

Mesa Crest – Mesa Crest Water Company
MG - million gallons
μg/l - micrograms per liter
mg/l - milligrams per liter
Min - Minimum
Mo - month
MUN - municipal supply
MWD – Metropolitan Water District of Southern California
NDMA - N-nitrosodimethylamine
NPDES - National Pollutant Discharge Elimination System
NTU - nephelometric turbidity units
O&M - Operations and Maintenance
Pasadena - City of Pasadena
PAYG - pay as you go
PCE - tetrachloroethylene
PPM - Parts per million
PUSD – Pasadena Unified School District
RCL&WA – Rubio Canon Land and Water Association
ROW – Rights-of-Way
RTS - Readiness-to-Serve charge
Rubio – Rubio Cañon Land and Water Association
RWC - Recycled Water Contribution
RWQCB - Regional Water Quality Control Board
SAT – Soil Aquifer Treatment
SJCWRP - San Jose Creek Water Reclamation Plant
SWRCB - State Water Resources Control Board
TAF - thousand acre-feet
TCE - trichloroethylene
TDS - Total dissolved solids
TOC - total organic carbon
ULARA - Upper Los Angeles River Area
UV - Ultraviolet
Valley – Valley Water Company
VOCs - Volatile organic compounds
VPWTP - Verdugo Park Water Treatment Plant
VWC – Valley Water Company
Weymouth – F.E. Weymouth Treatment Plant
WNWRP - Whittier Narrows Water Reclamation Plant
WSDM - Water Surplus and Drought Management
Yr - Year

A. INTRODUCTION

A-1. Introduction

Foothill Municipal Water District (FMWD) was formed in 1952 for the purpose of enabling its various member agencies to obtain supplemental water from the Metropolitan Water District of Southern California (MWD). The current member agencies of FMWD include:

1) Crescenta Valley Water District (Crescenta Valley)
2) Kinneloa Irrigation District (Kinneloa)
3) La Cañada Irrigation District (La Cañada)
4) Las Flores Water Company (Las Flores)
5) Lincoln Avenue Water Company (Lincoln)
6) Mesa Crest Water Company (Mesa Crest)
7) Rubio Cañon Land and Water Association (Rubio)
8) Valley Water Company (Valley)

The FMWD service area and each of its retail agencies are shown on Figure A-1.

Prior to joining MWD, FMWD member agencies relied on local supplies, primarily groundwater from the Verdugo and Raymond basins, a small amount of surface runoff from local mountains to meet the water demands of their customers, and imported water through interconnections with the City of Pasadena. Approximately 60 percent of water demands within FMWD are now met with imported water. Drought and environmental constraints on pumping water from the Sacramento/San Joaquin Delta have led to what is anticipated to be a long term reduction in imported water supplies available to Southern California. In response to the potentially limited future supply of imported water and the relative cost of imported water, FMWD has developed a local water supply program to improve long-term water supply reliability to its service area including development of a recycled water program. FMWD has retained engineering, financial, and other consultants to evaluate the feasibility of developing up to three satellite recycled water facilities; one near the Arroyo area of its service area, one more towards the west side of its service area in the Verdugo Basin and the third towards the eastside of its service in the Eaton Canyon area. The recycled water will be used for irrigation of large landscapes, such as Caltrans freeway medians, parks and sports fields, as well as recharging groundwater basins.

This Water Recycling Facilities Planning/Project Report is being prepared to evaluate the feasibility of using recycled water to offset the use of imported water. This report, partially funded by a grant ($75,000) from the State Water Resources Control Board, addresses the Arroyo, Verdugo Basin, and Eaton Canyon areas of FMWD's recycled water program.

A-2. Study Area

The Study Area for this assessment is separated into three separate hydrologic areas: (1) the Verdugo Basin Study Area, (2) the Arroyo Study Area, and (3) Eaton Canyon Study Area. The Verdugo Basin Study Area includes the service areas of FMWD member agencies within the Verdugo Basin watershed, including Crescenta Valley and portions of La Cañada. The Arroyo Study Area includes the service areas of FMWD member agencies within the Monk Hill subarea of the Raymond Basin, including Las Flores, Lincoln, Mesa Crest, Rubio, Valley, and the remaining portions of La Cañada. The Eaton Canyon Study Area includes the service area of Kinneloa, located within the Pasadena subarea of the Raymond Basin. Figure A-2 shows the locations of the Verdugo Basin watershed and Raymond Basin. Additional discussion of these areas is provided in Section B. Figure A-3 shows the locations of the FMWD member agencies and their relationship to the study areas.

B. STUDY AREA CHARACTERISTICS

B-1. Hydrologic Features.

B-1.1 **Raymond Basin**

The Raymond Basin is located in Los Angeles County about 10 miles north-easterly of downtown Los Angeles. The Raymond Basin is a wedge shaped area in the northwesterly portion of the San Gabriel Valley and is bounded on the north by the San Gabriel Mountains, on the west by the San Rafael Hills and is separated from the Main San Gabriel Basin on the southeast by the Raymond Fault. The Raymond Basin is divided into an eastern unit, which is the Santa Anita subarea, and the Western unit which is the Pasadena subarea and the Monk Hill subarea. The locations of the Monk Hill subarea, which includes the Arroyo Study Area, and the Pasadena subarea, which includes the Eaton Canyon Study Area, are shown in Figure A-2. The surface area of the Raymond Basin is about 40.9 square miles. Average precipitation in the Basin was about 16.1 inches during fiscal year (FY) 2008-09 and about 24.6 inches during FY 2007-08, with a 50-year mean of about 23.8 inches. Figure B-1 shows the historic rainfall for water years 1989-90 through 2008-09 using data from the Descanso Gardens rainfall station (Station No. 1071B), which is representative of the Basin. The principal streams in the Raymond Basin are the Arroyo Seco, Eaton Wash and Santa Anita Wash. The Arroyo Seco flows to the Los Angeles River, while Eaton Wash and Santa Anita Wash flow to the Rio Hondo, a tributary of the San Gabriel River.

B-1.2 **Verdugo Basin**

The Verdugo Basin is a groundwater basin with a surface area of approximately 5,000 acres located in the Crescenta Valley between the San Gabriel Mountains and the Verdugo Mountains. The Verdugo Basin is shown in Figure A-2 and Figure A-4. The Verdugo Basin is relatively small in area and relatively steeply sloping. MWD's "2007 Groundwater Assessment Study" indicates historic annual precipitation between 1949 and 2003 in the Verdugo Basin has ranged from 8.95 inches to 55.16 inches, with a long-term average of 23.37 inches.

B-2. Groundwater Basins (including quantities extracted by all users, natural and artificial recharges, losses by evapotranspiration, inflow and outflow of basins, and safe yield or overdraft).

B-2.1 **Raymond Basin**

The Raymond Basin is a groundwater basin with a surface area of approximately 40 square miles that extends from La Cañada Flintridge and the San Rafael Hills to the west, the San Gabriel Mountain foothills to the north, the Santa Anita Canyon to the east, and the Raymond Fault to the south. The western area of the Raymond Basin, which includes the Arroyo Study Area, is shown in Figure A-2. The groundwater basin is recharged by the Arroyo Seco, a tributary to the Los Angeles River, and by Eaton Wash, Santa Anita Wash, and other streams in the San Gabriel River watershed. Pumping rights to the Raymond Basin are adjudicated and are managed by the Raymond Basin Management Board. Sixteen parties have rights to pump from the Raymond Basin, which is separated into three major subareas: the Monk Hill Subarea, the Pasadena Subarea, and the Santa Anita Subarea.

Decreed rights for each of FMWD’s member agencies and the average, minimum, and maximum allowable extractions and water production over the ten year period from FY 2001-02 to FY 2010-11 are provided in Table B-1 for each member agency in the Monk Hill Subarea. Totals are provided in Table B-2 for Kinneloa’s pumping in the Pasadena Subarea.

Table B-1 Member Agency Extractions in the Monk Hill Subarea (Acre-feet per Year (AFY))

		"Decreed Right 1955"	Net Leases	Allowable Extraction	Amount Extracted	Balance
La Cañada Irrigation District	10 Yr Avg [1]	100.0	(10.7)	108.1	103.7	4.5
	Min	100.0	(75.0)	15.6	15.6	0.0
	Max	100.0	0.0	273.6	273.6	10.0
Las Flores Water Company	10 Yr Avg [1]	249.0	(18.1)	324.6	318.0	6.7
	Min	249.0	(125.0)	204.3	192.7	0.0
	Max	249.0	0.0	419.0	419.0	24.9
Lincoln Ave Water Company	10 Yr Avg [1]	567.0	877.2	1,624.2	1,633.6	(9.4)
	Min	567.0	0.0	793.1	761.5	(273.5)
	Max	567.0	2,000.0	2,678.3	2,951.8	56.7
Rubio Cañon Land & Water Assn.	10 Yr Avg [1]	1,221.0	0.0	1,442.2	1,373.4	68.8
	Min	1,221.0	0.0	1,212.9	1,090.8	(19.8)
	Max	1,221.0	0.0	1,688.1	1,661.7	122.1
Valley Water Company	10 Yr Avg [1]	797.0	30.5	1,292.4	1,244.9	47.6
	Min	797.0	(28.2)	909.8	909.8	0.0
	Max	797.0	48.9	1,558.3	1,478.6	79.7
Monk Hill Subarea	10 Yr Avg [1]	7,489.0	0.0	6,331.8	5,164.5	1,167.3
	Min	7,489.0	0.0	4,740.6	3,863.8	252.6
	Max	7,489.0	0.0	8,651.3	7,270.4	3,132.5

[1] 10-Year period from FY2001-02 to FY 2010-11

Table B-2 Member Agency Extractions in the Pasadena Subarea (AFY)

		"Decreed Right 1955"	Net Leases	Allowable Extraction [2]	Amount Extracted	Balance
Kinneloa Irrigation District	10 Yr Avg [1]	516.0	51.5	648.9	623.0	25.9
	Min	516.0	0.0	431.1	379.5	(43.4)
	Max	516.0	150.0	930.3	930.0	51.6
Pasadena Subarea	10 Yr Avg [1]	17,843.0	0.0	21,510.7	19,055.7	2,455.0
	Min	17,843.0	0.0	19,318.2	15,622.7	666.4
	Max	17,843.0	0.0	23,819.4	21,873.0	4,533.6

[1] 10-Year period from FY2001-02 to FY 2010-11

[2] Includes phased reduction for Decreed Rights to Pasadena Subarea beginning FY 2009-10

Natural recharge of groundwater occurs through infiltration and percolation of rainfall and surface runoff. Based on the 1954 "Report of Referee" for the Raymond Basin, the amount of water entering the Raymond Basin from precipitation, inflow from mountains, and inflow from hills was approximately 67,890 AFY over a 17 year average. The amount of water entering the Monk Hill subarea from precipitation, inflow from mountains, and inflow from hills was approximately 21,990 AFY over a 17 year average. MWD's "2007 Groundwater Assessment Study" indicates the Raymond Basin has a storage capacity of approximately 1.37 million acre-feet (MAF) with a natural safe yield of approximately 30,622 AFY (Monk Hill: 7,487 AFY; Pasadena: 17,843 AFY; Santa Anita: 5,290 AFY). Approximately one percent of groundwater in the Raymond Basin flows into the Main San Gabriel Basin.

In addition to the natural recharge listed above, artificial recharge occurs in the Raymond Basin through the use of imported water. Until May 2007, MWD made water available at discounted rates to agencies for replenishment of the groundwater basins. Because of three years of drought in Northern California, nine years on the Colorado River watershed and a decision by a Federal Judge that restricted pumping in the

Sacramento—San Joaquin Delta due to the diminishing population of the Delta Smelt, MWD ceased offering discounted water rates for replenishment water. In June 2011, discounted deliveries began again until the end of the calendar year. The program is undergoing a refinement process as to future availability. The two methods used by FMWD retail agencies to take deliveries of this water are injection and in-lieu replenishment. This water is kept in storage for times when replenishment deliveries are not available. The water is also used to shift imported water deliveries from peak demand summer periods to lower winter periods thereby reducing the need to construct more infrastructure to meet peaking needs.

Also, in February 2003, FMWD entered into a conjunctive use agreement (FHCUP) with MWD where MWD delivers water to FMWD for storage by the retail agencies in the Raymond Basin when supplies are plentiful and calls on FMWD's retail agencies to produce that water when supplies are short. FMWD pays for the water when the water is called at the existing MWD rates. In exchange for the ability to cycle water in the basin, MWD agreed to finance the construction of facilities to assist in delivering water to the area. The facility construction was completed in 2008.

MWD had delivered some water prior to the completion of construction and asked that the water be extracted from the groundwater basin. As of this writing, most of the water has been extracted from the groundwater basin.

B-2.2 **Verdugo Basin**

The Verdugo Basin was adjudicated in 1979 and two municipal producers, the City of Glendale (Glendale) and Crescenta Valley, possess all production rights. Crescenta Valley has a right to produce 3,294 AFY and Glendale has a right to produce 3,856 AFY in the Verdugo Basin. The Verdugo Basin is one of four Upper Los Angeles River Area (ULARA) basins included in the 1979 groundwater adjudication, commonly called the San Fernando Judgment. Production rights for Crescenta Valley in the Verdugo Basin and the average, minimum, and maximum water production over the ten year period from FY 2001-01 to FY 2010-11 are provided in Table B-3.

Table B-3 Member Agency Extractions in the Verdugo Basin (AFY)

		Production Rights	Amount Extracted
Crescenta Valley [1]	10 Yr Avg	3,294	3,068
	Min	3,294	2,609
	Max	3,294	3,687
Verdugo Basin [1], [2]	10 Yr Avg	7,150.00	5,137
	Min	7,150.00	4,194
	Max	7,150.00	6,013

[1] Crescenta Valley production obtained from Crescenta Valley

[2] City of Glendale production obtained from City of Glendale

During the past two decades, Crescenta Valley has exceeded its Verdugo Basin pumping right. Glendale has never pumped its full water right from the Verdugo Basin. Glendale's pumping has been limited due to lack of well capacity and water quality problems. Pump tests from recently drilled pilot wells indicate low production capacities. Glendale also operates the Glendale Water Treatment Plant, designed to remove volatile organic compounds from groundwater produced by its wells, and the Verdugo Park Water Treatment Plant, designed to remove turbidity and bacteria. Crescenta Valley also treats groundwater at its Glenwood ion exchange facility.

The only opportunity to increase the use of groundwater is to increase the artificial recharge of water to the Verdugo basin. Introducing new sources of water for groundwater recharge, such as recycled water and stormwater, may allow Crescenta Valley to produce additional water over its pumping rights. However, the ability to spread and extract groundwater would need approval of the ULARA Watermaster and meet all required conditions.

MWD's "2007 Groundwater Assessment Study" indicates the Verdugo Basin has a storage capacity of approximately 160,000 AF with a safe yield of approximately 7,150 AFY which is equivalent to the total production rights. Groundwater from the Verdugo Basin outflows into the San Fernando Basin to the west. In addition, an average of 300 to 400 AFY of underflow is estimated to pass from the Verdugo Basin into the Raymond Basin. Although, recharge spreading basins currently do not exist in the Verdugo Basin, modifications to existing debris basins are being considered to retain water and increase recharge rates.

B-3. Water Quality - Groundwater and Surface Water.

B-3.1 **Raymond Basin**

Raymond Basin groundwater quality data is summarized in Kinneloa's 2008 Annual Consumer Confidence Report, La Cañada's 2008 Annual Drinking Water Quality Report, Las Flores' 2008 Annual Consumer Confidence Report, Lincoln's 2008 Consumer Confidence Report, Rubio's 2008 Water Quality Report, and Valley's 2009 Consumer Confidence Report (See Appendix A). Groundwater is generally of good quality and Total Dissolved Solids (TDS) concentrations range from 200 parts per million (ppm) to 400 ppm in Kinneloa, 270 ppm to 550 ppm in La Cañada, approximately 430 ppm in Las Flores, 335 ppm to 340 ppm in Lincoln, 320 ppm to 410 ppm in Rubio, and 660 ppm to 830 ppm in Valley, with a secondary Maximum Contaminant Level (MCL) of 1,000 ppm. Specific water quality issues are discussed below.

Volatile organic compounds (VOCs) have been detected in several areas in the Raymond Basin, particularly in the vicinity of the Arroyo Seco. VOCs such as tetrachloroethylene (PCE) have been detected above the primary MCL of 5 micrograms per liter (μg/l) in Las Flores' Well No. 2 (maximum concentration of 14 μg/l during October 2003); and Valley's Wells No. 2 (maximum concentration of 10 μg/l during May 2001) and No. 3 (maximum concentration of 6 μg/l during June 2002). VOCs such as trichloroethylene (TCE) have been detected above the MCL of 5 μg/l in Lincoln's Well

No. 5 (maximum concentration of 79 μg/l during August 1986). VOCs such as carbon tetrachloride (CTC) have been detected above the MCL of 0.5 μg/l in Lincoln's Wells No. 3 (maximum concentration of 2.2 μg/l during August 2008) and No. 5 (maximum concentration of 2.1 μg/l during December 1986). These contaminants may have originated from the nearby Jet Propulsion Laboratory (JPL) Superfund site, or former dry cleaning sites and unsewered areas in La Cañada Flintridge, based on a review of the Remedial Investigation Addendum Work Plan[1] for the JPL site. Lincoln is able to serve water using Granular Activated Carbon treatment facilities. VOCs have not been detected at Las Flores' well for the last eight months; Las Flores' Granular Activated Carbon treatment facilities have been out of service for two years.

Perchlorate has been detected in several Raymond Basin wells and several monitoring wells in the vicinity of the JPL Superfund site. Perchlorate has been detected above the MCL of 6 μg/l in Las Flores' Well No. 2 (maximum concentration of 8.8 μg/l during November 2007), and Lincoln's Well No. 3 (maximum concentration of 16.7 μg/l during August 1997) and Well No. 5 (maximum concentration of 7 μg/l during September 1997). Lincoln is able to serve water through anion exchange resins and blending with FMWD imported water supplies. Las Flores is able to serve water through blending with FMWD imported water supplies.

High fluoride concentrations have been detected in the foothill areas and high nitrate concentrations have been detected in the Monk Hill Subarea and Pasadena Subarea. Fluoride has been detected above its MCL of 2 milligrams per liter (mg/l) in Kinneloa's Wilcox Well (recent concentration of 2.3 mg/l during August 2009). Nitrate has been detected above the MCL of 45 mg/l in both of La Cañada's wells, Las Flores' Well No. 2, and all four of Valley's wells. Kinneloa is able to serve water through blending with other

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[1] *Final Operable Unit 3, Remedial Investigation (RI) Addendum Work Plan (Pasadena Sampling Plan [PSP]-2004-1), National Aeronautics and Space Administration, Jet Propulsion Laboratory, Pasadena, California*. Prepared for National Aeronautics and Space Administration, Management Office, Jet Propulsion Laboratory, 4800 Oak Grove Drive, Pasadena, California 91109. Prepared by Battelle Environmental Restoration Department, 505 King Avenue, Columbus, Ohio 43201. November 2004.

local water supplies. La Cañada, Las Flores, and Valley are able to serve water through blending with imported water supplies.

FMWD also provides its member agencies within the western unit of the Raymond Basin with imported surface water supplies. FMWD receives imported water supplies from MWD's F.E. Weymouth Treatment Plant (Weymouth). Water quality data from Weymouth is provided in Appendix B and meets all California Department of Public Health (CDPH) water quality standards.

B-3.2 **Verdugo Basin**

Verdugo Basin groundwater quality data is summarized in the City of Glendale Water & Power (GWP) 2008 Water Quality Report and the Crescenta Valley's 2008 Annual Water Quality Report (See Appendix A). Groundwater in Verdugo Basin contains high concentrations of nitrate resulting in treatment of the groundwater. In addition to treatment, purchased surface water from MWD's Weymouth Treatment Plant is blended with groundwater from the Verdugo Basin to further lower concentrations of contaminants. TDS is reported below the MCL of 1,000 mg/l and ranges from approximately 210 to 786 mg/l. Specific water quality concerns within the basin are addressed below.

Nitrate has historically been the only constituent of concern within Verdugo Basin, primarily caused by agricultural activities and leaking septic systems in the La Crescenta area (Glendale, 2006). Nitrate values within the GWP Glorietta Wells 3, 4 and 6 range from approximately 26 to 51 mg/l[2], which are above the MCL of 45 mg/l. Nitrate values for groundwater delivered to the Verdugo Park Water Treatment Plant (VPWTP), which consist of Verdugo Wells A and B, as well as with groundwater from a

[2] Values represent constituent levels prior to blending with purchased SWP water from the MWD Weymouth Plant.

horizontal infiltration system range from 14 to 20 mg/l, which are below the MCL. During water year 2008/09 approximately 530 AF were treated.

Nitrate values for Crescenta Valley's groundwater ranges from 36 to 61 mg/l, which are above the MCL. Crescenta Valley currently pumps from five wells (6, 8, 10, 12 and 14). Groundwater from these wells is treated for nitrate at the Glenwood Ion Exchange Nitrate Removal Facility, which treated approximately 459 AF in Water Year 2008/09. Additionally, groundwater pumped from Wells 1, 5, 9 and 11 is blended with imported water in order to reduce the concentration of nitrate.

VOCs have been recently detected within the basin at levels above the detection limit. The source of VOCs is from leaking underground storage tanks containing gasoline and/or from gas station spills at the surface. In August of 2006 MTBE was detected at Crescenta Valley Well 7 at a concentration of 29 μg/l, exceeding the MCL of 13 μg/l. As a result, Crescenta Valley ceased production from this well. A sampling event in October 2006 showed the concentration of MTBE had risen to 50 μg/l in Well 7. However, in October 2007, the MTBE concentration dropped to 0.5 μg/l. Crescenta Valley reported in its 2008 annual groundwater report that MTBE concentrations in their active Verdugo Basin wells ranged from 0 to 14 μg/l. Additionally, PCE concentrations ranged from nondetect to 6.7 μg/l, with the higher concentrations exceeding the MCL of 5 μg/l. MTBE and PCE concentrations within the GWP Glorietta Wells have not been found to exceed the corresponding MCLs.

FMWD provides Crescenta Valley imported surface water supplies. As previously noted, FMWD receives imported water supplies from Weymouth. Water quality data from MWD's Weymouth Treatment Plant is provided in Appendix B and meets all CDPH water quality standards.

B-4. Land Use and Land Use Trends.

Information on existing land use was obtained from the Los Angeles County General Plan (December 2008) and the City of La Cañada Flintridge's "Land Use Element, City of La Cañada Flintridge", adopted November 15, 1993. Information on projected land use within the Study Areas was obtained from the Los Angeles County General Plan 2035, Public Review Draft, April 2011 and the City of La Cañada Flintridge General Plan (Vision 2030), Public Draft, December 2010. These reports do not provide a break down of land use information that is an exact correlation with the Study Areas. The information from these reports that most closely match the Study Area boundaries has been used below to describe existing use and land use trends.

The Los Angeles County General Plan (December 2008) provides information on the Eaton Canyon Study Area and portions of the Verdugo Basin Study Area and Arroyo Study Area. Relevant portions of the Los Angeles County General Plan (December 2008) are provided in Appendix C.1. The City of La Cañada Flintridge's "Land Use Element" provides information on portions of the Verdugo Basin Study Area and Arroyo Study Area. Relevant portions of the City of La Cañada Flintridge's "Land Use Element" are provided in Appendix C.3.

The Los Angeles County General Plan 2035 provides information on the Eaton Canyon Study Area and portions of the Verdugo Basin Study Area and Arroyo Study Area through the year 2035. Relevant portions of the Los Angeles County General Plan 2035, Public Review Draft are provided in Appendix C.2. The City of La Cañada Flintridge's General Plan (Vision 2030), provides information on portions of the Verdugo Basin Study Area and Arroyo Study Area through the year 2030. Relevant portions of the City of La Cañada Flintridge General Plan (Vision 2030), Public Draft are provided in Appendix C.4.

B-4.1 **Verdugo Basin Study Area**

As discussed previously, the Verdugo Basin Study Area includes Crescenta Valley and portions of La Cañada. Crescenta Valley is located in unincorporated areas of Los Angeles County (La Crescenta-Montrose area) and La Cañada is located in the City of La Cañada Flintridge. Figure B-2 shows the location of these areas.

Land use in the service area of Crescenta Valley (La Crescenta-Montrose area) is approximately 60 percent residential, with rural land comprising approximately 20 percent of the service area, land for public use/parks comprising approximately 10 percent of the service area, land for transportation corridor comprising approximately 5 percent of the service area, and land use for commercial/industrial comprising approximately 5 percent of the service area. Land use maps from the Los Angeles County General Plan are provided in Appendix C. Crescenta Valley's service area is experiencing densification of its housing structures (i.e., conversion of single-family dwellings to multi-unit residences).

Land use in the service area of La Cañada is over 70 percent residential, with open space/public land comprising approximately 25 percent of the service area, and commercial (community planned development) comprising less than 5 percent of the service area. Portions of the Land Use Element are provided in Appendix C. A significant portion of La Cañada's service area has been undergoing conversion from smaller homes to larger homes (mansionization).

B-4.2 **Arroyo Study Area**

As discussed previously, the Arroyo Study Area includes Valley, Mesa Crest, and portions of La Cañada. La Cañada, Valley, and Mesa Crest are located in the City of La Cañada Flintridge. Figure B-2 shows the location of the City of La Cañada Flintridge. The Arroyo Study Area also includes Las Flores, Lincoln, and Rubio, located in unincorporated areas of Los Angeles County (Altadena). Figure B-2 also shows the location of the Altadena area.

Land use in the service area of La Cañada is over 70 percent residential, with open space/public land comprising approximately 25 percent of the service area, and commercial (community planned development) comprising less than 5 percent of the service area. A significant portion of La Cañada's service area has been undergoing conversion from smaller homes to larger homes (mansionization).

Land use in the service area of Valley is over 60 percent residential, with open space/public land comprising approximately 25 percent of the service area, land for the "Downtown Plan" comprising approximately 10 percent of the service area, and commercial (community planned development) comprising less than 5 percent of the service area. Some conversions from smaller homes to larger homes (mansionization) are occurring in Valley's service area.

Land use in the service area of Mesa Crest is approximately 60 percent residential, with open space/public land comprising approximately 40 percent of the service area. The Mesa Crest service area has experienced many home remodeling expansions.

Land use in the service area of Las Flores is approximately 95 percent residential and 5 percent open space/public land. The Las Flores service area is currently experiencing minimal or no conversion to multi-unit dwellings.

Land use in the service area of Lincoln is approximately 50 percent residential, with rural land comprising approximately 25 percent of the service area, and open space/public/other use comprising approximately 25 percent of the service area. There is no significant land available in Lincoln's service area for large scale development and the housing density has remained relatively stable.

Land use in the service area of Rubio is approximately 75 percent residential, with approximately 15 percent rural/other use, and approximately 10 percent open space/public. Rubio's service area has remained stable with essentially no growth.

B-4.3 **Eaton Canyon Study Area**

As discussed previously, the Eaton Canyon Study Area includes Kinneloa, located in portions of the unincorporated areas of Los Angeles County (Altadena) and portions of the City of Pasadena. Figure B-2 shows the location of the City of Pasadena and Altadena area.

Land use in the service area of Kinneloa is approximately 55 percent residential, with approximately 45 percent open space/other use.

B-4.4 **Land Use Trends**

Table B-4 provides a summary of existing land use within the Study Areas. Table B-5 provides a summary of projected land use within the Study Areas over the next 20 to 25 years. Based on the existing and projected land use information, there is a slight projected increase in residential land use within the Study Areas. In addition, there are slight decreases in projected commercial/industrial and public/institutional (e.g. schools, churches, government buildings) land uses. In general, an increase in residential land use results in an increased amount of wastewater available for treatment and reuse as recycled water (See Section D). It is not anticipated the slight decrease in public/institutional land use would reduce the recycled water demands that have been identified for the proposed projects.

Table B-4 Existing Land Use in Study Area (Acres)

	Crescenta Area [1], [2]	Altadena Area [1], [2]	Kinneloa Area [1]	La Cañada Flintridge [2]	Total
Residential	1,454	3,033	517	3,088	8,092
Commercial / Light Industrial	190	62	0	63	315
Public / Institutional	66	70	0	781	917
Open Space / Recreational / Forest	560	515	435	938	2,448
Other				755	755
Total	2,270	3,680	952	5,625	12,527

[1] Based on Los Angeles County GIS Land Use Maps
[2] Land Use Element, City of La Cañada Flintridge, Adopted November 15, 1993

Table B-5 Projected Land Use in Study Area (Acres)

	Crescenta Area [1], [2]	Altadena Area [1], [2]	Kinneloa Area [1]	La Cañada Flintridge [2]	Total
Residential	1,454	3,002	548	3,397	8,401
Commercial / Light Industrial	210	62	0	20	292
Public / Institutional	66	95	0	269	430
Open Space / Recreational / Forest	540	521	404	985	2,450
Other				117	117
Total	2,270	3,680	952	4,788	11,690

[1] Based on Los Angeles County General Plan 2035, Public Review Draft, April 2011
[2] City of La Cañada Flintridge General Plan (Vision 2030), Public Draft, December 2010

B-5. Population Projections of Study Area.

Populations within the Study Areas were projected using 2010 population data provided by retail agencies. These same projections are in FMWD’s 2010 Regional Urban Water Management Plan update. Table B-6 provides combined population projections for the three Study Areas. Populations are estimated to increase from approximately 87,880 (current) to approximately 102,000 (in the year 2035). The population is estimated to grow at a rate of approximately 0.5% per year and assumes an outside boundary for planning purposes. This is lower than other projections by the Department of Finance and Southern California Association of Governments. The FMWD area is fully developed and limited growth is occurring with single family housing converting to multi-family housing. Once the economic turndown recovers, some of this limited slow growth should continue. These projections will also be refined as the 2010 census numbers are analyzed and new modeling is performed.

Table B-6 Combined Population Projections of Study Areas

	Population					
Agency	**2010**	**2015**	**2020**	**2025**	**2030**	**2035**
Crescenta Valley	35,000	36,423	37,903	39,444	41,047	42,715
Kinneloa	1,450	1,475	1,500	1,510	1,520	1,525
La Cañada	9,300	9,450	9,600	9,750	9,900	10,050
Las Flores	4,500	4,614	4,730	4,850	4,972	5,098
Lincoln	16,126	16,533	16,951	17,379	17,818	18,263
Mesa Crest	2,000	2,051	2,102	2,155	2,210	2,266
Rubio	9,600	9,842	10,091	10,346	10,607	10,875
Valley	9,900	10,150	10,406	10,669	10,938	11,211
Total FMWD	87,876	90,538	93,283	96,103	99,012	102,003

B-6. Beneficial Uses (of receiving waters and degree of use, portion of flow that is effluent).

Both local groundwater and local surface water are used for municipal supply (MUN). At this point in time there are no effluent discharges to receiving waters, either surface or groundwater, within the study area. Should the feasibility study recommend the development of groundwater recharge with effluent, it is anticipated that the amount of effluent that would be recharged into any of the basins in any given year would be less than five percent of the annual safe yield of that basin.

C. WATER SUPPLY CHARACTERISTICS AND FACILITIES

C-1. Description of All Wholesale and Retail Entities.

C-1.1 **FMWD**

FMWD is an MWD member agency delivering imported water supplies from the Colorado River into its approximate 22 square mile service area, including the City of La Cañada Flintridge and unincorporated Los Angeles County areas of La Crescenta and Altadena. FMWD's service area includes eight retail Member Agencies that individually receive varying amounts of imported water deliveries annually ranging from 0 to 100 percent of the source of supply. The Arroyo Seco generally separates FMWD's service area into the western portion and the eastern portion. The western portion of FMWD's service area includes Crescenta Valley, La Cañada, Valley, and Mesa Crest which are located adjacent to each other. The eastern portion of FMWD's service area includes Lincoln, Las Flores, Rubio, and Kinneloa. Imported water supplies from FMWD are not currently served to Kinneloa Irrigation District.

Retail water agencies within the Verdugo Basin Study Area include Crescenta Valley and portions of La Cañada. Retail water agencies within the Arroyo Study Area include Las Flores, Lincoln, Mesa Crest, Rubio, Valley, and the remaining portions of La Cañada. The retail water agency within the Eaton Canyon Study Area is Kinneloa. The service areas for these agencies were previously depicted in Figure A-3.

C-1.2 **Crescenta Valley Water District**

Crescenta Valley produces water from groundwater wells, receives imported water supplies from FMWD, and obtains a minor amount of local tunnel water. Crescenta Valley serves portions of the cities of Glendale and La Cañada Flintridge and unincorporated areas of La Crescenta and Montrose. Crescenta Valley's service area is adjacent to the City of Glendale on the south and west, and La Cañada on the east, with its northern boundary adjoining Angeles National Forest. Crescenta Valley, which is the largest retail member agency of FMWD, has approximately 8,100 service connections.

C-1.3 **Kinneloa Irrigation District**

Kinneloa serves unincorporated portions of Los Angeles County (Altadena) and portions of the City of Pasadena. Kinneloa obtains its water supply from groundwater pumping and tunnel production supplying surface runoff. Kinneloa's service area is located on the eastern edge of FMWD's service area, extending onto the slopes of the San Gabriel Mountains and surrounded by the City of Pasadena on three sides. Kinneloa has approximately 600 service connections.

C-1.4 **La Cañada Irrigation District**

La Cañada serves portions of the City of La Cañada Flintridge and unincorporated areas of Los Angeles County (Montrose). La Cañada obtains its water supply primarily from imported water supplies from FMWD, with the remaining sources of supply from surface water and groundwater. The service area of La Cañada is primarily located north of Interstate Freeway 210, extending to Ocean View Boulevard to the west, approximately Gould Avenue to the east, and south of the Angeles National Forest to the north. La Cañada has approximately 2,900 service connections.

C-1.5 **Las Flores Water Company**

Las Flores is a non-profit mutual water company that serves unincorporated portions of Los Angeles County (Altadena). Las Flores obtains its water supply from groundwater and imported water supplies from FMWD. Las Flores is located between Lincoln and Rubio. Las Flores has approximately 1,500 service connections.

C-1.6 **Lincoln Avenue Water Company**

Lincoln is a non-profit mutual water company that serves customers in unincorporated portions of Los Angeles County (Altadena). Lincoln obtains its water supply from groundwater, local surface water, and imported water supplies from FMWD. Lincoln has approximately 4,400 service connections.

C-1.7 **Mesa Crest Water Company**

Mesa Crest is an investor-owned water utility that serves customers in the northeastern portion of FMWD's western portion service area in the area of the La Cañada Flintridge golf course. Mesa Crest obtains its water supply solely from imported water supplies from FMWD. Mesa Crest has approximately 700 service connections.

C-1.8 **Rubio Cañon Land and Water Association**

Rubio is a non-profit mutual water company that serves unincorporated portions of Los Angeles County north of Pasadena (Altadena). Rubio obtains its water supply from groundwater from the Raymond Basin and imported water supplies from FMWD. Rubio has approximately 3,100 service connections.

C-1.9 **Valley Water Company**

Valley is a non-profit mutual water company that serves the City of La Cañada Flintridge. Valley obtains its water supply primarily from imported water supplies from FMWD, with the remaining supply sources from groundwater. Valley's service area is approximately 2,400 acres in the City of La Cañada Flintridge. Valley has approximately 3,600 service connections.

C-2. Sources of Water for Study Area and Major Facilities (including costs, subsidies, and customer prices).

The water supply sources within the Verdugo Basin Study Area and the Arroyo Study Area include imported surface water from FMWD and groundwater.

FMWD currently receives water delivered by MWD through MWD's 116-inch-diameter Upper Feeder at turnout FM-1 located in the vicinity of Seco Street and Rosemont

Avenue in Pasadena near the Rose Bowl. The turnout is nominally designed to deliver 40 cubic feet per second (cfs). A schematic showing FMWD's distribution system, including transmission lines, service connections, reservoirs, and pumps stations, is provided in Figure C-1. A further discussion of these facilities is provided in Section C-3.

FMWD's member agencies within the Verdugo Basin Study Area, Arroyo Study Area, and Eaton Canyon Study Area include Crescenta Valley, Kinneloa, La Cañada, Las Flores, Lincoln, Mesa Crest, Rubio, and Valley. Each of these agencies has its own distribution pipelines, connection(s) with FMWD (except Kinneloa), storage reservoirs, and emergency interconnection with other agencies (except Las Flores and Mesa Crest). Each member agency has groundwater production wells except Mesa Crest. Kinneloa, Crescenta Valley, and La Cañada also have tunnel water supply. La Cañada's tunnel supply was damaged by mudslides and repaired. Lincoln has local surface water supply collected from Millard Canyon. The pipes for this supply were damaged by the Station Fire. Lincoln is in the process of repairing these pipes. Mesa Crest's service area receives recycled water from County Sanitation Districts of Los Angeles County's (LACSD) La Cañada Water Reclamation Plant for golf course irrigation. A further discussion of these facilities is provided in Section C-3.

FMWD's water rate for Tier 1 water (effective January 1, 2011) is $744 per AF. A series of charges are also invoiced to the agencies. Two charges are pass-through of MWD charges to FMWD: the readiness-to-serve charge and capacity charge. The Readiness-to-Serve (RTS) charge recovers a portion of MWD's principal and interest payments on non-tax supported debt service that has been or will be issued to fund capital improvements necessary to meet standby service needs and emergency storage. The Capacity Charge recovers MWD costs incurred to provide distribution capacity used to meet peak day demands. FMWD also has an administrative and operating charge and capital and rehabilitation charge. The administrative and operating charge recovers those costs associated with the administration, operation and maintenance of the District and its distribution system. The capital and rehabilitation charge recovers those costs associated with the capital improvements necessary to continue meeting demand through both the existing potable system and new infrastructure both potable and nonpotable. Energy costs to pump water from FMWD's connection with MWD near the Rose Bowl are passed through based on water deliveries and energy usage to each agency. A copy of the portion of FMWD's Administrative Code detailing these charges is provided in Appendix D.

It is anticipated FMWD will generally pass-through MWD rate increases to its member agencies for imported water. MWD's rates for Tier 1 water are projected to increase annually to approximately $2,174 per AF by the year 2030 (see Table C-1). It is anticipated that the administrative and operating charge will typically increase based on the rate of inflation and the capital and rehabilitation charge will increase based on the projects identified to be completed if FMWD continues with PAYG (pay as you go) as the preferred payment option. It is anticipated that should FMWD obtain financing for capital projects, the capital and rehabilitation charge will be steadier rather than fluctuate as currently anticipated.

Table C-1 **Projected MWD Water Rate for Treated Full Service Tier 1**

Year	Projected MWD Rate for Treated Full Service Tier 1 ($/AF)
2010	$701
2015	$920
2020	$1,214
2025	$1,625
2030	$2,174

Source: MWD 2010 UWMP

Typical retail water rates in the Verdugo Basin Study Area, including Crescenta Valley and La Cañada, range from about $1,170 per AF to about $2,300 per AF depending on the amount of water used. Typical retail water rates in the Arroyo Study Area, including

Las Flores, Lincoln, Mesa Crest, Rubio, Valley, and La Cañada, range from about $910 per AF to about $2,300 per AF depending on the amount of water used. Typical retail water rates in the Eaton Canyon Study Area, including Kinneloa, range from about $1,400 per AF to about $1,780 per AF depending on the amount of water used. It is anticipated FMWD member agencies will generally increase the rate it charges its customers at a similar rate increase as FMWD. A table of agency rates is provided in Appendix E.

C-3. Capacities of Present Facilities and Existing Flows (including estimated years when capacities to be reached for major components such as water treatment plants, major transmission and storage facilities).

C-3.1 Verdugo Basin Study Area

The Verdugo Basin Study Area primarily includes the service areas of Crescenta Valley and portions of La Cañada.

Crescenta Valley obtains approximately 40 percent of its water supplies from imported water delivered from FMWD and approximately half of its water supplies from twelve groundwater wells located in the Verdugo Basin. Crescenta Valley provides service to its customers through eleven pressure zones and sixteen pumping stations. The elevation of the service area varies from approximately 1,200 feet to almost 3,000 feet above sea level. Crescenta Valley's distribution system contains seventeen storage reservoirs totaling 17.5 million gallons (MG). Crescenta Valley's imported water purchases during the last two decades have ranged from approximately 1,000 AFY to approximately 3,000 AFY. Crescenta Valley has connection capacity with FMWD of 8.85 cfs. Crescenta Valley also produces local tunnel water which yields, on the average, about 50 to 60 AFY. Crescenta Valley anticipates growth in its water demand will be met by additional purchases from FMWD. As discussed in Section B-3, Crescenta Valley operates the Glenwood Ion Exchange Nitrate Removal Facility which removes nitrate from groundwater from the Verdugo Basin. Water served by Crescenta Valley meets CDPH drinking water standards.

Crescenta Valley has several emergency interconnections with adjacent water suppliers. There is an interconnection with the City of Glendale for emergency use, with a capacity of five cfs. Crescenta Valley has an agreement and is planning to construct a new interconnection for emergency service purposes with the City of Los Angeles Department of Water and Power, with a planned delivery of about 2.2 cfs. There are two emergency interconnections with adjacent La Cañada, each rated at about one cfs, and each one-way in different directions.

La Cañada obtains about 90 percent of its water supply from imported water supplies delivered by FMWD, with the remaining supply sources from surface water from Pickens Canyon (approximately five percent) and groundwater from the Raymond Basin (approximately five percent). La Cañada produces from two infiltration tunnels in Pickens Canyon with a maximum combined capacity of about 300 gallons per minute (gpm). La Cañada produces groundwater from two wells located in the Raymond Basin (Monk Hill subarea) with capacities of 500 gpm and 750 gpm. La Cañada has seven storage tanks with a total capacity of just over six (6) MG. La Cañada receives imported water from connections of approximately 3.3 cfs and 3.6 cfs with FMWD. As indicated above, La Cañada has two interconnections with Crescenta Valley, each one-way and in different directions, each about one cfs. La Cañada has an emergency interconnection with Valley. La Cañada is considering a two way interconnection with Mesa Crest (6- or 8-inch).

C-3.2 **Arroyo Study Area**

The Arroyo Study Area includes the service areas of Las Flores, Lincoln, Mesa Crest, Rubio, and Valley, and portions of the service area of La Cañada. (A discussion of La Cañada's sources of water supplies is included in the discussion of the Verdugo Basin Study Area above).

Las Flores obtains about 30 percent of its water supply from groundwater from the Raymond Basin and the remainder from imported water delivered by FMWD. Las Flores operates a 650 gpm well (Mountain View Well No. 2) for groundwater production. Las Flores' service area is divided into three pressure zones that are each served by pumping stations to maintain adequate pressure changes. The two highest pressure zones also have five reservoirs that provide a total storage capacity of 4.55 MG. Las Flores has a two-way interconnection with Rubio, and a proposed two-way interconnection with Lincoln.

Lincoln obtains its water supply from groundwater from the Monk Hill subarea of the Raymond Basin, local surface water, and imported water supplies from FMWD. Lincoln's service area includes eight pressure zones with four pumping stations containing 16 pumps with a total capacity of about 15,500 gpm. Lincoln's system includes 13 storage tanks with a total capacity of 11.44 MG. Lincoln operates Well No. 3 and Well No. 5, with capacities of 900 gpm and 1,100 gpm, respectively. Well No. 5 has been modified to allow Raymond Basin injection for long term storage for later extraction during periods of emergency and drought. Lincoln also obtains local surface water collected from Millard Canyon which is treated in a filtration plant that can produce up to about 700 gpm. Lincoln has one proposed interconnection with Rubio and one proposed interconnection with Las Flores, which can each inject or produce water. Lincoln also has three interconnections with the City of Pasadena, with one that is two-way (about 0.7 cfs), one with unknown flow direction (about 2.2 cfs), and the other one with unknown flow rate and direction.

Mesa Crest's sole source of water supply is imported water delivered by FMWD. Mesa Crest can receive 1.7 cfs (763 gpm) from FMWD. There are four pressure zones in the system with five reservoirs totaling 3.5 MG. Mesa Crest currently does not have any interconnections with adjacent water suppliers. As discussed above, La Cañada is considering a two-way interconnection with Mesa Crest (6- or 8-inch).

Rubio obtains its water supply from groundwater from the Raymond Basin imported water supplies from FMWD and surface water from Rubio Canyon. The Rubio system has four storage reservoirs totaling approximately 7.8 MG. Rubio has one 8-inch interconnection (about 1.6 cfs) with the City of Pasadena (two-way), one proposed additional interconnection with Pasadena, one two-way interconnection with Las Flores, and one proposed two-way interconnection with Lincoln.

Valley obtains approximately 70 percent of its water supply from imported water supplies delivered by FMWD, with the remaining approximately 30 percent of its supply sources from groundwater production from the Raymond Basin. Valley operates four production wells, with a capacity of approximately 1,000 gpm each. Two of the four are operated primarily for groundwater production, while the other two wells are operated primarily for injection of imported water into the groundwater basin. (These later two wells can also be used for production). Valley serves its customers through five pressure zones and five reservoir sites totaling approximately 5.4 MG of storage. Valley has two emergency interconnections with the City of Pasadena (capacities of about 1.8 cfs each), with one two-way interconnection and another interconnection providing water only to the City of Pasadena. As indicated above, Valley has an emergency interconnection with La Cañada.

C-3.3 **Eaton Canyon Study Area**

The Eaton Canyon Study Area includes the service area of Kinneloa. Kinneloa obtains water supplies from groundwater pumping and tunnel production supplying surface runoff. Kinneloa operates two wells with capacities of approximately 800 gpm and 550 gpm. Kinneloa has ten reservoirs totaling approximately 4 MG of storage. Kinneloa has four interconnections with the City of Pasadena, consisting of a one-way connection from the City of Pasadena (about 1.9 cfs), two one-way connections to the City of Pasadena (about 0.8 cfs and 1.1 cfs), and one two-way connection (about 1.1 cfs).

C-3.4 **FMWD Facilities**

As indicated above, FMWD's service area is generally separated by the Arroyo Seco into a western portion and an eastern portion. The FMWD system provides imported water supplies to three service areas: Eastern (also named Altadena), Central (also named La Cañada), and Berkshire (also known as La Crescenta). Each service area includes two reservoirs, separately ranging in size from 1 to 1.4 MG. Imported water is supplied from MWD's 116-inch diameter Upper Feeder through a nominal 40 cfs connection (FM-1) located near the Rose Bowl (Seco Street and Rosemont Avenue). Imported water travels through approximately 6,500 feet of 39-inch cement mortar lined and coated (CMLC) steel pipeline to the main pumping plant P-1. From pumping plant P-1, the water is pumped to both the western portion and eastern portion of FMWD's service area. Figure C-1 shows a schematic of the FMWD distribution system, along with the transmission lines, reservoirs and member agency turnouts.

Pumping plant P-1 includes five (5) pumps delivering water to the western portion of FMWD's service area, where the Verdugo Basin Study Area and part of the Arroyo Study Area are located. These pumps include three 3,150 gpm pumps, one 3,545 gpm pump and one 1,655 gpm pump. Pumping plant P-1 also includes five (5) pumps delivering water to the eastern portion of FMWD's service area, where part of the Arroyo Study Area is located. The capacities of these pumps vary from 1,080 gpm to 2,025 gpm. The pumps at pumping plant P-1 have the ability to normally deliver 22.5 cfs to the western portion of FMWD's service area. The pumps at pumping plant P-1 also have the ability to normally deliver 12.5 cfs to the eastern portion of FMWD's service.

Pumping plant P-1 transmits water to the La Cañada Reservoirs utilizing approximately 1,000 feet of 36-inch, 8,000 feet of 30-inch and 3,500 feet of 24-inch diameter CMLC steel pipelines. The capacities of the two La Cañada Reservoirs are 1.2 MG and 1.0 MG. Pumping plant P-1 can also pump water through an 18,600 foot 24-inch extension to the La Crescenta reservoirs. Water is boosted through the Berkshire pumping plant along the route. There are four pumps (B-1 through B-4) in the Berkshire pumping plant, with two at 1,795 gpm, one at 1,935 gpm and the remaining unit a variable frequency drive. The motors associated with each pump are 300 horsepower each. The capacities of the two La Crescenta Reservoirs are each 1 MG.

Pumping plant P-1 transmits water to the eastern portion of FMWD's service area through an 11,800 foot 24-inch diameter CMLC steel pipeline with turnout service to Lincoln, Rubio, and Las Flores along the route. The capacities of the two Altadena Reservoirs are 1.4 MG and 1.2 MG.

FMWD has two interconnections with the City of Pasadena, with one 10 cfs connection delivering water to the FMWD's La Cañada Reservoirs from the City of Pasadena and the other interconnection at a Caltrans service yard on the eastern portion of FMWD's service area delivering water up to 3.5 cfs to the City of Pasadena. Recent tests have shown that Pasadena under certain conditions may be able to deliver water to FMWD at the Caltrans connection up to about four (4) cfs.

Based on FMWD not having four hours of potable water storage during a high demand peak period, the CDPH had recommended five years ago that another potable tank be constructed in the service area. Based on a current review of the system and plans to develop more recycled water in the service area, CDPH has indicated a willingness to retract that recommendation once the recycled water system is on-line.

C-4. Groundwater Management and Recharge, Overdraft Problems.

C-4.1 Raymond Basin

The Raymond Basin Judgment adjudicated groundwater rights based on a long-term average yield of the Raymond Basin. Due to recent multiple dry year conditions, the Raymond Basin Management Board has phased in a required 30 percent reduction for all Decreed Rights to the Pasadena Subarea over five years, beginning fiscal year 2009-10. The Judgment allows a party to exceed its Decreed Right by no more than 10 percent, which will be deducted from the following year's total allowable extraction. Conversely, a party is not allowed to carryover more than 10 percent of its Decreed Right to a subsequent year.

In addition to its Decreed Rights, the parties to the Raymond Basin Judgment have long-term storage accounts to store water within the Monk Hill and Pasadena Subareas. The storage accounts, created by the Raymond Basin Management Board, minimize the annual loss of Decreed rights due to non-pumping. As of June 30, 2009, Raymond Basin parties' allowable storage amount in the Pasadena Subarea account was capped at 27,016.5 AF.

Six of eight FMWD member agencies have water rights in the Raymond Basin, including Valley, Rubio, Lincoln, Las Flores, La Cañada, and Kinneloa. Valley, Rubio, Lincoln, Las Flores, and La Cañada produce groundwater from the Monk Hill Subarea. The 30% reduction in pumping does not impact these agencies since they are in the Monk Hill Subarea. Kinneloa produces groundwater from the Pasadena Subarea. It is able to offset the 30% reduction in pumping rights through use of surface water and when needed leasing unused production rights.

Decreed rights for each of FMWD's member agencies were provided in Table B-1. The average, minimum, and maximum allowable extractions and water production over the ten year period from FY 2001-02 to FY 2010-11 were also provided in Table B-1 for each member agency in the Monk Hill Subarea and the totals for all Monk Hill producers; and in Table B-2 for Kinneloa's pumping in the Pasadena Subarea and the totals for all the Pasadena Subarea producers.

In addition to these rights, agencies are able to artificially recharge the groundwater basin through the FHCUP and MWD's replenishment program when available. These programs are more fully described in Section B-2 above.

Member agencies are currently producing essentially the total amount of groundwater allowed under their existing water rights. The only opportunity to increase the use of groundwater is to increase recharge of water to the basin. Introducing new sources of groundwater recharge such as recycled water may allow member agencies to produce additional water over their Decreed Rights.

C-4.2 **Verdugo Basin**

The Verdugo Basin is managed by the Upper Los Angeles River Area (ULARA) Watermaster. In 1979, a court order established the City of Glendale (whose water rights are maintained by GWP) and Crescenta Valley the only two water-rights holders in the Verdugo Basin. Currently, there are a combined 17 production wells with an estimated total production volume of 7,400 AFY (Watermaster, 2010). GWP and Crescenta Valley currently have extraction rights of 3,856 AFY and 3,294 AFY respectively. However, due to water quality issues, a lack of production capabilities due to aging wells and a decline in the water table, extraction rights by GWP are not completely utilized. In 2005, GWP conducted a basin wide assessment to locate potential locations for future production wells in order to access their full extraction rights. In 2007 GWP began rehabilitation on the Foothill Well in hopes of expanding production capabilities within the Verdugo Basin. Additionally, in February 2009, GWP drilled a test borehole which is expected to produce 600 to 700 gpm, the completed well (Rockhaven Well) is anticipated to be in operation by early 2011 (See Figure A-4) (Watermaster 2010).

Table C-2 summarizes groundwater production within the Verdugo Basin over the last five fiscal years (to be consistent with available five-year data for historical water demands).

Table C-2 Verdugo Basin Extraction Volumes from Fiscal Years 2006-07 to 2010-11 (AFY)

	City of Glendale	Crescenta Valley	
2006-07	2,495.4	3,144	[1], [2]
2007-08	2,740.4	3,223	[1], [2]
2008-09	2,208.3	3,084	[1], [2]
2009-10	2,087.2	2,703	[1], [2]
2010-11	1,698.3	2,788	[1], [2]
Average Production	2,246	2,988	
Water Rights	3,856	3,294	

[1] City of Glendale production obtained from City of Glendale
[2] Crescenta Valley production obtained from Crescenta Valley

GWP currently operates five production wells within the Verdugo Basin, in addition to a horizontal infiltration system. As previously mentioned GWP is not completely utilizing its full groundwater extraction rights. Crescenta Valley currently operates twelve production wells within the Verdugo Basin[3]. During Water Year 2006/07, Crescenta Valley over-extracted by 12 AF without the permission of the Watermaster. Additionally in water years 2004/05 and 2005/06, Crescenta Valley extracted more than their assigned extraction right. In the past, GWP has allowed Crescenta Valley to over extract without compensation. However, Crescenta Valley and GWP are currently in the process of determining an agreement regarding compensation on overextraction. In water year 2008/09, Crescenta Valley under pumped their respective extraction rights by 337.5 AF.

Based on the ULARA Judgment the City of Los Angeles has the right to extract import return flows from Verdugo Basin but has never exercised this right.

[3] Well 2 is only used for emergency supply and is not operated on a regular basis.

In November 2006, the Verdugo Basin MTBE Task Force was established to investigate and expedite the cleanup of MTBE in order to return Crescenta Valley's wells to full operational capacity.

Currently, there are no artificial groundwater recharge (i.e., surface spreading or injection) activities within Verdugo Basin. Crescenta Valley, through a California Department of Water Resources Assembly Bill (AB) 303 Local Groundwater Assistance Grant, has conducted a feasibility study to investigate the potential for recharging and storing groundwater in the Verdugo Basin and the feasibility of implementing a conjunctive use program.[4] The groundwater storage capacity of the Basin has been estimated by the Watermaster to be approximately 160,000 AF. Since Water Year 2007/08, the change in storage has increased approximately 1,186 AF.

C-5. Water Use Trends and Future Demands, Prices, and Costs

C-5.1 Historical Demands

The average, minimum, and maximum total water demands, in acre-feet per year (AFY) over the past five years (fiscal years 2006-07 to 2010-11) are provided in Table C-3 for each member agency. The average, minimum, and maximum water demands from FMWD for each member agency are also provided.

[4] "Final Report, Verdugo Basin Groundwater Recharge, Storage, and Conjunctive Use Feasibility Study," prepared for Crescenta Valley Water District, prepared by Geomatrix, May 2005.

Table C-3 Historical Water Demands (AFY; Fiscal Years 2006-07 to 2010-11)

		Local Water Supplies	FMWD Deliveries	Agency Retail Demands
Foothill Municipal Water District	5 Yr Average	8,475.5	10,761.0	19,236.5
	Min	6,074.5	8,269.7	14,344.3
	Max	10,574.6	13,043.4	23,618.0
Crescenta Valley Water District	5 Yr Average	2,894.9	1,939.2	4,834.0
	Min	2,220.8	1,430.9	3,651.7
	Max	3,240.0	2,516.7	5,658.8
Kinneloa Irrigation District	5 Yr Average	660.3	0.0	660.3
	Min	549.5	0.0	549.5
	Max	930.3	0.0	930.3
La Cañada Irrigation District	5 Yr Average	101.4	2,596.5	2,697.9
	Min	36.1	1,950.3	1,986.5
	Max	138.1	3,152.4	3,263.8
Las Flores Water Company	5 Yr Average	323.6	573.4	897.1
	Min	264.2	408.8	673.0
	Max	358.2	741.2	1,099.4
Lincoln Avenue Water Company	5 Yr Average	2,025.2	1,323.9	3,349.1
	Min	895.1	878.4	2,227.8
	Max	3,016.5	1,737.3	4,450.9
Mesa Crest Water Company	5 Yr Average	0.0	672.5	672.5
	Min	0.0	516.7	516.7
	Max	0.0	774.3	774.3
Rubio Cañon Land & Water Assn.	5 Yr Average	1,479.6	773.8	2,253.3
	Min	1,095.7	346.2	1,746.1
	Max	1,709.0	1,045.6	2,701.5
Valley Water Company	5 Yr Average	990.4	2,881.7	3,872.2
	Min	767.2	1,925.3	2,692.5
	Max	1,307.2	3,987.9	5,295.1

Notes:

1. Data from FMWD and Raymond Basin Management Board (Kinneloa Irrigation District)

Table C-4 provides the average local water supply for each member agency as an annual quantity and as a percentage of total local water supplies. The table also shows annual average FMWD deliveries to each member agency as an annual quantity and as a percentage of total FWD deliveries.

Table C-4 Member Agency Water Supply Percentages

Water Agency	Local Water Supplies Quantity (AF)	Local Water Supplies Percent of Total Local Water (%)	FMWD Purchases Quantity (AF)	FMWD Purchases Percent of Total FMWD Deliveries (%)
Crescenta Valley Water District	2,894.9	34.2%	1,939.2	18.0%
Kinneloa Irrigation District	660.3	7.8%	0.0	0.0%
La Cañada Irrigation District	101.4	1.2%	2,596.5	24.1%
Las Flores Water Company	323.6	3.8%	573.4	5.3%
Lincoln Avenue Water Company	2,025.2	23.9%	1,323.9	12.3%
Mesa Crest Water Company	0.0	0.0%	672.5	6.2%
Rubio Land & Water Association	1,479.6	17.5%	773.8	7.2%
Valley Water Company	990.4	11.7%	2,881.7	26.8%
Total	8,475.5	100.0%	10,761.0	100.0%

Note: Quantities based on five year average (fiscal years 2006-07 to 2010-11)

C-5.2 **Projected Water Demands**

The projected future average annual water demands for each member agency are provided in Table C-5.

Table C-5 **Member Agency Water Demand Projections (AFY; Calendar Year)**

	2010		2015		2020		2025		2030		2035	
	Demand from FMWD	Total System Demand	Demand from FMWD	Total System Demand	Demand from FMWD	Total System Demand	Demand from FMWD	Total System Demand	Demand from FMWD	Total System Demand	Demand from FMWD	Total System Demand
Crescenta Valley Water District	1542	4330	1,956	5,150	2,281	5,200	2,396	5,250	2,516	5,300	2,646	5,325
Kinneloa Irrigation District	0	587	-	700	-	700	-	700	-	700	-	700
La Cañada Irrigation District	2166	2278	2,863	2,921	2,935	2,995	3,010	3,071	3,085	3,148	3,163	3,228
Las Flores Water Company	478	764	706	900	724	800	742	850	761	900	780	900
Lincoln Avenue Water Company	1333	2228	1,934	2,609	2,000	2,675	2,068	2,743	2,137	2,812	2,208	2,883
Mesa Crest Water Company	593	593	732	732	750	750	769	769	788	788	808	808
Rubio Cañon Land & Water Association	346	1925	772	2,271	569	2,069	621	2,121	675	2,174	730	2,229
Valley Water Company	2350	3330	2,331	3,600	2,400	3,200	2,400	3,200	2,400	3,200	2,400	3,200
Total	8,808	16,033	11,294	18,883	11,659	18,389	12,006	18,704	12,362	19,022	12,735	19,273

Notes:

1) 2010 demands based on FY2010-11 data. 2015 to 2035 “Demand from FMWD” based on FMWD’s 2010 Urban Water Management Plan, prepared June 2011. Crescenta Valley’s 2015 to 2035 “Total System Demand” based on Crescenta Valley’s “2010 Urban Water Management Plan, prepared June 2011. La Cañada Irrigation District’s demands based on FMWD’s demands approximately 98 percent of total system demands (per La Cañada Irrigation District). “Total System Demand” for remaining FMWD member agencies based on demand data provided by retail agencies.
2) Impacts of the recently passed Senate Bill 7 (SBX7_7) included in some projections. SBx7_7 requires a statewide reduction in water consumption of 10 percent by 2015 and 20 percent by the year 2020. Member agencies that have less than 3,000 connections and that supply no more than 3,000 AFY (Las Flores, Kinneloa and Mesa Crest) were excluded from the SBX7_7 calculations.

C-5.3 **Cost of Water - Groundwater**

Groundwater that is of good quality can typically be produced at cheaper costs than purchasing water from MWD. The cost is typically the cost of power to pump the groundwater, Operations and Maintenance (O&M) costs (typically a minimal amount), and the cost of the chlorine needed to treat the water before putting into the distribution system. The problem with costs arises when water is of poor quality and must be treated prior to introduction into the distribution system. Treatment can often add a significant cost in the form of the capital needed for treatment, resin or chemicals that are needed, O&M including power costs, and also brine or sludge disposal. As an example, the cost to install a 5,000 gpm nitrate treatment (regenerative ion exchange) to remove nitrate contamination was recently estimated at approximately $5 million in capital costs (equipment, site work, brine discharge connection, and electrical) and $0.8 million per year in O&M (brine disposal and salt). These costs need to be compared on a case-by case basis with MWD's water rates along with the risk each agency is willing to take on reliability when deciding on treatment.

C-5.4 **Cost of Water – Imported Water**

In addition to groundwater production, water agencies within the Verdugo Basin Study Area and Arroyo Study Area purchase imported water supplies from FMWD. FMWD purchases water from MWD at a rate of $744 per AF (calendar year 2011) for treated full service Tier 1 water.

It is anticipated FMWD will generally pass-through MWD rate increases to its member agencies for imported water. MWD's rates for Tier 1 water are projected to increase annual to approximately $2,174 per AF by the year 2030 (see Table C-1). It is anticipated that the administrative and operating charge will typically increase based on the rate of inflation and the capital and rehabilitation charge will increase based on the projects identified to be completed if FMWD continues with PAYG as the preferred payment option. It is anticipated that should FMWD obtain financing for capital projects, the capital and rehabilitation charge will be steadier rather than fluctuate as currently anticipated.

C-6. Quality of Water Supplies.

The quality of FMWD's imported water supply provided to water agencies and the quality of local water supplies within the Verdugo Basin Study Area, the Arroyo Study Area, and the Eaton Canyon Study Area are discussed in Section B-3.

C-7. Sources for Additional Water and Plans for New Facilities (for both the local entity and the wholesalers).

C-7.1 Conservation and Water-Use Efficiency

MWD

MWD[5] is aggressively pursuing water conservation in residential, commercial and industrial sectors through a variety of financial incentive-based approaches for water-saving devices. These have included high-efficiency clothes washers, high-efficiency toilets, weather-based irrigation controllers, rotary sprinkler nozzles, restaurant pre-rinse spray valves, medical equipment steam sterilizers, and cooling tower conductivity controllers. Intensive public outreach and education is carried out by MWD to encourage customers to save water and take advantage of rebates. This outreach, education and incentive payments are funded through the rates paid by its member agencies. Total incentive payments for FY 2007-08 were $18.1 million, which created 7,400 AF of new annual water savings. Combined with devices installed in prior years through MWD's Active Conservation Program, the total annual savings for FY 2008-09 is 120,000 AF.

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[5] Because FMWD's primary role has been to import water from MWD, it is appropriate to discuss some of MWD's sources for additional water and plans for new facilities as they relate to FMWD in this section as well as FMWD's and local entities' plans.

FMWD

FMWD has traditionally provided administration of MWD's water conservation programs to its local agencies. However in 2009 it began providing matching incentives for weather-based irrigation controllers and synthetic turf to achieve more participation locally. Consumer participation has been low and FMWD has revamped the program to achieve more consumer participation to encourage greater conservation in compliance with SBX7 7 goals. The program was changed to provide funding for rain barrels, turf removal and high efficiency toilets. Over $55,000 in incentives were provided the first year with almost 200 retail customers participating.

Additionally, in 2008, FMWD formed the Foothill Water Conservation Corps. The FWCC is made up of a group of volunteers that assist FMWD with various conservation events such as water fairs, school education, etc.

FMWD has also sponsored landscape classes offered through MWD in its service area. The classes have been well attended with interest by attendees and those on waiting lists for more classes.

Crescenta Valley

Crescenta Valley has had active conservation programs for many years within its service area. Currently it is employing a summer intern program as a means to educate the public on ways to conserve water. These interns patrol the Crescenta Valley service area daily noting addresses where water waste is occurring so that the employees may contact the resident regarding water-wise practices. Crescenta Valley has a Turf Rebate Program, promotes and supports MWD rebate programs, plans on the retrofit of some apartment buildings within Crescenta Valley boundaries and participates in and supports community events that span not only within the Crescenta Valley service area, but other districts as well. Additionally, Crescenta Valley is working with the cities of Burbank, Glendale, and Pasadena on a uniform message campaign to promote effective outdoor watering practices.

C-7.2 **Water Resource and System Planning**

MWD

The framework for regional water resource planning for MWD's service area is the Integrated Water Resources Plan (IRP), originally adopted by MWD's board in 1996. It was updated in 2004 and is currently being updated again in 2010. The IRP provided a diversified 20-year resource plan to balance locally-developed resources with imported supplies. It called for investments in water conservation, recycling, groundwater treatment, storage and transfers, and in return brought supply diversity and stability.

In 2007/2008 MWD compiled a five-year action plan to develop more local supplies to offset immediate impacts of the increased pumping restrictions in the Bay-Delta. Additionally, staff prepared an action plan for updating the IRP to maintain water supply reliability through 2035, as well as address emerging trends in demand and supply. This update is currently occurring.

In July 2009, MWD implemented the allocation portion of its Water Surplus and Drought Management (WSDM) Plan at a Level 2 with an overall regional reduction of 10%. (The WSDM Plan is a staged Plan which provides short-term planning strategies for managing MWD's portfolio of diverse water resource programs with the final stage being an allocation of resources.) The application of the water allocation portion of WSDM was rescinded in April 2011.

FMWD

Until 2007, when a decision by a Federal Judge severely restricted pumping in the Sacramento–San Joaquin Delta due to the diminishing population of the Delta Smelt, FMWD had served its member agencies with a main strategy of providing imported water supplies to supplement local resources based on the supply reliability developed through the IRP. However, based on the pumping restrictions, three years of drought in Northern California and eight years on the Colorado River watershed, it was apparent that in most years until a permanent fix is achieved for the Bay-Delta, there would be supply allocations from MWD. In response, FMWD's Board of Directors took action to reduce the impacts by initiating a long-term program to achieve increased independence from imported water supplies. This program includes increased conservation, use of recycled water and increased stormwater capture.

For FMWD, because of its dependence on imported water, the reduction in imported supplies from MWD under its WSDM Plan translated to about 15% although the regional shortage was 10%. FMWD mirrored for the most part the allocation from MWD to its member agencies using the same base period and methodology for allocating imported supplies. Depending on the mix of local supplies to imported supplies, member agencies have also passed through some type of allocation to retail customers.

C-7.3 **Future Facilities**

MWD

In December 2007, MWD and its member agencies completed a two-year Integrated Area Study that defined the future facilities needed to reliably deliver MWD's water supplies developed under the IRP. The process was designed to better coordinate local and regional infrastructure planning, clarify policy issues and evaluate alternative approaches to meet water demands over the next 50 years. The Integrated Area Study covered the region's four primary load areas, Central Pool, Riverside and San Diego, West Valley and San Bernardino. Except for the ozone retrofit at the F.E. Weymouth Treatment Plant, there is minimum impact of new facilities to FMWD.

FMWD

The majority of FMWD's infrastructure is about 60 years old. A capital improvement program and rehabilitation program for a five-year period was developed starting in 2009 (see Appendix F for most current five-year projection). For the existing distribution system, most of the program is for rehabilitation of existing facilities. However, as discussed previously, CDPH had recommended with its inspection five years ago that a new storage tank was needed to help meet peak demands. At the recent review of the system and plans for recycled water, CDPH has indicated a willingness to retract its recommendation for a new storage tank based on the development of recycled water within the service area. Additionally, a new emergency interconnection is being considered with the City of Glendale. This interconnection would supply water from MWD's Joseph Jensen Treatment Plant rather than Weymouth increasing reliability to the service area.

A major portion of the resources to be developed by FMWD is recycled water with some development of stormwater as it pertains to recycled water and to help member agencies with increased recharge and groundwater production.

The local agencies also have their own capital and rehabilitation programs. There are limited new facilities being constructed. Interconnections for emergency purposes have been identified and are being reviewed. These interconnections will be constructed as time and funding permit.

Crescenta Valley

In addition to the interconnections discussed above, Crescenta Valley is studying the recharge of the Verdugo Basin. As indicated in Section C-4 above, Crescenta Valley has conducted a feasibility study to investigate the potential for recharging and storing groundwater in the Verdugo Basin and the feasibility of implementing a conjunctive use program. That feasibility study concluded that recharge of precipitation runoff using infiltration galleries at Crescenta Valley County Park was the preferred alternative. Because of limited available land for development of new spreading areas, recharge is being considered at debris basins and also by constructing infiltration galleries adjacent to flood control channels.

La Cañada

La Cañada had plans for constructing a 2 million gallon reservoir on a site near the Angeles Forest. Due to the Station Fire the site has been compromised and La Cañada is now evaluating its alternatives.

Raymond Basin

The Los Angeles County Department of Public Works working with Raymond Basin is also reviewing the possibility of recharging stormwater in Eaton Wash. A pipeline would be constructed between Devil's Gate Dam in the Arroyo Study area and Eaton Wash spreading grounds in the Eaton Study area. Stormwater would be held behind Devil's Gate Dam and moved from that area using the pipeline to the Eaton Wash spreading grounds for recharge purposes. This spreading may help address the overdraft issue in the Pasadena subarea so that pumping rights no longer need to be reduced.

Pasadena is also considering construction of a pump back facility. A pipeline would be constructed from Devil's Gate Dam back up to Pasadena's spreading grounds in the Arroyo. Water would be held behind Devil's Gate Dam and pumped as capacity is available in Pasadena's spreading ponds for recharge into the Monk Hill subarea of the basin.

C-7.4 **Water Resources Data**

Figure C-2 displays the historical and estimated population served within MWD's service area since 1990. In 1990, the population served was approximately 15 million people. Since 1990, the population served has increased to nearly 19 million people. Demographic projections provided to MWD by regional planning agencies forecast additional increases in population, with an estimated 22 million people by the year 2030.

Figure C-3 displays the historical and estimated water sales within MWD's service area since 1990. In 1990, water sales reached record-high levels of more than 2.5 MAF. Since 1990, water sales have ranged between 1.5 and 2.5 MAF. The projections of water sales through the year 2030 range from 1.5 to more than 2.9 MAF. The wide range in MWD water sales, both historically and into the future, is attributed to varying weather conditions, and the production of locally-supplied water.

MWD anticipates meeting these increasing demands through a variety of their water resource programs. Additional retail level conservation is anticipated in response to the

“20 x 2020” conservation legislation and is expected to ramp up to 200,000 AF of demand reduction by 2020. Additional local resources, supported by the MWD Local Resources Program (LRP) are expected to grow by 16 thousand acre-feet (TAF) beginning in 2015 and reaching 46 TAF by 2025. In addition to these local measures, MWD is planning on a Delta Fix coming on line before 2025 which will significantly improve the reliability of SWP supplies. Continuing management of MWD’s storage portfolio along with selected transfers will also be used to meet the regions’ wholesale water need. A detailed presentation of the projected demands and supply capability is included as Appendix G. Appendix G includes a series of Tables presenting MWD’s plans for supplying supplemental water to the region under several hydrologic scenarios in five year increments out to the year 2035. Also presented are In-Region Storage Capabilities, California Aqueduct Capabilities and Colorado River Aqueduct Capabilities projected out to 2035. Finally, a near term projection of MWD Rates and Charges is included. These data are included to demonstrate the planning that has occurred to ensure the reliability of the imported water supplies for the region.

The MWD capital improvement plan is anticipated to continue averaging approximately $400 million per year for the foreseeable future. Figure C-4 depicts a breakdown of the next several years of capital expenditures for different improvement projects. The most significant capital improvements of concern to FMWD are the completion of the oxidation retrofit program at the Weymouth Treatment Plant, which is expected by 2015, and the completion of the Delta Fix.

D. WASTEWATER CHARACTERISTICS AND FACILITIES

D-1. Description of Entities.

The majority of the wastewater service in Los Angeles County is provided by either the City of Los Angeles through their Hyperion System or by the LACSD through their Joint Outfall System (JOS). FMWD straddles these two service areas and therefore, any local satellite project will impact downstream facilities in one or both of these systems to some degree. These facilities are described in the following paragraphs.

D-1.1 **Los Angeles County Sanitation Districts**

The LACSD are a confederation of 23 separate Districts working cooperatively to meet the water pollution control and solid waste management needs of approximately 5.7million people in Los Angeles County. The LACSD, which provide wastewater services within the FMWD service area, are Districts 16 (Pasadena), 17 (Altadena), 28 (the area of La Cañada Flintridge surrounding the La Cañada Country Club), and 34 (the remainder of La Cañada Flintridge). Of these Districts, only District 28 provides local wastewater treatment. The locations of these Districts are provided in Figure D-1.

The District 28 Water Reclamation Plant (also known as the La Cañada Water Reclamation Plant) is a secondary wastewater treatment plant with a capacity of 200,000 gallons per day. The plant provides wastewater treatment for the residential area around the country club and presently treats about 100,000 gallons per day. The treated effluent is discharged into ponds at the country club and is then pumped and used for irrigation of the fairways and greens. Disinfected secondary effluent meets the regulatory requirements for controlled access golf course irrigation and some landscape irrigation.

The 100,000 gallons per day of effluent are adequate to meet the irrigation needs in the cooler months although Mesa Crest provides supplemental water to the ponds during the warmer summer months.

D-1.2 **City of Los Angeles Department of Public Works and City of Glendale**

The Cities of Los Angeles and Glendale co-own the Los Angeles-Glendale Water Reclamation Plant (LAGWRP), with the City of Los Angeles' Bureau of Sanitation operating and maintaining the plant. The LAGWRP provides wastewater services to Eastern San Fernando Valley including the Glendale-Burbank-La Crescenta area. Crescenta Valley's service area and a small portion of La Cañada's service area are serviced by the LAGWRP. LAGWRP is located outside of FMWD's service area. It is a part of the City of Los Angeles' wastewater system which is depicted in Figure D-2.

D-1.3 **Crescenta Valley Water District Collection System**

Crescenta Valley constructed a wastewater collection system for its entire service area in the early 1980s under the Clean Water Grant Program. The collection system includes the far western part of La Cañada Flintridge as its tributary by gravity. Specifically, Ocean View Avenue and the YMCA on Foothill Boulevard are included within the Crescenta Valley system. Figure D-3 depicts the Crescenta Valley collection system which flows to LAGWRP through a separate trunk sewer.

D-1.4 **City of La Cañada Flintridge Sewering Program**

Until recently, the residential areas of La Cañada Flintridge have not had access to municipal sewer services. The Foothill Trunk Sewer (Figure D-4), which serves the business district, was constructed by the LACSD in 1996. The City is working through a long-range master plan to provide sewer services to all remaining properties. Initially, the City defined Master Plan Areas for the purposes of approval and development of collection systems in a logical manner. These areas are depicted on Figure D-5

Sewer Master Plan Area 1, constructed as Assessment District 98-1, was completed in 1999. Sewer Master Plan Area 2, constructed as Assessment District 02-1 was completed in summer 2005. Sewer Master Plan Areas 3A & 3B, constructed as Assessment District 04-1 were completed in June 2008. In its continuing efforts, the City's goal is to expand and improve the Citywide wastewater collection and transmission system for the future Sewer Project Areas 4, 5 and 6 (Figure D-6). The assessment ballot for Sewer Project Areas 5, 6E, and 6J were defeated by a two-to-one vote in October, 2009.

The Foothill Trunk Sewer is maintained by the LACSD. Sewer mains in Areas 1, 2, and 3 are maintained by the Los Angeles County Department of Public Works under contract with the City.

D-2. Description of Major Facilities (including capacities, present flows, plans for new facilities, description of treatment processes, design criteria).

Wastewater from the Arroyo and Eaton Canyon Study Areas are primarily treated at LACSD's San Jose Creek Water Reclamation Plant (SJCWRP) and Whittier Narrows Water Reclamation Plant (WNWRP). Wastewater from part of the Verdugo Basin Study Area (Crescenta Valley's service area and a small portion of La Cañada's service area) is treated at the LAGWRP. The SJCWRP and WNWRP are located approximately 15 miles from the Study Areas, while the LAGWRP is located approximately 7 miles from the Study Areas. Effluent from these plants is not proposed to be used for FWMD's recycled water program due to the infrastructure and transportation costs to bring it to the study area. There is a small existing wastewater treatment plant in the Arroyo Study Area treating wastewater from approximately 425 homes and the La Cañada Flintridge Country Club, which is referred to as the La Cañada Water Reclamation Plant. LACSD's trunk sewers are used to deliver wastewater from the portion of the Study Areas generally east of Windsor Avenue/Arroyo Boulevard to the SJCWRP, located in unincorporated Los Angeles County near the City of Whittier, and the portion of the Study Areas generally west of Windsor Avenue/Arroyo Boulevard to the WNWRP, located in the City of El Monte. The North Outfall Sewer delivers wastewater from applicable portions of the Verdugo Basin Study Area to LAGWRP located in the City of Los Angeles. The location of LACSD's main trunk lines and wastewater treatment plants were provided in Figure D-1. The location of the LAGWRP and main trunk lines were provided in Figure D-2. Descriptions of the SJCWRP, WNWRP, and LAGWRP are provided below to provide information on the current regional wastewater facilities treating wastewater from the Study Areas.

D-2.1 **San Jose Creek Water Reclamation Plant**

SJCWRP provides primary, secondary, and tertiary treatment with a treatment capacity of 100 million gallons per day (MGD), serving a population of approximately one million people. The treatment process is shown in Appendix H. As shown in Appendix H, influent wastewater from LACSD's trunk sewer enters primary settling tanks where solids are removed and returned for further treatment at LACSD's Joint Water Pollution Control Plant (JWPCP). After the primary settling tanks, wastewater containing dissolved and suspended materials (mostly organic) receives secondary treatment in aeration tanks and secondary settling tanks. In the aeration tanks, oxygen is added to promote degradation of the biological content of wastewater by microorganisms. After the aeration tanks, wastewater enters secondary settling tanks where the microorganisms clump together and settle to the bottom as activated sludge, where they are removed and recycled back into the treatment process. Waste activated sludge is discharged to LACSD's trunk sewer for further treatment at LACSD's JWPCP. After secondary treatment, wastewater receives tertiary treatment with gravity filters consisting of layers of anthracite coal, sand, and gravel to remove any remaining suspended materials from the water. The reclaimed water is then disinfected with chlorine to remove harmful bacteria and viruses. After disinfection, any remaining chlorine in the reclaimed water is removed using sulfur dioxide to protect aquatic life in the receiving environment.

SJCWRP treated approximately 76,830 AF of wastewater during FY 2009-10. Of this total, approximately 49,290 AF was discharged into spreading grounds or delivered for direct use (including irrigation of parks, schools, and greenbelts). Unused reclaimed water was discharged to the San Gabriel River.

D-2.2 **Whittier Narrows Water Reclamation Plant**

WNWRP provides primary, secondary, and tertiary treatment for up to 15 MGD of wastewater, serving a population of approximately 150,000 people. Capacity is currently available at the plant as approximately 4.7 MGD was treated in FY 2009-10 and 6 MGD was treated in FY 2008-09. The treatment process is shown in Appendix H. As shown in Appendix H, influent wastewater from LACSD's trunk sewer enters primary settling tanks where solids are removed and returned for further treatment at LACSD's JWPCP. After the primary settling tanks, wastewater containing dissolved and suspended materials (mostly organic) receives secondary treatment in aeration tanks and secondary settling tanks. In the aeration tanks, oxygen is added to promote degradation of the biological content of wastewater by microorganisms. After the aeration tanks, wastewater enters secondary settling tanks where the microorganisms clump together and settle to the bottom as activated sludge, where they are removed and recycled back into the treatment process. Waste activated sludge is discharged to LACSD's trunk sewer for further treatment at LACSD's JWPCP. After secondary treatment, wastewater receives tertiary treatment with gravity filters consisting of layers of anthracite coal, sand, and gravel to remove any remaining suspended materials from the water. The reclaimed water is then disinfected with sodium hypochlorite to remove harmful bacteria and viruses. (The WNWRP will be switching over to UV in the near future for disinfection.) After disinfection, any remaining chlorine in the reclaimed water is removed using sodium bisulfite to protect aquatic life in the receiving environment.

WNWRP treated approximately 5,300 AF of wastewater during FY 2009-10. Of this total, approximately 5,300 AF was discharged into spreading grounds or delivered for direct use (including irrigation of parks, schools, and greenbelts).

D-2.3 **Los Angeles-Glendale Water Reclamation Plant**

LAGWRP provides primary, secondary, and tertiary treatment of approximately 20 MGD of wastewater. The treatment process is shown in Appendix H. As shown in Appendix H, influent wastewater from the North Outfall Sewer enters the headworks/barscreens where solids (such as branches, plastics, and rags) and grit (sand, rocks, and small debris) are removed, as part of the preliminary treatment. After the preliminary treatment, the wastewater travels through the influent pumping facility and enters the primary treatment where the solids (sludge) settle to the bottom of the primary tanks. The primary sludge from the tanks is returned to the main sewer where it is sent to the City of Los Angeles' Hyperion Treatment Plant for further processing. Wastewater from the primary treatment tanks flows by gravity to the secondary treatment system where bacteria are added to the aeration tanks for the nitrification-denitrification process. In the aeration tanks, oxygen is added to speed up the bacteria's rate of decomposition. From the aeration tanks, the wastewater with activated sludge flows to the secondary clarifying tanks to allow settling of the activated sludge by gravity. A portion of the settled activated sludge is returned to the aeration tanks to maintain biological equilibrium in the aeration tanks, while the remaining portion is discharged to the sewer where it flows to the Hyperion Treatment Plant for further processing. After secondary treatment, the wastewater enters the tertiary treatment to allow any remaining solids to be removed by the dual-bed or tetra denite sand filters. After tertiary treatment, the wastewater is disinfected using sodium hypochlorite to remove any remaining pathogens or disease-carrying organisms. After disinfection, the wastewater is dechlorinated using sodium bisulfite to protect fish and other aquatic life in the receiving environment. The treated water is reclaimed or discharged into the Los Angeles River.

Approximately 4.5 MGD of the processed wastewater are used for reclaimed purposes by the City of Los Angeles Department of Public Works and the City of Glendale. Reclaimed uses include utilization at the plant for treatment processes and landscape irrigation; cooling water for the Glendale Steam Power Plant; and irrigation at Griffith

Park, freeway landscaping, local cemeteries, and nearby golf courses. Unused reclaimed water is discharged into the Los Angeles River.

D-2.4 **La Cañada Water Reclamation Plant**

The La Cañada Water Reclamation Plant, located in the City of La Cañada Flintridge, treats wastewater generated from a small area (the La Cañada Flintridge Country Club and approximately 425 homes) within the Study Areas. As discussed previously, the La Cañada Water Reclamation Plant provides secondary treatment of 200,000 gallons per day of wastewater. The treatment process is shown in Appendix H. As shown in Appendix H, influent wastewater goes through bar screens and comminutors where large objects are removed by the bar screens and shredded/reduced in size by the comminutors. Wastewater then enters aeration tanks where oxygen is added to promote degradation of the biological content of wastewater by microorganisms. After the aeration tanks, wastewater enters secondary settling tanks where the microorganisms clump together and settle to the bottom, where they are removed and recycled back into the treatment process. Waste sludge is discharged to LACSD's trunk sewer, which then flows towards the JWPCP. The secondary effluent is disinfected with chlorine prior to discharge to the four lakes on the Country Club golf course.

The La Cañada Water Reclamation Plant treated approximately 110 AF of wastewater during FY 2009-10, all of which was discharged into the lakes.

D-2.5 **Groundwater Reliability Improvement Program (GRIP) Project**

The Water Replenishment District of Southern California and LACSD are developing the proposed GRIP Project that will provide up to 21,000 AFY of advanced treated recycled water within the Central Basin through advanced treatment of effluent from the SJCWRP. A conceptual design report of the GRIP Project was completed in May 2009.

D-3. Water Quality of Effluent and any Seasonal Variation.

Recycled water quality produced from the SJCWRP and WNWRP was obtained from LACSD's "Status Report on Recycled Water Fiscal Year 2009-10" and is provided in Appendix I; however, it should be noted that these treatment plants are outside of the Study Areas for this report and effluent from these plants is not proposed to be a source of recycled water for the proposed projects. Mean, minimum, and maximum water quality concentrations during the sampling period are included. LACSD discharge, reuse, and recharge requirements are discussed in Section D-4.

Recycled water quality produced from the LAGWRP was obtained from LAGWRP's "Annual Waste Discharge Requirements for Title 22 Recycled Water Monitoring Report 2009" and is provided in Appendix J. It should be noted that LAGWRP is outside of the Study Areas for this report and effluent from this plant is not proposed to be a source of recycled water for the proposed projects. However, studies have been conducted to bring LAGWRP effluent to the Study Areas. The proposed use of LAGWRP effluent in the Study Areas will be discussed in a later section of this report. Discharge, reuse, and recharge requirements for the LAGWRP are discussed in Section D-4.

Recycled water quality from the GRIP Project is discussed in the Conceptual Level Study.[6] According to the Conceptual Level Study, compounds in the SJCWRP effluent that exceed current regulatory standards for groundwater recharge may be adequately removed using the treatment processes considered as part of the proposed treatment train for the GRIP Advanced Water Treatment Plant. The regulatory standards reviewed in the Conceptual Level Study include the Regional Water Quality Control Board's (RWQCB) discharge requirements under the National Pollutant Discharge Elimination System (NPDES) program, including the California Toxics Rule that regulates certain toxic pollutants; CDPH's draft regulation for Groundwater Recharge

[6] *Groundwater Reliability Improvement Program (GRIP), Conceptual Level Study*. Prepared by MWH. Prepared for Upper San Gabriel Valley Municipal Water District, Water Replenishment District of Southern California, and Sanitation Districts of Los Angeles County. Draft Final. May 1, 2009.

Reuse for recharge of recycled water into the groundwater; and, although not applicable, the California Office of Environmental Health Hazard Assessment Public Health Goals as a basis for future regulatory standards that should be reviewed during the planning phase.

D-4. Additional Facilities Needed to Comply with Waste Discharge Requirements.

LACSD treatment facilities are subject to regulations administered by the RWQCB. LACSD treatment plants hold permits under the NPDES program, which must be renewed every five years. The LACSD treatment plants are subject to discharge, reuse, and recharge permits. LACSD will need to construct any facilities necessary to remain in compliance with these permits. Recycled water use from the San Jose Creek Water Reclamation Plant is permitted under the California Regional Water Quality Control Board, Los Angeles Region (LARWQCB) Order Nos. 87-50 and 97-072 for direct, non-potable applications, No. 91-100 for groundwater replenishment. Recycled water use from the Whittier Narrows Water Reclamation Plant is permitted under the LARWQCB Order Nos. 88-107 and 97-072 for direct, non-potable applications, No. 91-100 for groundwater replenishment. Recycled water use from the La Cañada Water Reclamation Plant is permitted under the LARWQCB Order No. 00-099.

The LAGWRP is subject to regulations administered by the RWQCB. The LAGWRP holds an NPDES permit that requires periodic renewal (current permit expires on November 13, 2011). The LAGWRP is subject to applicable discharge, reuse, and recharge permits. The Cities of Los Angeles and Glendale will need to construct any facilities necessary to remain in compliance with these permits. Reuse of recycled water from the LAGWRP is permitted under LARWQCB Order Nos. R4-2007-0006 and R4-2008-0040.

D-5. Sources of Industrial or Other Problem Constituents and Control Measures.

D-5.1 County Sanitation Districts of Los Angeles County

LACSD defines industrial wastewater as "all wastewater from any manufacturing, processing, institutional, commercial, or agricultural operation, or any operation where the wastewater discharged includes significant quantities of waste of non-human origin". Based on Drinking Water Source Assessment and Protection Program reports, "Electrical/electronic manufacturing" industrial activities occur within Kinneloa; "Chemical/petroleum processing/storage" industrial activities occur within La Cañada and Valley; "Machine shops," "Metal plating/finishing/fabricating," "Plastics/synthetics producers," and "Wood/pulp/paper processing and mills" industrial activities occur within Lincoln; and "Food processing" industrial activities occur within Rubio.

Companies that discharge industrial wastewater must comply with LACSD wastewater ordinance requirements, which include LACSD's Industrial Wastewater Discharge Permit, Connection Fee, and Surcharge Programs. LACSD's Industrial Wastewater Discharge Permit Program allows LACSD to regulate industrial wastewater dischargers that may be sources of industrial or other problem constituents. The Permit requires pretreatment of industrial wastewaters before discharge and restricts and prohibits discharge of certain wastewaters. The Permit application requires submittal of wastewater analysis results that include conventional pollutants such as chemical oxygen demand, suspended solids, total dissolved solids, pH, and toxic pollutants that may be present in the wastewater (e.g., heavy metals and organics). The Connection Fee Program requires all new LACSD users, as well as existing users that significantly increase the quantity or strength of their wastewater discharge, to pay a portion of the costs for providing additional conveyance, treatment, and disposal facilities. The Surcharge Program requires all industrial companies discharging to LACSD to pay a portion of the wastewater treatment and disposal costs.

D-5.2 **City of Los Angeles Department of Public Works**

The Industrial Waste Management (IWMD) Division within the Bureau of Sanitation of the City of Los Angeles Department of Public Works monitors, regulates, and controls industrial wastewater discharges to the City's wastewater collection and treatment system. The City of Los Angeles defines industrial wastewater as waste-bearing water other than domestic wastewater, which is generated from manufacturing, commercial or other operations not excluding household type operations performed at commercial establishments for or to support commercial purposes. Land use in the service areas of Crescenta Valley and La Cañada that are served by the LAGWRP includes a small area of industrial use.

Companies that discharge industrial wastewater must comply with Section 64.30 of the Los Angeles Municipal Code, Industrial Waste Control Ordinance, which includes the City of Los Angeles' industrial wastewater permit program. The industrial wastewater permit allows the City of Los Angeles to protect its sewer collection and treatment systems, and to prevent regulated toxic wastewater constituents from passing through to receiving waters and recovered bio-solids. As part of the permit application, an industrial waste inspector will inspect the facility, verify all information provided in the permit application is complete and accurate, and identify all wastewater generating processes, methods of wastewater conveyance, and pretreatment systems. In addition to the permit application fee, there is also an annual Inspection and Control Fee which all permitted Users must pay for the basic level of services such as inspection, sampling, inventory control, and reporting; and a Quality Surcharge Fee for discharged wastewater that contains organic waste and solids above domestic levels.

IWMD staff reviews and processes the permit application to establish discharge limitations, monitoring, and reporting requirements. Included in the permit are conditions, obligations, and responsibilities under which an industrial user is permitted to discharge industrial wastewater to the sewer system. Businesses classified as

Significant Industrial Users (SIUs) by the City of Los Angeles are subject to more stringent requirements than other types of businesses.

D-6. Existing Recycling (including users, quantities, contractual and pricing arrangements).

The La Cañada Water Reclamation Plant provides extended aeration secondary treatment for 200,000 gallons of wastewater per day (see flow diagram in Appendix H). The plant serves the La Cañada Flintridge Country Club and 425 surrounding homes, the location of which is depicted on Figure D-7. All of the disinfected, secondary effluent is put into the four lakes on the 105 acre Country Club golf course. Lake water (augmented by potable water during the summer) is used for landscape irrigation of the golf course as depicted on Figure D-8. All of the approximately 1.1 million gallons produced at the La Cañada Water Reclamation Plant during 2009 was used for landscape irrigation of the golf course and in storage reservoirs or landscape impoundments.

D-7. Existing Rights to Use of Treated Effluent after Discharge.

Once treated effluent is discharged to the environment it is subject to being appropriated through the water rights proceedings of the State Water Resources Control Board. While the wastewater, raw or treated, remains within pipes or treatment facilities, it is the property of the owner of the facilities. With regard to this planning effort, which does not envision any surface water discharge, the raw wastewater is therefore owned by La Cañada Flintridge, Crescenta Valley, or the Sanitation Districts of Los Angeles County depending on whose facilities contain it. Should FMWD select an alternative that included diversion of effluent from LAGWRP for use within FMWD, a separate agreement with Glendale may have to be negotiated for rights to the effluent.

D-8. Wastewater Flow Variations - Hourly and Seasonal.

Hourly wastewater flow variations within the Foothill Boulevard Main Trunk are depicted for MH 46 on Figure D-9, MH 61 on Figure D-10 and MH B-1442 on Figure D-11. These Manhole locations can be found on Figure D-4. MH B-1442 essentially represents the entire flow from La Cañada Flintridge. As may be noted, the total hourly flow varies from about 0.1cfs to about 2.5 cfs on a daily basis. The monthly and daily flow variations for 2009 for the Crescenta Valley collection system at the Elk Station are presented on Table D-1. It can be noted from these data that there is not much seasonal or daily variation in the wastewater flows and that a flow of 1.25 to 1.5 MGD can be expected on any given day. Seasonal variations in wastewater flow in the area are represented by Figure D-12 which depicts the flow at the La Cañada Plant flow over the 2009 year. This indicates that there is not a significant seasonal variation in flows but that there may be short term aberrations most likely driven by rainfall induced infiltration/inflow.

Table D-1 Wastewater Flows at Elk Station

Month	2009			
	MG per month	MG per day	MG min day	MG max day
January	51.68	1.67	1.54	1.80
February	46.66	1.67	1.57	1.91
March	51.10	1.65	1.57	1.88
April	47.12	1.57	1.41	1.73
May	49.40	1.59	1.51	1.72
June	47.15	1.57	1.51	1.65
July	46.85	1.51	1.45	1.59
August	44.60	1.44	1.31	1.52
September	42.63	1.42	1.20	1.58
October	44.47	1.43	1.23	1.64
November	41.71	1.39	1.26	1.52
December	46.48	1.50	1.27	1.85
Total Flow MG	559.86			
Monthly Average	46.65			

E. TREATMENT REQUIREMENTS FOR DISCHARGE AND REUSE

E-1. Required Water Qualities for Potential Uses

Water quality requirements of recycled water for beneficial use are based on the anticipated use. Examples of the water quality issues that may be of concern for the different anticipated uses are presented in Table E-1.

Table E-1 Water Quality Concerns for Anticipated Uses

Type of Use	Water Quality Issues
Landscape Irrigation	TDS Sulfate Chloride Boron Sodium Absorption Ratio
Cooling Tower Makeup	TDS Orthophosphate
Groundwater Recharge	TDS Sulfate Chloride Boron Total Organic Carbon Nitrogen Compounds

The water quality concerns for landscape irrigation are driven by the potential impacts that the water quality will have on the plant growth patterns particularly for salt sensitive species. For cooling tower makeup uses, the concerns are for the number of cycles between blowdowns and the potential for fouling within the cooling towers. The groundwater recharge issues relate to the existing water quality and what assimilative capacity exists to avoid any issues with the groundwater quality objectives established in Water Quality Control Plans adopted by the RWQCBs for watersheds.

E-2. Water Quality, Treatment, and Operational Requirements for Recycled Water Uses

E-2.1 Non-Potable Uses of Recycled Water

Treatment and water quality requirements for non-potable uses of recycled water are specified in *Water Recycling Criteria*, California Code of Regulations, Title 22, Division 4, Chapter 3. These requirements are depicted in Figure E-1 and are summarized in Table E-2.

Table E-2 California Water Recycling Criteria: Treatment and Quality Requirements for Nonpotable Uses of Reclaimed Water

Type of Use	Total Coliform Limits[a]	Treatment Required
Irrigation of fodder, fiber, and seed crops, orchards[b] and vineyards[b], processed food crops, nonfoodbearing trees, ornamental nursery stock[c], and sod farms; flushing sanitary sewers	None required	Secondary
Irrigation of pasture for milking animals, landscape areas[d], ornamental nursery stock and sod farms where public access is not restricted; landscape impoundments; industrial or commercial cooling water where no mist is created; nonstructural fire fighting; industrial boiler feed; soil compaction; dust control; cleaning roads, sidewalks, and outdoor areas	≤23/100 mL ≤240/100 mL in more than one sample in any 30-day period	Secondary Disinfection
Irrigation of food crops[b]; restricted recreational impoundments; fish hatcheries	≤2.2/100 mL ≤23/100 mL in more than one sample in any 30-day period	Secondary Disinfection

Irrigation of food crops[e] and open access landscape areas[f]; toilet and urinal flushing; industrial process water; decorative fountains; commercial laundries and car washes; snow-making; structural fire fighting; industrial or commercial cooling where mist is created	240/100 mL (maximum)	Secondary Coagulation[g] Filtration[h] Disinfection
Nonrestricted recreational impoundments	≤2.2/100 mL ≤23/100 mL in more than one sample in any 30-day period 240/100 mL (maximum)	Secondary Coagulation Clarification[i] Filtration[h] Disinfection

a. Based on running 7-day median.

b. No contact between reclaimed water and edible portion of crop.

c. No irrigation for at least 14 days prior to harvesting, sale, or allowing public access.

d. Cemeteries, freeway landscaping, restricted access golf courses, and other controlled access areas.

e. Contact between reclaimed water and edible portion of crop; includes edible root crops.

f. Parks, playgrounds, schoolyards, residential landscaping, unrestricted access golf courses, and other uncontrolled access irrigation areas.

g. Not required if the turbidity of the influent to the filters is continuously measured, does not exceed 5 nephelometric turbidity units (NTU) for more than 15 minutes and never exceeds 10 NTU, and there is capability to automatically activate chemical addition or divert the wastewater if the filter influent turbidity exceeds 5 NTU for more than 15 minutes.

h. The turbidity after filtration through filter media cannot exceed 2 NTU within any 24-hour period, 5 NTU more than 5% of the time within a 24-hour period, and 10 NTU at any time. The turbidity after filtration through a membrane process cannot exceed 0.2 NTU more than 5% of the time within any 24-hour period and 0.5 NTU at any time.

i. Not required if reclaimed water is monitored for enteric viruses, *Giardia*, and *Cryptosporidium*.

Source: State of California. 2000. Water Recycling Criteria. California Code of Regulations, Title 22, Division 4, Chapter 3. California Department of Public Health, Sacramento, California.

E-2.2 **Use Area Requirements**

Reclaimed water use area setback distance requirements include the following:

- No irrigation or impoundment of undisinfected reclaimed water within 150 feet (50 meters) of any domestic water supply well;
- No irrigation of disinfected secondary-treated reclaimed water within 100 feet (30 meters) of any domestic water supply well;
- No irrigation with tertiary-treated (secondary treatment, filtration, and disinfection) reclaimed water within 50 feet (15 meters) of any domestic water supply well unless special conditions are met, and no impoundment of tertiary-treated reclaimed water within 100 feet (30 meters) of any domestic water supply well;
- Only tertiary-treated reclaimed water can be sprayed within 100 feet (30 meters) of a residence or places where more than incidental exposure is likely.

Other use area controls include the following:

- Confinement of runoff to the reclaimed water use area unless otherwise authorized by the regulatory agency;
- Prohibition of reclaimed water spray, mist, or runoff in dwellings, designated outdoor eating areas, or food handling facilities;
- Protection of drinking water fountains against contact with reclaimed water;
- Signs (see Figure E-2) at sites using reclaimed water that are accessible to the public, although educational programs or other approaches to assure public notification may be acceptable to CDPH;
- Prohibition of hose bibbs on reclaimed water piping systems accessible to the public.

The reuse criteria require compliance with the CDPH cross-connection control regulations. They require that water systems serving residences through a dual water system that uses reclaimed water for landscape irrigation must, as a minimum, be protected by a double check valve assembly backflow preventer. The same requirement applies to a public water system in buildings using reclaimed water in a separate piping system within buildings for fire protection. A reduced pressure principle backflow prevention device is required as a minimum to protect the potable system at sites other than those mentioned above. An air gap separation is required where a public water system is used to supplement a reclaimed water supply.

Requirements pertaining to color-coding reclaimed water pipe are included in California's Health and Safety Code, which states, in part, that: "All pipes installed above or below ground, on and after June 1, 1993, that are designed to carry recycled water, shall be colored purple or distinctively wrapped with purple tape." The Health and Safety Code further states that purple pipe or tape is not required for pipes used for water delivered for agricultural use and at municipal or industrial facilities that have established a labeling or marking system for reclaimed water on their premises, as otherwise required by a local agency, that clearly distinguishes reclaimed water from potable water.

E-2.3 **Groundwater Recharge with Recycled Water**

FMWD anticipates that portions or all of the treated effluent from the proposed satellite plants might be used for groundwater recharge in either or both the Verdugo Basin and the Raymond Basin. The CDPH Drinking Water Program's thinking on the regulation of recharge of groundwater with recycled municipal wastewater was presented in draft regulations published in August 2008. These draft regulations outline the criteria under which a groundwater recharge program must operate including treatment, blending and retention time requirements. These criteria are also influenced by the method of groundwater recharge that is used. Figure E-3 depicts the two paths that may be used for recharge.

Regardless of which method is used for groundwater recharge, CDPH has draft regulations to address the control of pathogenic organisms. These regulations stipulate that the recharge water shall be disinfected tertiary recycled water as a minimum and that it shall be retained underground for a minimum of six months prior to extraction for use as a drinking water supply. The recharge program must demonstrate that the minimum retention time has been met by the use of a tracer study prior to the end of the third month of operation. Prior to that, one of the retention time calculations outlined in Table E-3 may be used to estimate retention time.

Table E-3 Methods to Determine Retention Time for Groundwater Recharge

Planning and Engineering Report Effort vs. Retention Time				
Method	**General Accuracy**	**General Level of Effort**	**Retention Time (months)**	**Safety Factor**
Formula (Darcy's)	Poor	Some information on aquifer	24	4
3-D Model	Fair	Lots of information on aquifer	12	2
Intrinsic Tracer	Better	Sampling of existing indicators	9	1.5
Added Tracer	Desired	Track added tracer	6	1.0

Source: California's Draft Criteria for Groundwater Recharge (as of 9/12/2008). Presentation to Water Reuse Inland Empire Chapter, July 14, 2009 by Heather Collins

The draft groundwater recharge criteria also indicate that the recycled water shall be of municipal wastewater origin, and that the agency shall have a pretreatment and pollutant source control program to maintain an inventory of compounds discharged into the collection system and to assess the fate of specified contaminants. The source control program shall also have an outreach program to help the users manage and minimize the discharge of contaminants to the collection system.

There are also proposed limits on the recycled water contribution as a percentage of the groundwater. These are calculated based on limiting the amount of total organic carbon (TOC). Table E-4 presents examples of how the contribution may be calculated. In addition, treatment processes are required for that portion of the recycled wastewater stream needing additional treatment to meet the TOC limit. This is typically done using reverse osmosis and advanced oxidation treatment equivalent to a 1.2 log N-nitrosodimethylamine (NDMA) reduction and a 0.5 log 1.4-dioxane reduction.

Table E-4 Recycled Water Contribution (RWC)

$\text{TOC max} = \dfrac{0.5\ \text{mg/L}}{RWC_{proposed}}$	
Examples:	
RWC = 10% or 0.10;	TOC < 5.0 mg/L
RWC = 20% or 0.10;	TOC < 2.5 mg/L
RWC = 35% or 0.10;	TOC < 1.43 mg/L
RWC = 50% or 0.10;	TOC < 1.0 mg/L
RWC = 75% or 0.10;	TOC < 0.67 mg/L

Note: TOC is calculated on a 20 week average

Another way to help meet the RWC limits is through blending of the recycled water with another source of water. The water used for blending may consist of raw surface water, groundwater or stormwater. A source water evaluation for the water used for blending shall include a description of the water, delineation of the origin and extent of the water, susceptibility to contamination, identification of known or potential contaminants and an inventory of the potential sources of water contamination. The source of the water used for blending shall be monitored quarterly for nitrate and nitrite and there shall be a CDPH approved water quality monitoring plan for the purpose of demonstrating that the water meets specified primary MCLs and notification levels.

Monitoring wells shall be installed as a part of the recharge program at a location where the recharge water has been retained in the saturated zone for one to three months, but will take at least three months before reaching the nearest domestic water supply well and at an additional point or points between the application facility and the nearest downgradient domestic water supply well.

The required Title 22 Engineering Report identifying how the project will address the aforementioned issues will be prepared concurrently with the CEQA documents and facility designs. The report will then be submitted to the SWRCB for review and final approval.

E-3. Wastewater Discharge Requirements and Anticipated Changes in Requirements.

This study evaluates several alternatives for new upstream skimming plants which will withdraw raw wastewater from the existing collection system only during times when the reuse opportunities exist. It is anticipated the membrane bioreactors will be the treatment technology with the residuals being returned to the collection system for treatment. No discharge requirements currently exist and no discharges are anticipated from the proposed facilities other than for beneficial use.

E-4. Water Quality-Related Requirements of the RWQCB (to protect surface or groundwater from problems resulting from recycled water use).

E-4.1 **Statewide General Permit for Landscape Irrigation Uses of Municipal Recycled Water**

The RWQCB adopted the *"Statewide General Permit for Landscape Irrigation Uses of Municipal Recycled Water (General Permit – Water Quality Order No. 2009-0006-DWQ")*. In July 2009, the State Water Resources Control Board (SWRCB) adopted *"General Waste Discharge Requirements for Landscape Irrigation Uses of Municipal Recycled Water (General Permit).* For those eligible, the General Permit allows the use of recycled water for landscape irrigation.[7] The General Permit facilitates the

[7] Individually owned residences are not eligible for coverage under the General Permit. The RWQCBs will address individually owned residences on a case-by-case basis.

streamlining of the permitting process to reduce the overall costs normally incurred by the producer, distributors, and users of recycled water.

“Landscape Irrigation” uses include the following:

- Parks, greenbelts, and playgrounds
- School yards
- Athletic fields
- Golf courses
- Cemeteries
- Residential landscaping, common areas [7]
- Commercial landscaping, except eating areas
- Industrial landscaping, except eating areas
- Freeway, highway, and street landscaping.

To apply for coverage under the general permit, a project administrator must file a Notice of Intent (the form is available on the SWRCB website), providing a complete Operation and Maintenance Plan, and submitting the appropriate fee to the SWRCB. The SWRCB adopted Resolution No. 2009-0059 “*Approval of Certification Pursuant to the California Environmental Quality Act of the Mitigated Negative Declaration Covering General Waste Discharge Requirements for Landscape Irrigation Uses of Municipal Recycled Water - Water Quality Order No. 2009-0006-DWQ,*” which satisfies the California Environmental Quality Act documentation for the those eligible under the General Permit. The General Permit is consistent with the “*Recycled Water Policy,*” State and Federal water quality laws, including the statewide water quality standards established by CDPH.

E-4.2 **Recycled Water Policy**

The Recycled Water Policy (adopted February 3, 2009) of the SWRCB provides direction to the RWQCBs, proponents of recycled water projects, and the public regarding the appropriate criteria to be used by the SWRCB and the RWQCBs in issuing permits for recycled water projects. The Recycled Water Policy describes permitting criteria that are intended to streamline the permitting of recycled water projects.

The SWRCB shares jurisdiction over the use of recycled water with the RWQCBs and CDPH. The RWQCBs are charged with protecting surface and groundwater resources and the issuance of permits that implement CDPH recommendations, the Recycled Water Policy, and applicable laws.

The Recycled Water Policy requires the development of regional or sub-regional salt and nutrient management plans, instead of addressing groundwater salt and nutrient control solely through individual recycled water projects. The salt and nutrient management plan for each basin/sub-basin is to be prepared by local water and wastewater entities, together with local salt/nutrient contributing stakeholders, who will fund locally-driven and controlled collaborative processes open to all stakeholders. The salt and nutrient management plans must be completed and proposed to the RWQCB within five years of the date of the Recycled Water Policy, unless extended by the RWQCB but in no case shall the period of completion exceed seven years. The salt and nutrient management plan must consider the inclusion of a significant stormwater use and recharge component because stormwater is typically lower in nutrients and salts, and can augment local water supplies. The following components must be included in each salt and nutrient management plan: (a) a basin/sub-basin wide monitoring plan, (b) a provision for annual monitoring of Emerging Constituents/Constituents of Emerging Concern (e.g., endocrine disrupters, personal care products or pharmaceuticals) (CECs), (c) water recycling and stormwater recharge/use goals and objectives, (d) salt and nutrient source identification, basin/sub-basin assimilative capacity and loading estimates, together with fate and transport of salts and nutrients, (e) implementation measures to manage salt and nutrient loading in the basin on a sustainable basis, and (f) an antidegradation analysis.

The Recycled Water Policy addresses landscape irrigation projects that use recycled water, including the control of incidental runoff of recycled water. Landscape irrigation projects must include recycled water monitoring for CECs on an annual basis and priority pollutants on a twice annual basis, in addition to any other appropriate recycled water monitoring requirements. However, monitoring for CECs will not take effect until 18 months after the effective date of the Recycled Water Policy, unless requested by CDPH. Landscape irrigation projects that qualify for streamlined permitting are not required to include a project-specific receiving water and groundwater monitoring component unless required under the adopted salt and nutrient management plan. In addition, landscape irrigation projects that qualify for streamlined permitting and which are located within basins with salt and nutrient management plans in place may not require further antidegradation analysis.

The Recycled Water Policy also addresses recycled water groundwater recharge projects that must be reviewed and permitted on a site-specific basis. Recycled water groundwater recharge projects must comply with CDPH requirements for groundwater recharge projects. Recycled water groundwater recharge projects are required to implement a monitoring program for constituents of concern, and a monitoring program for CECs that is consistent with any actions by the SWRCB to address CECs, as described in the Recycled Water Policy (further discussed below). The recycled water groundwater recharge projects must include monitoring of recycled water for CECs on an annual basis and priority pollutants on a twice annual basis.

According to the Recycled Water Policy, the state of knowledge regarding CECs is incomplete. The Recycled Water Policy calls for the formation of an advisory panel (to be actively managed by the SWRCB) to address CECs as they relate to the use of recycled water, with a report to the SWRCB and CDPH within one year of the appointment of the panel. The advisory panel was formed in May 2009 and issued its final report to the SWRCB in June 2010.

E-4.3 **Los Angeles Regional Water Quality Control Board Basin Plan**

The LARWQCB Basin Plan[8] specifies water quality objectives which are "the allowable limits or levels of water quality constituents or characteristics which are established for the reasonable protection of beneficial uses of water or the prevention of nuisance within a specific area." Narrative or numerical water quality objectives applicable to all inland surface waters are provided in the LARWQCB Basin Plan (see Appendix K). Water quality objectives applicable to groundwaters are also provided in the LARWQCB Basin Plan (see Appendix K).

E-4.4 **Verdugo Basin**

Water quality related requirements to protect surface water and groundwater from use of recycled water in the Verdugo Basin is controlled by regulatory guidelines for application of recycled water on landscaped areas and regulatory guidelines which govern the use of recycled water for groundwater recharge. A description of the *"Recycled Water Policy"* recently adopted by the RWQCB is outlined above in the section entitled "Recycled Water Policy;" this policy would be applicable to Verdugo Basin. The following paragraphs indicate the regulatory guidance for use of recycled water for surface application and groundwater recharge for areas in the Verdugo Basin.

As stated in the "*Recycled Water Policy,*" the SWRCB finds that the use of water for irrigation may, regardless of its source, collectively affect groundwater quality over time. Therefore, consideration of recycled water use in the Verdugo Basin must include addressing requirements for surface application of recycled water as well as requirements for a groundwater recharge and reuse project.

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[8] *Water Quality Control Plan, Los Angeles Region, Basin Plan for the Coastal Watersheds of Los Angeles and Ventura Counties*, California Regional Water Quality Control Board, Los Angeles Region (4), Adopted June 13, 1994.

Water Quality objectives for the Verdugo Groundwater Basin are also specified by the LARWQCB Basin Plan. "Table 3-10. Water Quality Objectives for Selected Constituents in Regional Ground Waters" of the LARWQCB Basin Plan, lists water quality objectives applicable to regional groundwaters; water quality objectives for the Verdugo Basin are listed on page 3-20. Table E-5 below shows the water quality objectives for the Verdugo Basin as outlined in LARWQCB Basin Plan (see Appendix K).

Table E-5 Water Quality Objectives for Selected Constituents in Verdugo Basin

Verdugo Basin	TDS (mg/l)	Sulfate (mg/l)	Chloride (mg/l)	Boron (mg/l)
Verdugo Basin	600	150	100	0.5

E-4.5 **Raymond Basin**

Table E-6 shows the water quality objectives for selected constituents in inland surface waters of the Los Angeles River Watershed: above Figueroa Street, Rio Hondo above Santa Ana Freeway, Eaton Canyon Creek above Eaton Dam, and Arroyo Seco (above the spreading grounds). Table E-7 shows the water quality objectives for selected constituents in regional groundwaters for the Monk Hill sub-basin and Pasadena Area of the Raymond Basin.

Table E-6 Water Quality Objectives for Selected Constituents in Los Angeles River Watershed

Los Angeles River Watershed	TDS (mg/l)	Sulfate (mg/l)	Chloride (mg/l)
Above Figueroa Street	950	300	150
Rio Hondo above Santa Ana Freeway	750	300	150
Eaton Canyon Creek above Eaton Dam	250	30	10
Arroyo Seco (above spreading grounds)	300	40	15

Source: Table 3-8 of LARWQCB Basin Plan

Table E-7 Water Quality Objectives for Selected Constituents in Raymond Basin

Raymond Basin	TDS (mg/l)	Sulfate (mg/l)	Chloride (mg/l)	Boron (mg/l)
Monk Hill Sub-Basin	450	100	100	0.5
Pasadena Area	450	100	100	0.5

Source: Table 3-11 of LARWQCB Basin Plan

The Raymond Basin Management Board has developed a "Draft Criteria for Delivery of Supplemental Water."[9] The report established criteria to evaluate proposals for Supplemental Water recharge through which the Raymond Basin Management Board can manage both water supply and water quality, and advise regulatory agencies of those actions. The report provides a review of the three agencies responsible for setting guidelines and regulations associated with replenishing the groundwater in the Raymond Basin, i.e., Raymond Basin Management Board, RWQCB, and CDPH. The report summarized the CDPH Recycled Water Standards and RWQCB Basin Plan Objectives (see Appendix L).

[9] *Draft Criteria for Delivery of Supplemental Water*, Raymond Basin Management Board, March 2006. Prepared by Stetson Engineers Inc.

F. RECYCLED WATER MARKET

F-1. Description of Market Assessment Procedures

The list of types of use for which recycled water is approved within California is continuing to grow as the value of wastewater recycling as a reliable water resource is being more widely recognized. The CDPH which is responsible for Title 22 of the California Administrative Code and which establishes wastewater recycling criteria is nearing the end of a multi-year process to update the regulations. Many agencies throughout the State of California have been looking for new areas to put recycled water to beneficial use rather than waste it. Historically, both the regulatory agencies and the agencies operating recycled water systems have addressed controlled irrigation use as the primary use for recycled water. More recently, both have recognized the safety and benefit of industrial uses such as process water and cooling tower makeup water, commercial uses such as flushing of toilets in commercial buildings, and widened irrigation uses such as for raw edible food crops and landscape irrigation under individual homeowner control. A number of MWD member agencies or sub-agencies have successfully implemented these types of uses in the recent past with the approval of the State and local regulatory agencies.

In a previous study to assess the potential recycled water users within FMWD (Preliminary Water Reclamation Assessment, MORRIS Water Resources Consultants, May, 1996), each of the retail member agencies was asked to provide information and usage records for irrigation or other large volume water users within their respective service areas. The information obtained was compared with that available from the previous studies prepared for the Cities of Glendale and Pasadena. As would be expected, the bulk of the identified users fall into landscape irrigation such as medians, freeway landscape, schools, cemeteries and parks. A number of churches were identified as large water users but it is doubtful that significant landscape exists on their properties so they were culled from the lists.

The information obtained from the FMWD member agencies with regard to potential recycled water users is summarized in Table F-1. The locations of these users are depicted on Figure F-1. The total identified potential demand within FMWD which could be converted to recycled water was slightly more than 900 AFY at that time.

ID	Na
LACSD	
23	La Canada
Las Flores Wate	
24	Farnsworth
Lincoln Avenue	
25	Camp Gro
26	Charles W
27	Children's
27	Children's
27	Children's
28	Elementary
29	Elementary
30	Elementary
31	Five Acres
32	Frank D
33	J. K. Basso
34	Jirayr Zorth
35	L. A. Count
36	L. A. Count
37	Loma Alta
37	Loma Alta
37	Loma Alta
37	Loma Alta
38	Mountain V
39	Nazario's N
40	Optimist Bo
41	Richard Bo

ID	N…
42	The Sycam…
Mesa Crest W…	
43	Crescenta…
44	La Canada…
45	SCE Tract…
46	Stanfield…
47	Stanfield N…
48	VORPOA…
Rubio Canon…	
49	Eliot Middle…
50	Scripps Ho…
Valley Water C…	
51	Cal Trans…
52	Cal Trans…
53	Cal Trans…
54	Cal Trans…
55	Cal Trans…
56	Cal Trans…
57	Cal Trans…
58	Cal Trans…
59	City of La…
60	City of La…
61	City of La…
62	City of La…
63	City of La…

ID	N
64	City of La
65	City of La
66	Descanso G
66	Descanso G
67	Flintridge
68	Flintridge
69	La Canada
69	La Canada
70	La Canada
71	St. Francis

Notes:
* Estimated base
* 4-9T AF of Ra
Multiple entries

The listing of a user does not necessarily mean that it would be economical to serve them or that they would have any interest, but only that a potential exists. Any refinement of that status would require further study and evaluation. As would be expected, the pattern of use exhibits a significant seasonality with the peak month representing 187 percent of the average. This is not atypical of most recycled water systems and must be accommodated for in the design of any distribution system as would the fact that most irrigation occurs in the evening or nighttime hours. With the vast majority of the potential users being for landscape irrigation, it is expected that the peak day will approximate twice the peak month rate and the peak hour may be an additional 2.5 times which would result in planning numbers of 3.7 times average for the peak day and 9.0 times average for the peak hour flows.

Due to the relatively small amount of raw wastewater available within the local collection system, it is expected that the users will be limited to those in relatively close proximity to the potential sites for the satellite plants. For these reasons, the listing of the specific users for the expected alternatives will be included in Section G along with the alternative descriptions and economic evaluations. In addition, additional uses will be investigated, particularly those that can expand the use beyond the seasonality of landscape irrigation. Both cooling tower makeup and groundwater recharge opportunities will be looked into and incorporated into the alternatives as appropriate.

G. PROJECT ALTERNATIVE ANALYSIS

G-1. Planning and Design Assumptions:

G-1.1 **Delivery and System Pressure Criteria**

The distribution systems are designed to provide a minimum pressure of 60 pounds per square inch (psi) for direct user connections. Spreading or injection connections are designed for a nominal 10 psi at the delivery point. The pipelines are sized to maintain a unit headloss below 6 feet per 1,000 feet.

G-1.2 **Peak Delivery Criteria**

The system alternatives are designed to meet the peak monthly flows from the treatment plant with augmentation from system reservoirs to cover the increases necessary for peak day and diurnal variations.

G-1.3 **Storage Criteria**

System storage is sized for one maximum day with the reservoir pad set at 130 feet above the elevation of the highest direct user. Access to potable water supplies will be made available to augment recycled water supplies, if needed, during peak demand months. For system alternatives which only deliver for spreading or injection, no system storage is anticipated.

G-1.4 **Cost Basis: Cost Index, Discount Rate, Useful Lives, Etc.**

All costs are calculated in 2011 dollars with a discount rate of 6 percent used for economic analyses. An inflation rate of 3 percent per year is used for future costs. The useful lives for mechanical and electrical equipment are assumed at 20 years, structures at 30 years, pipelines at 50 years, reservoirs and recharge facilities at 75 years and civil works at 100 years. The criteria used for the development of construction costs are presented in Table G-1 and those used for the development of operation and maintenance costs are in Table G-2.

Table G-1	**Facility Costing Criteria**				
PIPELINES:					
	Diameter		Cost/Foot		
	4"		$45		
	6"		$60		
	8"		$75		
	10"		$90		
	12"		$105		
RESERVOIRS:					
	$0.75	per gallon of capacity			
PUMP STATIONS:					
	$3,000	per Horsepower of pumping capacity			
INFILTRATION GALLERIES:					
	$20,000	per acre			
LYSIMETERS:					
	$6,000	each			
MONITORING WELLS:					
	$250,000	each			
CONTINGENCY FACTOR:	30%				

Table G-2 Operation and Maintenance Costing Criteria

OPERATIONS:		
Pipelines:	0.5	days / month / 10,000 feet
Pump Stations:	2	days / month
Reservoirs:	0.5	days / month
Treatment:	0.5	days / week / 100,000 gal
MAINTENANCE		
Labor:		
Pipelines:	0.5	days / month / 10,000 feet
Pump Stations:	2	hours / month / 50 Hp
Treatment:	0.5	days / week / 100,000 gal
Reservoirs:	0.5	day / month
Spreading Basins:	1	day / month / acre
Parts:		
Pump Stations:	1.0%	of construction costs / year
Treatment:	1.0%	of construction costs / year
Materials:		
Pump Stations:	1.0%	of construction costs / year
Treatment:	1.0%	of construction costs / year
Reservoirs:	0.5%	of construction costs / year
UNIT RATES		
Labor:	$45	/hour
Power 2010 Ave.	$0.13	/kWh

G-1.5 **Rights-of-Way**

It is anticipated that most of the facilities that would be constructed would be in public Rights-of-Way (ROW). Much of this would be within local street ROW and some may be within Caltrans ROW for which an inter-agency agreement would be required. On some cases, new ROW may be required for the treatment facilities which may be handled through a lease or through purchase. An allowance for the costs of ROW is included within the economic analysis for each of the project alternatives.

G-1.6 **Planning Period**

The planning period for each of the alternative projects is based on the initial 20 years of operations. Assuming that the initial deliveries were made in 2014, thus the planning period would be through 2033.

G-2. Water Recycling Alternatives to be Evaluated

FMWD is considering up to 3 small scale satellite plants within different parts of its service area. Each plant could serve recycled water customers in relatively close proximity and/or deliver water for groundwater recharge. Direct reuse includes application of recycled water for landscape irrigation, cooling tower makeup water and carwash makeup water. For groundwater recharge, both direct spreading and the use of shallow infiltration galleries are possibilities.

G-2.1 **Treatment Alternatives**

Membrane bioreactors are planned as the primary treatment processes followed by ultraviolet (UV) disinfection. Additional treatment with reverse osmosis is not anticipated as groundwater recharge using injection wells is not being considered.

Alternatives also analyzed importing recycled water from areas outside of FMWD's service area for use. These are also more fully described below.

G-2.2 **Alternatives By Geography**

Alternatives have been developed for three different locations within FMWD, the Arroyo Seco area above Devil's Gate Dam (the A series of alternatives), in the Verdugo Basin area on the West side of the District (the V Series of alternatives) and on the east side in the vicinity of the Eaton Wash Spreading Grounds (the E series of alternatives). The

Arroyo Seco location has 8 alternatives that were studied, the Verdugo Basin location has 6 alternatives that were studied and the Eaton Wash location has 3 alternatives that were studied.

The section below groups the alternatives by geographic location. It then provides for each alternative a table which summarizes the potential market for the recycled water, a table which lists the elements needed for construction of the alternative including pipeline length and diameter and booster sizing, the alternative's costs and a figure depicting the distribution system. Once the alternatives were developed and the users identified, the potential demands were updated from those presented in Table F-1 by adjusting for current water use based on meter records. All of the alternatives include conversions of existing uses that already have dedicated meters separate from the potable uses at the site or are for a new groundwater system. Any retrofit costs are expected to be nominal and will be covered by FMWD as a part of their project costs. FMWD plans on owning and anticipates contracting with a provider of wastewater/water operations services to operate and maintain any facilities that would be constructed as a result of this program.

Arroyo Seco Alternative

Alternative A-1 includes a 0.25 MGD satellite plant on Oak Grove Drive south of La Cañada High School which will serve landscape irrigation customers in the area. The wastewater will be extracted from the LACSD Joint Outfall B – Unit 6 in Oak Grove Drive at Berkshire with the residuals returned to the same sewer downstream of the extraction location. The potential users and their demands are presented in Table G-3 and the distribution system is depicted in Figure G-1. Figure G-2 the treatment plant layout. Table G-4 lists the elements included within Alternative A-1 and their estimated costs. System storage will be accommodated by using two storage tanks on the JPL property that are no longer needed for potable water purposes.

Table G-3 **Alternative A-1 and A-7 Users**

User No.	Customer	Type	Demand (Acre-Feet)												
			Jan.	**Feb.**	**Mar.**	**Apr.**	**May**	**June**	**July**	**Aug.**	**Sep.**	**Oct.**	**Nov.**	**Dec.**	**Total**
52	Caltrans	Irrigation	0.40	0.46	0.32	0.48	0.42	0.46	0.36	0.28	0.48	0.24	0.33	0.54	4.77
54	Caltrans	Irrigation	0.56	0.66	0.49	0.71	0.64	0.72	0.59	0.61	0.78	0.39	0.49	1.23	7.87
57	Caltrans	Irrigation	0.10	0.05	0.00	0.06	0.13	0.11	0.15	0.08	0.12	0.05	0.07	0.13	1.06
60	La Canada Flintridge	Irrigation	0.00	0.00	0.00	0.00	0.02	0.03	0.03	0.03	0.03	0.01	0.01	0.00	0.16
61	La Canada Flintridge	Irrigation	0.00	0.00	0.00	0.01	0.03	0.04	0.04	0.04	0.04	0.02	0.01	0.01	0.24
67	Flintridge Prep	Irrigation	0.07	0.02	0.04	0.18	0.31	0.48	1.95	1.03	0.61	0.12	0.18	0.10	5.08
69	La Canada High School	Irrigation	0.68	0.74	1.03	1.43	1.98	3.30	3.48	5.70	2.65	3.10	0.00	1.22	25.31
71	St. Francis High School	Irrigation	0.16	0.08	0.14	0.21	0.32	0.33	0.36	0.46	0.31	0.34	0.27	0.18	3.18
Totals			**1.96**	**2.02**	**2.04**	**3.08**	**3.83**	**5.47**	**6.96**	**8.23**	**5.02**	**4.26**	**1.37**	**3.41**	**47.67**

Table G-4		Alternative A-1 Elements			
Item	**Size**	**Quantity**	**Units**	**Unit Cost**	**Cost**
Site Work		1	L.S.	$ 75,000	$ 75,000
Satellite Facility	0.25	1	L.S.	$ 150,000	$ 150,000
Structure		1	L.S.	$ 200,000	$ 200,000
MBR	0.25	1	MGD	$ 1,324,200	$ 1,324,200
UV Disinfection	0.25	1	MGD	$ 150,000	$ 150,000
Booster	50	1	Hp	$ 3,000	$ 150,000
PVC Pipe	4"	3,000	Feet	$ 45.00	$ 135,000
PVC Pipe	6"	7,800	Feet	$ 60.00	$ 468,000
Reservoir		Existing			$ -
Total					$ 2,652,200

Alternative A-2 is similar to Alternative A-1 but adds a groundwater recharge element with spreading basins along the west side of the Arroyo Seco near Hahamongna Watershed Park. The users are listed in Table G-5 and the distribution system is shown on Figure G-3. The system elements and their estimated costs are presented in Table G-6. The treatment facility will be the same as for Alternative A-1.

Table G-5 **Alternative A-2 and A-8 Users**

User No.	Customer	Type	Demand (Acre-Feet)												
			Jan.	**Feb.**	**Mar.**	**Apr.**	**May**	**June**	**July**	**Aug.**	**Sep.**	**Oct.**	**Nov.**	**Dec.**	**Total**
52	Caltrans	Irrigation	0.40	0.46	0.32	0.48	0.42	0.46	0.36	0.28	0.48	0.24	0.33	0.54	4.77
54	Caltrans	Irrigation	0.56	0.66	0.49	0.71	0.64	0.72	0.59	0.61	0.78	0.39	0.49	1.23	7.87
57	Caltrans	Irrigation	0.10	0.05	0.00	0.06	0.13	0.11	0.15	0.08	0.12	0.05	0.07	0.13	1.06
60	La Canada Flintridge	Irrigation	0.00	0.00	0.00	0.00	0.02	0.03	0.03	0.03	0.03	0.01	0.01	0.00	0.16
61	La Canada Flintridge	Irrigation	0.00	0.00	0.00	0.01	0.03	0.04	0.04	0.04	0.04	0.02	0.01	0.01	0.24
67	Flintridge Prep	Irrigation	0.07	0.02	0.04	0.18	0.31	0.48	1.95	1.03	0.61	0.12	0.18	0.10	5.08
69	La Canada High School	Irrigation	0.68	0.74	1.03	1.43	1.98	3.30	3.48	5.70	2.65	3.10	0.00	1.22	25.31
71	St. Francis High School	Irrigation	0.16	0.08	0.14	0.21	0.32	0.33	0.36	0.46	0.31	0.34	0.27	0.18	3.18
	FMWD Spreading	Recharge	21.82	19.45	21.74	19.93	19.95	17.55	16.82	15.55	17.99	19.52	21.64	20.37	232.33
Totals			**23.78**	**21.48**	**23.78**	**23.01**	**23.78**	**23.01**	**23.78**	**23.78**	**23.01**	**23.78**	**23.01**	**23.78**	**280.00**

Table G-6 **Alternative A-2 Elements**

Item	Size	Quantity	Units	Unit Cost	Cost
Site Work		1	L.S.	$ 75,000	$ 75,000
Satellite Facility	0.25	1	L.S.	$ 150,000	$ 150,000
Structure		1	L.S.	$ 200,000	$ 200,000
MBR	0.25	1	MGD	$ 1,324,200	$ 1,324,200
UV Disinfection	0.25	1	MGD	$ 150,000	$ 150,000
Booster	50	1	Hp	$ 3,000	$ 150,000
PVC Pipe	4"	3,000	Feet	$ 45.00	$ 135,000
PVC Pipe	6"	8,300	Feet	$ 60.00	$ 498,000
Reservoir		Existing			$ -
Basins		1.5	Acres	$ 100,000	$ 100,000
Lysimeters		5	Each	$ 6,000	$ 30,000
Monitoring Well	Existing				$ -
Total					$ 2,812,200

Alternative A-3 is again based on Alternative A-1 but with the addition of supplying cooling tower makeup water to JPL. Table G-7 lists the users while Figure G-4 depicts the system and Table G-8 lists the elements and their estimated costs. Again, the treatment facility is the same as with Alternative A-1.

Table G-7 **Alternative A-3 Users**

User No.	Customer	Type	Demand (Acre-Feet)												
			Jan.	**Feb.**	**Mar.**	**Apr.**	**May**	**June**	**July**	**Aug.**	**Sep.**	**Oct.**	**Nov.**	**Dec.**	**Total**
52	Caltrans	Irrigation	0.40	0.46	0.32	0.48	0.42	0.46	0.36	0.28	0.48	0.24	0.33	0.54	4.77
54	Caltrans	Irrigation	0.56	0.66	0.49	0.71	0.64	0.72	0.59	0.61	0.78	0.39	0.49	1.23	7.87
57	Caltrans	Irrigation	0.10	0.05	0.00	0.06	0.13	0.11	0.15	0.08	0.12	0.05	0.07	0.13	1.06
60	La Canada Flintridge	Irrigation	0.00	0.00	0.00	0.00	0.02	0.03	0.03	0.03	0.03	0.01	0.01	0.00	0.16
61	La Canada Flintridge	Irrigation	0.00	0.00	0.00	0.01	0.03	0.04	0.04	0.04	0.04	0.02	0.01	0.01	0.24
67	Flintridge Prep	Irrigation	0.07	0.02	0.04	0.18	0.31	0.48	1.95	1.03	0.61	0.12	0.18	0.10	5.08
69	La Canada High School	Irrigation	0.68	0.74	1.03	1.43	1.98	3.30	3.48	5.70	2.65	3.10	0.00	1.22	25.31
71	St. Francis High School	Irrigation	0.16	0.08	0.14	0.21	0.32	0.33	0.36	0.46	0.31	0.34	0.27	0.18	3.18
	Jet Propulsion Lab	Cooling	6.07	5.87	5.73	5.89	8.32	10.03	10.94	13.56	13.98	13.70	10.22	8.26	112.58
Totals			**8.04**	**7.90**	**7.77**	**8.97**	**12.16**	**15.50**	**17.90**	**21.79**	**19.00**	**17.97**	**11.59**	**11.67**	**160.25**

Table G-8 **Alternative A-3 Elements**

Item	Size	Quantity	Units	Unit Cost	Cost
Site Work		1	L.S.	$ 75,000	$ 75,000
Satellite Facility	0.25	1	L.S.	$ 150,000	$ 150,000
Structure		1	L.S.	$ 200,000	$ 200,000
MBR	0.25	1	MGD	$ 1,324,200	$ 1,324,200
Booster	50	1	Hp	$ 150,000	$ 150,000
Booster	50	1	Hp	$3,000	$ 150,000
PVC Pipe	4"	3,000	Feet	$ 45.00	$ 135,000
PVC Pipe	6"	7,800	Feet	$ 60.00	$ 468,000
Reservoir		Existing			$ -
Total					$ 2,652,200

Alternative A-4 is a combination of A-2 and A-3 with both spreading and cooling water makeup being added to the base Alternative A-1. Table G-9 presents the users and demands, Figure G-5 the system layout and Table G-10 the system elements and estimated costs. The treatment system is the same as with Alternative A-1.

Table G-9 **Alternative A-4 Users**

User No.	Customer	Type	Demand (Acre-Feet)												
			Jan.	**Feb.**	**Mar.**	**Apr.**	**May**	**June**	**July**	**Aug.**	**Sep.**	**Oct.**	**Nov.**	**Dec.**	**Total**
52	Caltrans	Irrigation	0.40	0.46	0.32	0.48	0.42	0.46	0.36	0.28	0.48	0.24	0.33	0.54	4.77
54	Caltrans	Irrigation	0.56	0.66	0.49	0.71	0.64	0.72	0.59	0.61	0.78	0.39	0.49	1.23	7.87
57	Caltrans	Irrigation	0.10	0.05	0.00	0.06	0.13	0.11	0.15	0.08	0.12	0.05	0.07	0.13	1.06
60	La Canada Flintridge	Irrigation	0.00	0.00	0.00	0.00	0.02	0.03	0.03	0.03	0.03	0.01	0.01	0.00	0.16
61	La Canada Flintridge	Irrigation	0.00	0.00	0.00	0.01	0.03	0.04	0.04	0.04	0.04	0.02	0.01	0.01	0.24
67	Flintridge Prep	Irrigation	0.07	0.02	0.04	0.18	0.31	0.48	1.95	1.03	0.61	0.12	0.18	0.10	5.08
69	La Canada High School	Irrigation	0.68	0.74	1.03	1.43	1.98	3.30	3.48	5.70	2.65	3.10	0.00	1.22	25.31
71	St. Francis High School	Irrigation	0.16	0.08	0.14	0.21	0.32	0.33	0.36	0.46	0.31	0.34	0.27	0.18	3.18
	Jet Propulsion Lab	Cooling	6.07	5.87	5.73	5.89	8.32	10.03	10.94	13.56	13.98	13.70	10.22	8.26	112.58
	FMWD Spreading	Recharge	15.74	13.58	16.01	14.05	11.62	7.52	5.88	1.99	4.01	5.82	11.42	12.11	119.75
Totals			**23.78**	**21.48**	**23.78**	**23.01**	**23.78**	**23.01**	**23.78**	**23.78**	**23.01**	**23.78**	**23.01**	**23.78**	**280.00**

Table G-10 **Alternative A-4 Elements**

Item	Size	Quantity	Units	Unit Cost	Cost
Site Work		1	L.S.	$ 50,000	$ 50,000
Satellite Facility	0.25	1	L.S.	$ 150,000	$ 150,000
Structure		1	L.S.	$ 100,000	$ 100,000
MBR	0.25	1	MGD	$ 1,324,200	$ 1,324,200
UV Disinfection	0.25	1	MGD	$ 100,000	$ 100,000
Booster	50	1	Hp	$ 3,000	$ 150,000
PVC Pipe	4"	3,000	Feet	$ 45.00	$ 135,000
PVC Pipe	6"	8,300	Feet	$ 60.00	$ 498,000
Reservoir		Existing			$ -
Basins		1.5	Acres	$ 100,000	$ 100,000
Lysimeters		5	Each	$ 6,000	$ 30,000
Monitoring Well	Existing				$ -
Total					$ 2,637,200

Similar to Alternative A-2 is Alternative A-5 but with the difference being that the groundwater recharge will be achieved by the use of shallow infiltration galleries. FMWD has approached Pasadena Unified School District (PUSD) with a plan to construct the infiltration galleries beneath the athletic fields north of John Muir High School. PUSD staff was receptive to negotiating terms for an agreement as long as construction and operation does not interfere with use of the field. The construction timeline of the MBR Plant will accommodate this request. The system users are listed in Table G-11, the layout on Figure G-6, the elements and cost estimates in Table G-12 and the treatment layout are the same as for A-1.

Table G-11 **Alternative A-5 Users**

User No.	Customer	Type	Demand (Acre-Feet)												
			Jan.	**Feb.**	**Mar.**	**Apr.**	**May**	**June**	**July**	**Aug.**	**Sep.**	**Oct.**	**Nov.**	**Dec.**	**Total**
52	Caltrans	Irrigation	0.40	0.46	0.32	0.48	0.42	0.46	0.36	0.28	0.48	0.24	0.33	0.54	4.77
54	Caltrans	Irrigation	0.56	0.66	0.49	0.71	0.64	0.72	0.59	0.61	0.78	0.39	0.49	1.23	7.87
57	Caltrans	Irrigation	0.10	0.05	0.00	0.06	0.13	0.11	0.15	0.08	0.12	0.05	0.07	0.13	1.06
60	La Canada Flintridge	Irrigation	0.00	0.00	0.00	0.00	0.02	0.03	0.03	0.03	0.03	0.01	0.01	0.00	0.16
61	La Canada Flintridge	Irrigation	0.00	0.00	0.00	0.01	0.03	0.04	0.04	0.04	0.04	0.02	0.01	0.01	0.24
67	Flintridge Prep	Irrigation	0.07	0.02	0.04	0.18	0.31	0.48	1.95	1.03	0.61	0.12	0.18	0.10	5.08
69	La Canada High School	Irrigation	0.68	0.74	1.03	1.43	1.98	3.30	3.48	5.70	2.65	3.10	0.00	1.22	25.31
71	St. Francis High School	Irrigation	0.16	0.08	0.14	0.21	0.32	0.33	0.36	0.46	0.31	0.34	0.27	0.18	3.18
	Infiltration Galleries	Recharge	21.82	19.45	21.74	19.93	19.95	17.55	16.82	15.55	17.99	19.52	21.64	20.37	232.33
Totals			23.78	21.48	23.78	23.01	23.78	23.01	23.78	23.78	23.01	23.78	23.01	23.78	280.00

Table G-12 **Alternative A-5 Elements**

Item	Size	Quantity	Units	Unit Cost	Cost
Site Work		1	L.S.	$ 75,000	$ 75,000
Satellite Facility	0.25	1	L.S.	$ 150,000	$ 150,000
Structure		1	L.S.	$ 200,000	$ 200,000
MBR	0.25	1	MGD	$ 1,324,200	$ 1,324,200
UV Disinfection	0.25	1	MGD	$ 200,000	$ 200,000
Booster	50	1	Hp	$ 3,000	$ 150,000
PVC Pipe	4"	7,300	Feet	$ 45.00	$ 328,500
PVC Pipe	6"	9,100	Feet	$ 60.00	$ 546,000
Reservoir		Existing			$ -
Infiltration Galleries		3	Acres	$ 20,000	$ 60,000
Lysimeters		5	each	$ 6,000	$ 30,000
Monitoring Well	Existing				$ -
Total					$ 3,063,700

Alternative A-6 is based on only the recharge component of Alternative A-5. The users, system schematic and elements are presented in Table G-13, Figure G-7 and Table G-14 respectively. There is no change to the basic treatment layout.

Table G-13 **Alternative A-6 Users**

User No.	Customer	Type	Demand (Acre-Feet)												
			Jan.	**Feb.**	**Mar.**	**Apr.**	**May**	**June**	**July**	**Aug.**	**Sep.**	**Oct.**	**Nov.**	**Dec.**	**Total**
	Infiltration Galleries	Recharge	24	21	24	23	24	23	24	24	23	24	23	24	280
Totals			24	21	24	23	24	23	24	24	23	24	23	24	280

Table G-14		Alternative A-6 Elements			
Item	**Size**	**Quantity**	**Units**	**Unit Cost**	**Cost**
Site Work		1	L.S.	$ 75,000	$ 75,000
Satellite Facility	0.25	1	L.S.	$ 150,000	$ 150,000
Structure		1	L.S.	$ 200,000	$ 200,000
MBR	0.25	1	MGD	$ 1,324,200	$ 1,324,200
UV Disinfection	0.25	1	MGD	$ 150,000	$ 150,000
Booster	5	1	Hp	$ 3,000	$ 15,000
PVC Pipe	4"	4,300	Feet	$ 45.00	$ 193,500
Infiltration Galleries		3	Acres	$ 20,000	$ 60,000
Lysimeters		5	Each	$ 6,000	$ 30,000
Monitoring Well	Existing				$ -
Total					$ 2,197,700

The City of Pasadena is also investigating the feasibility of developing a recycled water system using their contractual entitlement to a portion of the City of Glendale's supply from the LAGWRP. The final two A series alternatives are based on using recycled water from Pasadena rather than building a new satellite plant. Alternative A-7 is the same as A-1 except for the source of supply. The users were previously listed on Table G-3, the system schematic is presented in Figure G-8 and the elements and estimated costs are in Table G-15. There is no new treatment facility. The recycled water would be purchased from the City of Pasadena at a cost of $1,500 per AF which will increase over time.

Table G-15		Alternative A-7 Elements			
Item	**Size**	**Quantity**	**Units**	**Unit Cost**	**Cost**
PVC Pipe	4"	3,000	Feet	$ 45.00	$ 135,000
Total					**$ 135,000**

Alternative A-8, the last of the A series alternatives, is the same as A-2 but with supply from Pasadena. The users were presented previously in Table G-5, the schematic is depicted in Figure G-9 and the elements and costs in Table G-16. Again there is no new treatment facility rather the water is purchased from the City of Pasadena at a cost of $1,500 per AF which will increase over time.

Table G-16 Alternative A-8 Elements

Item	Size	Quantity	Units	Unit Cost	Cost
PVC Pipe	4"	3,000	Feet	$ 45.00	$ 135,000
PVC Pipe	6"	500	Feet	$ 60.00	$ 30,000
Basins		1.5	Acres	$ 100,000	$ 100,000
Lysimeters		5	Each	$ 6,000	$ 30,000
Monitoring Well	Existing				$ -
Total					$ 295,000

Verdugo Basin Alternative

The first two Verdugo Basin alternatives consist of serving landscape users only. Alternative V-1 includes the development of a 0.25 MGD local satellite plant on the south side of the Foothill Freeway (I-210) just east of Briggs Avenue. The wastewater will be extracted from the CVWD sewer in Briggs Avenue at the I-210 Freeway with the return of the residuals at a location downstream of the extraction. Alternative V-2 envisions serving the same users but with the supply coming from the City of Glendale at a rate of $530 per AF which will increase over time. The users for both of these alternatives are listed in Table G-17. Figure G-10 presents the schematic for Alternative V-1, Figure G-11 the treatment plant layout and Figure G-12 the Alternative V-2 schematic with no treatment facility. Tables G-18 and G-19 present the elements and estimated costs for Alternative V-1 and V-2 respectively.

In addition, there are four other alternatives that include groundwater recharge that have also been evaluated. Alternative V-3 includes a 0.5 MGD MBR at the same location as Alternative V-1 and groundwater recharge through shallow infiltration galleries near the western edge of the Raymond Basin. The schematic is presented in Figure G-13 and the elements and costs in Table G-20. Alternative V-4 is the same as V-3 except it uses the City of Glendale as the source of supply for the recycled water. Alternative V-4 is depicted in Figure G-14 and the elements and costs in Table G-21. Alternatives V-5 and V-6 are modifications to Alternatives V-3 and V-4 respectively with the local users identified for Alternative V-1 being added to the infiltration galleries as users as is shown on Table G-22. Alternative V-5 is depicted in Figure G-15. Alternative V-6 is depicted in Figure G-16. Tables G-23 and G-24 present the elements of Alternative V-5 and Alternative V-6 respectively.

Table G-17 **Alternative V-1 and V-2 Users**

User No.	Customer	Type	Demand (Acre-Feet)												
			Jan.	**Feb.**	**Mar.**	**Apr.**	**May**	**June**	**July**	**Aug.**	**Sep.**	**Oct.**	**Nov.**	**Dec.**	**Total**
1	Caltrans	Irrigation	1.10	0.20	0.20	0.56	0.56	1.04	1.04	1.02	1.02	0.94	0.94	1.10	9.72
2	Caltrans	Irrigation	2.16	0.48	0.48	1.20	1.20	1.84	1.84	1.30	1.30	1.28	1.28	2.16	16.54
3	Caltrans	Irrigation	1.10	0.20	0.20	0.56	0.56	1.04	1.04	1.02	1.02	0.94	0.94	1.10	9.72
4	Caltrans	Irrigation	1.99	0.00	0.00	0.77	0.77	1.95	1.95	2.89	2.89	2.67	2.67	1.99	20.56
7	Crescenta Valley High School	Irrigation	0.01	0.00	0.00	0.02	0.02	0.10	0.10	0.04	0.04	0.02	0.02	0.01	0.38
8	Glenhaven Park	Irrigation	0.30	0.18	0.18	0.39	0.39	0.46	0.46	0.44	0.44	0.43	0.43	0.30	4.39
11	L.A. County Sheriffs Office	Irrigation	0.44	0.76	0.76	1.16	1.16	0.50	0.50	0.50	0.50	0.97	0.97	0.44	8.65
14	Caltrans	Irrigation	0.44	0.76	0.76	1.16	1.16	0.50	0.50	0.50	0.50	0.97	0.97	0.44	8.65
15	Caltrans	Irrigation	0.00	0.35	0.35	1.22	1.22	0.51	0.51	0.63	0.63	0.85	0.85	0.00	7.12
16	Car Wash	Car Wash	0.51	0.51	0.78	0.79	0.82	0.82	0.87	0.87	0.98	0.98	0.39	0.39	8.71
21	Briggs Plaza	Irrigation	0.16	0.16	0.19	0.19	0.23	0.23	0.28	0.28	0.31	0.31	0.12	0.12	2.58
Totals			**8.22**	**3.59**	**3.89**	**7.99**	**8.06**	**8.99**	**9.09**	**9.50**	**9.64**	**10.37**	**9.59**	**8.06**	**97.00**

Table G-18 **Alternative V-1 Elements**

Item	Size	Quantity	Units	Unit Cost	Cost
Site Work		1	L.S.	$ 75,000	$ 75,000
Satellite Facility	0.25	1	L.S.	$ 150,000	$ 150,000
Structure		1	L.S.	$ 200,000	$ 200,000
MBR	0.25	1	MGD	$ 1,324,200	$ 1,324,200
Booster	40	1	Hp	$ 150,000	$ 150,000
Booster	40	1	Hp	$ 3,000	$ 120,000
PVC Pipe	4"	15,000	Feet	$ 45.00	$ 801,000
Reservoir	250,000	1	Gallons	$ 0.75	$ 187,500
Total					$ 2,582,700

Table G-19 **Alternative V-2 Elements**

Item	Size	Quantity	Units	Unit Cost	Cost
Booster	50	1	Hp	$ 3,000	$ 150,000
PVC Pipe	4"	22,600	Feet	$ 45.00	$ 1,017,000
Reservoir	250,000	1	Gallons	$0.75	$ 187,500
Total					$ 1,204,500

Table G-20 Alternative V-3 Elements

Item	Size	Quantity	Units	Unit Cost	Cost
Site Work		1	L.S.	$ 112,500	$ 112,500
Satellite Facility	0.5	1	L.S.	$ 170,000	$ 170,000
Structure		1	L.S.	$ 300,000	$ 300,000
MBR	0.5	1	MGD	$ 1,944,600	$ 1,944,600
UV Disinfection	0.5	1	MGD	$ 225,000	$ 225,000
Booster	30	1	Hp	$ 3,000	$ 90,000
PVC Pipe	4"	1,000	Feet	$ 45.00	$ 45,000
PVC Pipe	6"	13,900	Feet	$ 60.00	$ 834,000
Infiltration Galleries		3.1	Acres	$ 20,000	$ 62,000
Lysimeters		5	Each	$ 6,000	$ 30,000
Monitoring Well	Existing				$ -
Total					$ 3,230,600

Table G-21 Alternative V-4 Elements

Item	Size	Quantity	Units	Unit Cost	Cost
PVC Pipe	6"	9,900	Feet	$ 60.00	$ 594,000
Infiltration Galleries		3.1	Acres	$ 20,000	$ 62,000
Lysimeters		5	Each	$ 6,000	$ 30,000
Monitoring Well	Existing				$ -
Total					$ 686,000

Table G-22 **Alternative V-5 and V-6 Users**

User No.	Customer	Type	Demand (Acre-Feet)												
			Jan.	**Feb.**	**Mar.**	**Apr.**	**May**	**June**	**July**	**Aug.**	**Sep.**	**Oct.**	**Nov.**	**Dec.**	**Total**
1	Caltrans	Irrigation	1.10	0.20	0.20	0.56	0.56	1.04	1.04	1.02	1.02	0.94	0.94	1.10	9.72
2	Caltrans	Irrigation	2.16	0.48	0.48	1.20	1.20	1.84	1.84	1.30	1.30	1.28	1.28	2.16	16.54
3	Caltrans	Irrigation	1.10	0.20	0.20	0.56	0.56	1.04	1.04	1.02	1.02	0.94	0.94	1.10	9.72
4	Caltrans	Irrigation	1.99	0.00	0.00	0.77	0.77	1.95	1.95	2.89	2.89	2.67	2.67	1.99	20.56
7	Crescenta Valley High School	Irrigation	0.01	0.00	0.00	0.02	0.02	0.10	0.10	0.04	0.04	0.02	0.02	0.01	0.38
8	Glenhaven Park	Irrigation	0.30	0.18	0.18	0.39	0.39	0.46	0.46	0.44	0.44	0.43	0.43	0.30	4.39
11	L.A. County Sheriffs Office	Irrigation	0.44	0.76	0.76	1.16	1.16	0.50	0.50	0.50	0.50	0.97	0.97	0.44	8.65
14	Caltrans	Irrigation	0.44	0.76	0.76	1.16	1.16	0.50	0.50	0.50	0.50	0.97	0.97	0.44	8.65
15	Caltrans	Irrigation	0.00	0.35	0.35	1.22	1.22	0.51	0.51	0.63	0.63	0.85	0.85	0.00	7.12
16	Car Wash	Car Wash	0.51	0.51	0.78	0.79	0.82	0.82	0.87	0.87	0.98	0.98	0.39	0.39	8.71
21	Briggs Plaza	Irrigation	0.16	0.16	0.19	0.19	0.23	0.23	0.28	0.28	0.31	0.31	0.12	0.12	2.58
	Infiltration Galleries		39.34	39.37	43.67	38.03	39.50	37.03	38.47	38.06	36.39	37.20	36.44	39.50	463.00
Totals			47.56	42.96	47.56	46.03	47.56	46.03	47.56	47.56	46.03	47.56	46.03	47.56	560.00

Table G-23 Alternative V-5 Elements

Item	Size	Quantity	Units	Unit Cost	Cost
Site Work		1	L.S.	$ 112,500	$ 112,500
Satellite Facility	0.5	1	L.S.	$ 170,000	$ 170,000
Structure		1	L.S.	$ 300,000	$ 300,000
MBR	0.5	1	MGD	$ 1,944,600	$ 1,944,600
UV Disinfection	0.5	1	MGD	$ 300,000	$ 300,000
Distribution Booster	40	1	Hp	$ 3,000	$ 120,000
PVC Pipe	4"	8,500	Feet	$ 45	$ 382,500
PVC Pipe	6"	10,500	Feet	$ 60.00	$ 630,000
Infiltration Gallery Booster	20	1	HP	$ 3,000	$ 60,000
Infiltration Galleries		3.1	Acres	$ 20,000	$ 62,000
Lysimeters		5	Each	$ 6,000	$ 30,000
Monitoring Well		Existing			$ -
Reservoir	250,000	1	Gallons	$ 0.75	$ 187,500
Total					$ 3,716,600

Table G-24 Alternative V-6 Elements

Item	Size	Quantity	Units	Unit Cost	Cost
PVC Pipe	4"	19,400	Feet	$ 45.00	$ 873,000
PVC Pipe	6"	9,900	Feet	$ 60.00	$ 594,000
Distribution Booster	50	1	Hp	$ 3,000	$ 150,000
Infiltration Galleries		3.1	Acres	$ 20,000	$ 62,000
Lysimeters		5	Each	$ 6,000	$ 30,000
Monitoring Well		Existing			$ -
Reservoir	250,000	1	Gallons	$ 0.75	$ 187,500
Total					$ 1,896,500

Eaton Wash Spreading Grounds Alternative

The final series of alternatives are those at the Eaton Wash Spreading grounds and involve a groundwater recharge program of 0.25 MGD with Alternative E-1 extracting of wastewater from LACSD Joint Outfall B – Unit 5 in Washington Boulevard immediately to the west of the spreading basins with the return of the residuals to the same sewer downstream of the point of extraction, Alternative E-2 doing the same spreading operation but with recycled water from the City of Pasadena and Alternative E-3 uses the multi-agency GRIP program as the source of the recycled water at a cost of $1,000 per AF which will increase over time. Since the time that Alternative E-3 was developed, the GRIP program has been modified and this alternative is no longer viable for the FMWD. Additionally, further analysis has shown the cost of recycled water that would be provided by GRIP to be substantially more than the $1000 per AF originally used in the alternative analysis. Table G-25 presents the flow data for the E series alternatives which is the same independent of the recycled water source. Figure G-17 presents a schematic showing the relationship of the trunk sewer and the satellite plant to the spreading basins and Figure G-18 is a preliminary layout of the satellite plant for Alternative E-1. The elements and costs for Alternative E-1 are presented in Table G-26. Alternative E-2 is depicted on Figure G-19 with the elements and estimated costs presented in Table G-27 and Alternative E-3 is shown on Figure G-20 with the elements and costs listed in Table G-28.

Table G-25 **Alternative E-1, E-2 and E-3 Users**

User No.	Customer	Type	Demand (Acre-Feet)												
			Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.	Total
	FMWD	Spreading	47.56	42.96	47.56	46.03	47.56	46.03	47.56	47.56	46.03	47.56	46.03	47.56	560.00
Totals			47.56	42.96	47.56	46.03	47.56	46.03	47.56	47.56	46.03	47.56	46.03	47.56	560.00

Table G-26 **Alternative E-1 Elements**

Item	Size	Quantity	Units	Unit Cost	Cost
Site Work		1	L.S.	$ 112,500	$ 112,500
Satellite Facility	0.5	1	L.S.	$ 170,000	$ 170,000
Structure		1	L.S.	$ 300,000	$ 300,000
MBR	0.5	1	MGD	$ 1,944,600	$ 1,944,600
UV Disinfection	0.85	1	MGD	$ 300,000	$ 300,000
Booster	2	1	Hp	$ 3,000	$ 6,000
Basins		3	Acres	Existing	$ -
Lysimeters		5	Each	$ 6,000	$ 30,000
Monitoring Well		1	Each	$ 250,000	$ 250,000
Total					$ 2,530,600

Table G-27 **Alternative E-2 Elements**

Item	Size	Quantity	Units	Unit Cost	Cost
PVC Pipe	6"	19,000	Feet	$ 60.00	$ 1,140,000
Basins		3	Acres	Existing	$ -
Lysimeters		5	Each	$ 6,000	$ 30,000
Monitoring Well		1	Each	$ 250,000	$ 250,000
Total					$ 1,420,000

Table G-28 **Alternative E-3 Elements**

Item	Size	Quantity	Units	Unit Cost	Cost
Booster Station	150	1	Hp	$3,000	$ 450,000
PVC Pipe	6"	55,000	Feet	$ 60.00	$ 3,300,000
Basins		3	Acres	Existing	$ -
Lysimeters		5	Each	$ 6,000	$ 30,000
Monitoring Well		1	Each	$ 250,000	$ 250,000
Total					$ 4,030,000

G-3. Non-Recycled Water Alternatives

There is only one non-recycled water alternative for developing new water supplies within the service area. That alternative is the capture of more stormwater within the service area for recharge in the groundwater basins. The section below will discuss the various concepts that are being reviewed by groundwater entities within the service area.

G-3.1 **Debris Basins and Infiltration Galleries**

Debris basins are typically located at the mouth of canyons where rainfall runoff is concentrated and as a result, are potential areas to capture and retain runoff for groundwater recharge. By modifying existing debris basins into recharge basins, these basins can retain and recharge water which otherwise would flow to the ocean.

Use of debris basins for groundwater recharge has been analyzed by Geomatrix ("Final Report Verdugo Basin Groundwater Recharge, Storage, and Conjunctive Use Feasibility Study," prepared May 2005). Debris basins reviewed by Geomatrix include the Verdugo Debris Basin and the Pickens and Dunsmuir Debris Basins based on large tributary areas and flows. The recharge capacity of debris basins within the Raymond Basin (including Bigbrier, Cooks, Gould, Upper Gould, Halls, and Lincoln) located in the Monk Hill Subarea of the Raymond Basin has been reviewed ("Water Resources Plan, Alternatives Screening Report," prepared January 2009 by Stetson for FMWD).

Crescenta Valley is also pursuing grant funding to investigate the construction of infiltration galleries for recharge in the Verdugo Basin. It is anticipated that infiltration galleries could be placed along flood control channels, diverting flows into the galleries and recharging the basin. This operation would help increase the levels of the groundwater basin.

Although the debris basins and off channel infiltration galleries can be maintained to allow increased recharge, there are no available studies to determine the ability to produce water recharged in these areas. Additional studies would be required to determine how much net water would be saved as a result of maintenance. Safe yield studies to determine the impact of groundwater recharge from the debris basins into the Raymond Basin may also be required.

G-3.2 **Additional Spreading Grounds**

The City of Pasadena is exploring adding additional recharge ponds in the Arroyo for more stormwater capture and a possible pump back system where water would be held behind Devil's Gate Dam and pumped up to the recharge ponds. All agencies in the subbasin would benefit from these operations since basin levels would rise reducing pumping lift. However, because of limited available land and needs to set aside land for the environment and recreational use, the additional recharge ponds are limited in size and will not capture enough stormwater to significantly reduce dependence on imported water. Additionally, the Raymond Basin adjudication would need to be addressed regarding recharge of native waters.

G-3.3 **Devil's Gate Dam Water Transfer Project**

Los Angeles County Public Works is investigating a pump back system where water would be held behind Devil's Gate Dam and moved to the Eaton Canyon Spreading Grounds through the stormwater channels. This operation would help only one of the FMWD's retail agencies – Kinneloa. The reason is that the Raymond Basin is divided into three subbasins, the Monk Hill, Pasadena and Santa Anita. Water in the Monk Hill subbasin, on the Westside, spills into the Pasadena subbasin which then spills into the Santa Anita subbasin. However, water cannot move in the reverse direction. Five of FMWD's agencies have pumping rights and wells in the Monk Hill subbasin and only Kinneloa has rights and wells in the Pasadena subbasin. Mesa Crest has no pumping rights and Crescenta Valley's pumping rights are only in the Verdugo Basin. Additionally, the parties to the Pasadena subbasin adjudication are already in the second year of a voluntary program to reduce the basin pumping by 30 percent as it was found that the Basin was no longer able to meet the adjudicated levels of production. The recharge of both stormwater and recycled water in this area would assist in increasing basin levels and raise production to higher levels possibly back up to adjudicated rights.

These stormwater recharge projects are in conceptual stages at this time. However, should these projects proceed and even with conservation, the reduction in imported demands can be greater with the development of recycled water.

G-3.4 **Economic Costs of Non-Recycled Water Alternatives**

<u>Debris Basins and Infiltration Galleries</u>

Proposed improvements to the Verdugo Debris Basin were estimated by Geomatrix to cost $300,000 with an annual O&M cost of $242,000. Proposed improvements to the Pickens and Dunsmuir Debris Basins were estimated by Geomatrix to cost a total of $308,000 with an annual total O&M cost of $352,000. The estimated cost of water recharged by the improved Verdugo Basin debris basins ranges from approximately $750 per AF to $2,900 per AF.

The costs for expansion of the debris basins overlying the Raymond Basin are high. On average, the total annualized cost (6 percent over 30 years) for improvements plus annual maintenance costs per debris basin is approximately $320,000 per year. Based on an average yield of approximately 30 AFY per debris basin in the Raymond Basin, the estimated cost of water recharged by improved debris basins is approximately $10,700 per AF.

The cost of off channel infiltration galleries at Crescenta Valley Park were estimated at $1.7 million by Geomatrix and $3 million for flood channels from Dunsmuir, Shields-Eagle and Pickens debris basins. The estimated cost of water recharged through the off channel infiltration galleries ranges from approximately $420 per AF to $560 per AF.

Additional Spreading Ponds

The cost of installing additional recharge ponds in the Arroyo is estimated by the City of Pasadena Department of Water and Power as $440,000 for earthwork and $190,000 for piping. The new ponds would have a capacity of 14 cubic feet per second (cfs) which would increase the total spreading pond capacity in the Arroyo to 32 cfs or 62 acre feet per day.

Devil's Gate Dam Water Transfer Project

Los Angeles County Public Works estimates the costs for the Devil's Gate Dam Water Transfer Project to be between $12 and $16 million. The yield is expected to be between 2,300 and 4,200 acre-feet annually depending on hydrology.

G-4. Water Conservation/Reduction Analysis.

G-4.1 **Analysis**

FMWD has increased its conservation budget from $2,000 annually in fiscal year 2007-2008 to $27,500 annually starting in fiscal year 2010-11. (This budget was up to $50,000 in fiscal year 2010-11 due to water shortage conditions.) The money is used for various programs including rebates to customers to replace thirsty turf with California Friendly plants, highly efficient toilet rebates, rain barrel rebates and public outreach to encourage further conservation.

Implementation of conservation measures within FMWD's service area can reduce the water demands on local and imported water supplies. Conservation measures can be grouped into two general categories: (1) "hardware" devices or equipment and (2) behavior or management practices. The implementation of comprehensive conservation programs to reduce long-term water demands typically includes both hardware- and behavior-driven measures. Although the two types of measures require different levels of effort, both are required to meet conservation goals. For example, outdoor water conservation programs include ongoing landscape management practices (such as shorter lawn watering times) and one-time hardware measures (such as turf replacement and improved irrigation system controllers).

FMWD is a member of the California Urban Water Conservation Council. The 2010 FMWD UWMP provides descriptions of several water conservation programs, or Best Management Practices (BMPs), that are currently being practiced within FMWD's service area. These BMPs include "Residential Plumbing Retrofit," "Large Landscape Conservation Programs and Incentives," "High-Efficiency Washing Machine Rebate Programs," "Public Information Programs," and "Conservation Pricing."

During the recent process to develop MWD's Water Shortage Allocation Plan, MWD estimated the current total water savings from active and passive conservation measures within FMWD to be approximately 1,600 AFY. MWD has developed a methodology to estimate future potential water conservation savings within the MWD service area from active conservation programs, price induced savings, and code based savings. Projections for FMWD's service area from MWD's methodology were not available for this evaluation, however they may be available for future evaluations of potential water conservations savings. Based on discussions with the member agencies it appears there is the potential for additional water conservation savings from price induced programs, fixture rebates, and public education programs. However, reduction in outdoor water use may represent the potential for significant water savings in some portions of FMWD's service area since it is estimated that outdoor water use in some areas represents about 70-80% of total water use. Some conservation measures (such as rate structures and irrigation controller rebates) may need to be combined with significant public outreach efforts for the programs to be successful.

FMWD has also kicked off the Foothill Water Conservation Corps in an effort to develop conservation and public education further. The Corps represents volunteers in the community that help FMWD with conservation outreach such as manning booths at fairs and speaking at schools.

MWD (through the http://www.bewaterwise.com/ website) offers rebates for purchase and installation of high efficiency clothes washers (up to $85) weather-based irrigation controllers ($80 to $25 per station for more than 1 acre of landscape) and rotating sprinkler nozzles ($3 per nozzle for a minimum of 25 per application.) These devices can produce significant water savings. For example, high efficiency clothes washers can use up to 50 percent less water than standard clothes washers and weather-based irrigation controllers can reduce typical household water use by as much as 10 percent. In addition FMWD is offering its own rebates for rain barrels (up to $100 per barrel limit of 8 barrels), turf replacement ($1.00 per square foot up to $800) and high efficiency toilet (up to $50 per toilet maximum 4 toilets.)

FMWD also has a two-tiered rate commodity rate for water deliveries to its agencies. Retail agencies that use more than a certain amount pay a higher fee for that water.

The majority of agencies in the service area also have tiered rates for their customers. Use of tiered water rates alone may not be effective for achieving conservation savings in some areas. Implementation of a water budget allocation system with tiered billing rates (or budget-based rate structure) may be a more successful method to encourage conservation. A budget-based rate structure estimates the amount of water use for each household and business by taking into account how many people are using water at the location and how much irrigation is required for the lot. When customers use more water than needed, they are given progressively expensive penalties (i.e. double or triple the normal rate, or more).

In February 2008, the California Governor introduced a seven-part comprehensive plan for improving the Sacramento-San Joaquin Delta. A key component of the Governor's Delta plan was a goal to achieve 20 percent reduction in per capita water use statewide by the year 2020.

In March 2008, a 20x2020 Agency Team on Water Conservation was formed in response to the Governor's call for a statewide per capita savings.

In November 2009, Senate Bill 7 (SBX7-7; the Water Conservation Act of 2009) was enacted, requiring all water suppliers to increase water use efficiency. This legislation is divided into two sectors, urban water conservation and agricultural conservation. The urban provisions of SBX7-7 reflect the approach taken in the 20x2020 Water Conservation Plan discussed below. The legislation sets an overall goal of reducing per capita urban water use by 20 percent by December 31, 2020. The state shall make incremental progress towards this goal by reducing per capita water use by at least 10 percent by December 31, 2015. Highlights of this legislation are as follows:

- Each urban retail water supplier shall develop water use targets and an interim water use target by July 1, 2011.
- An urban retail water supplier shall include in its urban water management plan due July 2011, the baseline daily per capita water use, water use target, interim

water use target, and compliance daily per capita water use. DWR, through a public process and in consultation with the California Urban Water Conservation Council, shall develop technical methodologies and criteria for the consistent implementation of this part.

- DWR shall adopt regulations for implementation of the provisions relating to process water.
- A Commercial, Institutional, Industrial (CII) task force is to be established that will develop and implement urban best management practices for statewide water savings.
- Effective 2016, urban retail water suppliers who do not meet the water conservation requirements established by SBX7-7 are not eligible for State water grants or loans.

In February 2010, the "Final 20x2020 Water Conservation Plan" was released by the 20x2020 Agency Team. The 20x2020 Water Conservation Plan addresses only urban water use and conservation, and only potable water use. According to the 20x2020 Water Conservation Plan, non-potable recycled water was excluded in estimating the baseline per capita urban water use to give credit to agencies that have promoted recycled water in the past. The 20x2020 Water Conservation Plan recommends actions that will reduce per capita water use, not total urban water use, by 20 percent. Therefore, depending on the rate of population growth, total urban water use may never decrease and could eventually increase, even if all the recommendations in the 20x2020 Water Conservation Plan are successfully implemented.

Future water demands discussed in Section C-5 above assume compliance with the conservation requirements of SBX7-7.

G-4.2 **Impact on Recycling, if any**

As indicated above, conservation requirements of SBX7-7 impose a reduction in urban water use on a per capita basis, not total urban water use. As discussed in the 20x2020 Water Conservation Plan, depending on the rate of population growth, total urban water use may never decrease and could eventually increase, even if all the recommendations in the 20x2020 Water Conservation Plan are successfully implemented. In addition, future water conservation efforts will probably focus on reduction in residential irrigation and not indoor water use since a greater savings would likely be achieved there and the belief is that there has already been significant savings in indoor water use and likely a saturation point has been reached. Therefore, it is not anticipated water conservation requirements will lead to a reduction in the amount of wastewater available for recycling for this program in the future.

The 20x2020 Water Conservation Plan recommends the approach of considering recycling as a means to reduce use of potable water supplies. The approach counts recycling as a means to achieve a 20 percent reduction in potable water use and provides encouragement for recycled water use.

It is anticipated water conservation efforts will focus on residential water use and will not result in a significant reduction in the irrigation demands for the Public Agencies identified for the project alternatives.

G-4.3 **Recommendation**

FMWD should continue to support its member agencies' water conservation efforts through its own financial incentives and passing through financial incentives offered by MWD.

G-4.4 **Implementation**

Water conservation requirements mandated by SBX7-7 require implementation at the retail level by FMWD's member agencies.

G-5. No Project Alternative.

In the No Project Alternative, FMWD will continue to purchase imported water supplies from MWD. As discussed in Section C above, FMWD purchases water from MWD at a rate of $744 per AF (calendar year 2011) for treated full service Tier 1 water. As shown in Table C-1, MWD's rates for Tier 1 water are projected to increase annually to approximately $2,174 per AF by the year 2030.

As discussed in Section C, it is anticipated FMWD will generally pass-through MWD rate increases to its member agencies for imported water. It is anticipated that administrative and operating charges will typically increase based on the rate of inflation and capital and rehabilitation charges will increase based on the projects identified to be completed if FMWD continues with PAYG as the preferred payment option. It is anticipated that should FMWD obtain financing for capital projects, the capital and rehabilitation charge will be steadier rather than fluctuate as currently anticipated.

The reliability of MWD's imported water supplies will be affected by regulatory restrictions in the Delta that will prevent water agencies throughout the State from adequately replenishing their water reserves when wetter conditions return. MWD implemented its water allocation plan for the two consecutive years (July, 2009 through April, 2011) in response to the regulatory restrictions in the Delta. The well above normal snowpack in the Sierras enabled MWD to return to full service as well as to place significant quantities of surplus water into their storage accounts in 2011.

G-6. Comparison of Alternatives and Recommendation of Specific Alternative.

The economic analyses of Alternatives A-1 through 8, V-1 through 6, E-1 through 3 and the No Project alternative are presented in Tables G-29 through G-46. These economic evaluations are intended to determine the present worth of each alternative for comparative purposes. They are not intended for the development of alternative costs for rate setting purposes nor do they include any revenues from the sale of recycled water. Table G-47 presents a comparison of the present worth of all of the alternatives. A review of this table indicates that Alternative A-6 would be preferred for the Arroyo group, Alternative V-4 for the Verdugo group and Alternative E-1 for the Eaton Canyon group.

Table G-29

Economic Analysis of Alternative A-1

Year	Reclaimed Water Sales, AF	Design & Construction Cost $ /a/	O&M Costs, $ Fixed /b/	O&M Costs, $ Variable /b/	Salvage Value, $ /c/	Present Worth Factor at 6%	Present Worth of Costs, $ Design & Construction Cost	Present Worth of Costs, $ O & M Costs Fixed	Present Worth of Costs, $ O & M Costs Variable	Present Worth of Costs, $ Salvage Value	Present Worth of Costs, $ Total	Present Worth of Sales, AF
2011		910,572				1.06000	965,206	0	0		965,206	0
2012		3,577,974				1.00000	3,577,974	0	0		3,577,974	0
2013	48		92,248	51,345		0.94340		87,026	48,438		135,464	45
2014	48		95,015	52,885		0.89000		84,563	47,067		131,630	42
2015	48		97,865	54,472		0.83962		82,170	45,735		127,905	40
2016	48		100,801	56,106		0.79209		79,844	44,441		124,285	38
2017	48		103,825	57,789		0.74726		77,584	43,183		120,768	36
2018	48		106,940	59,523		0.70496		75,389	41,961		117,350	34
2019	48		110,148	61,308		0.66506		73,255	40,773		114,028	32
2020	48		113,453	63,147		0.62741		71,182	39,619		110,801	30
2021	48		116,856	65,042		0.59190		69,167	38,498		107,665	28
2022	48		120,362	66,993		0.55839		67,210	37,409		104,618	27
2023	48		123,973	69,003		0.52679		65,307	36,350		101,657	25
2024	48		127,692	71,073		0.49697		63,459	35,321		98,780	24
2025	48		131,523	73,205		0.46884		61,663	34,321		95,985	22
2026	48		135,469	75,401		0.44230		59,918	33,350		93,268	21
2027	48		139,533	77,663		0.41727		58,222	32,406		90,628	20
2028	48		143,719	79,993		0.39365		56,574	31,489		88,063	19
2029	48		148,030	82,393		0.37136		54,973	30,598		85,571	18
2030	48		152,471	84,865		0.35034		53,417	29,732		83,149	17
2031	48		157,045	87,411		0.33051		51,906	28,890		80,796	16
2032	48		161,757	90,033	964,860	0.31180		50,437	28,073	300,848	(222,339)	15
Total		4,488,546					4,543,181	1,343,266	747,657	300,848	6,333,256	547

Economic Analysis Model.xls

Unit Cost ($/AF) = (Total present worth of costs)/(Total present worth of sales)= **$11,582 per acre-foot**

/a/ All costs adjusted to 2010 dollars

/b/ We assumed that fixed costs equals 28% and variable costs is 72% of the total O&M costs

/c/ Useful lives: Pipelines, 50 yr; pump station mechanical/electrical, 20 yrs; storage reservoir, 75 yrs; site work, 100yrs. No salvage value for engineering, legal & administration costs.

Item		Cost $	Useful Life Yrs	Salvage Value $
Site Work		75,000	100	60,000
Sewer Scalping Facility		150,000	20	0
MBR Structure		200,000	100	160,000
MBR Treatment Plant		1,324,200	20	0
UV Disinfection		150,000	20	0
Booster Pumps		150,000	20	0
Distribution System		603,000	75	442,200
CEQA & Permitting		100,000		0
Preliminary Engineering Costs		125,110		0
Final Engineering Costs		375,330		0
Construction Services		100,088		0
Site Aquisition		100,000	100	80,000
Subtotal		3,452,728		742,200
Contingency	30%	1,035,818		222,660
Grand Total		4,488,546		964,860

Table G-30

Economic Analysis of Alternative A-2

Year	Reclaimed Water Sales, AF	Design & Construction Cost $ /a/	O&M Costs, $ Fixed /b/	O&M Costs, $ Variable /b/	Salvage Value, $ /c/	Present Worth Factor at 6%	Present Worth of Costs, $ Design & Construction Cost	Present Worth of Costs, $ O & M Costs Fixed	Present Worth of Costs, $ O & M Costs Variable	Present Worth of Costs, $ Salvage Value	Present Worth of Costs, $ Total	Present Worth of Sales, AF
2011		1,009,372				1.06000	1,069,934	0	0		1,069,934	0
2012		3,857,734				1.00000	3,857,734	0	0		3,857,734	0
2013	280		116,304	84,255		0.94340		109,720	79,486		189,206	264
2014	280		119,793	86,783		0.89000		106,615	77,236		183,851	249
2015	280		123,386	89,386		0.83962		103,598	75,050		178,648	235
2016	280		127,088	92,068		0.79209		100,666	72,926		173,592	222
2017	280		130,901	94,830		0.74726		97,817	70,862		168,679	209
2018	280		134,828	97,675		0.70496		95,048	68,857		163,905	197
2019	280		138,873	100,605		0.66506		92,358	66,908		159,266	186
2020	280		143,039	103,623		0.62741		89,744	65,014		154,759	176
2021	280		147,330	106,732		0.59190		87,204	63,174		150,379	166
2022	280		151,750	109,934		0.55839		84,736	61,387		146,123	156
2023	280		156,302	113,232		0.52679		82,338	59,649		141,987	148
2024	280		160,991	116,629		0.49697		80,008	57,961		137,969	139
2025	280		165,821	120,128		0.46884		77,743	56,321		134,064	131
2026	280		170,796	123,732		0.44230		75,543	54,727		130,270	124
2027	280		175,920	127,443		0.41727		73,405	53,178		126,583	117
2028	280		181,197	131,267		0.39365		71,328	51,673		123,000	110
2029	280		186,633	135,205		0.37136		69,309	50,210		119,519	104
2030	280		192,232	139,261		0.35034		67,347	48,789		116,137	98
2031	280		197,999	143,439		0.33051		65,441	47,408		112,850	93
2032	280		203,939	147,742	993,460	0.31180		63,589	46,067	309,766	(200,110)	87
Total		4,867,106					4,927,669	1,693,559	1,226,884	309,766	7,538,346	3,212

Economic Analysis Model.xls

Unit Cost ($/AF) = (Total present worth of costs)/(Total present worth of sales)= $2,347 per acre-foot

/a/ All costs adjusted to 2010 dollars

/b/ We assumed that fixed costs equals 28% and variable costs is 72% of the total O&M costs

/c/ Useful lives: Pipelines, 50 yr; pump station mechanical/electrical, 20 yrs; storage reservoir, 75 yrs; site work, 100yrs. No salvage value for engineering, legal & administration costs.

Item		Cost $	Useful Life Yrs	Salvage Value $
MBR Treatment Plant		1,324,200	20	0
Site Work		75,000	100	60,000
MBR Structure		200,000	100	160,000
Sewer Scalping Facility		150,000	20	0
UV Disinfection		200,000	20	0
Booster Pumps		150,000	20	0
Distribution System		633,000	75	464,200
Spreading Basins		100,000	100	0
Lysimeters		30,000	20	0
CEQA & Permitting		150,000		0
Preliminary Engineering Costs		131,610		0
Final Engineering Costs		394,830		0
Construction Services		105,288		0
Site Aquisition		100,000	100	80,000
Subtotal		3,743,928		764,200
Contingency	30%	1,123,178		229,260
Grand Total		4,867,106		993,460

Table G-31

Economic Analysis of Alternative A-3

Year	Reclaimed Water Sales, AF	Design & Construction Cost $ /a/	O&M Costs, $ Fixed /b/	O&M Costs, $ Variable /b/	Salvage Value, $ /c/	Present Worth Factor at 6%	Present Worth of Costs, $ Design & Construction Cost	Present Worth of Costs, $ O & M Costs Fixed	Present Worth of Costs, $ O & M Costs Variable	Present Worth of Costs, $ Salvage Value	Present Worth of Costs, $ Total	Present Worth of Sales, AF
2011		910,572				1.06000	965,206	0	0		965,206	0
2012		3,577,974				1.00000	3,577,974	0	0		3,577,974	0
2013	160		92,248	67,292		0.94340		87,026	63,483		150,509	151
2014	160		95,015	69,311		0.89000		84,563	61,687		146,250	143
2015	160		97,865	71,390		0.83962		82,170	59,941		142,111	135
2016	160		100,801	73,532		0.79209		79,844	58,244		138,089	127
2017	160		103,825	75,738		0.74726		77,584	56,596		134,180	120
2018	160		106,940	78,010		0.70496		75,389	54,994		130,383	113
2019	160		110,148	80,351		0.66506		73,255	53,438		126,693	107
2020	160		113,453	82,761		0.62741		71,182	51,925		123,107	101
2021	160		116,856	85,244		0.59190		69,167	50,456		119,623	95
2022	160		120,362	87,801		0.55839		67,210	49,028		116,237	89
2023	160		123,973	90,435		0.52679		65,307	47,640		112,948	84
2024	160		127,692	93,148		0.49697		63,459	46,292		109,751	80
2025	160		131,523	95,943		0.46884		61,663	44,982		106,645	75
2026	160		135,469	98,821		0.44230		59,918	43,709		103,627	71
2027	160		139,533	101,786		0.41727		58,222	42,472		100,694	67
2028	160		143,719	104,839		0.39365		56,574	41,270		97,844	63
2029	160		148,030	107,984		0.37136		54,973	40,102		95,075	60
2030	160		152,471	111,224		0.35034		53,417	38,967		92,384	56
2031	160		157,045	114,561		0.33051		51,906	37,864		89,769	53
2032	0		161,757	117,998	964,860	0.31180		50,437	36,792	300,848	(213,619)	0
Total		4,488,546					4,543,181	1,343,266	979,880	300,848	6,565,479	1,788

Economic Analysis Model.xls

Unit Cost ($/AF) = (Total present worth of costs)/(Total present worth of sales)= $3,672 per acre-foot

/a/ All costs adjusted to 2010 dollars

/b/ We assumed that fixed costs equals 28% and variable costs is 72% of the total O&M costs

/c/ Useful lives: Pipelines, 50 yr; pump station mechanical/electrical, 20 yrs; storage reservoir, 75 yrs; site work, 100yrs. No salvage value for engineering, legal & administration costs.

Item		Cost $	Useful Life Yrs	Salvage Value $
Site Work		75,000	100	60,000
Sewer Scalping Facility		150,000	20	0
MBR Structure		200,000	100	160,000
MBR Treatment Plant		1,324,200	20	0
UV Disinfection		150,000	20	0
Booster Pumps		150,000	20	0
Distribution System		603,000	75	442,200
CEQA & Permitting		100,000		0
Preliminary Engineering Costs		125,110		0
Final Engineering Costs		375,330		0
Construction Services		100,088		0
Site Aquisition		100,000	100	80,000
Subtotal		3,452,728		742,200
Contingency	30%	1,035,818		222,660
Grand Total		4,488,546		964,860

Table G-32

Economic Analysis of Alternative A-4

Year	Reclaimed Water Sales, AF	Design & Construction Cost $ /a/	O&M Costs, $ Fixed /b/	O&M Costs, $ Variable /b/	Salvage Value, $ /c/	Present Worth Factor at 6%	Present Worth of Costs, $ Design & Construction Cost	Present Worth of Costs, $ O & M Costs Fixed	Present Worth of Costs, $ O & M Costs Variable	Present Worth of Costs, $ Salvage Value	Present Worth of Costs, $ Total	Present Worth of Sales, AF
2011		976,872				1.06000	1,035,484	0	0		1,035,484	0
2012		3,558,734				1.00000	3,558,734	0	0		3,558,734	0
2013	160		116,304	83,614		0.94340		109,720	78,881		188,601	151
2014	160		119,793	86,122		0.89000		106,615	76,648		183,263	143
2015	160		123,386	88,706		0.83962		103,598	74,479		178,077	135
2016	160		127,088	91,367		0.79209		100,666	72,371		173,037	127
2017	160		130,901	94,108		0.74726		97,817	70,323		168,140	120
2018	160		134,828	96,931		0.70496		95,048	68,333		163,381	113
2019	160		138,873	99,839		0.66506		92,358	66,399		158,757	107
2020	160		143,039	102,834		0.62741		89,744	64,519		154,264	101
2021	160		147,330	105,919		0.59190		87,204	62,693		149,898	95
2022	160		151,750	109,097		0.55839		84,736	60,919		145,655	89
2023	160		156,302	112,370		0.52679		82,338	59,195		141,533	84
2024	160		160,991	115,741		0.49697		80,008	57,520		137,527	80
2025	160		165,821	119,213		0.46884		77,743	55,892		133,635	75
2026	160		170,796	122,789		0.44230		75,543	54,310		129,853	71
2027	160		175,920	126,473		0.41727		73,405	52,773		126,178	67
2028	160		181,197	130,267		0.39365		71,328	51,279		122,607	63
2029	160		186,633	134,175		0.37136		69,309	49,828		119,137	60
2030	160		192,232	138,201		0.35034		67,347	48,418		115,765	56
2031	160		197,999	142,347		0.33051		65,441	47,047		112,489	53
2032	160.2531768		203,939	146,617	967,460	0.31180		63,589	45,716	301,659	(192,354)	50
Total		4,535,606					4,594,219	1,693,559	1,217,543	301,659	7,203,662	1,838

Economic Analysis Model.xls

Unit Cost ($/AF) = (Total present worth of costs)/(Total present worth of sales)= **$3,919 per acre-foot**

/a/ All costs adjusted to 2010 dollars

/b/ We assumed that fixed costs equals 28% and variable costs is 72% of the total O&M costs

/c/ Useful lives: Pipelines, 50 yr; pump station mechanical/electrical, 20 yrs; storage reservoir, 75 yrs; site work, 100yrs. No salvage value for engineering, legal & administration costs.

Item		Cost $	Useful Life Yrs	Salvage Valı $
Site Work		50,000	100	40,000
Sewer Scalping Facility		150,000	20	0
MBR Structure		100,000	100	80,000
MBR Treatment Plant		1,324,200	20	0
UV Disinfection		100,000	20	0
Booster Pumps		150,000	20	0
Distribution System		633,000	75	464,200
Spreading Basins		100,000	100	80,000
Lysimeters		30,000	20	0
CEQA & Permitting		150,000		0
Preliminary Engineering Costs		125,360		0
Final Engineering Costs		376,080		0
Construction Services		100,288		0
Site Aquisition		100,000	100	80,000
Subtotal		3,488,928		744,200
Contingency	30%	1,046,678		223,260
Grandtotal		4,535,606		967,460

Table G-33

Economic Analysis of Alternative A-5

Year	Reclaimed Water Sales, AF	Design & Construction Cost $ /a/	O&M Costs, $ Fixed /b/	O&M Costs, $ Variable /b/	Salvage Value, $ /c/	Present Worth Factor at 6%	Present Worth of Costs, $ Design & Construction Cost	Present Worth of Costs, $ O & M Costs Fixed	Present Worth of Costs, $ O & M Costs Variable	Present Worth of Costs, $ Salvage Value	Present Worth of Costs, $ Total	Present Worth of Sales, AF
2011		1,061,762				1.06000	1,125,468				1,125,468	
2012		4,130,162				1.00000	4,130,162				4,130,162	
2013	280		112,027	84,255		0.94340		105,686	79,486		185,172	264
2014	280		115,388	86,783		0.89000		102,695	77,236		179,931	249
2015	280		118,849	89,386		0.83962		99,788	75,050		174,839	235
2016	280		122,415	92,068		0.79209		96,964	72,926		169,890	222
2017	280		126,087	94,830		0.74726		94,220	70,862		165,082	209
2018	280		129,870	97,675		0.70496		91,553	68,857		160,410	197
2019	280		133,766	100,605		0.66506		88,962	66,908		155,870	186
2020	280		137,779	103,623		0.62741		86,444	65,014		151,459	176
2021	280		141,912	106,732		0.59190		83,998	63,174		147,172	166
2022	280		146,170	109,934		0.55839		81,620	61,387		143,007	156
2023	280		150,555	113,232		0.52679		79,310	59,649		138,959	148
2024	280		155,071	116,629		0.49697		77,066	57,961		135,027	139
2025	280		159,723	120,128		0.46884		74,885	56,321		131,205	131
2026	280		164,515	123,732		0.44230		72,765	54,727		127,492	124
2027	280		169,451	127,443		0.41727		70,706	53,178		123,884	117
2028	280		174,534	131,267		0.39365		68,705	51,673		120,377	110
2029	280		179,770	135,205		0.37136		66,760	50,210		116,970	104
2030	280		185,163	139,261		0.35034		64,871	48,789		113,660	98
2031	280		190,718	143,439		0.33051		63,035	47,408		110,443	93
2032	280		196,440	147,742	1,280,890	0.31180		61,251	46,067	399,388	(292,070)	87
Total		5,191,924					5,255,630	1,631,282	1,226,884	399,388	7,714,409	3,212

Economic Analysis Model.xls

Unit Cost ($/AF) = (Total present worth of costs)/(Total present worth of sales)= **$2,402 per acre-foot**

/a/ All costs adjusted to 2010 dollars

/b/ We assumed that fixed costs equals 28% and variable costs is 72% of the total O&M costs

/c/ Useful lives: Pipelines, 50 yr; pump station mechanical/electrical, 20 yrs; storage reservoir, 75 yrs; site work, 100yrs. No salvage value for engineering, legal & administration costs.

Item		Cost $	Useful Life Yrs	Salvage Value $
Site Work		75,000	100	60,000
Sewer Scalping Facility		150,000	20	0
MBR Structure		200,000	100	160,000
MBR Treatment Plant		1,324,200	20	0
UV Disinfection		200,000	20	0
Booster Pumps		150,000	20	0
Distribution System		874,500	75	641,300
Leach Fields		60,000	75	44,000
Lysimeters		30,000	20	0
CEQA & Permitting		150,000		0
Preliminary Engineering Costs		141,685		0
Final Engineering Costs		425,055		0
Construction Services		113,348		0
Site Aquisition		100,000	100	80,000
Subtotal		3,993,788		985,300
Contingency	30%	1,198,136		295,590
Grand Total		5,191,924		1,280,890

Table G-34

Economic Analysis of Alternative A-6

Year	Reclaimed Water Sales, AF	Design & Construction Cost $ /a/	O&M Costs, $ Fixed /b/	O&M Costs, $ Variable /b/	Salvage Value, $ /c/	Present Worth Factor at 6%	Present Worth of Costs, $ Design & Construction Cost	Present Worth of Costs, $ O & M Costs Fixed	Present Worth of Costs, $ O & M Costs Variable	Present Worth of Costs, $ Salvage Value	Present Worth of Costs, $ Total	Present Worth of Sales, AF
2011		849,602				1.06000	900,578				900,578	
2012		2,909,470				1.00000	2,909,470				2,909,470	
2013	280		94,650	46,533		0.94340		89,292	43,899		133,191	264
2014	280		97,489	47,929		0.89000		86,765	42,657		129,422	249
2015	280		100,414	49,367		0.83962		84,309	41,449		125,759	235
2016	280		103,426	50,848		0.79209		81,923	40,276		122,199	222
2017	280		106,529	52,373		0.74726		79,605	39,136		118,741	209
2018	280		109,725	53,944		0.70496		77,352	38,029		115,380	197
2019	280		113,017	55,563		0.66506		75,162	36,952		112,115	186
2020	280		116,407	57,230		0.62741		73,035	35,907		108,942	176
2021	280		119,899	58,947		0.59190		70,968	34,890		105,859	166
2022	280		123,496	60,715		0.55839		68,960	33,903		102,863	156
2023	280		127,201	62,536		0.52679		67,008	32,943		99,951	148
2024	280		131,017	64,413		0.49697		65,112	32,011		97,123	139
2025	280		134,948	66,345		0.46884		63,269	31,105		94,374	131
2026	280		138,996	68,335		0.44230		61,478	30,225		91,703	124
2027	280		143,166	70,385		0.41727		59,738	29,369		89,108	117
2028	280		147,461	72,497		0.39365		58,047	28,538		86,586	110
2029	280		151,885	74,672		0.37136		56,405	27,730		84,135	104
2030	280		156,441	76,912		0.35034		54,808	26,946		81,754	98
2031	280		161,135	79,219		0.33051		53,257	26,183		79,440	93
2032	280		165,969	81,596	631,670	0.31180		51,750	25,442	196,958	(119,766)	87
Total		3,759,072					3,810,048	1,378,243	677,591	196,958	5,668,925	3,212

Economic Analysis Model.xls

Unit Cost ($/AF) = (Total present worth of costs)/(Total present worth of sales)= **$1,765 per acre-foot**

/a/ All costs adjusted to 2010 dollars

/b/ We assumed that fixed costs equals 28% and variable costs is 72% of the total O&M costs

/c/ Useful lives: Pipelines, 50 yr; pump station mechanical/electrical, 20 yrs; storage reservoir, 75 yrs; site work, 100yrs. No salvage value for engineering, legal & administration costs.

Item		Cost $	Useful Life Yrs	Salvage Value $
Site Work		75,000	100	60,000
Sewer Scalping Facility		150,000	20	0
MBR Structure		200,000	100	160,000
MBR Treatment Plant		1,324,200	20	0
UV Disnifection		150,000	20	0
Booster Pumps		15,000	20	0
Distribution System		193,500	75	141,900
Leach Fields		60,000	75	44,000
Lysimeters		30,000	20	0
CEQA & Permitting		150,000		0
Preliminary Engineering Costs		100,885		0
Final Engineering Costs		302,655		0
Construction Services		40,354		0
Site Aquisition		100,000	100	80,000
Subtotal		2,891,594		485,900
Contingency	30%	867,478		145,770
Grand Total		3,759,072		631,670

Table G-35

Economic Analysis of Alternative A-7

Year	Reclaimed Water Sales, AF	Design & Construction Cost $ /a/	O&M Costs, $ Fixed /b/	O&M Costs, $ Variable /b/	Source Water $	Salvage Value, $ /c/	Present Worth Factor at 6%	Present Worth of Costs, $ Design & Construction Cost	Present Worth of Costs, $ O & M Costs Fixed	Present Worth of Costs, $ O & M Costs Variable	Present Worth of Costs, $ Source Water	Present Worth of Costs, $ Salvage Value	Present Worth of Costs, $ Total	Present Worth of Sales, AF
2011		132,600					1.06000	140,556					208,017	
2012		182,520					1.00000	182,520					248,071	
2013	48		13,296	0	71,508		0.94340		12,543	0	67,461		76,240	45
2014	48		13,695	0	73,654		0.89000		12,188	0	65,551		74,082	42
2015	48		14,106	0	75,863		0.83962		11,843	0	63,696		71,985	40
2016	48		14,529	0	78,139		0.79209		11,508	0	61,893		69,948	38
2017	48		14,965	0	80,483		0.74726		11,183	0	60,142		67,968	36
2018	48		15,414	0	82,898		0.70496		10,866	0	58,440		66,045	34
2019	48		15,876	0	85,385		0.66506		10,559	0	56,786		64,175	32
2020	48		16,352	0	87,946		0.62741		10,260	0	55,178		62,359	30
2021	48		16,843	0	90,585		0.59190		9,969	0	53,617		60,594	28
2022	48		17,348	0	93,302		0.55839		9,687	0	52,099		58,879	27
2023	48		17,869	0	96,101		0.52679		9,413	0	50,625		57,213	25
2024	48		18,405	0	98,984		0.49697		9,147	0	49,192		55,594	24
2025	48		18,957	0	101,954		0.46884		8,888	0	47,800		54,020	22
2026	48		19,526	0	105,012		0.44230		8,636	0	46,447		52,491	21
2027	48		20,111	0	108,163		0.41727		8,392	0	45,133		51,006	20
2028	48		20,715	0	111,408		0.39365		8,154	0	43,855		49,562	19
2029	48		21,336	0	114,750		0.37136		7,923	0	42,614		48,160	18
2030	48		21,976	0	118,192		0.35034		7,699	0	41,408		46,796	17
2031	48		22,636	0	121,738		0.33051		7,481	0	40,236		7,481	16
2032	48		23,315	0	125,390	128,700	0.31180		7,270	0	39,097	40,129	(32,860)	15
Total		315,120						323,076	193,610	0		40,129	1,517,827	547

Economic Analysis Model.xls

Unit Cost ($/AF) = (Total present worth of costs)/(Total present worth of sales)= $2,776 per acre-foot

/a/ All costs adjusted to 2010 dollars

/b/ We assumed that fixed costs equals 28% and variable costs is 72% of the total O&M costs

/c/ Useful lives: Pipelines, 50 yr; pump station mechanical/electrical, 20 yrs; storage reservoir, 75 yrs; site work, 100yrs. No salvage value for engineering, legal & administration costs.

Item		Cost $	Useful Life Yrs	Salvage Valu $
Distribution System		135,000	75	99,000
CEQA & Permitting		75,000		0
Preliminary Engineering Costs		6,750		0
Final Engineering Costs		20,250		0
Construction Services		5,400		0
Subtotal		242,400		99,000
Contingency	30%	72,720		29,700
Grand Total		315,120		128,700

Table G-36

Economic Analysis of Alternative A-8

Year	Reclaimed Water Sales, AF	Design & Construction Cost $ /a/	O&M Costs, $		Source Water $	Salvage Value, $ /c/	Present Worth Factor at 6%	Present Worth of Costs, $						Present Worth of Sales, AF
			Fixed /b/	Variable /b/				Design & Construction Cost	O & M Costs Fixed	O & M Costs Variable	Source Water	Salvage Value	Total	
2011		263,900					1.06000	279,734					279,734	0
2012		397,280					1.00000	397,280					397,280	0
2013	280		37,352	0	420,000		0.94340		35,238	0	396,226		431,464	264
2014	280		38,473	0	432,600		0.89000		34,240	0	385,012		419,253	249
2015	280		39,627	0	445,578		0.83962		33,271	0	374,116		407,387	235
2016	280		40,816	0	458,945		0.79209		32,330	0	363,528		395,857	222
2017	280		42,040	0	472,714		0.74726		31,415	0	353,239		384,654	209
2018	280		43,301	0	486,895		0.70496		30,526	0	343,242		373,767	197
2019	280		44,600	0	501,502		0.66506		29,662	0	333,527		363,189	186
2020	280		45,938	0	516,547		0.62741		28,822	0	324,088		352,910	176
2021	280		47,316	0	532,043		0.59190		28,007	0	314,916		342,922	166
2022	280		48,736	0	548,005		0.55839		27,214	0	306,003		333,217	156
2023	280		50,198	0	564,445		0.52679		26,444	0	297,343		323,786	148
2024	280		51,704	0	581,378		0.49697		25,695	0	288,927		314,622	139
2025	280		53,255	0	598,820		0.46884		24,968	0	280,750		305,718	131
2026	280		54,853	0	616,784		0.44230		24,261	0	272,804		297,066	124
2027	280		56,498	0	635,288		0.41727		23,575	0	265,083		288,658	117
2028	280		58,193	0	654,346		0.39365		22,908	0	257,581		280,489	110
2029	280		59,939	0	673,977		0.37136		22,259	0	250,291		272,550	104
2030	280		61,737	0	694,196		0.35034		21,629	0	243,207		264,836	98
2031	280		63,589	0	715,022		0.33051		21,017	0	236,324		257,341	93
2032	280		65,497	0	736,473	261,300	0.31180		20,422	0	229,636	81,475	168,583	87
Total		661,180						677,014	543,902	0		81,475	7,255,286	3,212

Economic Analysis Model.xls

Unit Cost ($/AF) = (Total present worth of costs)/(Total present worth of sales)= $2,259 per acre-foot

/a/ All costs adjusted to 2010 dollars

/b/ We assumed that fixed costs equals 28% and variable costs is 72% of the total O&M costs

/c/ Useful lives: Pipelines, 50 yr; pump station mechanical/electrical, 20 yrs; storage reservoir, 75 yrs; site work, 100yrs. No salvage value for engineering, legal & administration costs.

Item		Cost $	Useful Life Yrs	Salvage Valu $
Distribution System		165,000	75	121,000
Spreading Basins		100,000	100	80,000
Lysimeters		30,000	20	0
CEQA & Permitting		150,000		0
Preliminary Engineering Costs		13,250		0
Final Engineering Costs		39,750		0
Construction Services		10,600		0
Subtotal		508,600		201,000
Contingency	30%	152,580		60,300
Grand Total		661,180		261,300

Table G-37

Economic Analysis of Alternative V-1

Year	Reclaimed Water Sales, AF	Design & Construction Cost $ /a/	O&M Costs, $ Fixed /b/	O&M Costs, $ Variable /b/	Salvage Value, $ /c/	Present Worth Factor at 6%	Present Worth of Costs, $ Design & Construction Cost	Present Worth of Costs, $ O & M Costs Fixed	Present Worth of Costs, $ O & M Costs Variable	Present Worth of Costs, $ Salvage Value	Present Worth of Costs, $ Total	Present Worth of Sales, AF
2011		1,003,002				1.06000	1,063,182				1,063,182	
2012		4,058,610				1.00000	4,058,610				4,058,610	
2013	97		141,772	87,066		0.94340		133,747	82,138		215,885	92
2014	97		146,025	89,678		0.89000		129,962	79,813		209,775	86
2015	97		150,405	92,368		0.83962		126,283	77,554		203,838	81
2016	97		154,918	95,139		0.79209		122,709	75,359		198,069	77
2017	97		159,565	97,994		0.74726		119,236	73,227		192,463	72
2018	97		164,352	100,933		0.70496		115,862	71,154		187,016	68
2019	97		169,283	103,961		0.66506		112,583	69,140		181,723	65
2020	97		174,361	107,080		0.62741		109,396	67,184		176,580	61
2021	97		179,592	110,293		0.59190		106,300	65,282		171,582	57
2022	97		184,980	113,601		0.55839		103,292	63,434		166,726	54
2023	97		190,529	117,010		0.52679		100,368	61,639		162,008	51
2024	97		196,245	120,520		0.49697		97,528	59,895		157,422	48
2025	97		202,132	124,135		0.46884		94,768	58,200		152,967	45
2026	97		208,196	127,859		0.44230		92,085	56,552		148,638	43
2027	97		214,442	131,695		0.41727		89,479	54,952		144,431	40
2028	97		220,876	135,646		0.39365		86,947	53,397		140,343	38
2029	97		227,502	139,716		0.37136		84,486	51,885		136,371	36
2030	97		234,327	143,907		0.35034		82,095	50,417		132,512	34
2031	97		241,357	148,224		0.33051		79,772	48,990		128,762	32
2032	97		248,597	152,671	1,332,370	0.31180		77,514	47,604	415,439	(290,322)	30
Total		5,061,612					5,121,793	2,064,412	1,267,816	415,439	8,038,581	1,113

Economic Analysis Model.xls

Unit Cost ($/AF) = (Total present worth of costs)/(Total present worth of sales)= **$7,225 per acre-foot**

/a/ All costs adjusted to 2010 dollars

/b/ We assumed that fixed costs equals 28% and variable costs is 72% of the total O&M costs

/c/ Useful lives: Pipelines, 50 yr; pump station mechanical/electrical, 20 yrs; storage reservoir, 75 yrs; site work, 100yrs. No salvage value for engineering, legal & administration costs.

Item		Cost $	Useful Life Yrs	Salvage Value $
Site Work		75,000	100	60,000
Sewer Scalping Facility		150,000	20	0
MBR Structure		200,000	100	160,000
MBR Treatment Plant		1,324,200	20	0
UV Disinfection		150,000	20	0
Booster Pumps		120,000	20	0
Distribution System		801,000	75	587,400
Reservoir		187,500	75	137,500
CEQA & Permitting		100,000		0
Preliminary Engineering Costs		142,885		0
Final Engineering Costs		428,655		0
Construction Services		114,308		0
Site Aquisition		100,000	100	80,000
Subtotal		3,893,548		1,024,900
Contingency	30%	1,168,064		307,470
Grand Total		5,061,612		1,332,370

Table G-38

Economic Analysis of Alternative V-2

Year	Reclaimed Water Sales, AF	Design & Construction Cost $ /a/	O&M Costs, $ Fixed /b/	O&M Costs, $ Variable /b/	Source Water $	Salvage Value, $ /c/	Present Worth Factor at 6%	Present Worth of Costs, $ Design & Construction Cost	Present Worth of Costs, $ O & M Costs Fixed	Present Worth of Costs, $ O & M Costs Variable	Present Worth of Costs, $ Source Water	Present Worth of Costs, $ Salvage Value	Present Worth of Costs, $ Total	Present Worth of Sales, AF
2011		612,170					1.06000	648,900					648,900	
2012		1,831,284					1.00000	1,831,284					1,831,284	
2013	97		144,145	88,428	51,412		0.94340		135,986	83,423	48,502		267,911	92
2014	97		148,470	91,081	52,954		0.89000		132,137	81,062	47,129		260,329	86
2015	97		152,924	93,814	54,543		0.83962		128,398	78,768	45,795		252,961	81
2016	97		157,511	96,628	56,179		0.79209		124,764	76,539	44,499		245,802	77
2017	97		162,237	99,527	57,865		0.74726		121,233	74,372	43,240		238,845	72
2018	97		167,104	102,513	59,601		0.70496		117,802	72,267	42,016		232,085	68
2019	97		172,117	105,588	61,389		0.66506		114,468	70,222	40,827		225,517	65
2020	97		177,280	108,756	63,230		0.62741		111,228	68,235	39,672		219,134	61
2021	97		182,599	112,018	65,127		0.59190		108,080	66,304	38,549		212,932	57
2022	97		188,077	115,379	67,081		0.55839		105,021	64,427	37,458		206,906	54
2023	97		193,719	118,840	69,094		0.52679		102,049	62,604	36,398		201,050	51
2024	97		199,531	122,406	71,166		0.49697		99,161	60,832	35,368		195,360	48
2025	97		205,517	126,078	73,301		0.46884		96,354	59,110	34,367		189,831	45
2026	97		211,682	129,860	75,500		0.44230		93,627	57,437	33,394		184,458	43
2027	97		218,033	133,756	77,765		0.41727		90,977	55,812	32,449		179,238	40
2028	97		224,574	137,769	80,098		0.39365		88,403	54,232	31,530		174,165	38
2029	97		231,311	141,902	82,501		0.37136		85,901	52,697	30,638		169,236	36
2030	97		238,250	146,159	84,976		0.35034		83,469	51,206	29,771		164,446	34
2031	97		245,398	150,543	87,526		0.33051		81,107	49,757	28,928		159,792	32
2032	97		252,759	155,060	90,151	1,252,290	0.31180		78,812	48,348	28,110	390,470	(235,200)	30
Total		2,443,454						2,480,184	2,098,975	1,287,653		390,470	6,224,981	1,113

Economic Analysis Model.xls

Unit Cost ($/AF) = (Total present worth of costs)/(Total present worth of sales)= $5,595 per acre-foot

/a/ All costs adjusted to 2010 dollars
/b/ We assumed that fixed costs equals 28% and variable costs is 72% of the total O&M costs
/c/ Useful lives: Pipelines, 50 yr; pump station mechanical/electrical, 20 yrs; storage reservoir, 75 yrs; site work, 100yrs. No salvage value for engineering, legal & administration costs.

Item		Cost $	Useful Life Yrs	Salvage Value $
Booster Pumps		150,000	20	0
Supply Piping		342,000	75	250,800
Distribution System		675,000	75	495,000
Reservoir		187,500	75	137,500
CEQA & Permitting		100,000		0
Preliminary Engineering Costs		67,725		0
Final Engineering Costs		203,175		0
Construction Services		54,180		0
Site Aquisition		100,000	100	80,000
Subtotal		1,879,580		963,300
Contingency	30%	563,874		288,990
Grand Total		2,443,454		1,252,290

Table G-39

Economic Analysis of Alternative V-3

Year	Reclaimed Water Sales, AF	Design & Construction Cost $ /a/	O&M Costs, $ Fixed /b/	O&M Costs, $ Variable /b/	Salvage Value, $ /c/	Present Worth Factor at 6%	Present Worth of Costs, $ Design & Construction Cost	Present Worth of Costs, $ O & M Costs Fixed	Present Worth of Costs, $ O & M Costs Variable	Present Worth of Costs, $ Salvage Value	Present Worth of Costs, $ Total	Present Worth of Sales, AF
2011		1,173,406				1.06000	1,243,810				1,243,810	
2012		5,081,211				1.00000	5,081,211				5,081,211	
2013	560		153,295	18,963		0.94340		144,618	17,889		162,507	528
2014	560		157,894	19,531		0.89000		140,525	17,383		157,908	498
2015	560		162,630	20,117		0.83962		136,548	16,891		153,439	470
2016	560		167,509	20,721		0.79209		132,683	16,413		149,096	444
2017	560		172,535	21,342		0.74726		128,928	15,948		144,876	418
2018	560		177,711	21,983		0.70496		125,279	15,497		140,776	395
2019	560		183,042	22,642		0.66506		121,733	15,058		136,792	372
2020	560		188,533	23,322		0.62741		118,288	14,632		132,920	351
2021	560		194,189	24,021		0.59190		114,940	14,218		129,158	331
2022	560		200,015	24,742		0.55839		111,687	13,816		125,503	313
2023	560		206,015	25,484		0.52679		108,526	13,425		121,951	295
2024	560		212,196	26,249		0.49697		105,455	13,045		118,500	278
2025	560		218,562	27,036		0.46884		102,470	12,676		115,146	263
2026	560		225,119	27,847		0.44230		99,570	12,317		111,887	248
2027	560		231,872	28,683		0.41727		96,752	11,968		108,720	234
2028	560		238,828	29,543		0.39365		94,014	11,629		105,643	220
2029	560		245,993	30,429		0.37136		91,353	11,300		102,653	208
2030	560		253,373	31,342		0.35034		88,768	10,981		99,748	196
2031	560		260,974	32,282		0.33051		86,255	10,670		96,925	185
2032	560		268,803	33,251	1,335,187	0.31180		83,814	10,368	416,318	(322,136)	175
Total		6,254,617					6,325,022	2,232,207	276,123	416,318	8,417,035	6,423

Economic Analysis Model.xls

Unit Cost ($/AF) = (Total present worth of costs)/(Total present worth of sales)= **$1,310 per acre-foot**

/a/ All costs adjusted to 2010 dollars

/b/ We assumed that fixed costs equals 28% and variable costs is 72% of the total O&M costs

/c/ Useful lives: Pipelines, 50 yr; pump station mechanical/electrical, 20 yrs; storage reservoir, 75 yrs; site work, 100yrs. No salvage value for engineering, legal & administration costs.

Item		Cost $	Useful Life Yrs	Salvage Value $
Site Work		112,500	100	90,000
Scalping Facility		170,000	20	0
Structure		300,000	100	240,000
MBR		1,944,600	20	0
UV Disinfection		225,000	20	0
Booster		90,000	20	0
PVC Pipe		834,000	75	611,600
Leach Fields		62,000	75	45,467
Lysimeters		30,000	20	0
CEQA & Permitting		150,000		0
Preliminary Engineering C		175,655		0
Final Engineering Costs		526,965		0
Construction Services		140,524		0
Site Aquisition		50,000	100	40,000
Subtotal		4,811,244		1,027,067
Contingency	30%	1,443,373		308,120
Grand Total		6,254,617		1,335,187

Table G-40

Economic Analysis of Alternative V-4

Year	Reclaimed Water Sales, AF	Design & Construction Cost $ /a/	O&M Costs, $ Fixed /b/	O&M Costs, $ Variable /b/	Source Water $	Salvage Value, $ /c/	Present Worth Factor at 6%	Present Worth of Costs, $: Design & Construction Cost	Present Worth of Costs, $: O & M Costs Fixed	Present Worth of Costs, $: O & M Costs Variable	Present Worth of Costs, $: Source Water	Present Worth of Costs, $: Salvage Value	Present Worth of Costs, $: Total	Present Worth of Sales, AF
2011		365,040					1.06000	386,942					386,942	
2012		585,208					1.00000	585,208					585,208	
2013	560		33,637	0	296,800		0.94340		31,733	0	280,000		311,733	528
2014	560		34,646	0	305,704		0.89000		30,835	0	272,075		302,910	498
2015	560		35,685	0	314,875		0.83962		29,962	0	264,375		294,337	470
2016	560		36,756	0	324,321		0.79209		29,114	0	256,893		286,007	444
2017	560		37,859	0	334,051		0.74726		28,290	0	249,622		277,912	418
2018	560		38,994	0	344,073		0.70496		27,489	0	242,558		270,047	395
2019	560		40,164	0	354,395		0.66506		26,711	0	235,693		262,404	372
2020	560		41,369	0	365,027		0.62741		25,955	0	229,022		254,978	351
2021	560		42,610	0	375,977		0.59190		25,221	0	222,540		247,761	331
2022	560		43,888	0	387,257		0.55839		24,507	0	216,242		240,749	313
2023	560		45,205	0	398,874		0.52679		23,813	0	210,122		233,936	295
2024	560		46,561	0	410,841		0.49697		23,139	0	204,175		227,315	278
2025	560		47,958	0	423,166		0.46884		22,485	0	198,397		220,881	263
2026	560		49,397	0	435,861		0.44230		21,848	0	192,782		214,630	248
2027	560		50,879	0	448,937		0.41727		21,230	0	187,326		208,555	234
2028	560		52,405	0	462,405		0.39365		20,629	0	182,024		202,653	220
2029	560		53,977	0	476,277		0.37136		20,045	0	176,872		196,917	208
2030	560		55,597	0	490,565		0.35034		19,478	0	171,866		191,344	196
2031	560		57,264	0	505,282		0.33051		18,927	0	167,002		185,929	185
2032	560		58,982	0	520,441	437,147	0.31180		18,391	0	162,276	136,304	44,362	175
Total		950,248						972,150	489,803	0		136,304	5,647,512	6,423

Economic Analysis Model.xls

Unit Cost ($/AF) = (Total present worth of costs)/(Total present worth of sales)= **$879 per acre-foot**

/a/ All costs adjusted to 2010 dollars
/b/ We assumed that fixed costs equals 28% and variable costs is 72% of the total O&M costs
/c/ Useful lives: Pipelines, 50 yr; pump station mechanical/electrical, 20 yrs; storage reservoir, 75 yrs; site work, 100yrs. No salvage value for engineering, legal & administration costs.

Item		Cost $	Useful Life Yrs	Salvage Val $
Supply Piping		342,000	75	250,800
Leach Fields		62,000	75	45,467
Lysimeters		30,000	20	0
CEQA & Permitting		150,000		0
Preliminary Engineering Cc		20,200		0
Final Engineering Costs		60,600		0
Construction Services		16,160		0
Site Aquisition		50,000	100	40,000
Subtotal		730,960		336,267
Contingency	30%	219,288		100,880
Grand Total		950,248		437,147

Table G-41

Economic Analysis of Alternative V-5

Year	Reclaimed Water Sales, AF	Design & Construction Cost $ /a/	O&M Costs, $		Salvage Value, $ /c/	Present Worth Factor at 6%	Present Worth of Costs, $					Present Worth of Sales, AF
			Fixed /b/	Variable /b/			Design & Construction Cost	O & M Costs		Salvage Value	Total	
								Fixed	Variable			
2011		1,227,616				1.06000	1,301,273				1,301,273	
2012		5,782,353				1.00000	5,782,353				5,782,353	
2013	560		106,842	125,275		0.94340		100,794	118,184		218,978	528
2014	560		110,047	129,033		0.89000		97,942	114,839		212,780	498
2015	560		113,349	132,904		0.83962		95,170	111,589		206,758	470
2016	560		116,749	136,891		0.79209		92,476	108,430		200,907	444
2017	560		120,252	140,998		0.74726		89,859	105,362		195,221	418
2018	560		123,859	145,228		0.70496		87,316	102,380		189,695	395
2019	560		127,575	149,584		0.66506		84,845	99,482		184,327	372
2020	560		131,402	154,072		0.62741		82,443	96,667		179,110	351
2021	560		135,344	158,694		0.59190		80,110	93,931		174,041	331
2022	560		139,405	163,455		0.55839		77,843	91,272		169,115	313
2023	560		143,587	168,358		0.52679		75,640	88,689		164,329	295
2024	560		147,894	173,409		0.49697		73,499	86,179		159,678	278
2025	560		152,331	178,612		0.46884		71,419	83,740		155,159	263
2026	560		156,901	183,970		0.44230		69,397	81,370		150,768	248
2027	560		161,608	189,489		0.41727		67,433	79,067		146,501	234
2028	560		166,456	195,174		0.39365		65,525	76,829		142,354	220
2029	560		171,450	201,029		0.37136		63,670	74,655		138,325	208
2030	560		176,594	207,060		0.35034		61,868	72,542		134,411	196
2031	560		181,891	213,271		0.33051		60,117	70,489		130,606	185
2032	560		187,348	219,670	1,684,107	0.31180		58,416	68,494	525,112	(398,202)	175
Total		7,009,969					7,083,626	1,555,783	1,824,189	525,112	9,938,486	6,423

Economic Analysis Model.xls

Unit Cost ($/AF) = (Total present worth of costs)/(Total present worth of sales)= **$1,547 per acre-foot**

/a/ All costs adjusted to 2010 dollars
/b/ We assumed that fixed costs equals 28% and variable costs is 72% of the total O&M costs
/c/ Useful lives: Pipelines, 50 yr; pump station mechanical/electrical, 20 yrs; storage reservoir, 75 yrs; site work, 100yrs. No salvage value for engineering, legal & administration costs.

Item		Cost $	Useful Life Yrs	Salvage Valu $
Site Work		112,500	100	90,000
Scalping Facility		170,000	20	0
Structure		300,000	100	240,000
MBR		1,944,600	20	0
UV Disinfection		300,000	20	0
Distribution Booster		120,000	20	0
PVC Pipe		1,012,500	75	742,500
Recharge Booster		60,000	20	0
Leach Fields		62,000	75	45,467
Lysimeters		30,000	20	0
Reservoir		187,500	75	137,500
CEQA & Permitting		150,000		0
Preliminary Engineering Costs		186,080		0
Final Engineering Costs		558,240		0
Construction Services		148,864		0
Site Aquisition		50,000	100	40,000
Subtotal		5,392,284		1,295,467
Contingency	30%	1,617,685		388,640
Grand Total		7,009,969		1,684,107

Table G-42

Economic Analysis of Alternative V-6

Year	Reclaimed Water Sales, AF	Design & Construction Cost $ /a/	O&M Costs, $ Fixed /b/	O&M Costs, $ Variable /b/	Source Water $	Salvage Value, $ /c/	Present Worth Factor at 6%	Present Worth of Costs, $: Design & Construction Cost	Present Worth of Costs, $: O & M Costs Fixed	Present Worth of Costs, $: O & M Costs Variable	Present Worth of Costs, $: Source Water	Present Worth of Costs, $: Salvage Value	Present Worth of Costs, $: Total	Present Worth of Sales, AF
2011		482,040					1.06000	510,962					510,962	
2012		2,673,658					1.00000	2,673,658					2,673,658	
2013	560		28,198	7,436	296,800		0.94340		26,602	7,015	280,000		313,617	528
2014	560		29,044	7,659	305,704		0.89000		25,849	6,817	272,075		304,741	498
2015	560		29,915	7,889	314,875		0.83962		25,117	6,624	264,375		296,116	470
2016	560		30,812	8,126	324,321		0.79209		24,406	6,436	256,893		287,735	444
2017	560		31,737	8,369	334,051		0.74726		23,715	6,254	249,622		279,592	418
2018	560		32,689	8,620	344,073		0.70496		23,044	6,077	242,558		271,679	395
2019	560		33,669	8,879	354,395		0.66506		22,392	5,905	235,693		263,990	372
2020	560		34,679	9,145	365,027		0.62741		21,758	5,738	229,022		256,518	351
2021	560		35,720	9,420	375,977		0.59190		21,143	5,576	222,540		249,258	331
2022	560		36,791	9,702	387,257		0.55839		20,544	5,418	216,242		242,204	313
2023	560		37,895	9,993	398,874		0.52679		19,963	5,264	210,122		235,349	295
2024	560		39,032	10,293	410,841		0.49697		19,398	5,115	204,175		228,688	278
2025	560		40,203	10,602	423,166		0.46884		18,849	4,971	198,397		222,216	263
2026	560		41,409	10,920	435,861		0.44230		18,315	4,830	192,782		215,927	248
2027	560		42,651	11,248	448,937		0.41727		17,797	4,693	187,326		209,816	234
2028	560		43,931	11,585	462,405		0.39365		17,293	4,560	182,024		203,878	220
2029	560		45,249	11,933	476,277		0.37136		16,804	4,431	176,872		198,107	208
2030	560		46,606	12,291	490,565		0.35034		16,328	4,306	171,866		192,501	196
2031	560		48,005	12,659	505,282		0.33051		15,866	4,184	167,002		187,053	185
2032	560		49,445	13,039	520,441	1,808,517	0.31180		15,417	4,066	162,276	563,904	(382,145)	175
Total		3,155,698						3,184,620	410,600	108,280		563,904	7,461,459	6,423

Economic Analysis Model.xls

Unit Cost ($/AF) = (Total present worth of costs)/(Total present worth of sales)= **$1,162 per acre-foot**

/a/ All costs adjusted to 2010 dollars

/b/ We assumed that fixed costs equals 28% and variable costs is 72% of the total O&M costs

/c/ Useful lives: Pipelines, 50 yr; pump station mechanical/electrical, 20 yrs; storage reservoir, 75 yrs; site work, 100yrs. No salvage value for engineering, legal & administration costs.

Item		Cost $	Useful Life Yrs	Salvage Valu $
Supply Piping		792,000	75	580,800
Distribution Piping		801,000	75	587,400
Distribution Booster		150,000	20	0
Reservoir		187,500	75	137,500
Leach Fields		62,000	75	45,467
Lysimeter		30,000	20	0
CEQA & Permitting		150,000		0
Preliminary Engineering C		42,700		0
Final Engineering Costs		128,100		0
Construction Services		34,160		0
Site Aquisition		50,000	100	40,000
Subtotal		2,427,460		1,391,167
Contingency	30%	728,238		417,350
Grand Total		3,155,698		1,808,517

Table G-43

Economic Analysis of Alternative E-1

Year	Reclaimed Water Sales, AF	Design & Construction Cost $ /a/	O&M Costs, $		Salvage Value, $ /c/	Present Worth Factor at 6%	Present Worth of Costs, $					Present Worth of Sales, AF
			Fixed /b/	Variable /b/			Design & Construction Cost	O & M Costs Fixed	O & M Costs Variable	Salvage Value	Total	
2011		853,606				1.06000	904,822	0	0		904,822	0
2012		4,178,751				1.00000	4,178,751	0	0		4,178,751	0
2013	560		158,942	83,967		0.94340		149,945	79,214		229,159	528
2014	560		163,710	86,486		0.89000		145,702	76,972		222,674	498
2015	560		168,622	89,080		0.83962		141,578	74,794		216,371	470
2016	560		173,680	91,753		0.79209		137,571	72,677		210,248	444
2017	560		178,891	94,505		0.74726		133,677	70,620		204,297	418
2018	560		184,257	97,340		0.70496		129,894	68,621		198,515	395
2019	560		189,785	100,261		0.66506		126,218	66,679		192,897	372
2020	560		195,479	103,268		0.62741		122,646	64,792		187,438	351
2021	560		201,343	106,367		0.59190		119,175	62,958		182,133	331
2022	560		207,383	109,558		0.55839		115,802	61,176		176,978	313
2023	560		213,605	112,844		0.52679		112,524	59,445		171,969	295
2024	560		220,013	116,230		0.49697		109,340	57,763		167,102	278
2025	560		226,613	119,716		0.46884		106,245	56,128		162,373	263
2026	560		233,412	123,308		0.44230		103,238	54,539		157,777	248
2027	560		240,414	127,007		0.41727		100,316	52,996		153,312	234
2028	560		247,626	130,817		0.39365		97,477	51,496		148,973	220
2029	560		255,055	134,742		0.37136		94,718	50,038		144,757	208
2030	560		262,707	138,784		0.35034		92,038	48,622		140,660	196
2031	560		270,588	142,948		0.33051		89,433	47,246		136,679	185
2032	560		278,706	147,236	667,333	0.31180		86,902	45,909	208,078	(75,267)	175
Total		5,032,357					5,083,574	2,314,439	1,222,684	208,078	8,412,619	6,423

Economic Analysis Model.xls

Unit Cost ($/AF) = (Total present worth of costs)/(Total present worth of sales)= **$1,310 per acre-foot**

/a/ All costs adjusted to 2010 dollars

/b/ We assumed that fixed costs equals 28% and variable costs is 72% of the total O&M costs

/c/ Useful lives: Pipelines, 50 yr; pump station mechanical/electrical, 20 yrs; storage reservoir, 75 yrs; site work, 100yrs. No salvage value for engineering, legal & administration costs.

Item		Cost $	Useful Life Yrs	Salvage Val $
Site Work		112,500	100	90,000
Sewer Scalping Facility		170,000	20	0
MBR Structure		300,000	100	240,000
MBR Treatment Plant		1,944,600	20	0
UV Disinfection		300,000	20	0
Booster Pumps		6,000	20	0
Lysimeters		30,000	20	0
Monitoring Well		250,000	75	183,333
CEQA & Permitting		150,000		0
Preliminary Engineering Costs		126,655		0
Final Engineering Costs		379,965		0
Construction Services		101,324		0
Site Aquisition		0	100	0
Subtotal		3,871,044		513,333
Contingency	30%	1,161,313		154,000
Grand Total		5,032,357		667,333

Table G-44

Economic Analysis of Alternative E-2

Year	Reclaimed Water Sales, AF	Design & Construction Cost $ /a/	O&M Costs, $ Fixed /b/	O&M Costs, $ Variable /b/	Source Water $	Salvage Value, $ /c/	Present Worth Factor at 6%	Present Worth of Costs, $ Design & Construction Cost	Present Worth of Costs, $ O & M Costs Fixed	Present Worth of Costs, $ O & M Costs Variable	Present Worth of Costs, $ Source Water	Present Worth of Costs, $ Salvage Value	Present Worth of Costs, $ Total	Present Worth of Sales, AF
2011		491,400					1.06000	520,884					520,884	
2012		1,905,280					1.00000	1,905,280					1,905,280	
2013	560		50,528	0	840,000		0.94340		47,668	0	792,453		840,121	528
2014	560		52,044	0	865,200		0.89000		46,319	0	770,025		816,344	498
2015	560		53,605	0	891,156		0.83962		45,008	0	748,232		793,240	470
2016	560		55,213	0	917,891		0.79209		43,734	0	727,055		770,790	444
2017	560		56,870	0	945,427		0.74726		42,496	0	706,478		748,975	418
2018	560		58,576	0	973,790		0.70496		41,294	0	686,484		727,777	395
2019	560		60,333	0	1,003,004		0.66506		40,125	0	667,055		707,180	372
2020	560		62,143	0	1,033,094		0.62741		38,989	0	648,176		687,165	351
2021	560		64,007	0	1,064,087		0.59190		37,886	0	629,831		667,717	331
2022	560		65,928	0	1,096,009		0.55839		36,814	0	612,006		648,820	313
2023	560		67,905	0	1,128,890		0.52679		35,772	0	594,685		630,457	295
2024	560		69,943	0	1,162,756		0.49697		34,759	0	577,854		612,614	278
2025	560		72,041	0	1,197,639		0.46884		33,776	0	561,500		595,276	263
2026	560		74,202	0	1,233,568		0.44230		32,820	0	545,608		578,428	248
2027	560		76,428	0	1,270,575		0.41727		31,891	0	530,167		562,057	234
2028	560		78,721	0	1,308,693		0.39365		30,988	0	515,162		546,150	220
2029	560		81,083	0	1,347,953		0.37136		30,111	0	500,582		530,693	208
2030	560		83,515	0	1,388,392		0.35034		29,259	0	486,415		515,674	196
2031	560		86,021	0	1,430,044		0.33051		28,431	0	472,648		501,079	185
2032	560		88,601	0	1,472,945	1,325,133	0.31180		27,626	0	459,271	413,183	73,715	175
Total		2,396,680						2,426,164	735,765	0	12,231,687	413,183	14,980,434	6,423

Economic Analysis Model.xls

Unit Cost ($/AF) = (Total present worth of costs)/(Total present worth of sales)= $2,332 per acre-foot

/a/ All costs adjusted to 2010 dollars

/b/ We assumed that fixed costs equals 28% and variable costs is 72% of the total O&M costs

/c/ Useful lives: Pipelines, 50 yr; pump station mechanical/electrical, 20 yrs; storage reservoir, 75 yrs; site work, 100yrs. No salvage value for engineering, legal & administration costs.

Item		Cost $	Useful Life Yrs	Salvage Value $
Source Water Piping		1,140,000	75	836,000
Lysimeters		30,000	20	0
Monitoring Well		250,000	75	183,333
CEQA & Permitting		150,000		0
Preliminary Engineering Costs		57,000		0
Final Engineering Costs		171,000		0
Construction Services		45,600		0
Subtotal		1,843,600		1,019,333
Contingency	30%	553,080		305,800
Grand Total		2,396,680		1,325,133

Table G-45

Economic Analysis of Alternative E-3

Year	Reclaimed Water Sales, AF	Design & Construction Cost $ /a/	O&M Costs, $ Fixed /b/	O&M Costs, $ Variable /b/	Source Water $	Salvage Value, $ /c/	Present Worth Factor at 6%	Present Worth of Costs, $: Design & Construction Cost	Present Worth of Costs, $: O & M Costs Fixed	Present Worth of Costs, $: O & M Costs Variable	Present Worth of Costs, $: Source Water	Present Worth of Costs, $: Salvage Value	Present Worth of Costs, $: Total	Present Worth of Sales, AF
2011		1,170,000					1.06000	1,240,200					1,240,200	
2012		5,434,000					1.00000	5,434,000					5,434,000	
2013	560		80,300	118,991	560,000		0.94340		75,755	112,255	528,302		716,312	528
2014	560		82,709	122,560	576,800		0.89000		73,611	109,078	513,350		696,039	498
2015	560		85,190	126,237	594,104		0.83962		71,527	105,991	498,821		676,340	470
2016	560		87,746	130,024	611,927		0.79209		69,503	102,991	484,704		657,198	444
2017	560		90,378	133,925	630,285		0.74726		67,536	100,077	470,986		638,598	418
2018	560		93,090	137,943	649,193		0.70496		65,625	97,244	457,656		620,525	395
2019	560		95,882	142,081	668,669		0.66506		63,767	94,492	444,703		602,963	372
2020	560		98,759	146,343	688,729		0.62741		61,963	91,818	432,117		585,898	351
2021	560		101,722	150,734	709,391		0.59190		60,209	89,219	419,888		569,316	331
2022	560		104,773	155,256	730,673		0.55839		58,505	86,694	408,004		553,203	313
2023	560		107,916	159,913	752,593		0.52679		56,849	84,240	396,457		537,546	295
2024	560		111,154	164,711	775,171		0.49697		55,240	81,856	385,236		522,333	278
2025	560		114,489	169,652	798,426		0.46884		53,677	79,540	374,333		507,550	263
2026	560		117,923	174,742	822,379		0.44230		52,158	77,288	363,739		493,185	248
2027	560		121,461	179,984	847,050		0.41727		50,681	75,101	353,444		479,227	234
2028	560		125,105	185,384	872,462		0.39365		49,247	72,976	343,441		465,664	220
2029	560		128,858	190,945	898,636		0.37136		47,853	70,910	333,721		452,485	208
2030	560		132,724	196,673	925,595		0.35034		46,499	68,903	324,276		439,679	196
2031	560		136,705	202,574	953,363		0.33051		45,183	66,953	315,099		427,235	185
2032	560		140,807	208,651	981,963	3,384,333	0.31180		43,904	65,058	306,181	1,055,251	(840,108)	175
Total		6,604,000						6,674,200	1,169,291	1,732,686	8,154,458	1,055,251	16,675,384	6,423

Economic Analysis Model.xls

Unit Cost ($/AF) = (Total present worth of costs)/(Total present worth of sales)= $2,596 per acre-foot

/a/ All costs adjusted to 2010 dollars
/b/ We assumed that fixed costs equals 28% and variable costs is 72% of the total O&M costs
/c/ Useful lives: Pipelines, 50 yr; pump station mechanical/electrical, 20 yrs; storage reservoir, 75 yrs; site work, 100yrs. No salvage value for engineering, legal & administration costs.

Item		Cost $	Useful Life Yrs	Salvage Value $
Booster Pumps		450,000	20	0
Source Water Piping		3,300,000	75	2,420,000
Lysimeters		30,000	20	0
Monitoring Well		250,000	75	183,333
CEQA & Permitting		150,000		0
Preliminary Engineering Costs		187,500		0
Final Engineering Costs		562,500		0
Construction Services		150,000		0
Subtotal		5,080,000		2,603,333
Contingency	30%	1,524,000		781,000
Grand Total		6,604,000		3,384,333

Table G-46

Economic Analysis of MWD Supply

Year	Reclaimed Water Sales, AF	Design & Construction Cost $ /a/	O&M Costs, $ Fixed /b/	O&M Costs, $ Variable /b/	MWD Water Rate	MWD Water Cost	Salvage Value, $ /c/	Present Worth Factor at 6%	Present Worth of Costs, $: Design & Construction Cost	Present Worth of Costs, $: O & M Costs Fixed	Present Worth of Costs, $: O & M Costs Variable	Present Worth of Costs, $: Source Water	Present Worth of Costs, $: Salvage Value	Present Worth of Costs, $: Total	Present Worth of Sales, AF
2011								1.06000						0	
2012								1.00000						0	
2013	560		0	0	$ 833	466,480		0.94340		0	0	440,075		0	528
2014	560		0	0	$ 877	491,120		0.89000		0	0	437,095		0	498
2015	560		0	0	$ 920	515,200		0.83962		0	0	432,572		0	470
2016	560		0	0	$ 970	543,200		0.79209		0	0	430,265		0	444
2017	560		0	0	$ 1,023	572,880		0.74726		0	0	428,089		0	418
2018	560		0	0	$ 1,079	604,240		0.70496		0	0	425,965		0	395
2019	560		0	0	$ 1,146	641,760		0.66506		0	0	426,807		0	372
2020	560		0	0	$ 1,214	679,840		0.62741		0	0	426,540		0	351
2021	560		0	0	$ 1,287	720,630		0.59190		0	0	426,540		0	331
2022	560		0	0	$ 1,364	763,868		0.55839		0	0	426,540		0	313
2023	560		0	0	$ 1,446	809,700		0.52679		0	0	426,540		0	295
2024	560		0	0	$ 1,533	858,282		0.49697		0	0	426,540		0	278
2025	560		0	0	$ 1,625	909,779		0.46884		0	0	426,540		0	263
2026	560		0	0	$ 1,722	964,366		0.44230		0	0	426,540		0	248
2027	560		0	0	$ 1,825	1,022,228		0.41727		0	0	426,540		0	234
2028	560		0	0	$ 1,935	1,083,562		0.39365		0	0	426,540		0	220
2029	560		0	0	$ 2,051	1,148,575		0.37136		0	0	426,540		0	208
2030	560		0	0	$ 2,174	1,217,490		0.35034		0	0	426,540		0	196
2031	560		0	0	$ 2,305	1,290,539		0.33051		0	0	426,540		0	185
2032	560		0	0	$ 2,443	1,367,972	0	0.31180		0	0	426,540	0	0	175
Total		0							0	0	0	8,565,890	0	0	6,423

Economic Analysis Model.xls

Unit Cost ($/AF) = (Total present worth of costs)/(Total present worth of sales)= $1,334 per acre-foot

/a/ All costs adjusted to 2010 dollars

/b/ We assumed that fixed costs equals 28% and variable costs is 72% of the total O&M costs

/c/ Useful lives: Pipelines, 50 yr; pump station mechanical/electrical, 20 yrs; storage reservoir, 75 yrs; site work, 100yrs. No salvage value for engineering, legal & administration costs.

Table G-47

Comparison of Alternatives

Alternative	Per Acre Foot Present Worth
A-1	$11,582
A-2	$2,347
A-3	$3,672
A-4	$3,919
A-5	$2,402
A-6	$1,765
A-7	$2,776
A-8	$2,259
V-1	$7,225
V-2	$5,595
V-3	$1,310
V-4	$879
V-5	$1,547
V-6	$1,162
E-1	$1,310
E-2	$2,332
E-3	$2,596
MWD	$1,334

H. RECOMMENDED FACILITIES PROJECT PLAN

H-1. Recommended Projects

There is an apparent best alternative within each of the geographical areas of FMWD from a cost perspective. For the Arroyo Seco area, it is Alternative A-6; for the Verdugo Basin area, it is Alternative V-4 and for the Eaton Wash area, it is Alternative E-1. For each of these alternatives, the user ends up as FMWD with groundwater recharge credits in the Raymond Basin available for extraction by their various member agencies. This additional recharge will help in improving the reliability of the Basin for the FMWD member agencies.

However, this low cost approach excludes use of recycled water in the CVWD area although CVWD benefits from the lower costs of wastewater treatment at LAGWRP with lower amounts of wastewater being treated at the facility. Alternative V-6 at a higher cost would include direct use of recycled water in the service area while still recharging the leftover water into the Raymond Basin. The other benefit of this alternative is that it continues to reduce costs to CVWD for the cost of wastewater treatment at LAGWRP. As described in more detail in Section H-5, only the Arroyo Seco option is recommended for implementation as this time.

H-2. Project Refinements

There were no project refinements beyond those done during the alternatives analysis.

H-3. Energy Analysis for Each Alternative (including direct and construction energy).

The energy components for the various alternatives include the energy required to treat the wastewater to the proper quality, the pumping energy to transport the treated wastewater to its point of use and, in the cases incorporating groundwater recharge, the energy required to extract the recharge water. In the cases that include the purchase of treated wastewater from another entity, no treatment energy is included as it would be the same as currently used to treat the wastewater for disposal. The resulting energy requirements are then compared against the existing energy requirements for the imported water supply. In that the incremental imported supply is from the East Branch of the State Water Project, the energy required to get it to the Pasadena area is 3,200 kWh/AF. This is sufficient for the water supply in the Eaton Wash area but it takes FMWD an additional 435 kWh/AF to lift the imported supply to Arroyo Seco area and 1,064 kWh/AF to lift it to the Verdugo Basin area. The energy required to recover the recharged water is based on the average groundwater pumping rate of 570 kWh/AF. The resulting net energy savings, or cost, for each of the alternatives is summarized in Table H-1.

Table H-1 Annual Energy Consumption (kWh)

Alternative	AFY Produced	AFY Recharged	Production	Extraction	Total	Import	Savings
A-1	47.67	-	367,033	-	367,033	173,288	(193,744)
A-2	280.00	232.33	610,617	132,427	743,043	1,017,800	274,757
A-3	160.25	-	485,068	-	485,068	582,520	97,452
A-4	280.00	119.75	610,617	68,256	678,872	1,017,800	338,928
A-5	280.00	232.33	610,617	132,427	743,043	1,017,800	274,757
A-6	280	280	346,408	159,600	506,008	1,017,800	511,792
A-7	47.67	-	-	-	-	173,288	173,288
A-8	280.00	232.33	-	132,427	132,427	1,017,800	885,373
V-1	97.00	-	651,298	-	651,298	413,625	(237,673)
V-2	97.00	-	661,468	-	661,468	413,625	(247,844)
V-3	560.00	560.00	111,038	319,200	430,238	2,387,840	1,957,602
V-4	560.00	560.00	-	319,200	319,200	2,387,840	2,068,640
V-5	560.00	463.00	771,792	263,908	1,035,700	2,387,840	1,352,140
V-6	560.00	463.00	45,662	263,908	309,569	2,387,840	2,078,271
E-1	560.00	560.00	622,359	319,200	941,559	1,792,000	850,441
E-2	560.00	560.00	-	319,200	319,200	1,792,000	1,472,800
E-3	560.00	560.00	880,697	319,200	1,199,897	1,792,000	592,103

H-4. Water Quality Impacts

H-4.1 **Effect on Receiving Water by Removing or Reducing Discharge of Effluent, Including Effect on Beneficial Uses Resulting from Reduced Flow**

The alternatives evaluated require either development of satellite plants of up to 0.5 MGD capacity or the use of treated effluent from existing tertiary treatment facilities. The wastewater treatment plants potentially affected by the satellite activities include LAGWRP (design capacity of 20 MGD), SJCWRP (design capacity of 100 MGD), and WNWRP (design capacity of 15 MGD).

H-4.2 **Groundwater Impacts**

This section discusses the groundwater impacts from spreading of effluent produced from the proposed satellite plants. Based on the alternatives evaluation, potential groundwater recharge areas include the eastern Monk Hill subarea, the Arroyo Seco and Eaton Wash.

As indicated in Section E above, it is anticipated the membrane bioreactors will be the treatment technology for the proposed satellite plants, with the residuals being returned to the collection system for treatment. UV disinfection will follow treatment by the membrane bioreactors.

The approximate quality of the effluent from the proposed membrane bioreactors satellite plants is anticipated to be as follows:

- TDS: 800 mg/l
- Total nitrogen: 12 mg/l
- TOC: 10 mg/l
- Turbidity: 0.5 NTU.

As indicated in Section E above, the CDPH Recycled Water Standards and RWQCB Basin Plan Objectives (groundwater) for the Raymond Basin are summarized in the Raymond Basin Management Board's report entitled "Draft Criteria for Delivery of Supplemental Water" (see Appendix L), and the Raymond Basin criteria for the above constituents are as follows:

- TDS: 500-1,000 mg/l (CDPH); 450 mg/l (RWQCB)
- Total nitrogen: 10 mg/l (CDPH); 8 mg/l (RWQCB)
- TOC: 20 mg/l (CDPH; not required by RWQCB)
- Turbidity: 5 NTU (CDPH; not required by RWQCB).

Except for TDS (RWQCB Basin Plan Objectives only) and total nitrogen, the anticipated quality of the effluent from the proposed satellite plants, for the above constituents, are within the criteria for the Raymond Basin.

The draft CDPH groundwater recharge regulations published in August 2008[10] proposes a revised limit for TOC rather than the CDPH limit in the "Draft Criteria for Delivery of Supplemental Water" for the Raymond Basin[11]. The proposed TOC limit is dependent on the recycled water contribution (RWC), as discussed in Section E above. Based on the draft CDPH groundwater recharge regulations, the RWC value for the effluent from the proposed satellite plants with a maximum TOC concentration of 10 mg/l shall not exceed 5.0 percent.

The amount of water entering the Monk Hill subarea, where the Arroyo Seco is located, from precipitation, inflow from mountains, and inflow from hills was approximately 22,410 AFY over a 12 year average (see Section B above). The proposed quantity of groundwater recharge is about 280 AFY for the Arroyo Seco and about 560 AFY for the Verdugo project recharge into the eastern Monk Hill subarea. The Arroyo Seco project

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[10] Groundwater Recharge Reuse, DRAFT Regulation. California Department of Public Health. August 5, 2008.
[11] *Draft Criteria for Delivery of Supplemental Water*, Raymond Basin Management Board, March 2006. Prepared by Stetson Engineers Inc.

would result in an RWC of 1.2 percent, below the allowed 5.0 percent. The Verdugo project would result in an RWC of 2.4 percent, below the allowed 5.0 percent. The amount of water entering the Pasadena subarea where the Eaton Wash is located was approximately 34,420 AFY over a 12 year average period. The proposed quantity of groundwater recharge is about 560 AFY for the Eaton Wash. This would result in an RWC of 1.6 percent, below the allowed 5.0 percent.

An analysis was performed of artificial recharge of recycled water at three potential sites in the Raymond Basin. The three proposed sites are Arroyo, Verdugo, and Eaton Wash (see Figure H-1).

The purpose of the analysis was to determine the recycled water contribution based on the CDPH regulatory guidelines and the amount of diluent water available as underflow at each site. It is proposed to use shallow subsurface infiltration galleries to artificially recharge the recycled water.

The procedure used included reviewing CDPH regulations and Inland Empire Utility Agency's process for recharging recycled water. The use of underflow as diluent water is logical for the proposed recycled water recharge areas as the Raymond Basin is large and the underflow has been clearly defined. Due to the geohydrological characteristics of the ground water basin, recharge or underflow occurs over a broad area and the quantity of underflow will mix with the recycled water to provide sufficient diluent water to meet the Recycled Water Contribution (RWC) requirement. In all scenarios, the proposed RWC was less than the 50% maximum RWC established by CDPH. Specifically, the steps and assumptions included:

- Review of the soil aquifer treatment (SAT) process for removing organics in the vadose zone.
- Maximum allowed Recycled Water Contribution (RWC) is 50% per CDPH regulations.
- Performed analytical calculations of ground water recharge and recycled water mound extent.

- Superimposed ground water recharge mound on regional ground water flow regime.
- Determined area of mixing between underflow as diluent and recycled water recharge from infiltration galleries.
- Determined available diluent from underflow based on lateral extent of recycled water mound and underflow based on a Darcian calculation beneath the infiltration galleries.
- Calculated total Recycled Water Contribution for proposed infiltration gallery fields based on the following relationship:

$$\text{RWC (\%)} = \left(\frac{\text{recycled water}}{\text{recycled water + diluent}} \right) \times 100$$

- Calculated Maximum Total Organic Carbon (TOC) and RWC related based on the following relationship:

$$\text{TOC (mg/L)} = \left(\frac{0.5}{\text{RWC}} \right)$$

- Identified nearest production wells to each of the infiltration galleries and estimated travel time to each of these wells.

Figures H-2, H-3 and H-4 show graphically the proposed infiltration gallery areas for the proposed recharge of recycled water. Included on the figures are summaries of the key parameters used as well as the results.

The following summary table and attached Table H-3 and Figures H-2, H-3 and H-4 summarize the recycled water recharge analysis for the three specific areas:

Table H-2

Summary of Key Parameters for the Three Proposed Recycled Water Recharge Areas

Area	No. of Infiltration Galleries	Individual Recharge Area[1] (acres)	Total Recharge Area (acres)	Recharging Period (days)	Annual Recharge Each Recharge Cycle (acre-ft/yr)	Available Underflow as Diluent Water (acre-ft/yr)	Recycled Water Contribution %
Arroyo	2	(1.5), (1.5)	3.0	365	274/274	371	43/43
Verdugo	3	(1.0 + 0.6), (1.5)	3.1	300	292/274	547	35/33
Eaton Wash	3	(2.25 + 0.75), (3.0)	6.0	365	548/548	2,190	20/20

1 – ( ) denotes infiltration gallery area or combination of infiltration gallery areas which will be used during the recharging period.

Table H-3

Summary of Recycled Water and Recharge Parameters for

Arroyo, Verdugo and Eaton Wash Infiltration Galleries

		ARROYO		VERDUGO		EATON WASH	
		Arroyo Infiltration Gallery A	**Arroyo Infiltration Gallery B**	**Verdugo Infiltration Galleries A & B**	**Verdugo Infiltration Gallery C**	**Eaton Wash Infiltration Gallery A**	**Eaton Wash Infiltration Galleries B & C**
Saturated Thickness	ft	220	220	150	150	460	460
Groundwater Flow Direction		SE	Se	SE	SE	SE	SR
Hydraulic Gradient	$\Delta h/\Delta x$	0.03	0.03	0.05	0.05	0.053	0.053
Hydraulic Conductivity	gpd/ft^2	100	100	100	100	100	100
Effective Porosity		0.2	0.2	0.2	0.2	0.2	0.2
Seepage Velocity	ft/day	2.01	2.01	3.35	3.35	3.55	3.55
Transmissivity in Infiltration Gallery Area	gpd/ft	22,000	22,000	15,000	15,000	46,000	46,000
Operational Period	days	365	365	300	300	365	365
Number of Infiltration galleries		2	2	2	1	1	2
Surface area of Infiltration Gallery(s)	acres	1.5	1.5	1.6	1.5	3.0	3.0
Infiltration Rate	ft/day	0.5	0.5	0.5	0.5	0.5	0.5
Percolation Rate	MGD	0.24	0.24	0.26	0.24	0.49	0.49
Proposed Recycled Water	acre-ft/yr	274	274	292	274	548	548
Extent of Recharge Mound Perpendicular to Flow Direction	ft	500	500	650	650	800	800
Nearest Downgradient Production Well		P-SHE	P-SHE	LCID-1	LCID-1	P-TOW	P-TOW
Distance to Nearest Downgradient Production Well	ft	1,350	1,350	4,900	4,900	3,600	3,600
Estimated Travel Time to Nearest Production Well	years	1.8	1.8	4.0	4.0	2.8	2.8
Available Diluent from Underflow	acre-ft/yr	371	371	547	547	2190	2190

Recycled Water Contribution (RWC) = RW ÷ (RW + Diluent)	%	42.5%	42.5%	34.8%	34.8%	20.0%	20.0%
Maximum Allowable Total Organic Carbon at Lysimeter TOC = 0.5/RWC	mg/l	1.18	1.18	1.44	1.50	2.50	2.50

The assimilative capacity of the Raymond Basin for TDS will be addressed in a Salt and Nutrient Management Plan that has been initiated for the Raymond Basin. Although the information regarding the inputs and outputs of TDS in the Raymond Basin has not been compiled yet a preliminary evaluation of the assimilative capacity for TDS based on an average basin wide groundwater TDS level of 372 mg/l and approximately 1 million acre feet of groundwater in storage as reported by the California Department of Water Resources Bulletin No. 118, the RWQCB's TDS objective of 450 mg/l, the Raymond Basin would have an assimilative capacity of approximately 280 million pounds. The estimated salt assimilative capacity used by the Verdugo project, the Arroyo Seco project, and the Eaton Wash project combined is approximately 1.3 million pounds per year based on total recharge of 1,400 AFY (560 AFY for the Verdugo project, 280 AFY for the Arroyo Seco project and 560 AFY for the Eaton Wash project), a TDS concentration of 800 mg/l for the recycled water and a Basin Plan Objective for TDS of 450 mg/l. Since the assimilative capacity for TDS that would be used by the projects is a very small portion of the estimated assimilative capacity of the groundwater the projects are not anticipated to have a significant impact on the TDS concentration of the groundwater basin, although a more thorough evaluation of the assimilative capacity of the Raymond Basin will be conducted as part of the Salt and Nutrient Management Plan.

As discussed above it is anticipated the projects will have not have significant impact on the groundwater in the Raymond Basin and will meet the requirements of the RWQCB and the CDPH for TDS, Nitrate, and TOC.

H-5. Additional Project Considerations and Project Implementation

It is FMWD's desire to proceed with the project implementation of the three projects subsequent to the approval of the Feasibility Study. However, it appears that there are a couple of issues of concern that have arisen in regard to two of the alternatives. The Upper Los Angeles River Area (ULARA) Watermaster has indicated that water from the Verdugo Basin may not be exported to another basin. Until this issue is resolved, FMWD will be unable to proceed with Alternative V-5. Additionally, Crescenta Valley and Glendale have indicated an interest in developing their own recycled water project in the Crescenta Valley area. Until a decision is made, FMWD does not wish to proceed on any alternative regarding the Verdugo Study area to avoid duplication of effort. LACSD has also indicated that they have committed all available wastewater from the Altadena and Pasadena areas to the proposed GRIP project and other downstream users. Due to this issue, FMWD will be unable to proceed with Alternative E-1. Based on these considerations, FMWD is proceeding with Alternative A-6 at this time. FMWD preliminary implementation schedule is presented in Figure H-5. It should be noted that unless all agreements are in place, outside funding is obtained, and permitting is acquired, preliminary design will not proceed. A draft recycled water mandatory use ordinance is provided in Appendix M. Copies of letters of interest or intent from recycled water users are provided in Appendix N. Although FMWD plans on owning all facilities, FMWD is a potable water wholesaler and has no certified wastewater system operators, therefore they plan on contracting with one of the contract operations providers that are active in southern California for the ongoing system operations and maintenance.

H-6. CDPH and RWQCB Coordination

On May 12, 2011, FMWD met with CDPH to review the proposed project and infiltration galleries concept. An analysis of recycled water contribution at three recharge sites: John Muir High School, La Canada Unified School District's ball fields off of Cornishon Avenue, and Eaton Wash were provided. CDPH was provided with a draft of the recycled water report and on November 11, 2011 a conference call was held to discuss the project. CDPH believed that the current draft groundwater regulations allowed for recharge of recycled water through infiltration galleries. They raise the issue of wanting to make sure that TOCs and nitrogen are addressed appropriately to meet the basin plan and lysimeters are placed appropriately to monitor the quality of water. FMWD will coordinate further with CDPH as required.

On June 10, FMWD met with the LARWQB. LARWQB staff said that the following information is needed before a permit can be issued:

1. Current background levels of water quality.
2. Historic use of the land to ensure that there is no constituent that has or could cause problems with this operation.
3. Look at the impact of the perchlorate plume and recharge.
4. Quarterly monitoring of the groundwater and also whatever CDPH specifies. The monitoring should be both up gradient and down gradient of the recharge site and within 300 feet of the site. The screening of the wells is also important in this monitoring.
5. They also asked that we look at the rate of recharge to ensure that there is no overflow from the filtration galleries due to a storm.
6. LARWQB asked that a Form 200 be filled out and submitted. A copy is shown in Appendix O.

FMWD will coordinate further with LARWQCB as required.

H-7. Interagency Agreements

FMWD has met with the Agencies and other entities with which it anticipates having agreements for the implementation of the preferred alternative and has developed outlines of the proposed agreements or drafts of proposed agreements which are included in Appendix P. These Agencies and entities are: LACSD for the extraction of wastewater from their trunk sewer and the return of residuals to the same sewer; Pasadena Unified School District for the use of their athletic fields at John Muir High School for the development and operation of the shallow infiltration galleries; La Cañada United Methodist Church for the placement of the MBR Plant; and the Raymond Basin Management Board for the management and accounting of the recycled water recharged into the basin.

H-8. Public Outreach

Considerable public outreach has been undertaken by FMWD regarding recycled water. Public Outreach regarding development of recycled water in the service area began before the Facilities Planning Study was started as part of FMWD's Local, Reliable Water Supply Program. The Program includes developing recycled water, conservation, capturing stormwater and rehabilitating our current infrastructure.

First a survey was completed by EMC Research, Inc. One of the questions asked in the survey was: "The Local Water Supply Program will include conservation programs, expanded use of recycled water, capturing stormwater and retrofitting our pipes and reservoirs so we can store more water locally." Respondents had a choice of four categories: "Definitely Yes, Probably/Lean Yes, Undecided, Total No". Eighty percent of respondents fell into the categories of "Definitely Yes" and "Probably/Lean Yes".

Significant outreach was done as the District kick-started this program. This outreach included four public forums where recycled water was discussed, two newsletters (copies provided in Appendix Q) and presentations by FMWD staff and members of the Board of Directors at retail agency Board meetings and the City of La Cañada Flintridge City Council and Town Councils of Altadena and La Crescenta. Discussions were also held with the City of La Cañada Flintridge's Mayor's Blue Ribbon Committee on Local Water Issues. In addition, three tours of MBR plants located in Malibu were provided to interested parties. About 30 people attended. A representative of the company that operates the plants explained the MBR process.

During the development of the draft paper, there was discussion with representatives of the Los Angeles County Sanitation Districts, California Department of Public Health, Los Angeles County Regional Board, Raymond Basin Watermaster, Upper Los Angeles River Area Watermaster, City of Pasadena, City of Glendale and Crescenta Valley Water District regarding the development of recycled water.

Finally, before the draft paper was submitted, an FMWD Board of Directors workshop was held on December 6, 2010, which was publicly noticed, to describe the findings of the Facilities Planning Study.

After the workshop, FMWD staff offered to provide the same presentation to member retail agency Board's of Directors. One member retail agency asked for this presentation. Additionally, the Executive Summary of draft findings and the presentation were provided on FMWD's website.

As the paper was updated, presentations were provided at member agency Board of Director meetings. Four member agencies requested the presentation. A presentation was provided to the Raymond Basin Pumping and Storage Committee. No concerns were raised and the attendees were looking forward to a finalized study.

Reaction has been mostly positive from those in attendance. A letter was submitted by Las Flores Water Company asking that substantial funds not be committed to recycled water if the legal rights to wastewater flows have not been obtained from LACSD (See Appendix Q). Because of wastewater flow limitations, the Eaton Canyon Project is on hold at the current time. FMWD and LACSD have had discussions about the Arroyo Project and have had preliminary discussions regarding contract terms with respect to use of the flows as shown in Appendix P. Additionally, one customer has spoken to the Board stating that FMWD is too small to complete this project alone. As stated previously, FMWD has partnered with LACSD, a large organization with experience in recycled water including the construction and operation of an MBR Plant in Antelope Valley. Raymond Basin Water Master submitted a letter of comment which will be addressed as the Plan is developed further. Also, a support letter was provided by Metropolitan Water District of Southern California.

Finally, before the draft paper was submitted, an FMWD Board of Directors workshop was held on December 12, 2011, which was publicly noticed, to describe the findings of the Facilities Planning Study. Some questions were asked and responses provided to the questions. The Board gave no additional direction at the workshop. Staff will begin looking for additional funding to support the feasibility of the project. Once funding is identified, staff will bring further recommendations for action to the Board.

I. CONSTRUCTION FINANCING PLAN AND REVENUE PROGRAM

I-1. Sources and Timing of Funds for Design and Construction

The recycled water project will likely be financed through a single revenue bond issue with the repayment stream generated by the sale of the groundwater recharge credits either to FMWD Member Agencies or to the Raymond Basin Watermaster. (The FMWD Board of Directors will be reviewing this option along with financing other capital projects with a bond.) Expected sunk costs associated with the bond issue may be up to 1% of the size of the loan. (For example, sunk costs for an issuance of a $1,000,000 loan may be up to $10,000.) District revenues and reserves may be used to finance activities during the design and permitting phase with the bond issuance timed to generate funds for the facility construction. FMWD is planning on applying to MWD for financial assistance through their Local Projects Program, to the U.S. Bureau of Reclamation for assistance through Title XVI and to the SWRCB for low interest loans and/or the various bond authorities in which there are remaining funds available (i.e. Proposition 50, Proposition 84). Any assistance that is obtained will assist in reducing the costs of the program and in improving its overall cost effectiveness.

I-2. Pricing Policy for Recycled Water

The price of imported water without any outside funding the first 15 years of the project is estimated to be greater than the price of imported water. Thus, the District will be looking for outside funding to support the project. This funding includes Metropolitan's Local Resources Program (MWD LRP) as well as grants from State and Federal entities. Because the water is being recharged for production by local agency wells, the recycled water price needs to take into consideration the energy cost of pumping groundwater. Should this outside funding not be available, the District will likely not proceed with the project.

I-3. Costs that Can be Allocated to Water Pollution Control

The portions of the capital and the OM&R costs that can be attributed to the MBR systems can be allocated to water pollution control as they replace that which is currently provided either through LACSD or the City of Glendale. As FMWD does not have any direct relationship to the existing wastewater system users nor do any of their Member Agencies with the exception of CVWD, it does not anticipate attempting to recover that portion of the system costs from the wastewater system users.

I-4. Annual Projections

Water prices for each user or category of users.

As there is only one category of users, that being the extraction of recharged recycled water by FMWD member agencies, the water prices will be as calculated using the pricing policy.

Recycled water used by each user.

FMWD member agencies which have pumping rights within the Monk Hill Sub-basin of the Raymond Basin will be allocated a share of the recharged recycled water proportional to their historical 10 year running average of imported water purchases. These agencies include La Cañada Irrigation District, Valley Water Company, Lincoln Avenue Water Company, Los Flores Water Company and Rubio Canyon Water Company. The initial estimated annual share of recycled water for each agency is presented in Table I-2. These shares may be transferred to another member agency either permanently or annually should the retail agency choose to not participate in a project.

Annual costs (required revenue) of recycling project.

Table I-1 presents the projected capital costs, annual costs, and O&M costs for the recommended alternative. This table does not include any outside funding. Table I-3 and Table I-4 (with MWD LRP funding) present the annual costs of the recycling project.

Both tables present the amount of other State and Federal funding required to allow the project to cost less than imported water.

Allocation of costs to users.

Table I-5 presents the projected annual costs to those agencies with access to the recycled water based on their use of their allocation presented in Table I-2 and the unit price from Table I-3/Table I-4 assuming that outside funding is received. Table I-6 conversely shows the projected costs of imported water. Over a 30 year period, there would be a net savings of approximately $5.5 million using recycled water that has been able to obtain funding versus imported water.

Unit costs to serve each user or category of users.

The rates charged will be sufficient to cover the capital recovery including any coverage ratios as well as the operations, maintenance and repair (OM&R) of the installed system. The costs of the system will be accounted for in the development of a single recycled water rate which will increase over time as OM&R costs increase. As there is only one category of users, that being the extraction of recharged recycled water by FMWD member agencies, the unit costs for all users will be the same and will be those identified in Table I-3/Table I-4 under Projected Per Acre-foot Charge For Recycled Water Column assuming all outside funding is obtained.

Unit price of recycled water for each user or category of users.

As there is only one category of users, that being the extraction of recharged recycled water by FMWD member agencies, the water prices will be as calculated using the pricing policy. These prices are presented in Table I-3/Table I-4.

Sensitivity analysis assuming portion of potential users fail to use recycled water.

Should any of the member agencies fail to produce their allocation in a given year, their remaining allocation goes into their respective groundwater storage account which can be reserved for future year use or which can be sold to another producer with pumping rights in the Monk Hill Sub-basin.

I-5. Sunk Costs and Indebtedness

There are no sunk costs or additional indebtedness anticipated for this project other than for the bond issue addressed in Section I-1.

Table I-1 Recycled Water Costs

Alternative	Reclaimed Water Sales (AF)	Total Capital Cost ($)	Annual Capital Cost[1] ($)	O&M Costs ($)	Total Annual Costs ($)	Unit Costs ($/AF)
A-6	280	$ 3,759,072	$ (230,775)	$ 141,183	$ 371,958	$ 1,328.42
V-6[2]	560	$ 3,155,698	$ (193,733)	$ 332,434	$ 526,167	$ 939.58
E-1[2]	560	$ 5,032,357	$ (308,944)	$ 242,909	$ 551,853	$ 985.45

1) based on an interest rate of 4.5%

recovery period in years 30

2) Alternative is being deferred indefinitely

Table I-2 Initial Estimated Annual Share of Recycled Water

	FY 2001-2010 Average Sales (AF)*	% Sales and Share of Recycled Water	Share of 280 AF
LCID	2,806	30%	83
Las Flores	694	7%	21
LAWC	1,564	17%	46
RCL&WA	1,181	12%	35
VWC	3,213	34%	95
TOTAL	9,457	100%	280

** This will change with the ten-year rolling average of imported water sales.*

Table I-3 Annual Costs of Recycling Project

	MWD Tier 1	FMWD Average Energy Cost	Total Average Cost of Imported Water	Recycled Water Cost	Average Cost of Pumping Groundwater Water	Total Cost of Recycled Water	Projected Per AF Charge for Recycled Water	Outside Funding Needed to Cover Costs	Amount Recycled Water Cost is Lower than Cost of Imported Water Based on Receiving Outside Funding
Year 1	$ 794	$ 50	$ 844	$ 1,328	$ 100	$ 1,428	$ 694	$ 634	$ 150
Year 2	$ 833	$ 52	$ 885	$ 1,344	$ 103	$ 1,447	$ 730	$ 614	$ 155
Year 3	$ 877	$ 53	$ 930	$ 1,359	$ 106	$ 1,465	$ 771	$ 588	$ 159
Year 4	$ 920	$ 55	$ 975	$ 1,375	$ 109	$ 1,484	$ 811	$ 564	$ 164
Year 5	$ 970	$ 56	$ 1,026	$ 1,392	$ 113	$ 1,504	$ 857	$ 534	$ 169
Year 6	$ 1,023	$ 58	$ 1,081	$ 1,409	$ 116	$ 1,525	$ 907	$ 502	$ 174
Year 7	$ 1,079	$ 60	$ 1,139	$ 1,426	$ 119	$ 1,546	$ 960	$ 467	$ 179
Year 8	$ 1,146	$ 61	$ 1,207	$ 1,444	$ 123	$ 1,567	$ 1,023	$ 421	$ 184
Year 9	$ 1,214	$ 63	$ 1,277	$ 1,463	$ 127	$ 1,590	$ 1,087	$ 376	$ 190
Year 10	$ 1,287	$ 65	$ 1,352	$ 1,482	$ 130	$ 1,613	$ 1,156	$ 326	$ 196
Year 11	$ 1,364	$ 67	$ 1,431	$ 1,502	$ 134	$ 1,636	$ 1,230	$ 272	$ 202
Year 12	$ 1,446	$ 69	$ 1,515	$ 1,522	$ 138	$ 1,661	$ 1,307	$ 215	$ 208
Year 13	$ 1,533	$ 71	$ 1,604	$ 1,543	$ 143	$ 1,686	$ 1,390	$ 153	$ 214
Year 14	$ 1,625	$ 73	$ 1,698	$ 1,565	$ 147	$ 1,712	$ 1,478	$ 87	$ 220
Year 15	$ 1,722	$ 76	$ 1,798	$ 1,587	$ 151	$ 1,738	$ 1,587	$ -	$ 211
Year 16	$ 1,825	$ 78	$ 1,903	$ 1,610	$ 156	$ 1,766	$ 1,610	$ -	$ 294
Year 17	$ 1,935	$ 80	$ 2,015	$ 1,633	$ 160	$ 1,794	$ 1,633	$ -	$ 382
Year 18	$ 2,051	$ 83	$ 2,134	$ 1,658	$ 165	$ 1,823	$ 1,658	$ -	$ 476
Year 19	$ 2,174	$ 85	$ 2,259	$ 1,683	$ 170	$ 1,853	$ 1,683	$ -	$ 577
Year 20	$ 2,305	$ 88	$ 2,392	$ 1,708	$ 175	$ 1,884	$ 1,708	$ -	$ 684
Year 21	$ 2,443	$ 90	$ 2,533	$ 1,735	$ 181	$ 1,915	$ 1,735	$ -	$ 798
Year 22	$ 2,589	$ 93	$ 2,682	$ 1,762	$ 186	$ 1,948	$ 1,762	$ -	$ 920
Year 23	$ 2,745	$ 96	$ 2,841	$ 1,790	$ 192	$ 1,982	$ 1,790	$ -	$ 1,050
Year 24	$ 2,909	$ 99	$ 3,008	$ 1,819	$ 197	$ 2,017	$ 1,819	$ -	$ 1,189
Year 25	$ 3,084	$ 102	$ 3,186	$ 1,849	$ 203	$ 2,052	$ 1,849	$ -	$ 1,336
Year 26	$ 3,269	$ 105	$ 3,374	$ 1,880	$ 209	$ 2,089	$ 1,880	$ -	$ 1,494
Year 27	$ 3,465	$ 108	$ 3,573	$ 1,912	$ 216	$ 2,127	$ 1,912	$ -	$ 1,661
Year 28	$ 3,673	$ 111	$ 3,784	$ 1,944	$ 222	$ 2,166	$ 1,944	$ -	$ 1,840
Year 29	$ 3,893	$ 114	$ 4,008	$ 1,978	$ 229	$ 2,207	$ 1,978	$ -	$ 2,030
Year 30	$ 4,127	$ 118	$ 4,245	$ 2,012	$ 236	$ 2,248	$ 2,012	$ -	$ 2,232

Table I-4 Annual Costs of Recycling Project (with MWD LRP Funding)

	MWD Tier 1	FMWD Average Energy Cost	Total Average Cost of Imported Water	Recycled Water Cost	LRP Incentive	Average Cost of Pumping Groundwater Water	Total Cost of Recycled Water	Projected Per AF Charge for Recycled Water	Other Outside Funding Needed to Cover Costs	Amount Recycled Water Cost is Lower than Cost of Imported Water Based on Receiving Outside Funding
Year 1	$ 794	$ 50	$ 844	$ 1,328	$ 250	$ 100	$ 1,178	$ 694	$ 384	$ 150
Year 2	$ 833	$ 52	$ 885	$ 1,344	$ 250	$ 103	$ 1,197	$ 730	$ 364	$ 155
Year 3	$ 877	$ 53	$ 930	$ 1,359	$ 250	$ 106	$ 1,215	$ 771	$ 338	$ 159
Year 4	$ 920	$ 55	$ 975	$ 1,375	$ 250	$ 109	$ 1,234	$ 811	$ 314	$ 164
Year 5	$ 970	$ 56	$ 1,026	$ 1,392	$ 250	$ 113	$ 1,254	$ 857	$ 284	$ 169
Year 6	$ 1,023	$ 58	$ 1,081	$ 1,409	$ 250	$ 116	$ 1,275	$ 907	$ 252	$ 174
Year 7	$ 1,079	$ 60	$ 1,139	$ 1,426	$ 250	$ 119	$ 1,296	$ 960	$ 217	$ 179
Year 8	$ 1,146	$ 61	$ 1,207	$ 1,444	$ 250	$ 123	$ 1,317	$ 1,023	$ 171	$ 184
Year 9	$ 1,214	$ 63	$ 1,277	$ 1,463	$ 197	$ 127	$ 1,393	$ 1,087	$ 179	$ 190
Year 10	$ 1,287	$ 65	$ 1,352	$ 1,482	$ 140	$ 130	$ 1,472	$ 1,156	$ 186	$ 196
Year 11	$ 1,364	$ 67	$ 1,431	$ 1,502	$ 79	$ 134	$ 1,557	$ 1,230	$ 193	$ 202
Year 12	$ 1,446	$ 69	$ 1,515	$ 1,522	$ 14	$ 138	$ 1,646	$ 1,307	$ 200	$ 208
Year 13	$ 1,533	$ 71	$ 1,604	$ 1,543	$ -	$ 143	$ 1,686	$ 1,390	$ 153	$ 214
Year 14	$ 1,625	$ 73	$ 1,698	$ 1,565	$ -	$ 147	$ 1,712	$ 1,478	$ 87	$ 220
Year 15	$ 1,722	$ 76	$ 1,798	$ 1,587	$ -	$ 151	$ 1,738	$ 1,587	$ -	$ 211
Year 16	$ 1,825	$ 78	$ 1,903	$ 1,610	$ -	$ 156	$ 1,766	$ 1,610	$ -	$ 294
Year 17	$ 1,935	$ 80	$ 2,015	$ 1,633	$ -	$ 160	$ 1,794	$ 1,633	$ -	$ 382
Year 18	$ 2,051	$ 83	$ 2,134	$ 1,658	$ -	$ 165	$ 1,823	$ 1,658	$ -	$ 476
Year 19	$ 2,174	$ 85	$ 2,259	$ 1,683	$ -	$ 170	$ 1,853	$ 1,683	$ -	$ 577
Year 20	$ 2,305	$ 88	$ 2,392	$ 1,708	$ -	$ 175	$ 1,884	$ 1,708	$ -	$ 684
Year 21	$ 2,443	$ 90	$ 2,533	$ 1,735	$ -	$ 181	$ 1,915	$ 1,735	$ -	$ 798
Year 22	$ 2,589	$ 93	$ 2,682	$ 1,762	$ -	$ 186	$ 1,948	$ 1,762	$ -	$ 920
Year 23	$ 2,745	$ 96	$ 2,841	$ 1,790	$ -	$ 192	$ 1,982	$ 1,790	$ -	$ 1,050
Year 24	$ 2,909	$ 99	$ 3,008	$ 1,819	$ -	$ 197	$ 2,017	$ 1,819	$ -	$ 1,189
Year 25	$ 3,084	$ 102	$ 3,186	$ 1,849	$ -	$ 203	$ 2,052	$ 1,849	$ -	$ 1,336
Year 26	$ 3,269	$ 105	$ 3,374	$ 1,880	$ -	$ 209	$ 2,089	$ 1,880	$ -	$ 1,494
Year 27	$ 3,465	$ 108	$ 3,573	$ 1,912	$ -	$ 216	$ 2,127	$ 1,912	$ -	$ 1,661
Year 28	$ 3,673	$ 111	$ 3,784	$ 1,944	$ -	$ 222	$ 2,166	$ 1,944	$ -	$ 1,840
Year 29	$ 3,893	$ 114	$ 4,008	$ 1,978	$ -	$ 229	$ 2,207	$ 1,978	$ -	$ 2,030
Year 30	$ 4,127	$ 118	$ 4,245	$ 2,012	$ -	$ 236	$ 2,248	$ 2,012	$ -	$ 2,232

Table I-5 Annual Cost Allocations of Recycling Project

	LCID	Las Flores	LAWC	RCL&WA	VWC	TOTAL
Year 1	$ 57,602	$ 14,574	$ 31,924	$ 24,290	$ 65,930	$ 194,320
Year 2	$ 60,590	$ 15,330	$ 33,580	$ 25,550	$ 69,350	$ 204,400
Year 3	$ 63,986	$ 16,189	$ 35,462	$ 26,982	$ 73,236	$ 215,855
Year 4	$ 67,290	$ 17,025	$ 37,293	$ 28,375	$ 77,019	$ 227,004
Year 5	$ 71,168	$ 18,006	$ 39,443	$ 30,011	$ 81,458	$ 240,086
Year 6	$ 75,287	$ 19,049	$ 41,725	$ 31,748	$ 86,172	$ 253,980
Year 7	$ 79,646	$ 20,151	$ 44,141	$ 33,586	$ 91,162	$ 268,687
Year 8	$ 84,910	$ 21,483	$ 47,059	$ 35,805	$ 97,186	$ 286,444
Year 9	$ 90,248	$ 22,834	$ 50,017	$ 38,056	$ 103,296	$ 304,450
Year 10	$ 95,978	$ 24,284	$ 53,193	$ 40,473	$ 109,854	$ 323,782
Year 11	$ 102,062	$ 25,823	$ 56,564	$ 43,038	$ 116,818	$ 344,304
Year 12	$ 108,520	$ 27,457	$ 60,144	$ 45,761	$ 124,210	$ 366,092
Year 13	$ 115,376	$ 29,191	$ 63,943	$ 48,652	$ 132,057	$ 389,220
Year 14	$ 122,653	$ 31,033	$ 67,977	$ 51,721	$ 140,386	$ 413,771
Year 15	$ 131,711	$ 33,324	$ 72,997	$ 55,541	$ 150,754	$ 444,327
Year 16	$ 133,610	$ 33,805	$ 74,049	$ 56,342	$ 152,927	$ 450,733
Year 17	$ 135,566	$ 34,300	$ 75,133	$ 57,166	$ 155,166	$ 457,332
Year 18	$ 137,581	$ 34,810	$ 76,250	$ 58,016	$ 157,472	$ 464,129
Year 19	$ 139,656	$ 35,335	$ 77,400	$ 58,891	$ 159,847	$ 471,129
Year 20	$ 141,794	$ 35,875	$ 78,584	$ 59,792	$ 162,294	$ 478,340
Year 21	$ 143,995	$ 36,433	$ 79,805	$ 60,721	$ 164,814	$ 485,767
Year 22	$ 146,263	$ 37,006	$ 81,061	$ 61,677	$ 167,409	$ 493,416
Year 23	$ 148,598	$ 37,597	$ 82,356	$ 62,662	$ 170,082	$ 501,296
Year 24	$ 151,004	$ 38,206	$ 83,689	$ 63,676	$ 172,836	$ 509,411
Year 25	$ 153,482	$ 38,833	$ 85,062	$ 64,721	$ 175,672	$ 517,770
Year 26	$ 156,034	$ 39,479	$ 86,477	$ 65,798	$ 178,593	$ 526,380
Year 27	$ 158,663	$ 40,144	$ 87,934	$ 66,906	$ 181,602	$ 535,248
Year 28	$ 161,371	$ 40,829	$ 89,434	$ 68,048	$ 184,701	$ 544,383
Year 29	$ 164,159	$ 41,534	$ 90,980	$ 69,224	$ 187,893	$ 553,791
Year 30	$ 167,032	$ 42,261	$ 92,572	$ 70,435	$ 191,181	$ 563,481
Total	$ 3,565,836	$ 902,199	$ 1,976,246	$ 1,503,666	$ 4,081,378	$ 12,029,326

Table I-6 Avoided Cost of Purchasing MWD Water

	LCID	Las Flores	LAWC	RCL&WA	VWC	TOTAL
Year 1	$ 70,052	$ 17,724	$ 38,824	$ 29,540	$ 80,180	$ 236,320
Year 2	$ 73,414	$ 18,575	$ 40,687	$ 30,958	$ 84,028	$ 247,660
Year 3	$ 77,194	$ 19,531	$ 42,782	$ 32,552	$ 88,354	$ 260,413
Year 4	$ 80,895	$ 20,467	$ 44,833	$ 34,112	$ 92,590	$ 272,898
Year 5	$ 85,181	$ 21,552	$ 47,209	$ 35,920	$ 97,496	$ 287,357
Year 6	$ 89,720	$ 22,700	$ 49,724	$ 37,834	$ 102,692	$ 302,670
Year 7	$ 94,512	$ 23,913	$ 52,380	$ 39,855	$ 108,177	$ 318,837
Year 8	$ 100,222	$ 25,357	$ 55,545	$ 42,262	$ 114,712	$ 338,098
Year 9	$ 106,019	$ 26,824	$ 58,758	$ 44,707	$ 121,347	$ 357,655
Year 10	$ 112,223	$ 28,394	$ 62,196	$ 47,323	$ 128,447	$ 378,582
Year 11	$ 118,793	$ 30,056	$ 65,837	$ 50,094	$ 135,968	$ 400,749
Year 12	$ 125,754	$ 31,817	$ 69,695	$ 53,029	$ 143,935	$ 424,229
Year 13	$ 133,127	$ 33,683	$ 73,781	$ 56,138	$ 152,374	$ 449,102
Year 14	$ 140,937	$ 35,659	$ 78,109	$ 59,431	$ 161,313	$ 475,449
Year 15	$ 149,210	$ 37,752	$ 82,695	$ 62,920	$ 170,783	$ 503,359
Year 16	$ 157,974	$ 39,969	$ 87,552	$ 66,616	$ 180,814	$ 532,926
Year 17	$ 167,259	$ 42,319	$ 92,698	$ 70,531	$ 191,441	$ 564,247
Year 18	$ 177,095	$ 44,807	$ 98,149	$ 74,678	$ 202,699	$ 597,428
Year 19	$ 187,514	$ 47,443	$ 103,924	$ 79,072	$ 214,625	$ 632,579
Year 20	$ 198,553	$ 50,236	$ 110,042	$ 83,727	$ 227,260	$ 669,819
Year 21	$ 210,248	$ 53,195	$ 116,523	$ 88,659	$ 240,646	$ 709,271
Year 22	$ 222,638	$ 56,330	$ 123,390	$ 93,884	$ 254,827	$ 751,069
Year 23	$ 235,765	$ 59,651	$ 130,665	$ 99,419	$ 269,852	$ 795,352
Year 24	$ 249,672	$ 63,170	$ 138,373	$ 105,284	$ 285,770	$ 842,268
Year 25	$ 264,407	$ 66,898	$ 146,539	$ 111,497	$ 302,635	$ 891,975
Year 26	$ 280,018	$ 70,848	$ 155,191	$ 118,080	$ 320,503	$ 944,640
Year 27	$ 296,559	$ 75,033	$ 164,358	$ 125,055	$ 339,435	$ 1,000,439
Year 28	$ 314,084	$ 79,467	$ 174,071	$ 132,445	$ 359,494	$ 1,059,560
Year 29	$ 332,652	$ 84,165	$ 184,362	$ 140,275	$ 380,747	$ 1,122,200
Year 30	$ 352,327	$ 89,143	$ 195,265	$ 148,571	$ 403,265	$ 1,188,572
Net Savings	$ 5,204,018	$ 1,316,679	$ 2,884,155	$ 2,194,465	$ 5,956,406	$ 17,555,723
	$ 1,638,182	$ 414,480	$ 907,908	$ 690,800	$ 1,875,028	$ 5,526,398

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Ms. Nina Jazmadarian
General Manager
Foothill Municipal Water District
4536 Hampton Road
La Cañada Flintridge, CA 91011

October 3, 2012

Foothill Municipal Water District – Water Recycling Facilities Planning/Project Report

Dear Ms. Jazmadarian:

This letter report provides a review of the recommended project from the Water Recycling Facilities Planning/Project Report (Water Recycling Report) dated January 27, 2012. This report was prepared by other consulting firms under contract with Foothill Municipal Water District (FMWD). The recommendation from the Water Recycling Report was to proceed with Alternative A-6 from the Water Recycling Report based on grant funding. The other two study areas were deferred.

FMWD retained Phoenix Civil Engineering, Inc. (Phoenix) to review the opinion of probable construction costs (OPCC) as well as the overall economic analysis of Alternative A-6 based upon Phoenix staff's experience with recycled water (treatment, distribution and operations) over the last 19 years. This letter report provides a comparison for Alternative A-6 from the Water Recycling Report and our recommendations on the OPCC and the economic analysis which includes modifications to the Operations and Maintenance (O&M) plan. ***Figure 1*** provides an overall layout of the project with the understanding that the infiltration galleries for the groundwater recharge might be changed from John Muir High School (Water Recycling Report identified location) to La Cañada High School.

Pipeline Background

Foothill Municipal Water District (FMWD) was formed in 1952 for the purpose of enabling its various member agencies to obtain supplemental water from the Metropolitan Water District of Southern California (MWD). The current member agencies of FMWD include:

1) Crescenta Valley Water District (Crescenta Valley)
2) Kinneloa Irrigation District (Kinneloa)
3) La Cañada Irrigation District (La Cañada)
4) Las Flores Water Company (Las Flores)
5) Lincoln Avenue Water Company (Lincoln)
6) Mesa Crest Water Company (Mesa Crest)
7) Rubio Cañon Land and Water Association (Rubio)
8) Valley Water Company (Valley)

Prior to joining MWD, FMWD member agencies relied on local supplies, primarily groundwater from the Verdugo and Raymond basins, a small amount of surface runoff from local mountains to meet the water demands of their customers, and imported water through interconnections with the City of Pasadena. Approximately 60 percent of water demands within FMWD are now met with imported water. Drought and environmental constraints on pumping water from the Sacramento/San Joaquin Delta have led to what is anticipated to be a long term reduction in imported water supplies available to Southern California. In response to the potentially limited future supply of imported water and the relative cost of imported water, FMWD has developed a local water supply program to improve long-term water supply reliability to its service area including development of a recycled water program. FMWD has retained Phoenix to evaluate the OPCC and economic analysis for a satellite recycled water facility referred to as Alternative A-6 near the Arroyo Seco area of its service area. The recycled water will be used for recharging a groundwater basin via infiltration galleries. This Alternative A-6 is within the Arroyo Seco hydrologic areas. The Arroyo Study Area includes the service areas of FMWD member agencies within the Monk Hill subarea of the Raymond Basin, including Las Flores, La Cañada, Lincoln, Mesa Crest, Rubio, Valley, and the remaining portions of the City of La Cañada Flintridge. Mesa Crest, although in the study area has no rights to produce from the groundwater basin.

Existing Project

Alternative A-6 includes a 0.25 MGD satellite reclamation plant potentially at La Cañada United Methodist Church on Oak Grove Drive south of La Cañada High School which may be the proposed location for the infiltration galleries for the proposed groundwater recharge in the area. A satellite reclamation plant is one typically located upstream of a larger wastewater treatment plant that is supplied from a local sewer for the source of wastewater which treats and discharges the treated effluent for either irrigation purposes or for groundwater recharge. Satellite reclamation plants typically return the solids to the sewer system for treatment at the downstream wastewater treatment Plant. FMWD has approached La Cañada Unified School District (LCUSD) with a plan to construct the infiltration galleries beneath the athletic fields at La Cañada High School which would be the discharge location for the treated effluent from the satellite reclamation plant. LCUSD staff was receptive to negotiating terms for an agreement as long as construction and operation does not interfere with use of the fields. Should geohydrologic studies prove that groundwater recharge via infiltration galleries can work at La Cañada High School and based on negotiations with LCUSD, then the facilities may be constructed there reducing the cost of the Project. The construction timeline of the satellite reclamation plant will accommodate the needs of La Cañada High School as well as the City of La Cañada Flintridge as the fields are under a joint use agreement.

The wastewater will be extracted from the LACSD Joint Outfall B – Unit 6 in Oak Grove Drive at Berkshire Place with the residuals returned to the same sewer pipeline downstream of the extraction location. Approximately 280 acre-feet per year (AFY) will be utilized for groundwater recharge and the distribution system is depicted in Figure 1. The monthly groundwater recharge potentially ranges from 21 to 24 AF per month. ***Figure 2*** provides the treatment plant layout and Table 1 provides the **originally** proposed OPCC.

Table 1 - Alternative A-6 OPCC

Item	Size	Quantity	Units	Unit Cost	Cost
Site Work		1	L.S.	$ 75,000	$ 75,000
Scalping Facility	0.25	1	L.S.	$ 150,000	$ 150,000
Structure		1	L.S.	$ 200,000	$ 200,000
MBR	0.25	1	MGD	$ 1,324,200	$ 1,324,200
UV Disinfection	0.25	1	MGD	$ 150,000	$ 150,000
Booster	1	5	Hp	$ 3,000	$ 15,000
PVC Pipe	4"	4,300	Feet	$ 45.00	$ 193,500
Infiltration Galleries		3	Acres	$ 20,000	$ 60,000
Lysimeters		5	Each	$ 6,000	$ 30,000

Monitoring Well	Existing				$ -
Total					$ 2,197,700

The overall economic analysis for Alternative A-6 can be found in ***Figure 3*** which is Table G-34 from the Water Recycling Report. No changes were presented and the overall unit cost ($ per AF) for recycled water was $1,765 per AF.

Reevaluated Alternative A-6 Costs

As part of the scope of services, Phoenix was to provide an assessment of the costs for the Alternative A-6. Phoenix staff evaluated the OPCC provided within Water Recycling Report and compared these costs to other satellite reclamation plants utilizing the proposed treatment technology called "membrane bioreactors (MBRs)". The other satellite reclamation plants located within the Cities of Anaheim, Malibu and Santa Paula utilized for cost comparisons included costs for design, construction, construction management and operations and maintenance. Based upon the evaluation and taking into account that all costs are to be adjusted into 2010 dollars, Table 2 was developed to provide a summary of the reevaluated OPCC for Alternative A-6.

Table 2 – Reevaluated Alternative A-6 OPCC

Item	Size	Quantity	Units	Unit Cost	Cost
Site Work		1	L.S.	$ 52,500	$ 52,500
Scalping Facility	0.25	1	L.S.	$ 105,000	$ 105,000
Structure		1	L.S.	$ 140,000	$ 140,000
MBR	0.25	1	MGD	$ 926,050	$ 926,050
UV Disinfection	0.25	1	MGD	$ 105,000	$ 105,000
Booster (1)	1	5	Hp	$ 3,000	$ 15,000
PVC Pipe (2)	4"	4,300	Feet	$ 31.50	$ 134,450
Infiltration Galleries		3	Acres	$ 14,000	$ 42,000
Lysimeters		5	Each	$ 4,000	$ 20,000
Monitoring Well	Existing				$ -
Total					$ 1,540,000

(1) Might not be necessary due to the revised PUSD location selected (John Muir High School to La Cañada High School)
(2) The pipeline quantity can be greatly reduced due to the change in location for the infiltration gallery from John Muir High School to La Cañada High School. However the quantity was not modified in order to keep an "apples to apples" comparison.

Based on the above OPCC evaluation, Phoenix revised the economic analysis of Alternative A-6 utilizing Table G-34 from the Water Recycling report. The economic analysis includes the following elements:

- Recycled Water Sales (AFY)
- Design and Construction Costs
- Operation & Maintenance Costs (both fixed and variable)
- Salvage Value

Phoenix staff utilized the exact same economic analysis assumptions as outlined in the Water Recycling Report which includes the following economic analysis:

- Provide the present worth of the above elements at a 6-percent value in order to calculate the unit cost ($ per AF)
- Unit cost then calculated at the total present worth of cost divided by total present worth of sales
- The assumed fixed costs and variable costs percentages of 28-percent and 72-percent of the total O&M costs remained
- The useful life of the pipeline, pump station (mechanical/electrical), storage reservoir, and site work remained at 50 years, 20 years, 75 years and 100 years, respectively.

The overall economic analysis for Alternative A-6 can be found in ***Figure 4*** and the overall unit cost ($ per AF) for recycled water was $1,246 per AF.

Conclusions

As part of the scope of services, Phoenix was to provide an economic analysis of Alternative A-6. Based on the review of the Water Recycling Report, Phoenix has provided a $519 per AF decrease in the overall economic analysis.

While the revised overall cost for the recycled water associated with Alternative A-6 is projected to be $1,246 per AF this is compared to current Metropolitan Water District (MWD) Tier 1 rate for 2012 of $794 per AF. The MWD Tier 1 rate is to increase to $847 per AF and $890 per AF in 2013 and 2014, respectively. For the purposes of planning, MWD staff has provided projections for an additional two years which is when the project could be reasonably be completed and discharging recycled water to the infiltration galleries. Projected MWD melded rates for Tier 1 and Tier 2 would be $923 per AF and $969 per AF in 2015 and 2016, respectively. These projected rates were provided by MWD staff to be utilized when preparing a Local Resource Program funding application. It would be reasonable to assume that FMWD could recover the $277 per AF difference ($1,246/AF - $969/AF = $277/AF) with local, State and Federal funding for the period of time until the MWD rate surpasses the cost of the Alternative A-6 recycled water.

As with most recycled water projects looking to offset groundwater production, the Alternative A-6 project will face challenges to demonstrate short term financial benefit based on the above mentioned $1,246 per AF in addition to the cost of power to pump groundwater from existing wells when compared to the imported state water. An evaluation on the short term financial benefit in the first year utilizing the $847 per AF cost for MWD Tier 1 rates should include the other cost components for those member agencies who can participate with the cost components including:

- Ready-To-Serve (RTS) and Capacity Charge (CC) per AF
- Average energy costs
- Costs of producing groundwater

For most of the member agencies the recycled water project shows a positive $ per AF for each member agency who can participate in the project.

Recommendation

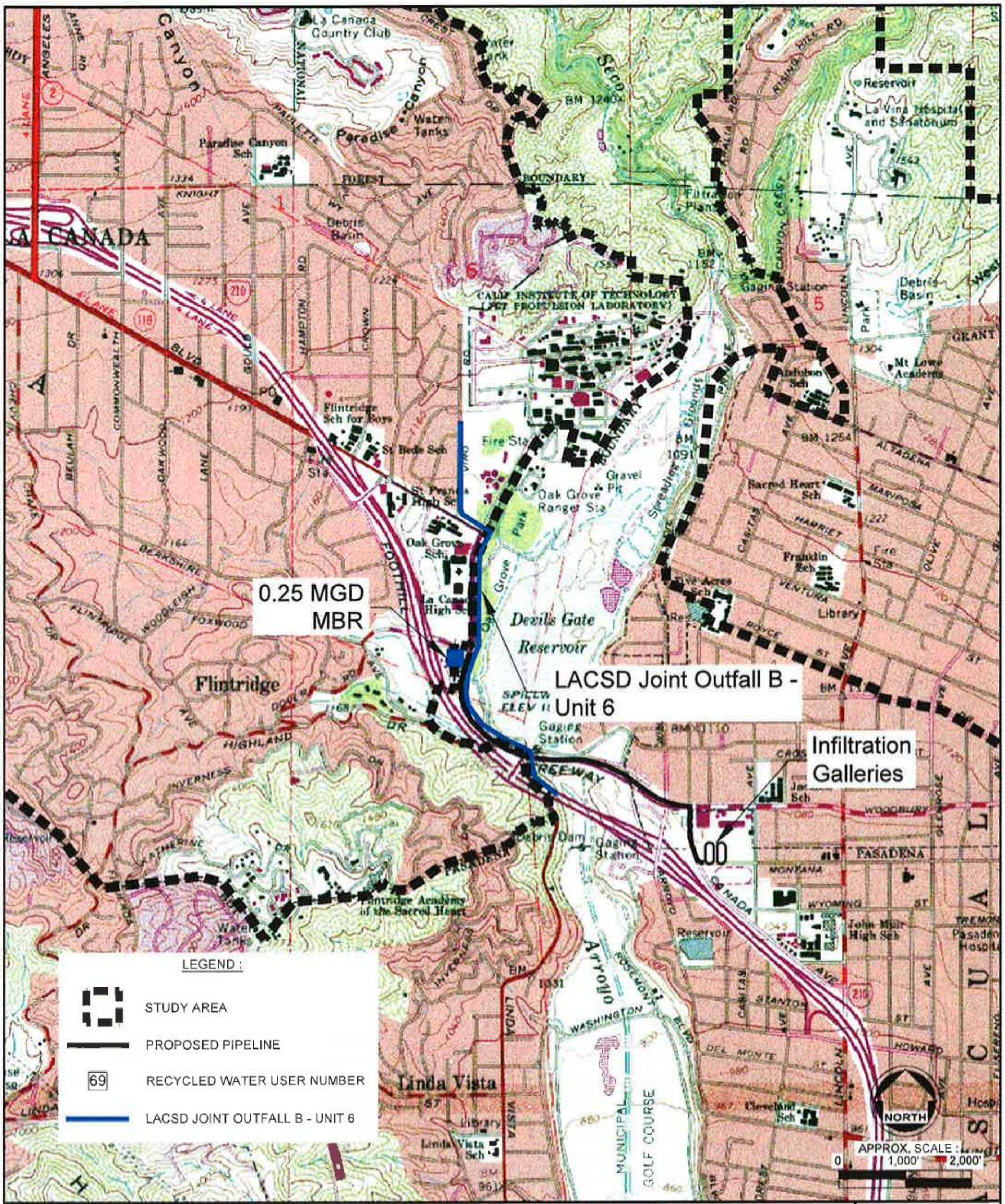
As outlined in the Water Recycling Report, Phoenix would suggest the following recommendations be considered as an overall recycled water program be developed around Alternative A-6 which will allow other recycled water projects to be included as they are further developed. The recommendations include:

- Development of a briefing document that can be utilized by FMWD when discussing the project with the member agencies, funding agencies, regulatory agencies, participating agencies/organizations and the public.
- Investigate and determine local (MWD LRP), State (State Water Resources Control Board Proposition 50 and Proposition 84) and Federal (U.S. Bureau of Reclamation Title XVI and Water SMART) funding opportunities.
- Investigate and determine the level of California Environmental Quality Act (CEQA) process that will be necessary for the alternatives under consideration. Please note that CEQA should be in place before any field investigation is authorized.
- Adoption of the Mandatory Use Ordinance as developed in Appendix M of the Water Recycling Report.
- Continued California Department of Public Health and Regional Water Quality Control Board coordination to further discuss the project and the infiltration gallery concept.
- Investigate and implement interagency agreements with Los Angeles County Sanitation District, La Cañada United Methodist Church and Raymond Management Board, PUSD or alternative LCUSD and the City of La Cañada Flintridge.
- Consider and determine the levels of public outreach for Alternative A-6 and the overall recycled water program.
- Investigate and prepare an energy analysis (i.e. Greenhouse Gas Evaluation) for the Alternative A-6

Sincerely,

Jon Turner, PE
Principal Engineer

John Robinson
Consultant



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FOOTHILL MUNICIPAL WATER DISTRICT

Alternative A-6 Schematic

FIGURE G-7

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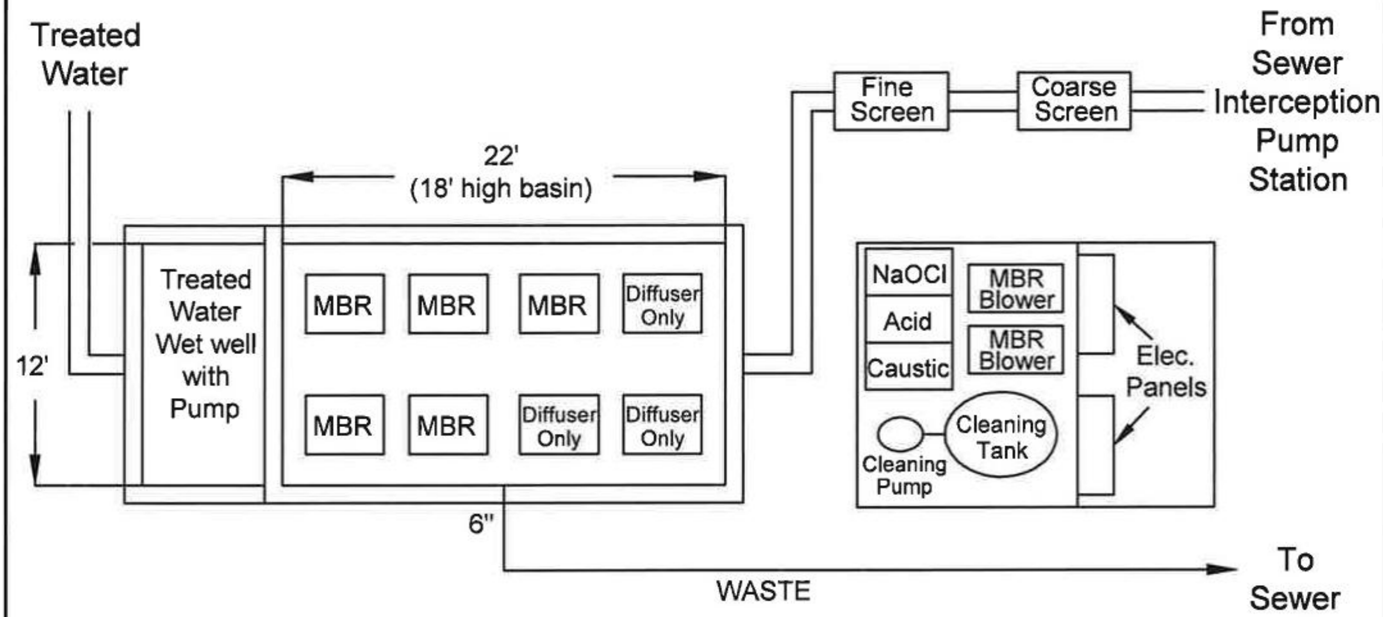

0.25 MGD MBR

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FOOTHILL MUNICIPAL WATER DISTRICT

Alternative A Series Plant Layout

FIGURE G-2

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FIGURE 3

Economic Analysis of Alternative A-6

Year	Reclaimed Water Sales, AF	Design & Construction Cost $ /a/	O&M Costs, $ Fixed /b/	O&M Costs, $ Variable /b/	Salvage Value, $ /c/	Present Worth Factor at 6%	Present Worth of Costs, $ Design & Construction Cost	Present Worth of Costs, $ O & M Costs Fixed	Present Worth of Costs, $ O & M Costs Variable	Present Worth of Costs, $ Salvage Value	Present Worth of Costs, $ Total	Present Worth of Sales, AF
2011		849,602				1.06000	900,578				900,578	
2012		2,909,470				1.00000	2,909,470				2,909,470	
2013	280		94,650	46,533		0.94340		89,292	43,899		133,191	264
2014	280		97,489	47,929		0.89000		86,765	42,657		129,422	249
2015	280		100,414	49,367		0.83962		84,309	41,449		125,759	235
2016	280		103,426	50,848		0.79209		81,923	40,276		122,199	222
2017	280		106,529	52,373		0.74726		79,605	39,136		118,741	209
2018	280		109,725	53,944		0.70496		77,352	38,029		115,380	197
2019	280		113,017	55,563		0.66506		75,162	36,952		112,115	186
2020	280		116,407	57,230		0.62741		73,035	35,907		108,942	176
2021	280		119,899	58,947		0.59190		70,968	34,890		105,859	166
2022	280		123,496	60,715		0.55839		68,960	33,903		102,863	156
2023	280		127,201	62,536		0.52679		67,008	32,943		99,951	148
2024	280		131,017	64,413		0.49697		65,112	32,011		97,123	139
2025	280		134,948	66,345		0.46884		63,269	31,105		94,374	131
2026	280		138,996	68,335		0.44230		61,478	30,225		91,703	124
2027	280		143,166	70,385		0.41727		59,738	29,369		89,108	117
2028	280		147,461	72,497		0.39365		58,047	28,538		86,586	110
2029	280		151,885	74,672		0.37136		56,405	27,730		84,135	104
2030	280		156,441	76,912		0.35034		54,808	26,946		81,754	98
2031	280		161,135	79,219		0.33051		53,257	26,183		79,440	93
2032	280		165,969	81,596	631,670	0.31180		51,750	25,442	196,958	(119,766)	87
Total		3,759,072					3,810,048	1,378,243	677,591	196,958	5,668,925	3,212

Economic Analysis Model.xls

Unit Cost ($/AF) = (Total present worth of costs)/(Total present worth of sales)= $1,765 per acre-foot

/a/ All costs adjusted to 2010 dollars

/b/ We assumed that fixed costs equals 28% and variable costs is 72% of the total O&M costs

/c/ Useful lives: Pipelines, 50 yr; pump station mechanical/electrical, 20 yrs; storage reservoir, 75 yrs; site work, 100yrs. No salvage value for engineering, legal & administration costs.

Item		Cost $	Useful Life Yrs	Salvage Value $
Site Work		75,000	100	60,000
Sewer Scalping Facility		150,000	20	0
MBR Structure		200,000	100	160,000
MBR Treatment Plant		1,324,200	20	0
UV Disnifection		150,000	20	0
Booster Pumps		15,000	20	0
Distribution System		193,500	75	141,900
Leach Fields		60,000	75	44,000
Lysimeters		30,000	20	0
CEQA & Permitting		150,000		0
Preliminary Engineering Costs		100,885		0
Final Engineering Costs		302,655		0
Construction Services		40,354		0
Site Aquisition		100,000	100	80,000
Subtotal		2,891,594		485,900
Contingency	30%	867,478		145,770
Grand Total		3,759,072		631,670

FIGURE 4

Economic Analysis of Alternative A-6

Year	Reclaimed Water Sales, AF /a/	Design & Construction Cost $ /b/	O&M Costs, $ Fixed /c/	O&M Costs, $ Variable /c/	Salvage Value, $ /d/	Present Worth Factor at 6%	Present Worth of Costs, $ Design & Construction Cost	Present Worth of Costs, $ O & M Costs Fixed	Present Worth of Costs, $ O & M Costs Variable	Present Worth of Costs, $ Salvage Value	Present Worth of Costs, $ Total	Present Worth of Sales, AF
2011		577,300				1.06000	611,938				611,938	
2012		2,358,000				1.00000	2,358,000				2,358,000	
2013	302		59,730	43,069		0.94340		56,349	40,631		96,980	285
2014	302		61,521	44,361		0.89000		54,754	39,481		94,235	269
2015	302		63,367	45,692		0.83962		53,204	38,364		91,568	254
2016	302		65,268	47,063		0.79209		51,698	37,278		88,976	239
2017	302		67,226	48,474		0.74726		50,235	36,223		86,458	226
2018	302		69,243	49,929		0.70496		48,814	35,198		84,011	213
2019	302		71,320	51,427		0.66506		47,432	34,202		81,634	201
2020	302		73,460	52,969		0.62741		46,090	33,234		79,323	190
2021	302		75,664	54,558		0.59190		44,785	32,293		77,078	179
2022	302		77,934	56,195		0.55839		43,518	31,379		74,897	169
2023	302		80,272	57,881		0.52679		42,286	30,491		72,777	159
2024	302		82,680	59,617		0.49697		41,089	29,628		70,717	150
2025	302		85,160	61,406		0.46884		39,926	28,790		68,716	142
2026	302		87,715	63,248		0.44230		38,796	27,975		66,771	134
2027	302		90,346	65,146		0.41727		37,698	27,183		64,881	126
2028	302		93,057	67,100		0.39365		36,631	26,414		63,045	119
2029	302		95,848	69,113		0.37136		35,595	25,666		61,261	112
2030	302		98,724	71,186		0.35034		34,587	24,940		59,527	106
2031	302		101,686	73,322		0.33051		33,608	24,234		57,842	100
2032	302		104,736	75,522	475,155	0.31180		32,657	23,548	148,156	(91,950)	94
Total		2,935,300					2,969,938	869,755	627,149	148,156	4,318,686	3,466

Economic Analysis Model.xls

Unit Cost ($/AF) = (Total present worth of costs)/(Total present worth of sales)= $1,246 per acre-foot

/a/ Reclaimed sales are based on 318 AFY minus a 5% due to the variability of storm water

/b/ All costs adjusted to 2010 dollars

/c/ We assumed that fixed costs equals 28% and variable costs is 72% of the total O&M costs

/d/ Useful lives: Pipelines, 50 yr; pump station mechanical/electrical, 20 yrs; storage reservoir, 75 yrs; site work, 100yrs. No salvage value for engineering, legal & administration costs.

	Item	Cost $	Useful Life Yrs	Salvage Value $
A	Direct Proj Admin./Ed. & Outreach	146,000	100	
B	Site Work	52,500	100	42,000
C	Sewer Scalping Facility	105,000	20	0
D	MBR Structure	140,000	100	112,000
E	MBR Treatment Plant	926,050	20	0
F	UV Disnifection	105,000	20	0
G	Booster Pumps	15,000	20	0
H	Distribution System	134,450	75	98,597
I	Leach Fields	42,000	75	30,800
J	Lysimeters	20,000	20	0
K	CEQA & Permitting	177,100		0
L	Preliminary Engineering Costs	164,825		0
M	Final Engineering Costs	157,500		0
N	Construction Services	56,000		0
O	Site Acquisition (i.e. Land Acquisition)	70,000	100	
P	Other	7,875		56,000
	Subtotal	2,319,300		339,397
	Contingency 40%	616,000 [(1)]		135,759
	Grand Total	2,935,300		475,155

(1) 40% on construction costs only which starting with Site Work thru Lysimeters

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